DIFFUSING LEAN FROM MANUFACTURING OPERATIONS TO THE WIDER ORGANISATION: LESSONS LEARNT FROM THE EXPERIENCES OF MIDDLE MANAGEMENT WITHIN A UK MEDICAL MANUFACTURER

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This dissertation is submitted to Cardiff University
in partial fulfilment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

January 2022

ABSTRACT

To date, previous research has insufficiently covered the scenario in which lean is internally diffused from manufacturing operations to the wider organisation. At the same time, no distinction is usually made upon the different hierarchical levels when researching lean, although it is widely accepted that the middle management layer is central to its implementation and sustainability. Taking into consideration that middle managers have a 360° perspective within an organisation as they constitute the intermediary between the strategic and the operational level, more attention should be paid to their experiences to learn how lean can be successfully diffused from manufacturing operations to the wider organisation and how it can be sustained.

Against this background, a longitudinal in-depth single-case study within a UK medical manufacturer was adopted. Initially, 49 face-to-face interviews across all hierarchies were conducted to understand how the diffusion of lean from manufacturing operations to the wider organisation had evolved to date. Mainly with middle managers, a second wave of 16 face-to-face interviews was conducted to consider their experiences during this process. Several group interviews, observations, and documentary evidence supplemented the empirical dataset.

This case study presents how lean can be diffused from manufacturing operations to the wider organisation, while the results suggest that this is no easy undertaking. In essence, varying local conditions and needs complicate managing its implementation. At the same time, large lean maturity gaps between manufacturing operations and the wider organisation add to the complexity and make mismanagement more likely. Lessons learnt from middle management experiences teach how diffusing lean from manufacturing operations to the wider organisation should have been managed to avoid stalling. A series of managerial implications are derived from these insights, providing senior managers with a better understanding of what to pay attention to.

ACKNOWLEDGEMENTS

In retrospect, undertaking this research project has been an insightful journey and a learning experience for life. I must admit, however, that it would have not been possible to reach this stage without the support of various individuals whom I would like to thank below.

First, I would like to express my sincere gratitude to my first supervisor, Prof. Maneesh Kumar. It is with great honour that I had the opportunity to work with such an experienced academic. I am very grateful to you for your continuous guidance and helpful advice over the years. Apart from doctoral studies, I am grateful to you for supporting my personal development and shaping my academic profile. Thank you for your excellent mentorship and for believing in me and my work; you gave me the confidence to believe in myself.

Second, I would like to thank my second supervisor, Prof. Pauline Found. Likewise, it is with great honour that I had the opportunity to work with such an experienced academic. I am especially grateful that you have joined the supervisory team in January 2020. I greatly appreciate your constructive comments and your valuable feedback on my work. Thank you for the excellent guidance and advice you have given me in the last years.

Third, I would like to thank my external examiner, Dr Tammi Sinha (Solent University), and my internal examiner, Dr Daniel Eyers (Cardiff University), for taking the time to review my PhD thesis. I appreciate the constructive discussion we had during my viva. Thank you very much for your suggestions and valuable comments; your thoughtful feedback has clearly enabled me to improve the quality of my work. I value your input very much.

Fourth, I would like to say “thank you” to my financial sponsors, namely, (1) Olympus Surgical UK, (2) the Economic and Social Research Council, and (3) Lean Competency System. Without you, it would have not been possible to undertake this research project. Your generous financial assistance is greatly appreciated, and I am deeply grateful for that.

Fifth, I would like to express my sincere gratitude to the case organisation’s senior representatives who granted me access. Equally, I thank each and every research participant who took part in this research project. I greatly appreciate your interest in my work, your valuable contributions, and your time. Without your participation, this PhD thesis would not have been possible.

Sixth, I would like to thank Prof. Luigi de Luca who also chaired my viva, Lydia Taylor, and Sol Salah from the PhD Research Office team for their continuous support in all kinds of matters over the past years. I have really enjoyed being part of this PhD cohort and this cross-sectional community you formed.

Seventh, I would like to thank Dr Jane Lynch who supervised my MBA thesis at Cardiff Business School in 2015. Thanks to her excellent supervision and mentorship in the past, I could discover my passion for academia. Without this positive experience, I would have never embarked on doctoral studies.

Eighth, I would like to say “thank you” to the entire team of the Logistics and Operations Management Section. I am grateful for any feedback on my work (e.g., during LOMSAC conferences) and have always enjoyed working in this friendly research environment.

Ninth, I would like to express a big “thank you” to all my fellow PhD students. There are a few with whom I have formed wonderful friendships over the years. I always enjoyed having endless discussions about our PhD topics. Even in tough times, you have made my PhD journey joyful. In the end, it was always clear to us that we were in the same boat; indeed, we each had our own challenges, but a sorrow shared was always a sorrow halved. I am really glad that I was able to get to know each and every one of you.

Finally, I would like to thank my family. Without the support they have given me for over 33 years, I would not be at this point where I am now. Throughout these years, my parents victimised a lot and paved the way for me to go to university one day. They had much more faith in me than I had in myself. I am grateful for their unconditional support and patience during these years.

PUBLICATIONS

Peer-reviewed journal articles

- Reynders, P., Kumar, M. and Found, P. 2022. '*Lean* on me': an integrative literature review on the middle management role in lean. *Total Quality Management & Business Excellence* 33(3/4), pp. 318-354.

Conference contributions

- Reynders, P., Kumar, M. and Pye, A. 2019. Exploring the relationship between soft lean practices and innovative work behaviour: a case study approach. *26th International Annual European Operations Management Association Conference*. 17-19 June, Helsinki, Finland.
- Reynders, P., Kumar, M. and Pye, A. 2018. The impact of employee empowerment on sustaining continuous improvement in manufacturing: an empirical case study. *21st International Quality Management & Organisational Development Conference*. 22-24 August, Cardiff, United Kingdom.

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Abbreviation(s)	Meaning(s)
3P	Purpose-process-people
5S	Seiri (sort), seiton (set), seiso (shine), seiketsu (standardise), shitsuke (sustain)
AJG	Academic Journal Guide
CI	Continuous improvement
DMAIC	Define measure, analyse, improve, control
EFQM	European Foundation for Quality Management
ESRC	Economic and Social Research Council
FAIR	Focus-alignment-integration-review
HK	Hoshin kanri
HR	Human resource
HRM	Human resource management
IMVP	International Motor Vehicle Program
JIT	Just-in-time
KBI	Key behaviour indicator
KPI	Key performance indicator
L&D	Learning & Development
LSS	Lean six sigma
LSW	Leader standard work
MIT	Massachusetts Institute of Technology
MX	Manufacturing excellence
NNVA	Necessary but non-value-adding
NVA	Non-value-adding
OM	Operations management
OPS	Operations
PDCA	Plan-do-check-act
PDR	Performance and development review
PDSA	Plan-do-study-act
QA	Quality assurance
QC	Quality control
QCDE	Quality-cost-delivery-education
QM	Quality management
R&D	Research & Development
R&R	Reward and recognition
RAQA	Regulatory Affairs & Quality Assurance
RQ	Research question
SGAE	Selling, General & Administrative Expenses
STS	Socio-technical systems
TPS	Toyota Production System
TQM	Total quality management
UK	United Kingdom
US	United States
VA	Value-adding
VMB	Visual management board
VoC	Voice of the Customer
VSM	Value stream mapping
WIP	Work-in-progress
WLG	Wider leadership group
WW2	World War II

1. Introduction

1.1 Background and scope

1.1.1 Introduction to lean

In retrospect, the business environment has become more competitive. That is why organisations seek ways how to gain more competitive edge. To avoid being "stuck in the middle"[1], Porter (1985) has already suggested how organisations can generate competitive advantages by either focusing on (1) cost leadership, (2) differentiation, (3) or exploiting a niche. Nowadays, however, organisations increasingly strive for ongoing operational optimisation of their existing activities and seek becoming "lean" (Bateman 2005; Hirzel *et al.* 2017) by changing the way they operate so that constantly changing customer needs can be satisfied with as few resources as possible (Jasti and Kodali 2015). In doing so, such organisations have focused on enhancing customer value (Hines *et al.* 2004) by eliminating or reducing waste along the value stream (Jasti and Kodali 2015).

In 1988, the term "lean" was coined by Krafcik (1988) as part of the Massachusetts Institute of Technology (MIT) International Motor Vehicle Programs (IMVP) study. This study explored the Toyota Production System (TPS) to identify the causes of Toyota's competitive advantage. Two years later, the term "lean" was disseminated by the book "*The Machine that Changed the World*" by Womack *et al.* (1990).

Although lean lacks a universally accepted definition (Hines *et al.* 2004; Papadopoulou and Özbayrak 2005; Holweg 2007; Shah and Ward 2007; Pettersen 2009; Arlbjørn and Freytag 2013; Bhamu and Sangwan 2014; Samuel *et al.* 2015; Bouranta *et al.* 2021), it is usually associated with "doing more with less" (Womack and Jones 1996; Bicheno and Holweg 2016) and relies upon five key principles, namely, (1) defining value from the customer's perspective, (2) identifying the value stream of a product (or service), (3) increasing flow, (4) creating pull, and (5) pursuing perfection (Womack and Jones 1996).

Mistakenly, lean is described as "the pursuit of waste elimination" (Hopp and Spearman 2021, p. 612) in most practitioner literature. In the past, it has therefore mainly been associated with its tools and techniques that help to increase flow and to tackle inefficiencies by identifying (e.g., via value stream mapping [VSM]) and minimising (e.g., via kanban) waste in processes (Hadid and Mansouri 2014). Such tools and techniques are *process-focused* because

[1] The term "stuck in the middle" was coined by Porter (1985). An organisation that is "stuck in the middle" either pursues none of Porter's (1985) generic strategies (i.e., [1] cost leadership, [2] differentiation, or [3] exploiting a niche) or more than one simultaneously while failing to achieve them due to their inherent contradictions. Such organisations are outcompeted by organisations with a single strategic focus on cost leadership, differentiation, *or* exploiting a niche.

they are primarily concerned with streamlining the value stream. In the literature, they are frequently referred to as "hard lean practices" (Bortolotti *et al.* 2015; Danese *et al.* 2017, 2018; Sakthi Nagaraj *et al.* 2019).

The fifth lean principle, that is, "perfection", conditions human involvement and human engagement, though. While hard lean practices constitute tools and techniques that mainly help to identify and to minimise waste, so-called "soft lean practices" (e.g., training, recognition, and leadership) are concerned with human factors[2] and social relations. In contrast to hard lean practices, they are *employee-focused* and less visible (Bortolotti *et al.* 2015). In this regard, lean has recently evolved from a process-focused approach to a holistic management philosophy in which employees' personal development and creating a positive work environment have received more attention (Fotopoulos and Psomas 2009; Calvo-Mora *et al.* 2014; Hadid and Mansouri 2014; Bortolotti *et al.* 2015; Costa *et al.* 2019; Sakthi Nagaraj *et al.* 2019; Cadden *et al.* 2020; Sahoo 2020; Bouranta *et al.* 2021).

Today, lean is therefore widely conceived as a socio-technical system (STS), functioning as an interplay between hard and soft lean practices (Shah and Ward 2007; Hadid and Mansouri 2014; Bortolotti *et al.* 2015; Hadid *et al.* 2016; Sakthi Nagaraj *et al.* 2019). The STS theory suggests that both social and technical sub-systems must operate in harmony to achieve superior performance. In combination with hard lean practices, soft lean practices promote change towards a CI culture (Martínez-Jurado *et al.* 2013; Martínez-Jurado and Moyano-Fuentes 2014). In addition, they enhance the operational performance (Samson and Terziovski 1999; Shah and Ward 2003; Jørgensen *et al.* 2007; Hadid and Mansouri 2014; Bortolotti *et al.* 2015; Zeng *et al.* 2015; Magnani *et al.* 2019; Sakthi Nagaraj *et al.* 2019). Failing to pay attention to soft lean practices, however, is associated with limited success (Hadid and Mansouri 2014; Bortolotti *et al.* 2015; Hadid *et al.* 2016) and argued to undermine lean sustainability (Liker 2004; Liker and Rother 2011; Martínez-Jurado *et al.* 2013; Costa *et al.* 2019). That is simply because a sole focus on hard lean practices disregards the social sub-system of a STS. In this regard, a few studies suggest that a consideration of soft lean practices explains why some organisations perform better than others (Bonavia and Marin-Garcia 2011; Bortolotti *et al.* 2015; Bouranta *et al.* 2021). To date, however, most research on lean still remains process-focused.

[2] Human factors are concerned with the understanding of interactions amongst human beings and their work environment, affecting their physical, mental, and perceptual capabilities (Sakthi Nagaraj *et al.* 2019).

> "[I]t is largely due to the ease of measurement that researchers frequently concentrate on the technical elements both in characterizing Lean and in measuring performance, over the social and behavioral aspects, resulting in their under representation and the ubiquity of the narrower 'process lens' in academic research" (Shah and Holweg in Cusumano *et al.* 2021, p. 8).

Importantly, being lean is neither a state nor a final destination but an *ongoing* striving for perfection (Womack and Jones 1996). Associated with continuous improvement (CI), keeping up this ongoing striving for perfection is referred to as "lean sustainability". In essence, lean sustainability means maintaining a self-perpetuating improvement momentum (Lucey *et al.* 2005). It is achieved as soon as sufficient capabilities are developed to preserve the improvement momentum from the bottom up (Bessant and Caffyn 1997; Jørgensen *et al.* 2007; Costa *et al.* 2019). If an organisation fails to achieve lean sustainability, it violates the fifth principle (i.e., pursuing perfection).

1.1.2 Implementing lean along the entire value stream

In 1996, Womack and Jones (1996) had formally introduced the term "lean thinking" to represent a broader application of lean. That is because lean is applicable anywhere where value flows horizontally through an organisation regardless of the sector it operates in (Rother and Shook 1998). Despite its origin in manufacturing, lean has therefore already been successfully adopted in office operations (Hadid and Mansouri 2014) and sectors beyond. Amongst others, these sectors include finance (Swank 2003; Bortolotti and Romano 2012), retail (Bruce *et al.* 2004), the public sector (Hines *et al.* 2004; Bateman *et al.* 2014), healthcare (Massey and Williams 2006), and construction (Jørgensen and Emmitt 2008). At the same time, research on lean in support functions (e.g., procurement, engineering, accounting, and sales) shows that its applicability is not limited to core operations in manufacturing; instead, it encompasses all functional areas of the wider organisation likewise (Cudney and Elrod 2011). Its suitability for environments outside of manufacturing has been proven several times and is, in fact, endorsed by multiple academics (e.g., Bane 2002; Ehrlich 2006; Piercy and Rich 2009a, 2009b; Carlborg *et al.* 2013; Hadid and Mansouri 2014).

Closely followed by public sector organisations, service organisations were the first organisations outside of manufacturing experimenting with lean (Hines *et al.* 2004; Bateman *et al.* 2014). In the 1990s, academic interest in researching lean in service organisation therefore increased likewise (e.g., Bowen and Youngdahl 1998; Womack and Jones 2006). To date, however, an imbalance regarding contemporary research about lean remains because

manufacturing settings dominate with 72.5% whereas only 10.83% of the research is conducted in the service sector (Danese *et al.* 2018). In other words, research about lean in services remains sparse. This has to do with the circumstance that implementing lean has mostly been limited to manufacturing operations on the shopfloor (Shah in Åhlström *et al.* 2021) and is traditionally associated with production processes (Selvaraju *et al.* 2012).

In the industry, such an imbalance prevails equally. Although administrative activities or office operations in white-collar environments are seen as an internal value-adding service to manufacturing (Bicheno 2008; Chiarini 2012), most manufacturing organisations continue to focus solely on optimising their manufacturing areas (Boyle *et al.* 2011; Selvaraju *et al.* 2012; Jasti and Kodali 2015). Improvement efforts beyond manufacturing areas remain therefore sparse likewise. Such an attitude, however, disregards major parts of the value stream because lead times of administrative activities can make up 60 to 80% of overall lead times (Strategic Direction 2005) and are often carried out inefficiently (Piercy and Rich 2009a; Bortolotti *et al.* 2010). Fullerton *et al.* (2014) remark that "operations management cannot operate in a vacuum" (p. 414) and that lean should not solely be implemented in manufacturing with isolated activities. Instead, they argue, lean must extend beyond manufacturing operations because it can only unleash its full potential and generate the most value once it is implemented organisation-wide.

Ideally, lean should be approached holistically (Emiliani 2003; Womack *et al.* 2003; Bhasin 2012a, 2015). In its ultimate extent, lean is then not only implemented within the entire organisation but also along the supply chain, including internal and external customers, suppliers, and multiple other stakeholders (Womack and Jones 1994; Baker 2002; Bhasin and Burcher 2006; Hines *et al.* 2008; Piercy and Rich 2009b). In doing so, lean principles are expanded end-to-end along the value stream (Liker 2004; Bhasin and Burcher 2006; Hines *et al.* 2008). If lean is adopted in its most consequent form, an entity is either referred to as a "lean enterprise" (Smeds 1994; Womack and Jones 1994; Cooper 1995, 1996; Bhasin and Burcher 2006) or an "extended lean enterprise" (Hines *et al.* 2008, 2020).

After all, superior competitive advantage is only gained by applying lean, associated with its effectiveness and efficiency improvements, to an entire value stream. In the end, however, it speaks for itself that lean sustainability becomes an even greater challenge as complexity increases. That is because all stakeholders along the value stream must be engaged simultaneously. It is therefore important to be aware of how to multi-manage different functional areas within an organisation so that lean sustainability can be maintained.

1.2 Aims and research questions

1.2.1 Diffusing lean from manufacturing operations to the wider organisation

Most likely, the most prominent example for an organisation-wide approach to lean is the TPS where underlying lean principles are equally embedded across all international sites (Liker and Morgan 2006). In simple terms, the TPS is a multi-plant improvement programme, framing a set of lean concepts with several hard and soft lean practices. Today, there is a well-established literature stream about the TPS while its success entices imitation (James and Jones 2014; Netland and Ferdows 2014).

In essence, programmes, such as the TPS, provide a formalised and coordinated structure to implementing lean, enhancing CI capabilities, and instilling a CI culture (Netland and Aspelund 2014; Netland and Ferdows 2014; Boscari *et al.* 2016).

> "However, an inherent challenge in implementing these programs is that every plant is different – in location, size, history, process technology, labor situation and other circumstances" (Netland and Ferdows 2014, p. 84).

Given the varying local conditions and needs, sites are not contextually homogeneous but heterogeneous (Maritan and Brush 2003; Netland and Aspelund 2014; Netland and Ferdows 2014; Boscari *et al.* 2016). Hence, conformity is likely to conflict with local contingencies (Netland and Aspelund 2014). Investigating the transference of the TPS from Japan to an overseas site in India, James and Jones (2014) present, for instance, multiple encountered complexities associated with diffusing lean internationally. Consistent with Netland and Aspelund (2014), they address the adoption-adaption dilemma and emphasise the role that local context plays. To supplement Netland and Ferdows' (2014) quote from above, such "other circumstances" (p. 84) may also include the following. First, although in practice often ignored (Boscari *et al.* 2016), different lean maturity levels across sites exacerbate lean management along the lean voyage significantly (Netland and Ferdows 2016). Associated with that, pace rates of lean implementation may differ depending on the local conditions (e.g., because of an unfavourable local sub-culture; Netland *et al.* 2021). Second, recipients may lack absorptive capacity or simply willingness to engage (Maritan and Brush 2003; Bortolotti *et al.* 2015; Kelly and Hines 2019) why mechanisms for tacit knowledge transfer (Bortolotti *et al.* 2015) concern a challenge likewise (Netland and Aspelund 2014; Boscari *et al.* 2016).

Insights from existing studies as presented above are limited to multi-plant improvement programmes, though. In academia, diffusing lean has mainly been investigated from a corporate point of view where a multi-plant improvement programme or a set of lean practices

is rolled out (inter)nationally across sites (e.g., Maritan and Brush 2003; Aoki 2008; Inkpen 2008; Yu and Zaheer 2010; Netland 2013; James and Jones 2014; Netland and Aspelund 2014; Netland and Ferdows 2014, 2016; Netland and Sanchez 2014; Netland *et al.* 2014; Boscari *et al.* 2016; Danese *et al.* 2017). Inside a single organisation, however, similar conditions (e.g., heterogeneity or lean maturity differences) are likely to prevail between different functional areas likewise when embarking on lean. To date, an in-depth analysis at the site level that investigates the diffusion of lean intraorganisationally (i.e., from a specific area to another or even to several other areas at the same time) remains overlooked, though. Very little is known about the dynamics, how such intraorganisational diffusion processes evolve, and what challenges will be encountered along the way.

In any case, most academic research inside of organisations is mainly concerned with specific focus areas (e.g., either manufacturing *or* service; Danese *et al.* 2018) and overlooks the need for more organisation-wide research. Of course, it is not denied that studies of lean on specific processes remain sparse and are encouraged (e.g., product development, sales and marketing, and human resource management [HRM]; ibid); however, this attitude still neglects an organisation's systemic entirety (Fullerton *et al.* 2014; Jasti and Kodali 2015). Two noteworthy exceptions include Kelly and Hines (2019) and Hines *et al.* (2020).

In practice, it is not unusual that diffusion processes are set in motion. For instance, early successes with lean resulting from initial pilots "infect" other functional areas and spread traction (Alukal 2003; Scherrer-Rathje *et al.* 2009; Netland and Ferdows 2016; Robert *et al.* 2019). A challenge that may arise in this situation concerns lean's transferability as local contingencies (e.g., sub-cultures; Crute *et al.* 2003; Bhasin 2015; Netland *et al.* 2021) remain. That is because lean

> "is not a context-free methodology and so transfer without adaptation is bound to deliver very limited, focal results that will pale into insignificance compared to what lean has achieved in the manufacturing world" (Radnor and Holweg 2010, p. 10).

In office environments, which undoubtedly make up a large proportion of manufacturing organisations, difficulties associated with lean's transferability have already been observed in several studies (e.g., Hines and Taylor 2000; Åhlström 2004; Strategic Direction 2005; Baines *et al.* 2006; Liker and Morgan 2006; Found and Harrison 2012; Laureani and Antony 2012; Beckers 2015; da Silva *et al.* 2015). Not uncommonly, this has to do with the circumstance that lean had been evolving, developing, and maturing for much longer in manufacturing environments than in non-manufacturing environments where it found application at a much

later time (Hasle *et al.* 2016). Even if waste is much more difficult to detect in non-manufacturing environments (Hines and Taylor 2000; Strategic Direction 2005; Baines *et al.* 2006; Liker and Morgan 2006; Found and Harrison 2012; Laureani and Antony 2012; da Silva *et al.* 2015), the key principles of lean remain the same (Hines *et al.* 2004, 2008; Baines *et al.* 2006; Liker and Morgan 2006; Antony *et al.* 2017), although they may need some refinement to suit service operations (Åhlström 2004; Hines *et al.* 2004; Womack and Jones 2005a; Maleyeff 2006; Bateman *et al.* 2014). Under these circumstances, competitive advantage is gained as soon as an understanding is developed how to successfully apply lean in processes beyond manufacturing so that the entire value stream is encompassed.

Therefore, the first aim of this study is to understand how lean can be diffused from manufacturing operations to the wider organisation. By virtue of the preceding discussion and under consideration of the empirical context to be studied, the author proposes an explorative research approach with the following research question to fill this void.

RQ1. How can lean be diffused from manufacturing operations to the wider organisation?[3]

The case study exemplifies an organisation in which lean is diffused from manufacturing to office operations in the wider organisation while several challenges upon lean implementation and lean sustainability are encountered. Note that only 2% of previous studies on lean production investigated manufacturing *and* services at the same time (Marodin and Saurin 2013). Instead, the focus is usually put on one or the other. By adopting a single-case study design within a UK medical manufacturer, this study counteracts as part of an organisation-wide lean implementation where non-manufacturing functions (e.g., HR and finance) concern support functions and serve as internal services to the case organisation's core operations in manufacturing. Especially in highly regulated industries, such as medical manufacturing (Brown *et al.* 2008; Eatock *et al.* 2009; Gollan *et al.* 2014), implementing lean along the entire value stream makes a lot of sense because the simple levers for achieving competitive advantage lie beyond highly regulated manufacturing processes that require time-consuming

[3] It is worth mentioning that this research question evolved empirically as part of a funded research project by the Economic and Social Research Council (ESRC) within a local UK site of a multi-national medical manufacturing organisation. Over a series of meetings with senior representatives, a research focus had been negotiated that met the case organisation's needs and academic relevance. In this process, the ESRC-funded research project's original focus (i.e., "*Continuous improvement training and accreditation, innovative work behaviour, and the Kata approach: building sustainable CI organisations*") shifted somewhat towards how lean can be diffused from manufacturing operations to the wider organisation. That was also because the case organisation's agenda had changed. However, examining how to build sustainable CI organisations remained a central focus. In 2016, the first contact was established between the case organisation and the author. In the time the author joined, the case organisation embarked on implementing lean outside of manufacturing. In the previous two years, lean was only introduced in its manufacturing environment.

reverification and revalidation when changes are made. In doing so, this research moves beyond studying a specific activity, as widely seen in research contexts within manufacturing, and captures a bigger picture that the lean enterprise calls for (Fullerton *et al.* 2014; Jasti and Kodali 2015). To the best of the author's knowledge, this is the first attempt to examine lean when it is diffused from manufacturing operations to the wider organisation.

It is obvious that a longitudinal approach must be pursued, whereas most research on lean remains cross-sectional, though (Jasti and Kodali 2014, 2015; Danese *et al.* 2018). That is because observing the lean evolution promises to develop a more grounded understanding of how change occurs and how lean may eventually be sustained.

> "Developing a comprehensive understanding beyond manufacturing into the social and technical elements spanning the entire enterprise requires long-term orientation" (Shah and Holweg in Cusumano *et al.* 2021, p. 8).

In their literature review, Danese *et al.* (2018) determine a lack of longitudinal case studies that identify "the hard and soft practices needed to sustain lean outcomes over years" (p. 597). Too often, lean's long-term view is overlooked (Jasti and Kodali 2014; Danese *et al.* 2018; Gaiardelli *et al.* 2019). Commonly, post-hoc analyses with a sole focus on highly matured organisations are performed. Such an attitude, however, neglects the evolutionary nature (Tortorella and Fogliatto 2017). Several lean maturity models (e.g., Bateman and David 2002; Bateman 2005; Netland and Ferdows 2014, 2016; Netland *et al.* 2014; Piercy and Rich 2015; Hines *et al.* 2020) emphasise a long-term perspective towards perfection. At the same time, lean conditions long-term commitment (Bhasin and Burcher 2006; Jasti and Kodali 2014).

1.2.2 Lessons learnt from the experiences of middle management during the diffusion of lean from manufacturing operations to the wider organisation

In the UK, reality shows that no more than 10% of the organisations pursuing lean implementation have managed to introduce it effectively (Bhasin and Burcher 2006; Bhasin 2012a). Conversely, this means that it is rather unlikely that organisations will succeed with their first attempt. Instead, it becomes more relevant how failed attempts can be revitalised. To date, however, only Jørgensen *et al.* (2003) and Scherrer *et al.* (2009) have provided some insights, which is why the literature lacks research that investigates

> "how failing CI implementations can be redirected, rejuvenated, or revived" (Jørgensen *et al.* 2003, p. 1260).

In the existing body of knowledge, some evidence underlines the relevance of middle management for lean implementation (e.g., Camuffo and Gerli 2005; Emiliani and Stec 2005; Holmemo and Ingvaldsen 2016; Reynders *et al.* 2022). That is, for instance, because of the following reasons. First, middle managers are "'culture carriers' to implement the lean programme" (Poksinska *et al.* 2013, p. 896) and stimulate change by incorporating soft lean practices and by living to those (Rother 2010; Holmemo and Ingvaldsen 2016; Reynders *et al.* 2022). Second, they are the intermediary between the strategic and the operational level, translating strategy into operational routines and reconciling strategic matters with daily challenges (Nonaka 1988; Westley 1990; Floyd and Wooldridge 1996, 1997; Engle *et al.* 2017; Tortorella *et al.* 2017). Third, they are involved in daily challenges and continuously interact with stakeholders. Bamford and Forrester (2003), for instance, show that middle managers have the most direct contacts in- and outside their area of responsibility. Such a 360° perspective enables them to influence in every direction and to be attentive to surrounding issues (Floyd and Wooldridge 1994; Dutton *et al.* 1997; Harrington and Williams 2004).

In this position, middle managers have a comprehensive understanding of their organisation and are well aware of a system's operational procedures and dysfunctions. Improvements can only be obtained "with an understanding of the interactions that take place within the dysfunctional pre-existing system" (Rich and Piercy 2013, p. 964), after all. Some even say that middle managers are "in a better position to initiate and assess alternative courses of action" (Wooldridge and Floyd 1990, p. 240) than senior managers. In Australia, for instance, senior management are often unaware of their management standards and overestimate their performance (Green *et al.* 2009; Gollan *et al.* 2014). It comes therefore not as a surprise that Wooldridge *et al.* (2008) argue that

> "middle management is a necessary point of observation from which to study the organizational process associated with building and renewing capabilities" (p. 1191).

In this context, "building and renewing capabilities" (Wooldridge *et al.* 2008, p. 1191) concerns bottom-up capabilities to realise lean sustainability.

To date, "typically, no distinctions are made between different layers of management" (Holmemo and Ingvaldsen 2016, p. 1332) in lean research, although internal dynamics, events, and dysfunctions are evidently not equally experienced at different hierarchical levels (e.g., barriers to lean implementation; Lodgaard *et al.* 2016). Equally roles, responsibilities, and leadership practices (Netland *et al.* 2019; Reynders *et al.* 2022) as well as the degree of

influence to initiate, manage, and sustain change vary (Sohal and Egglestone 1994; Huy 2002; Oakland 2011). In fact,

> "our understanding of middle management is remarkably thin, compared with research conducted on higher management" (Osterman 2008, p. 2).

In respect of the important role that middle management occupy during lean implementation and its sustainability (Reynders *et al.* 2022), this circumstance further justifies the necessity to pay closer attention to the middle management layer.

By virtue of the preceding discussion, this study suggests that middle managers possess the most valuable knowledge to draw from in order to learn how lean can be sustained when diffusing it from manufacturing operations to the wider organisation. In STS terminology, this suggests that middle managers have the capabilities and best knowledge to jointly optimise the social and technical parts of a STS for achieving lean sustainability. Therefore, the second aim of this study is to learn from the experiences of middle managers how lean can be sustained when diffusing it from manufacturing operations to the wider organisation. Against this background, the following research question is proposed.

> *RQ2*. What are the lessons learnt from the experiences of middle management during the diffusion of lean from manufacturing operations to the wider organisation so that lean can be sustained?

In summary, the first part of this study examines a UK medical manufacturer (first unit of analysis) to find out how lean can be diffused from manufacturing operations to the wider organisation, while the second part of this study looks at middle managers' (second unit of analysis) experiences during this process to find out how lean can be sustained.

1.3 Structure and outlook

The structure of this research is as follows. At first, relevant literature is reviewed to present the current state of knowledge. Prior to introducing lean, its umbrella domains quality management and CI are introduced. Then, the literature review highlights the origin of lean, its principles and tools, and its application beyond manufacturing associated with challenges when adopting lean in environments other than manufacturing. Importantly, the concept of the lean enterprise is touched upon to underline the importance of seeing organisations and their value streams in their entirety. Associated with lean sustainability, the importance of appropriate change management in conjunction with soft lean practices is emphasised. In this regard, the literature review introduces to STS theory occupying the theoretical lens. In its final part, the

literature review touches upon the concept of lean leadership and highlights the middle management role and its relevance during the implementation of lean.

The methods chapter justifies the research design. This includes explanations of the empirical context and why a qualitative case-study method associated with data collection methods, such as interviews and observations, was selected. Likewise, the template analysis technique to analyse the data, the reliability and validity tests carried out to strengthen the robustness of this research, and ethical considerations are touched upon.

The fourth chapter contains the results. The results are presented in correspondence to the themes developed from the template analysis and in a chronological order over a timespan of over five years to maintain the evolutionary character of lean implementation. In this way, organisational learnings from phase to phase become more obvious. To be more precise, the chapter presents the evolution from lean's origin in manufacturing operations up to where middle management identify the failure factors why lean implementation had stalled. Hence, the entire chapter covers the first research questions, whereas the second research question is covered more extensively towards the latter part.

The fifth chapter discusses the findings. First, the case organisation's approach to diffusing lean from manufacturing operations to the wider organisation is discussed and compared with existing insights from the literature. Second, considering the challenges with lean implementation outside of manufacturing operations, evolving lean maturity gaps between functional areas in this process are illustrated. Third, the underlying reasons for these lean maturity gaps and failure with implementing lean are explained based on experiences of middle management and references to the existing literature.

The last chapter briefly summarises the insights of this study and infers managerial implications. Moreover, the contributions to academia are articulated in a separate part. Finally, research limitations and avenues for future research are formulated.

2. Literature review

The literature review examines the literature relevant to this study. In terms of structure, the chapter begins with the methodology, describing how the narrative literature review was conducted. Second, a general introduction to quality management follows to provide some background knowledge on the broader scope of this study. Third, the literature review presents an introduction to CI as the umbrella theme. Fourth, within this overarching theme, lean is the focus of this study. Accordingly, its current understanding, its application in manufacturing and diffusion in office (or service) environments, and its reliance on human engagement to maintain CI sustainability are addressed. Towards the end, the literature review discusses lean leadership and the role of middle management. Finally, a brief summarisation is given.

2.1 Methodology of literature review

While the latter briefly introduced the structure of the literature review, this sub-chapter depicts on its methodology adopted. The procedure how the literature review was carried out and further considerations are justified and elaborated on, accordingly.

In essence, the nature of the literature review is narrative. Usually part of a thesis, as the case was here, a narrative literature review enables coverage of critical aspects of the current state of knowledge and a broad range of issues within a particular research domain. Narrative literature reviews, such as the following, are

> "written report[s] that summarize […] and critique the literature on a particular topic, without providing any integration of either quantitative findings or qualitative findings" (Onwuegbuzie and Frels 2016, p. 23). They "represent the most common class of literature review [and] provide a broad overview of a topic" (p. 24).

A systematic approach was not followed because of the following reasons. First, the literature review had been developing organically. Unlike systematic approaches, this means that the literature review was non-linear (ibid). For instance, the starting point was not always an electronic search on a database (e.g., fundamentals and principles were often sourced from textbooks to gain an overview of a certain topic). Plus, the abductive nature of this study came along with numerous interactions between the literature and data. This means that the literature was not scanned as part of a single approach but iteratively, involving various search cycles. In several cases, data collected in the case organisation has led to the need to cover further literature streams. This circumstance is consistent with the exploratory character of the first research question. Second, the author made himself familiar with literature beyond the scope

likewise. However, including literature beyond the scope is nearly impossible when following a systematic review because systematic approaches usually adhere to explicit inclusion and exclusion criteria (ibid; e.g., via search terms).

Thus, a holistic and systematic approach in which each single piece of research is considered was infeasible to approach; however, although narrative literature reviews usually do not provide any information about how the review was carried out (ibid), the literature review of several sub-chapters followed a structure to a certain degree, as described more closely in the following.

Initially, the literature review's focus was set on peer-reviewed journal articles available in English language. Depending on each sub-chapter, relevant search terms to be contained in the title, abstract, or author keywords were defined. These search terms were then used for an initial electronic search on various databases. In doing so, electronic databases that cover major production and operations management-related top-tier journals (*Elsevier/ScienceDirect*, *Emerald Insight*, *INFORMS PubsOnLine*, *Taylor & Francis*, and *Wiley*) were selected (Table 2.1).

Table 2.1 Journal selection

No.	Production and operations management-related journals	AJG (2018)[a]	Database(s)				
			Elsevier	*Emerald Insight*	*INFORMS PubsOnLine*	*Taylor & Francis*	*Wiley*
1	*Journal of Operations Management*	4*					•
2	*International Journal of Operations & Production Management*	4	•				
3	*Production and Operations Management*	4					•
4	*International Journal of Production Economics*	3		•			
5	*International Journal of Production Research*	3				•	
6	*Manufacturing and Service Operations Management*	3			•		
7	*Production Planning & Control*	3				•	

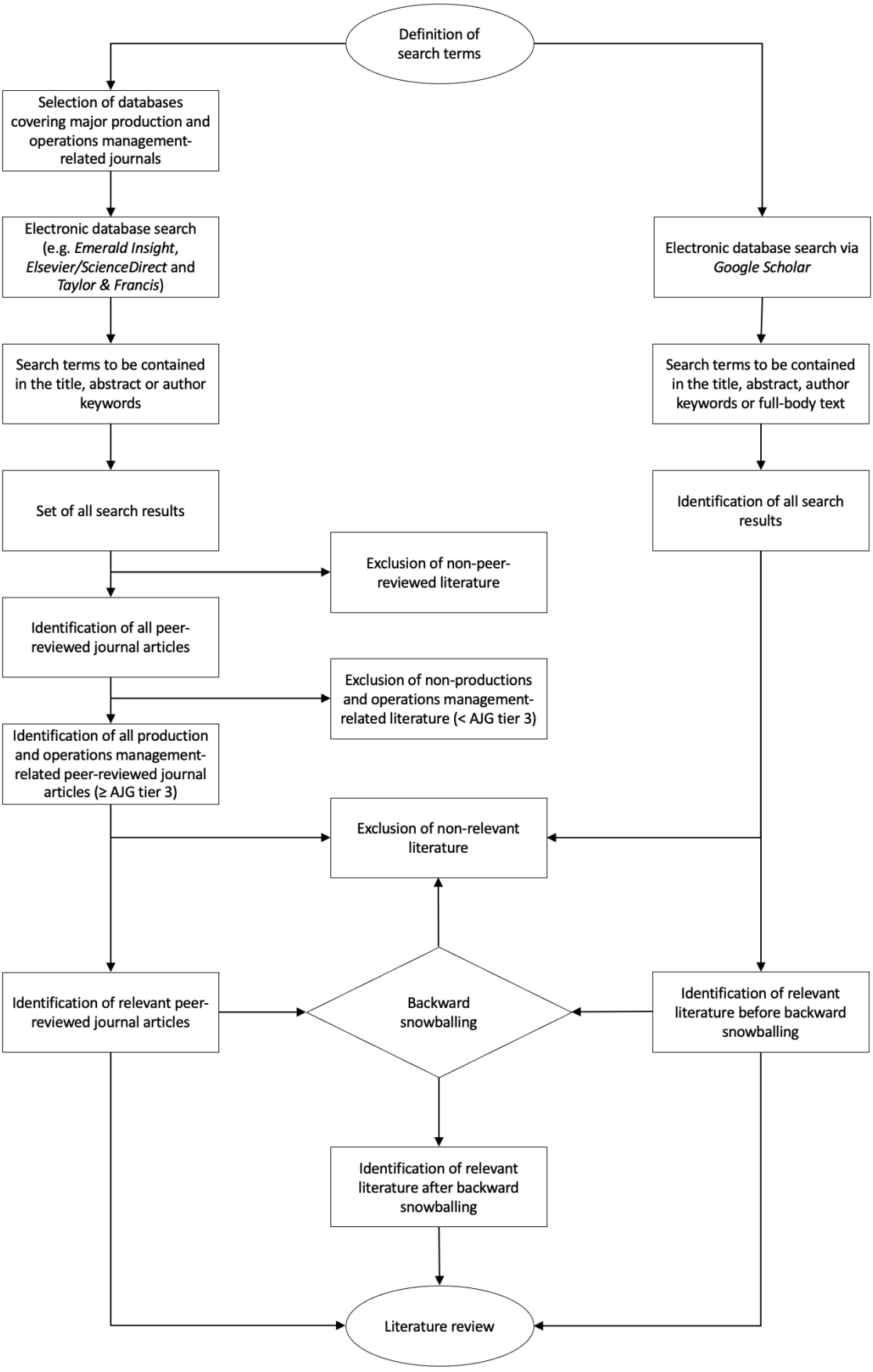
Source: Author
Note(s): (a) Academic Journal Guide (2018)

The first set of search results contained literature that matched the search terms. In the next step, non-peer-reviewed literature was excluded. Afterwards, the focus was put on production and operations management-related journals articles published in journals that are classified as tier 3 or better (i.e., tier 3, tier 4, and tier 4*) according to the Academic Journal Guide (AJG; 2018) by the Chartered Association of Business Schools (see Table 2.1). Then, abstracts were scanned to decide upon the suitability of each journal article for further review. In doing so, non-relevant literature was filtered out from the pool of search results, leaving the author with literature considered as potentially relevant for this literature review.

Although initially disregarded, further literature (including tier-2 journal articles and lower, grey literature, and textbooks) was identified through cross-reading (backward snowballing; van Wee and Banister 2016) based on the preliminary database search results. In addition, *Google Scholar* was used, enabling to complement the search results. *Google Scholar* was insofar powerful because it is a meta-search engine that covers multiple databases with rich literature (Frank *et al.* 2017). Sometimes, additional selections upon inclusion of further literature were made on a case-by-case basis, where appropriate. Some selections, for instance, concerned the inclusion of relevant HRM literature.

Admittedly, relevant journal articles gained through backward snowballing made up most of the literature reviewed. Taking the exponential nature of the backward-snowballing process into account, this circumstance does not surprise at all. That being said, relevant articles identified in top-tier journals built the foundation for this literature review, as they were the starting point for further literature to be reviewed. Over a five-year period, this process involved numerous iterations. Since the literature review evolved organically rather than in a structured way, it is impossible to reconstruct the search process in detail. Figure 2.1, however, is an attempt to illustrate the basic idea behind the methodology and serves thus as a visual orientation how the literature review of this study was carried out.

Figure 2.1 Methodology of literature review



Source: Adapted from Reynders *et al.* (2022)

2.2 Introduction to quality management

To begin with, this section introduces to quality management (QM) as the overarching domain in which this thesis is thematically located. At first, the term "quality" is defined while the different phases of the evolution of QM are described more closely afterwards.

2.2.1 Definition of quality

Before discussing QM and its evolution, it is necessary to have a closer look at the meaning of quality and what it constitutes. In their work, Reeves and Bednar (1994) drilled down on defining what quality means and what it comprises. Reviewing many definitions of quality that developed over time, they concluded that a universal one is non-existent. More precisely, the definitions of quality are inconsistent and vary (Reeves and Bednar 1994; Dale *et al.* 2010).

Over time, however, four main views of quality crystallised out, namely, quality in the sense of (1) excellence, (2) value, (3) conformance and specifications, and (4) meeting and/or exceeding expectations (Table 2.2). Some argue one reason lies in the fact that perceptions of quality vary depending on the context (Reeves and Bednar 1994). Due to the nature of their research, scholars in the field of operations management (OM), for instance, often tend to utilise the third view of quality (i.e., quality in the sense of conformance and specifications). In contrast, the last one (i.e., quality in the sense of meeting and/or exceeding expectations) is predominantly used within the field of marketing (ibid), and quality in the sense of excellence is often used under consideration of "top quality", meaning the "best" products or services, such as supercars or luxury watches (Oakland 2014), which is indeed a subjective matter.

Oakland (2014), however, perceives that the definition of quality in the sense of excellence falls too short because he believes that quality must be defined in a way so that it is manageable. Hence, he defines quality as "*meeting the customer requirements* [italics in original]" (p. 4) and is therefore an advocate of the fourth view. Due to its broad applicability, the fourth view (i.e., seeing quality as meeting and/or exceeding expectations) is widely accepted across different industries and across different academic domains (also within the OM domain), making up the most prevalent definition of quality at present (Reeves and Bednar 1994; Oakland 2014).

Juran and de Feo (2010) define quality as the "fitness for purpose of use" (p. 4), having "the right features to satisfy customer needs with little or no failures" (p. 4). Their definition of quality comprises conformance and specifications, as well as customer requirements, which brings two views together in one definition. Similarly, the BS EN ISO 9000 standard, which defines fundamentals and vocabulary relating to QM systems, perceives quality as the

"degree to which a set of inherent characteristics fulfils requirements" (BS EN ISO 9000 2000).

Yet, it does not specify the term "requirements", hence, leaving it open whether conformance and specifications, customer requirements, or even both are concerned.

Table 2.2 Four views on defining quality

No.	View(s) of quality	Description(s)	Nature(s)	Relevant definition(s)
Quality in the sense of…				
1	…excellence	Understood as an ideal in terms of the highest form of all This ideal often applies to one or more features of a product or service (e.g., speed for a car)	Subjective Qualitative	"[Quality] means investment of the best skill and effort possible to produce the finest and most admirable results possible […] You do it well or you do it half-well. […] Quality is achieving or reaching for the highest standard as against being satisfied with the sloppy or fraudulent. […] It does not allow compromise with the second-rate" (Tuchman 1980, p. 38).
2	…value	Understood as the price-performance ratio ("best deal wins") Perception that the consumer is the "arbiter of trade" (Johnson 1988, p. 286), which results in market-orientation	Objective Quantitative	"Quality does not have the popular meaning of 'best' in any absolute sense. It means 'best for certain customer conditions.' These conditions are (a) the actual use and (b) the selling price of the product. Product quality cannot be thought of apart from product cost" (Feigenbaum 1951, p. 10).
3	…conformance and specifications	Perception that quality is objective and therefore quantifiable and measurable Standards can be developed, and performance can be measured through statistical procedures	Objective Quantitative	"We must define quality of product in such a way that the numerical measure of this quality serves the following two purposes: 1. To make it possible for one to see whether or not the quality of product for a given period differs from that for some other period taken as a basis of comparison. 2. To make possible the comparison of qualities of product for two or more periods to determine whether or not the differences are greater than should be left to chance" (Shewhart 1931, p. 44).
4	…meeting and/or exceeding expectations	Perception that the customer defines what quality constitutes	Subjective Qualitative	"Only customers judge quality; all other judgments are essentially irrelevant" (Zeithaml *et al.* 1990). "Quality is whatever the customers say it is, and the quality of a particular product or service is whatever the customer perceives it to be" (Buzzell and Gale 1987, p. 111). "*Quality* [italics in original] […] is […] *meeting the customer requirements* [italics in original]" (Oakland 2014, p. 4).

Source: Adapted from Reeves and Bednar (1994)

Illustrating the change of perception of what quality constitutes, Feigenbaum (1951) who initially defined quality as "best for certain customer conditions" (p. 10) revised his definition in 1961 and added that quality is

> "the composite of product characteristics of engineering and manufacture that determine the degree to which the product in use will meet the expectations of the customer" (Feigenbaum 1961, p. 13).

That is because he identified the relevance of the role that the customer plays when defining quality. In addition, Juran and de Feo (2010) as well as Oakland (2014) bring the role of reliability into play because reliability ensures that a product or service has the ability to continue fulfilling the customer needs. They expand that organisations, which successfully fulfil the needs of their customers over time, establish a reputation of excellence.

The term "quality" as such is either used in a qualitative or in a quantitative way (see Table 2.2). In a qualitative way, the term is usually used in a non-technical context, for instance, in the form of a personal perception or in advertising (e.g., "top quality car"). In that case, however, Dale *et al.* (2010) allude that

> "the word quality is used highly subjectively and in its strictest sense is being misused" (p. 6).

In a quantitative way, however, quality becomes measurable and comparable. Situations involve analyses, which examine the uniformity and conformance of product specifications or performance levels of services, for instance (Dale *et al.* 2010). In regard to quality in the sense of value, price-performance measures similarly enable a comparison, for instance, through benchmarks in the form of price comparisons based on identical product specifications.

Reflecting upon the complexity of quality (e.g., different interpretations of quality and approach to quality over time), it can be concluded that it is challenging to clearly define quality and thus to make the term graspable (ibid). Taking this into account, it is argued that multiple definitions of quality are still necessary to picture the depth of the concept appropriately (Reeves and Bednar 1994). Since the variety of interpretations leads to misunderstandings in some circumstances, Dale *et al.* (2010) propose that individuals are supposed to make sure that people surrounding them have the same or, at least, a similar understanding of the meaning of quality when communicating.

2.2.2 Evolution of quality management

In recent years, various systems developed to improve and to manage quality. Initiatives, namely, quality control (QC) and quality assurance (QA), substituted or complemented

inspection activities over time as businesses are moving towards a total quality management (TQM) approach these days – an organisation-wide process of CI.

The literature identifies five different phases of the evolution of QM, initially originating from inspection activities with the aim to detect and rectify errors and evolving to QM as an organisation-wide philosophy, termed as "TQM" (Bounds *et al.* 1994; Kaye and Anderson 1999; Dale *et al.* 2010), and Beyond TQM (Kaye and Dyason 1995). In Table 2.3, an overview of each of the phases is provided, explaining each single level in more detail.

Table 2.3 Five levels in the evolution of quality management

No.	Phase(s)	Description(s)	Purpose(s)	Measure(s)
1	Inspection	Error detection Rectification	Prevents "out-of-specification" products and services reaching the market	Checking work after the event Identifying sources of non-conformance Taking corrective action
2	Quality control	Statistics Process analysis Quality standards	Solves the root cause of quality problems	Self-inspection Quality planning and procedures Use of basic statistics Quality manual Use of process performance data
3	Quality assurance	Quality systems Quality costing Problem-solving Quality planning	Broadens the organisational responsibility	Develop quality systems Use of quality cost data Quality planning Use of statistical process control Involve non-operations functions
4	Total quality management	Quality is strategic	Makes quality central and strategic in the organisation	Teamwork Employee involvement Staff empowerment Process management Performance management Involves all operations and all suppliers and customers
5	Beyond total quality management	Constant change Flexibility Competition on all critical success factors	"Competitive" continuous improvement	Review of critical success factors Benchmarking Staff development Interorganisational partnerships Continuous customer focus

Source: Adapted from Kaye and Dyason (1995); Hill (2005); Dale *et al.* (2010)

2.2.2.1 Inspection

The first phase within the evolution of QM is the inspection. According to the BS EN ISO 9000 standard, an inspection is defined as a

> "conformity evaluation by observation and judgment accompanied as appropriate by measurement, testing or gauging" (BS EN ISO 9000 2000).

An inspection refers to a validation of finished work (e.g., a product check). In essence, inspections aim at the detection of errors through the identification of sources of non-compliance (Dale *et al.* 2010; Oakland 2014). In other words, an inspection evaluates to what extent a product or a service meets the quality requirements. The purpose of this is to avoid that products market, which do not meet these requirements. In case of error detection, corrective actions are usually undertaken (Dale *et al.* 2010).

2.2.2.2 Quality control

The second phase within the evolution of QM is QC. The BS EN ISO 9000 standard defines QC as a

> "a part of quality management focused on fulfilling quality requirements" (BS EN ISO 9000 2000).

In comparison to the inspection, QC constitutes a more analytical approach. QC makes use of statistics and process analyses to identify variations from the standard (Dale *et al.* 2010; Juran and de Feo 2010). Thus, QC aims at identifying the root cause of quality issues, yet it requires performance data for evaluation purposes (Dale *et al.* 2010). In essence, QC involves monitoring activities that aim at achieving and maintaining the desired quality of a product or service, as well as the identification and elimination of errors (Oakland 2014).

2.2.2.3 Quality assurance

Within the evolution of QM, the third phase is QA. According to the BS EN ISO 9000 standard, QA is defined as a

> "a part of quality management focused on providing confidence that quality requirements will be fulfilled" (BS EN ISO 9000 2000).

QA involves the development of integrated management systems and quality planning through planned and systematic activities (Oakland 2014). As compared to QC, QA extends the use of statistical control instruments and widens the organisational responsibility in terms of quality

by involving non-operational functions. Rather than detecting errors and problem-solving as in QC (i.e., finding and fixing), QA is more focused on the prevention of errors and defects as well as on the avoidance of problems (Dale *et al.* 2010). Moreover, QA deals with "assessment[s] of […] adequacy, the audit of the operation of the system and the review of the system itself" (Oakland 2014, p. 14). Thus, QA seeks to verify whether control is being maintained while the purpose of QC is to maintain control (Juran and de Feo 2010).

2.2.2.4 Total quality management

The first three phases considered quality as a problem to be solved. In the 1980s, however, organisations identified that they could gain a competitive edge by having a strategic focus on quality (Kaye and Anderson 1999). Accordingly, the fourth phase within the evolution of QM is TQM. TQM evolved to a strategic philosophy that puts quality in the focus of the organisation and involves organisation-wide efforts to turn quality to the top priority on all verticals of the business. TQM-orientated organisations are characterised by high levels of teamwork, employee involvement, and employee empowerment (Dale *et al.* 2010), which enables "that quality [is] fully integrated into business strategy […] and that it [is] adequately deployed" (Kaye and Anderson 1999, p. 486). TQM integrates stakeholders, such as customers and suppliers, into its strategy and requires the participation of every member at every level of the organisation to meet their needs. In essence, TQM is both a philosophy and a set of QM principles, which are also defined in the BS EN ISO 9000 standard (Kaye and Anderson 1999; Dale *et al.* 2010). Table 2.4 highlights each of the eight TQM principles.

Table 2.4 Principles of total quality management

No.	Principle(s)	Description(s)
1	Customer focus	Organisations depend on their customer and therefore should understand current and future customer needs, should meet customer requirements, and should strive to exceed customer expectations.
2	Leadership	Leaders establish unity of purpose and direction of the organisation. They should create and maintain the internal environment in which people can become fully involved in achieving the organisation's objectives.
3	Involvement of people	People at all levels are the essence of an organisation and their involvement enables their abilities to be used for the organisation's benefit.
4	Process approach	A desired result is achieved more efficiently when activities and related resources are managed as a process.
5	System approach to management	Identifying, understanding, and managing interrelated processes as a system contributes to the organisation's effectiveness and efficiency in achieving its objectives.

No.	Principle(s)	Description(s)
6	Continual improvement	Continual improvement of the organisation's overall performance should be a permanent objective of the organisation.
7	Factual approach to decision-making	Effective decisions are based on the analysis of data and information.
8	Mutually beneficial supplier relationships	An organisation and its suppliers are interdependent, and a mutually beneficial relationship enhances the ability of both to create value.

Source: BS EN ISO 9000 (2000)

2.2.2.5 Beyond total quality management

While Dale *et al.* (2010) merely discuss four levels in the evolution of TQM, Kaye and Dyason (1995) identify a fifth one, which they termed as "Beyond TQM". In essence, Kaye and Dyason 1995) criticise that TQM as strategic management approach does not fulfil the requirements to adequately comply with ever-changing challenges in the contemporary business environment, being shaped by uncertainty and unpredictability. Their main point of concern is the capability to be flexible enough to react to changes in customer demand or in the market. In this regard, the focus of Beyond TQM lies on what they call "competitive continuous improvement" (p. 34; i.e., the ability to develop and to maintain responsiveness and adaptiveness to changes in the market and customer demand).

2.3 Introduction to continuous improvement

Ultimately, TQM seeks to improve quality and performance in a rapidly changing business environment with the aim to meet and/or exceed customer needs. It is therefore an approach to achieving CI (Kaye and Anderson 1999). The following introduces the concept of CI. Initially, selected definitions are reviewed while a brief outline of its evolution and its historical development provides relevant background information afterwards. Moreover, the core principles of CI are introduced.

2.3.1 Definition of continuous improvement

Driven by the desire to meet contemporary dynamics and complexity, organisations had begun to compete on the ability to continuously improve their processes (Teece 2007; Hirzel *et al.* 2017). In the spirit of "doing more with less" (Fryer *et al.* 2007, p. 500), CI is usually associated with cost, quality, productivity, and efficiency matters, whereby it is not only concerned with process improvements but also with the optimisation of products and systems with the overarching aim to enhance customer value (Terziovski and Sohal 2000; Swartling and Olausson 2011; Hirzel *et al.* 2017; Galeazzo *et al.* 2021). In essence,

> "CI consist of highly frequent minor changes that, added up, may entail a revolution" (Costa *et al.* 2019, p. 1). It has aims at "stepwise adjustments and modifications of products and processes to positively influence waste reduction and customer satisfaction" (Galeazzo *et al.* 2021, p. 34).

By implication, the concept of CI is a pivotal element to achieve operational excellence and "stems from basic human curiosity and a desire to improve things" (Bessant *et al.* 1994, p. 17). Yet, the term itself is rather used as an '"umbrella' concept tying bits and pieces together to a comprehensible whole" (Berger 1997, p. 110). While its fundamental idea originates from the Japanese term "kaizen" ("kai" = "change" and "zen" = "for the better"; Singh and Singh 2012; Glover 2015), the definitions of CI still vary (Swartling and Olausson 2011). That being said, Table 2.5 illustrates a compilation of definitions on CI that are more recent or often cited in the vast literature in a chronological order and indicates that there is no consensus about what CI constitutes.

Table 2.5 Definitions of continuous improvement

Author(s)	Definition(s)
Deming (quoted in Anderson *et al.* 1994)	"the propensity of the organization to pursue incremental and innovative improvements of its processes, product, and services" (p. 480)
Deming (quoted in Juergensen 2000)	"improvement initiatives that increase successes and reduce failures" (p. 3)
Deming (1986) and Imai (1986) quoted in Wu and Chen (2006)	"a company-wide focus to improve process performance" (p. 698)
Bessant *et al.* (1994)	"a company-wide process of focused and continuous incremental innovation" (p. 18)
Locke and Jain (1995)	"any and all organisational efforts designed to inculcate a culture of continuous improvement and change, which fosters continual learning and innovation within the organization" (p. 54)
Jha *et al.* (1996)	"a collection of activities that constitute a process intended to achieve improvement" (p. 22)
Bessant and Caffyn (1997)	"'*...an organisation-wide process of focussed and sustained incremental innovation...* [italics in original]', recognising that most innovative activity is not of the 'breakthrough' variety, but incremental in nature, depending for its effect on sustained and focussed attack" (p. 4)
Boer *et al.* (2000)	"the planned, organized and systematic process of ongoing, incremental and company-wide change of existing practices aimed at improving company performance" (p. xxiii)
Gertsen (2001)	"an improvement process that is systematically applied, carried out in small steps, and to a large extent relies on employee participation" (p. 304)
Bhuiyan and Baghel (2005)	"a culture of sustained improvement targeting the elimination of waste in all systems and processes of an organization. It involves everyone working

Author(s)	Definition(s)
	together to make improvements without necessarily making huge capital investments." (p. 761)
Marin-Garcia *et al.* (2008)	"small incremental changes in productive processes or in working practices that permit an improvement in some indicator of performance" (p. 57)
Anand *et al.* (2009)	"a systematic effort to seek out and apply new ways of doing work i.e. actively and repeatedly making process improvements" (p. 444)
Swartling and Olausson (2011)	"an improvement process that is systematically applied, improves organisational performance is carried out in small steps and relies at least to some extent on employee participation" (p. 339)
Singh and Singh (2015)	"a culture of sustained improvement aimed at eliminating waste in all organizational systems and processes, and involving all organizational participants" (p. 76)
Li *et al.* (2016)	"the most effective way for manufacturing and service organisation[s] to improve performance, efficiency, quality and competitiveness" (p. 6283)
Hirzel *et al.* (2017)	"a bundle of principles, activities and tools within a company that aim to generate a planned and systematic improvement process of incremental and ongoing change" (p. 1563)
Galeazzo *et al.* (2021)	"a dynamic capability […] that is patterned after management methods such as PDCA (plan-do-check-act), six sigma, TQM (total quality management) and kaizen events" (p. 34)

Source: Author

For instance, there is ambiguity about the nature of CI. While some authors define CI as a process, others conceive it as a propensity, as organisational efforts, as a collection of activities or as a culture. Another peculiarity lies in definitions prior to 1998, as they associate CI with innovation, whereas post-2000 definitions increasingly consider the necessity for involving employees. Despite these differences, a few key characteristics can be extracted from the listed definitions based on several overlapping. First, CI is an organisation-wide change activity. Second, CI is a never-ending cycle rather than a goal or final destination. Third, CI requires the involvement of members of the organisation. Fourth, CI seeks ongoing incremental optimisation, involving endeavours to steadily challenge the status quo for the better.

Despite the reorientation from mass production towards the pursuit of satisfying customer needs around 1990 (Reis *et al.* 2003), many definitions still lack consideration of the customer, as CI ultimately seeks increasing the value-added; and "[b]ecause value-added is defined in relation to the final customer […], CI is necessarily customer oriented" (Jha *et al.* 1996, p. 24). Hence, CI does not simply constitute another initiative for cost reduction or efficiency increase,

but rather a philosophy that seeks to promote improvement on all verticals of the business to enhance the customer value (Jha *et al.* 1996; Terziovski and Sohal 2000).

Based on the aforementioned characteristics, this study operationalises the following definition and conceives CI as an organisation-wide change activity that involves each member of the organisation with the overall aim to constantly challenge the status quo for incremental optimisation purposes towards an increase of customer value.

2.3.2 Evolution of continuous improvement

The origin of modern improvement initiatives can be traced back to the 19th century. In this time, US and UK organisations had begun to encourage improvement-orientated behaviour through the introduction of recognition systems that rewarded positive change. While Scottish shipbuilders launched suggestions schemes in 1871, for instance (Schroeder and Robinson 1991), NCR Corporation introduced rewarding schemes, as well as personal-development opportunities and further improved their labour conditions towards the end of the 1800s (Bhuiyan and Baghel 2005).

Around 1900, scientific management methods attracted interest. Deming (1986) always stressed the relevance of collecting data (Zangwill and Kantor 1998), as "problems of improvement commence once you achieve statistical control" (Deming 1986 quoted in Bond 1999, p. 1320). In particular, they helped the manufacturing sector to identify issues in the production process and to come up with respective solutions. Moreover, scientific management methods organised and controlled the production process; time trials estimated production rates and led to standardised procedures (Bhuiyan and Baghel 2005). Statistical reasoning significantly underpinned CI and shaped the movement (Zangwill and Kantor 1998).

An ever-increasing demand for munition during World War II (WW2) led to high degrees of process optimisation within US factories because the US government decided to boost the productivity through the introduction of a nationwide "Training Within Industry" programme (Robinson 1991). This programme included a "Job Method Training" that raised the awareness of line managers regarding the relevance of scientific management methods (Bhuiyan and Baghel 2005).

Introduced by US occupation forces after WW2, these programmes reached Japan in the late 1940s with the aim of rebuilding the Japanese industry without huge investments to avoid starvation and turmoil in the Japanese society (Schroeder and Robinson 1991; Jha *et al.* 1996; Bhuiyan and Baghel 2005; Seth and Gupta 2005). From that point on, the Japanese elaborated on the US programmes and developed their own modified CI programmes. These days, the

Japanese CI philosophy is mostly known under the term "kaizen" (Imai 1986). Kaizen became very popular in Japan because it involved a low-investment method that increased the quality and productivity. In 1973, the oil shock sped up the kaizen movement (Jha *et al.* 1996).

A few decades after WW2, the industrial dominance of the US led to business complacency, which resulted in a decline of CI programmes within the US industry in turn. In the early 1980s, though, CI programmes made it back to the US (Main 1994), as Japanese foreign direct investments in the US urged local firms to remain competitive (Jha *et al.* 1996). The business environment had become increasingly competitive due to a globalising world (Terziovski and Sohal 2000; Singh and Singh 2012, 2015), which urged organisations to strive for ongoing optimisation in order to ensure long-term business profitability, and new technologies aggravated the situation for organisations (Terziovski and Sohal 2000; Marin-Garcia *et al.* 2008). Considering this, CI is pivotal for meeting today's challenges (Bessant and Caffyn 1997). In particular, contested markets are "pools of sharks" (referred to as the "red ocean" in the strategic management literature; Kim and Mauborgne 2005) and often require a strategic orientation towards cost leadership or differentiation in order to sustain a competitive advantage (Porter 1985; Terziovski and Sohal 2000). With that said, CI is particularly conducive to strategies pursuing to compete on cost and/or quality; on the one hand, CI seeks an efficient allocation of resources to reduce cost, and, on the other hand, it seeks an increase in quality and efficiency (Jha *et al.* 1996; Li *et al.* 2016). Imai (1986) reported, for instance, that CI can boost the productivity by more than 100% without any huge investments while others reported about similar positive outcomes due to CI likewise (e.g., Doig *et al.* 2001; Liker 2004).

In the 1980s, a focus on quality was mainly perceived as an instrument to gain competitive advantage (e.g., Porter 1985). A decade later, however, organisations increasingly focused on the customer and moved away from mass production (Reis *et al.* 2003). Due to an ever-changing customer demand and the necessity to adapt to their needs within a short time, quality became more central to businesses and was therefore increasingly integrated into the corporate strategy (Kaye and Anderson 1999). Similarly, Jha *et al.* (1996) describe the exponential increase of academic interest in CI. In their literature review, they identified that only three articles on CI were published in 1982/83, while, in 1989/90, there were 143 articles and already 306 in 1993. Regarding the time delay, there seems to be some evidence that the industrial interest in CI led to a strong academic focus over time. Especially in the modern era, customers gained the upper hand in the buyer-seller relationship because of their facilitated access to information (e.g., internet; Reis *et al.* 2003).

In summary, many of the modern Japanese management initiatives that we know about nowadays have technically their origin in the US. Schroeder and Robinson (1991) underline this in their article "*America's most successful export to Japan: continuous improvement programs*". However, although isolated CI elements can be traced back to western manufacturing, it must be noted that the most renowned and most successful CI programmes with relevance for today still have their roots in Japan (Singh and Singh 2015). While experts, such as Deming or Juran, involve key contributors who exported CI programmes to Japan (Robinson 1991), Imai (1986) is one of the key pioneers who significantly coined the Japanese kaizen philosophy.

2.3.3 Principles of continuous improvement

It speaks for itself that good performance results from good processes; superior performance, however, results from CI initiated by human labour (Berger 1997; de Leede and Looise 1999; Singh and Singh 2015; Hirzel *et al.* 2017; Costa *et al.* 2019).

> "Kaizen is process-oriented, i.e. before results can be improved; processes must be improved, as opposed to result-orientation where outcomes are all that counts" (Imai 1986, pp. 16-17).

According to the idea of CI, optimisation is always possible, even if it seems that no issues are present for the moment (Swartling and Olausson 2011). Following this, Imai (1986) and Liker (2004) reported that even despite substantial CI experience, improvements can be further exploited, which stresses the enduring and never-ending nature of CI again.

2.3.3.1 Plan-do-study-act cycle

With reference to this, CI has its roots in the scientific method (Anand *et al.* 2009) and is fundamentally based on Shewhart's (1939) "Shewhart cycle" from 1939. Over time, the Shewhart cycle evolved to what is nowadays better known as Deming's (1993) "plan-do-study-act (PDSA) cycle". Without going all too much into details, the following introduces the development of the PDSA cycle.

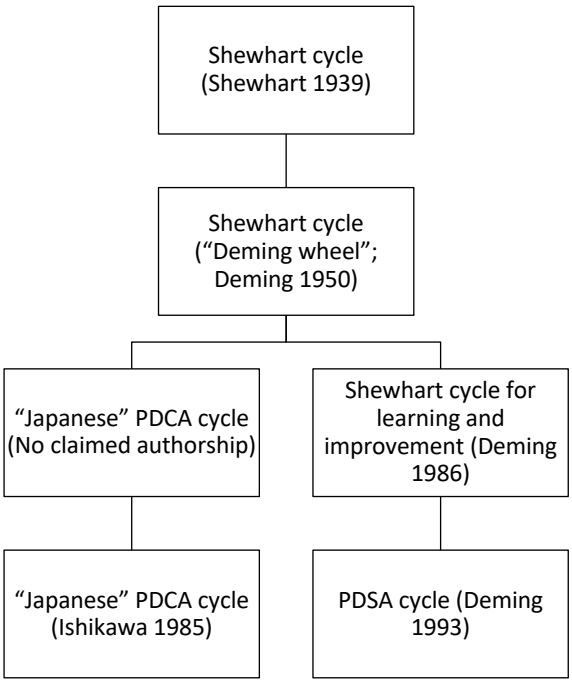
Initially, the Shewhart cycle aimed at getting a better understanding of viewing production as a system through three steps, namely, (1) specifying, (2) producing, and (3) inspecting. Referring to this, Shewhart (1939) noted that

> "[i]t may be helpful to think of the three steps in the mass production process as steps in the scientific method. In this sense, specification, production, and inspection correspond respectively to making a

hypothesis, carrying out an experiment, and testing the hypothesis. The three steps constitute a dynamic scientific process of acquiring knowledge" (p. 45).

In 1950, Deming (1950), Shewhart's PhD student, modified the Shewhart cycle. His four-step cycle, also known as the "Deming wheel", involved (1) design, (2) produce, (3) sell, and (4) redesign based on market research. Over time, this modification of Shewhart's work evolved in two different directions simultaneously (Figure 2.2).

Figure 2.2 Evolution of Deming's plan-do-study-act cycle



Source: Adapted from Moen and Norman (2010)

The first path roots in Japan. During a seminar, Deming introduced his modification to Japanese practitioners who, in turn, developed the "Japanese plan-do-check-act (PDCA) cycle" from that (Moen and Norman 2010). While the Japanese abstracted Deming's (1950) work to magnify its applicability, there is nobody claiming authorship of this cycle (Imai 1986). Table 2.6 illustrates the parallels between the Deming wheel and the Japanese PDCA cycle and indicates how the four phases were modified.

Table 2.6 Parallels between the Deming wheel and the Japanese PDCA cycle

No.	Phase(s)		Parallel(s)
	Deming wheel	*Japanese PDCA cycle*	
1	Design	Plan	Designing the product refers to the planning phase when managing

No.	Phase(s)		Parallel(s)
	Deming wheel	*Japanese PDCA cycle*	
2	Produce	Do	Producing the product refers to doing in the form of operationalising the plan
3	Sell	Check	Sales data are an instrument to check if the product is accepted by the market
4	Redesign	Act	Redesigning refers to reacting upon market changes and restarts the cycle

Source: Adapted from Imai (1986)

In 1985, Ishikawa (1985) enhanced the Japanese PDCA cycle, mainly through the extension of two components. On the one hand, he added methods that are conducive to reaching objectives in the planning phase and, on the other hand, he added training and development to the third phase.

In contrast, the second pathway evolved 36 years after Deming's modification of the Shewhart cycle. In 1986, Deming (1986) introduced another updated version of the Shewhart cycle from 1950 and named it the "Shewhart cycle for learning and improvement". For simplification purposes, Deming (1993) revised the cycle in 1993 again, which is nowadays better known as the "PDSA cycle" (Moen and Norman 2010). Table 2.7 introduces each step of the PDSA cycle more in detail.

Table 2.7 PDSA cycle

No.	Phase(s)	Action(s)
1	Plan	Identify a problem or an opportunity, and hypothesise change that improves the situation
2	Do	Pilot the hypothesised change and measure the outcome
3	Study	Monitor the impact of change and review whether the desired outcome is achieved
4	Act	If the desired outcome is achieved, implement, and standardise the activity, otherwise go back to the first phase and repeat the cycle from the beginning

Source: Adapted from Deming (1993)

Deming always insisted that the PDSA cycle is based on his work from 1950 and not on the Japanese PDCA cycle. In letters to Moen during the 1990s, Deming gave feedback on Moen and his colleagues' manuscript in which they made use of the PDCA cycle. Deming (quoted in Moen and Norman 2010) responded the following.

> "Be sure to call it PDSA, not the corruption PDCA" (p. 27), and added, "I don't know the source of the cycle that you propose. How the PDCA ever came into existence I know not" (p. 27).

Mistakenly, there is a widespread misconception that Deming developed the PDCA cycle (Imai 1986), as authors, such as Jha *et al.* (1996) and Singh and Singh (2015) refer to the Deming cycle when discussing the PDCA cycle, purporting that Deming is associated with the Japanese

modification of his work. In contrast, others rightfully refer to the PDSA cycle when discussing the Deming cycle (e.g., Marin-Garcia *et al.* 2008).

Ultimately, the difference between both cycles lies in the nature of the third phase. While "check" implies a comparison between the current state and expected results, "study" puts an emphasis on the learning effect. Thus, lessons learnt by "checking" are what Deming (1986, 1993) particularly accentuates. To avoid confusion and to be in line with Deming's point of view, this study will operationalise Deming's (1993) PDSA cycle.

2.3.3.2 Improving cycle and standardising cycle

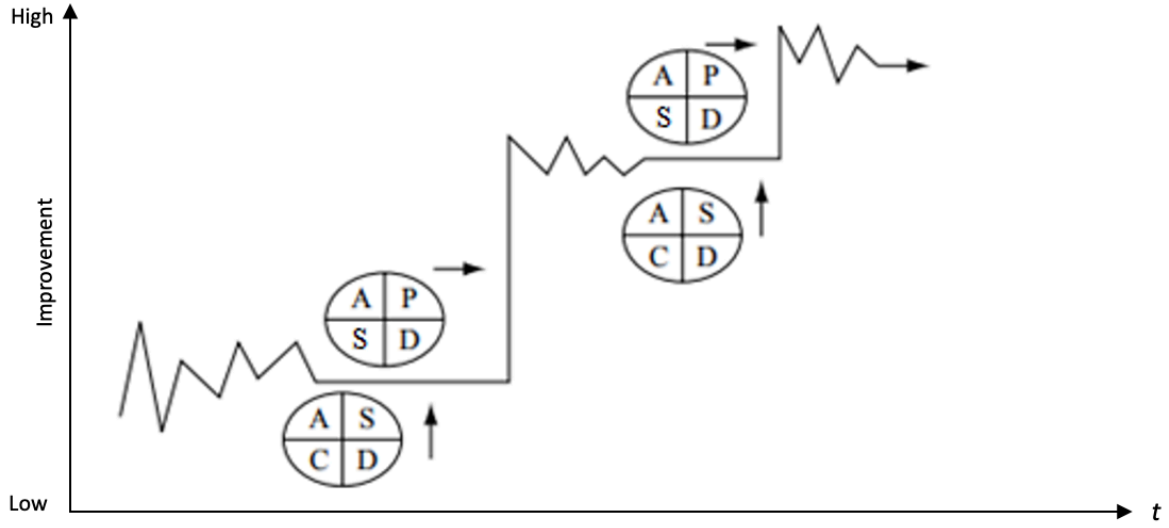
The PDSA cycle is also termed as the "improving cycle" (Jha *et al.* 1996; Singh and Singh 2015). Jha *et al.* (1996) note that control and stability are crucial to CI, and since change is often associated with unforeseeable side effects, the "standardising cycle", namely, the "standardise-do-check-act cycle", complements the PDSA cycle and irons out abnormalities that occur after implementing change before proceeding to a new PDSA cycle (Singh and Singh 2015).

> "Lasting improvements can only be achieved if innovations are combined with an ongoing effort to maintain and improve standard performance levels" (Imai 1986, pp. 6-7).

As soon as standard work is defined, performance can be measured and improved. Therefore, the PDSA cycle considers standardised routine work as the basis for improvement, while a modification of the current standard constitutes change for the better (Berger 1997; Chen *et al.* 2000; Terziovski and Sohal 2000). In simple terms, "the standardizing cycle maintains current work processes, while the improving cycle improves them" (Singh and Singh 2015, p. 87). Imai (1986) makes it obvious that "[t]here can be no improvement where there are no standards" (p. 74).

Visualising the relationship between the improving cycle and the standardising cycle, Figure 2.3 further illustrates why organisations cannot achieve CI when they rely on their status quo. These gradual improvements based on ever-changing standards demonstrate the incremental nature of CI (Bessant and Caffyn 1997) with the aim of constantly "reach new 'benchmarks'" (Terziovski and Sohal 2000, p. 540). Reflecting upon incremental change in the sense of the PDSA cycle, CI is associated with learning by nature (Delbridge and Barton 2002), significantly driven through statistical reasoning (Zangwill and Kantor 1998) because lessons learnt are fed into future changes (Choi 1995).

Figure 2.3 Improving cycle, standardising cycle, and interaction of both cycles



Source: Adapted from Imai (1997)

Improvements emerge from the recognition of undesired variation within the processes (Imai 1986) and as both cycles have their roots in the scientific management methods, Choi (1995) stresses that only if data are collected and analysed afterwards, then corrective measures can be derived from statistical reasoning and finally enable CI. Following the idea of statistical reasoning, it is thus necessary to put suitable metrics and systems in place that help to monitor and to control the processes in order to identify undesired variation that deviates from the standard (Berger 1997; Bond 1999; Singh and Singh 2015). If there is no control over the process, even a good performance is insufficient because the variables that cause perceived success are not obvious; and, ultimately, there needs to be clarity about what is stable and what is unstable (Singh and Singh 2015).

Imai (1986) suggests that there are three different types of CI, namely, (1) management-, (2) group-, and (3) individual-orientated CI. Since the management-orientated CI relates to aspects of corporate strategy and concerns organisational alignment in terms of systems, controlling and decision-making (Berger 1997), it is perceived as the most important type (Singh and Singh 2012). Therefore, CI requires management commitment and the willingness to set it as a top priority in the organisation (Imai 1986; Terziovski and Sohal 2000). In contrast, group-orientated CI involves problem-solving groups on a day-to-day basis to overcome everyday issues without management involvement. Singh and Singh (2015) note that team approaches are the most common one when adopting CI, while Marin-Garcia *et al.* (2008) point out that the best CI outcomes are usually achieved through teamwork. Last, individual-orientated CI is considered as the bottom-up approach in which individuals come up with

recommendations for problem-solving individually (Singh and Singh 2012). Although Marin-Garcia *et al.* (2008) state that group outcomes are usually better than individual ones, they still note that individual-orientated CI (e.g., via suggestion systems) has the potential to be as successful as group-orientated CI as long as it is well managed.

In view of the latter, the third and last principle involves the role of people within the CI process (Imai 1986; Berger 1997).

> "Kaizen is people-oriented and should involve everyone in the organization from top management to workers at the shop floor" (Berger 1997, p. 112). In addition, "[k]aizen is based on a belief in people's inherent desire for quality and worth, and management has to believe that it is going to 'pay' in the long run" (Imai 1986, p. 40).

Thus, a well-functioning CI strategy is heavily reliant upon employee participation (Terziovski and Sohal 2000); and, in particular, in view of group- and individual-orientated CI, it becomes clear that individuals need to be provided with the required skillsets and be given the opportunities to contribute to the CI process. Finally, management must acknowledge desired behaviours while recognising and rewarding them, accordingly (Berger 1997).

2.3.4 Continuous improvement maturity models

Achieving best-practice work routines in an organisation takes effort and time, considering the change that is involved. In order to visualise the progress over time, various scholars developed CI maturity models that indicate the extent to which organisations have implemented and committed themselves to CI (e.g., Bessant and Caffyn 1997; Bessant *et al.* 2001; de Jager *et al.* 2004; Dabhilkar *et al.* 2007).

Accordingly, Table 2.8 reviews and consolidates three different CI maturity models and compares them with Dale *et al.*'s (2010; originally in Lascelles and Dale 1991) levels of TQM adoption to illustrate the parallels between CI and TQM. Although Lascelles and Dale (1991) note that their maturity model does not necessarily reflect six distinct stages that organisations undergo, they still argue that their labels refer to typical characteristics and behaviours that are visible throughout an organisation's TQM journey.

Table 2.8 Continuous improvement and total quality management maturity models

No.	Reference(s)				Description(s)
	Continuous improvement			*TQM*	
	1	*2*	*3*	*4*	
1				Uncommitted	There is no long-term plan for an implementation of continuous improvement and organisations are not convinced by the benefits that continuous improvement is associated with
2				Drifters	Drifting organisations develop an understanding of the key concepts and are characterised by not having a clearly defined baseline as they relaunch approaches in response to contemporary trends
3	Walking the talk	Understanding improvement	Understanding improvement behaviour	Drifters	Employees from all levels demonstrate a shared belief in the value of incremental employee contribution and, when something goes wrong, their natural reaction is to look for reasons why rather than to blame individuals
4	Getting the improvement habit	Getting the improvement habit	Consistency in improvement	Tool-pushers	Employees initiate and carry through improvement activities using measurement, tools, and techniques
5	Focusing improvement	Focusing improvement	Strategy deployment behaviour	Improvers	Employees use the organisation's strategic goals and objectives to assess and prioritise improvements, and they can monitor the impact of improvements on these goals and objectives
6	Leading the way	Leading the way	Improvement leadership	Improvers	Managers recognise employees' contributions to improvement and support employee experiments
7		Aligning improvement		Improvers	The improvement system is designed and continuously amended to fit within the current organisational structure and infrastructure
8	Spreading the word	Shared problem-solving	Cross-functional improvement	Improvers	Employees demonstrate a holistic and customer-centric view in improvement by cooperating with various hierarchical levels and across internal departments, as well as with outside agencies (e.g., customers, suppliers)
9		Improvement of improvement		Improvers	The improvement system is continuously monitored and reviewed in relation to the organisation as a whole, leading to its amendment or regeneration
10	Building the learning organisation	The learning organisation	Idea management/ participation in improvement	Award-winners	Employees at all levels articulate, consolidate, and share their learning (e.g., using a formal knowledge management system)
11				World class	The organisation demonstrates a clear maturity and continuous improvement is holistically integrated into the business strategy

Source: Adapted from Knol *et al.* (2018a)
Note(s): (1) Bessant and Caffyn (1997); (2) Bessant *et al.* (2001); Dabhilkar *et al.* (2007); (3) de Jager *et al.* (2004); (4) Dale *et al.* (2010)

As illustrated in Table 2.8, scholars identified different maturity levels during the implementation of CI; and although the maturity models differ within the literature, there seems to be a consensus on what constitutes a best-practice organisation. Like Dale *et al.*'s (2010) levels of TQM adoption, the maturity models emphasise the necessity of the soft side that relates to people and their behaviour. In particular, the last stages highlight the importance of right behaviours because they determine whether or not CI (or TQM, respectively) will be sustained in the future. Yet, behaviours do not only include employee behaviour towards CI, but they also include management behaviours, that is, recognising and supporting employees, for instance (Knol *et al.* 2018a). In addition, Table 2.8 underlines the necessity of a holistic integration into the business strategy that drives continuous change for the better.

In summary, CI and TQM go hand in hand in the sense that the soft side relating to people in an organisation cannot be neglected when striving for operational excellence. This, in fact, aligns with Costa *et al.* (2019) who pronounce the importance of people to achieve sustainable CI. The importance of the soft side for CI (and TQM respectively) becomes more evident when reviewing the academic literature on common implementation barriers (Table. 2.9).

Table 2.9 Continuous improvement barriers

No.	Barrier(s) to implementing continuous improvement	Reference(s)							*f*
		1	*2*	*3*	*4*	*5*	*6*	*7*	
1	Paying inadequate attention to customers		•		•		•	•	4
2	Inability to change organisational culture		•	•		•			3
3	Lack of a formalised strategic plan for change				•		•	•	3
4	Lack of leadership			•	•		•		3
5	Lack of management commitment	•	•					•	3
6	Lack of proper training	•	•			•			3
7	Lack of resources provided	•	•					•	3
8	Drive for short-term financial results		•		•				2
9	Human resource management					•	•		2
10	Lack of resources						•	•	2
11	Use of an off-the-shelf programme	•	•						2
12	Attitude towards quality					•			1
13	Employee's resistance to change							•	1
14	Equipment					•			1
15	Failure to change organisational philosophy	•							1
16	Inability to build a learning organisation that provides for continuous improvement		•						1
17	Inadequate knowledge or understanding of CI		•						1
18	Inadequate use of empowerment and teamwork		•						1
19	Inappropriate reward system		•						1
20	Incompatible organisational structure and isolated individuals and departments		•						1
21	Ineffective measurement techniques		•						1
22	Information					•			1
23	Infrastructure barrier			•					1
24	Interdepartmental relations					•			1

No.	Barrier(s) to implementing continuous improvement	Reference(s)							*f*
		1	*2*	*3*	*4*	*5*	*6*	*7*	
25	Lack of a company-wide definition of continuous improvement				•				1
26	Lack of benchmarking							•	1
27	Lack of effective measurement of quality improvement	•							1
28	Lack of employee trust in senior management				•				1
29	Lack of real employee empowerment				•				1
30	Lack of strong motivation				•				1
31	Lack of time to devote to improvement initiative				•				1
32	Lack of total involvement							•	1
33	Machines					•			1
34	Materials					•			1
35	Method					•			1
36	Organisational barrier			•					1
37	Politics and turf issues				•				1
38	Poor interorganisational communication				•				1
39	Resistance of the workforce	•							1
40	Teamwork complacency	•							1
41	View of quality programme as a quick fix				•				1

Source: Adapted from Bhat and Rajashekhar (2009)

Note(s): (1) Rahim and Whalen (1994); (2) Masters (1996); (3) Ngai and Cheng (1997); (4) Salegna and Fazel (2000); (5) Amar and Zain (2002); (6) Sebastianelli and Tamimi (2003); (7) Bhat and Rajashekhar (2009)

In view of Table 2.9, it becomes evident that aspects related to paying inadequate attention to customers ($f = 4$), a lack of management commitment ($f = 3$), a lack of proper training ($f = 3$), a lack of resources provided ($f = 3$), an inability to change organisational culture ($f = 3$), a lack of a formalised strategic plan for change ($f = 3$) and a lack of leadership ($f = 3$) constitute often-discussed barriers to implement CI. In fact, these key barriers relate to people to a considerably large extent.

2.4 Introduction to lean

The academic literature tends to address CI as a wider concept (Jha *et al.* 1996); and, following this, the term CI has become very popular and is often associated with different improvement approaches (Caffyn 1999; Marin-Garcia *et al.* 2008), which make use of at least a few of the elements of CI (Jha *et al.* 1996). Accordingly, various CI methodologies emerged from the basic CI philosophy over time, building upon the basic idea of quality and/or process improvement with the aim of rationalising operations (Bhuiyan and Baghel 2005). In their literature review, Bhuiyan and Baghel (2005) remarked that lean manufacturing, six sigma, the balanced scorecard, and lean six sigma (LSS; as a hybrid approach) are the most known CI methodologies. Other ones, for instance, involve business process reengineering, theory of constraints, quick response manufacturing, and total productive maintenance. Unlike others, (e.g., Bhasin and Burcher 2006; Bhasin 2008), however, Bhuiyan and Baghel (2005) do not

distinguish between CI methodologies at the strategic level (i.e., as a philosophy, e.g., lean manufacturing) and CI methodologies at the operational or technical level (i.e., as a toolbox, e.g., balanced scorecard), which leads to confusion.

In the following, the concept of lean is presented in more detail. Like the previous section, selected definitions are reviewed. Subsequently, a brief outline of its evolution and its historical development is presented, which provides some relevant background information. In addition, the core principles of lean are introduced. Finally, more clarity is brought regarding the distinction between the strategic and the operational nature of lean. As the focus is on lean in this research, other CI methodologies are not elaborated on in depth.

2.4.1 Definition of lean

The term "lean" was initially coined by Krafcik (1988); and although it is one of the most known and widespread CI concepts, a general definition is non-existent (Hines *et al.* 2004; Papadopoulou and Özbayrak 2005; Holweg 2007; Shah and Ward 2007; Pettersen 2009; Arlbjørn and Freytag 2013; Bhamu and Sangwan 2014; Samuel *et al.* 2015; Bouranta *et al.* 2021). Regarding the metaphor of the blind men touching an elephant but perceiving various animals, Samuel *et al.* (2015) argue that a lack of a generally accepted definition is because of an under-exploration of the concept. It comes therefore as no surprise that there are also discussions about whether or not lean constitutes a theory (Åhlström *et al.* 2021).

In their literature review, Bhamu and Sangwan (2014) examined 33 definitions of lean and conclude that there is no consensus what lean actually constitutes because scholars seem to have different perceptions about the characteristics that lean comprises. Similarly, Pettersen (2009) concludes that there is no consensus on defining lean within the academic literature, as their key reason lies in the continuous development of the concept (see Table 2.11). More precisely, lean has continuously evolved from its traditional understanding associated with insights gained from the TPS in the late 1980s (Browning and de Treville 2021; Netland in Cusumano *et al.* 2021) towards a broader and more holistic understanding of "good management" as known from the concept of excellence ("enterprise excellence"; Hines and Butterworth 2019; Hines in Åhlström *et al.* 2021; Hines *et al.* 2021; "general operational excellence"; Browning and de Treville 2021). Some confusion remains, though, at what point lean has become indistinguishable and outgrowing its name (Browning and de Treville 2021).

In line with that, Hopp and Spearman (2021) argue that "Lean as a title may have an expiration date" (p. 624). It is steadily developing and a definition of it would merely result in having a "snapshot" (Muffatto 1999; Hines *et al.* 2004; Pettersen 2009). Therefore, Pettersen

(2009) refers to having "a 'still image' of a moving target, only being valid in a certain point of time" (p. 295) when attempting to define lean. Consistent with that, Samuel *et al.* (2015) reviewed several definitions between 1987 and 2012 as part of a literature review and conclude as follows.

> "'Lean' can be described as polymorphic; meaning different things to different people, at different moments in time" (p. 1388).

Against this background, Hopp and Spearman (2021) have recently concluded that lean can be seen through four different lenses ([1] a process, [2] a flow, [3] a network, and [4] an organisation lens). A very abstract view offers Netland (in Cusumano *et al.* 2021) who suggests seeing lean as a business phenomenon, which can be manifested in various ways (e.g., culture and behaviours, strategy, practices, etc). That is because it entails evolutionary and context-dependent characteristics.

In Table 2.10, often-cited definitions of lean are illustrated in a chronological order to visualise how different perceptions evolved over time. Although a certain diversity of definitions is illustrated, the author does not claim that Table 2.10 is comprehensive (see Samuel [2011] for a comprehensive review).

Table 2.10 Definitions of lean

Author(s)	Definition(s)	Focus	
		Efficiency	*Effectiveness*
Womack *et al.* (1990)	"Lean production is lean because it uses less of everything compared with mass production – half the human effort in the factory, half the manufacturing space, half the investment in tools, half the engineering hours to develop a new product in half the time. Also, it requires keeping far less than half the needed inventory on site, results in fewer defects, and produces a greater and ever growing variety of products" (p. 13).	•	○
Liker (1996)	"a philosophy that when implemented reduces the time from customer order to delivery by eliminating sources of waste in the production flow" (p. 481)	•	
Shah and Ward (2003)	"Lean production is a multi-dimensional approach that encompasses a wide variety of management practices, including just-in-time, quality systems, work teams, cellular manufacturing, supplier management, etc. in an integrated system. The core thrust of lean production is that these practices can work synergistically to create a streamlined, high quality system that produces finished products at the pace of customer demand with little or no waste" (p. 129).	•	○
Seth and Gupta (2005)	"Lean production (also known as 'lean manufacturing' or just 'lean') refers to a manufacturing paradigm based on the fundamental goal of continuously minimizing waste to maximize flow" (p. 45).	•	
de Treville and Antonakis (2006)	"Lean production is an integrated manufacturing system that is intended to maximize the capacity utilization and minimize the buffer inventories of a given operation through minimizing system variability (related to arrival rates, processing times, and process conformance to specifications)" (p. 102).	•	
Shah and Ward (2007)	"Lean production is an integrated socio-technical system whose main objective is to eliminate waste by concurrently reducing or minimizing supplier, customer, and internal variability" (p. 791).	•	○
Holden *et al.* (2015)	"Lean is a set of philosophies, principles, and methods for (re)designing organizations to maximize value and minimize waste, thus improving performance" (p. 181)	•	○
Bicheno and Holweg (2016)	"Lean is 'doing more with less'. This is of course directly in line with the definition of productivity (outputs/inputs). But this should be interpreted more widely as doing good for customers and stakeholders with less resources – materials, energy, pollution – to achieve ultimate sustainability" (p. 1).	•	•
Holweg and Maylor (2018)	"[L]ean is a philosophy that is derived from a repetitive manufacturing context that seeks to eradicate undesired waste and variation from the process" (p. 1373)-	•	
Hines *et al.* (2020)	"a lifelong journey to create a culture of improvement based on a rigorous use of four core systems that ensures improvements are aligned, behaviours are exemplified, improvement is both planned and organic, systems are checked, and people are continually coached and developed" (p. 402)		
Hopp and Spearman (2021)	"*Lean is the pursuit of waste elimination* [italics in original] […] *Lean seeks to minimize the cost of excess inventory, capacity or time* [italics in original] […] *Lean is a systematic process for reducing the cost of waste* [italics in original] […] *Lean is an organizational culture that encourages continual reduction of the cost of waste* [italics in original]" (p. 612).	•	
Netland (in Cusumano *et al.* 2021)	"Lean, defined as a phenomenon, manifests itself in distinct 'Lean' cultures, strategies, rules, technologies, work practices, and behaviors that can be observed in companies. Because companies evolve, so does Lean" (p. 10).		

Source: Author
Note(s): (•) Included; (○) briefly included

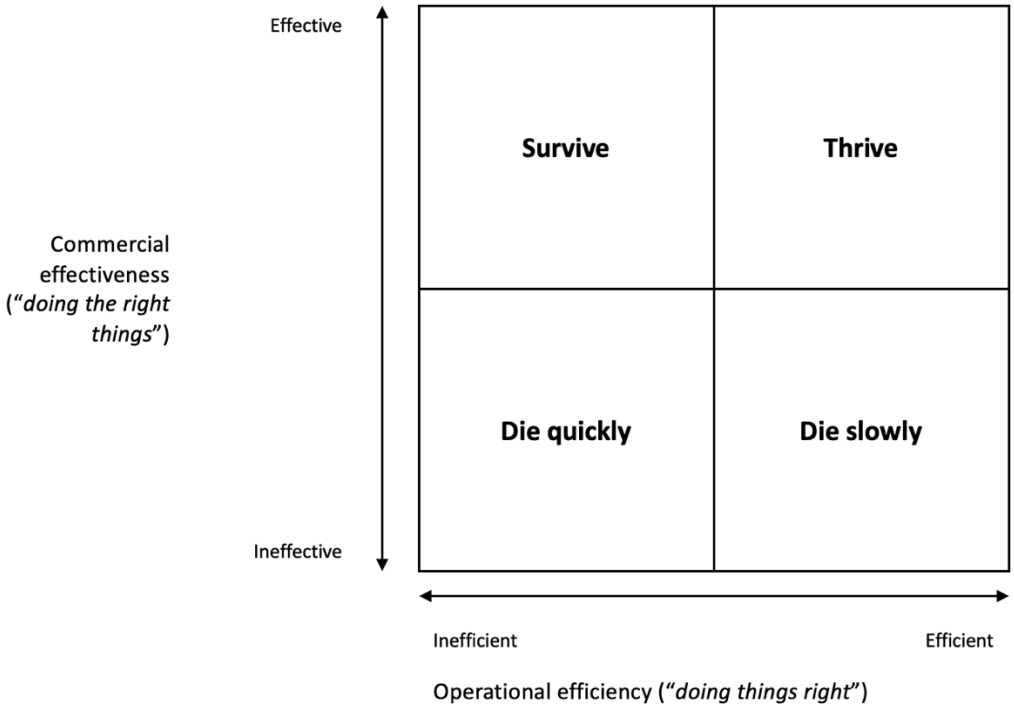
When defining lean, Wickramasinghe and Wickramasinghe (2017) refer to the coverage of effectiveness and efficiency. Effectiveness concerns the relationship between output and organisational objectives (Wickramasinghe and Wickramasinghe 2017) or "a focus on achieving the opportunity" (Ward *et al.* in Cusumano *et al.* 2021, p. 6) whereas efficiency refers to the relationship between input and output (Wickramasinghe and Wickramasinghe 2017) whereby aims are achieved with fewer resources (Ward *et al.* in Cusumano *et al.* 2021). Lean, however, pursues effectiveness first by focusing on customer value and addresses efficiency afterwards by reducing or eliminating waste. That is because efficiency is pointless without being effective in the first place (Netland and Ward *et al.* in Cusumano *et al.* 2021).

Although Table 2.10 is not a comprehensive review, it still evidences that many often-cited definitions lack such consideration. Instead, they merely perceive lean from an efficiency perspective while often neglecting the aspect of effectiveness, which refers to a key pillar of lean, that is, value creation under consideration of customer focus and satisfaction. As Porter and Stern (1999) point out,

> "[T]he transformation of knowledge into new products, processes, and services – involves more than just science and technology. It involves discerning and meeting the needs of the customers" (p. 12).

Likewise, Hines *et al.* (2008) accentuate the relevance of efficiency and effectiveness (Figure 2.4).

Figure 2.4 Efficiency-effectiveness matrix



Source: Hines *et al.* (2008)

While being commercially effective and operationally efficient is associated with long-term success, being both inefficient as well as ineffective comes close to self-destruction. Regarding their matrix, it becomes obvious that commercial effectiveness plays a more superior role than operational efficiency. With that said, organisations might be good in what they do, but once the market does not accept their products or services (anymore), the business will not sustain in the long-term. For instance, the BlackBerry case revealed that organisations must keep up with the times. More precisely, BlackBerry missed the change to touchscreen technology in the mobile market. Despite of having superior features in the market, such as battery life and call quality, BlackBerry insisted on their physical keyboards and neglected the accompanied change of customer demand (Gans 2016), which ultimately led to financial issues and a loss of market leadership. In summary, commercial effectiveness constitutes the capability to fulfil customer needs, yet considering that there are more efficient ways to do so.

Interestingly, however, Hines *et al.* (2020) attempted to redefine their understanding of lean twelve years later. In their new definition, the authors neither cover efficiency nor effectiveness aspects but put their focus on the life-long development of an improvement culture instead. In doing so, Hines *et al.* (2020) shift away from lean's technical nature towards lean as being an underlying mindset that ultimately encourages improvement behaviour.

In this study, a simplified version is operationalised. Hereinafter, lean is defined as an infinite journey towards perfection based on the underlying idea to maximise customer value and minimise waste by developing an improvement culture. At the same time, it is assumed that lean can take different shapes and may therefore look differently across departments, organisations, and industries. As lean evolved over time indeed, its evolution is introduced in the following.

2.4.2 Evolution of lean

As to the evolution of lean, its history traces back to the early 20th century when Henry Ford systemised mass car manufacturing. In doing so, he rationalised manufacturing processes through the ongoing identification and elimination of waste (so-called "non-value-adding [NVA] activities"). Associated with the CI movement, the Japanese adopted Ford's system after WW2, and further refined the Fordist approach to comply with the Japanese market conditions, such as lower car volumes and more flexibility to be able to quickly respond to a change in customer demand (Bhuiyan and Baghel 2005; Seth and Gupta 2005). More importantly, however, the Japanese sought ways how to improve the production with avoiding huge investments because the economy was not doing well after WW2 (Bhamu and Sangwan 2014).

In 1973, the oil crisis dramatised the economic situation and did not only affect the society but also the competitive landscape. Accordingly, there was a challenge to address the customer needs while also meeting the economic conditions back then (Ohno 1988).

In retrospect, lean originated at Toyota in Japan (Hines *et al.* 2004; Holweg 2007). Seeking to maintain a continuous production flow, the Toyota engineers Taiichi Ohno ("Ōno" in Japanese) and Shigeo Shingo ("Shingō" in Japanese) developed the TPS, which has become today's basis for many production systems worldwide (Womack *et al.* 1990; Seth and Gupta 2005; Bhamu and Sangwan 2014). Based on a just-in-time (JIT) production system and a focus on employees through active employee involvement, TPS enabled to produce with lower inventory, less human labour, a lower number of defects, and further allowed to come up with more variety for the customer. Moreover, the system increased the competitiveness through a reduction of cost and an increase in quality and efficiency, resulting in more customer value (Bhamu and Sangwan 2014). At the expense of variety, mass production could still offer products to consumers at a lower price point. In comparison to workers in this standardised environment, however, Toyota's employees were more encouraged and showed a higher morale at the workplace due to more flexibility and task variation. In fact, a multi-skilled workforce enabled to manage the variety of products in terms of quality, development, and cost optimisation, which strengthened Toyota's competitive edge in turn (Womack *et al.* 1990).

In the 1980s, several researchers had started to explore the TPS to identify the causes for Toyota's competitive advantage as part of the MIT IMVP study. Initially being coined by IMVP researcher Krafcik (1988) in 1988, the term "lean" was disseminated by Womack *et al.*'s (1990) book "*The Machine that Changed the World*" two years later. In this decade, it was, in fact, the most cited book within the OM domain (Holweg 2007). In their best-selling book, the authors discuss the performance gap between the western and the Japanese car industry (Stone 2012; Bhamu and Sangwan 2014) and identified that Japanese car manufacturing was as twice as productive as in the West and 100 times better in quality (Womack *et al.* 1990).

Like CI (Jha *et al.* 1996), the academic interest in lean has steadily increased over the last decades (Stone 2012). Bhamu and Sangwan's (2014), Hines *et al.*'s (2004, 2021), and Hines' (in Åhlström *et al.* 2021) overviews of the chronicle changes in lean research highlight that the concept was initially focused on cost reduction and productivity improvement whereas the customer had begun to play a more central role over time. In the modern era, interest in behavioural aspects has gained much more traction likewise. Hence, the research agenda shifted from its technical aspects towards an investigation of the softer dimension of lean, involving areas associated with human factors, including but not limited to culture and HRM (e.g., Hadid

and Mansouri 2014; Hines *et al.* 2020; Hines in Åhlström *et al.* 2021; Hines *et al.* 2021). In 2014, *The International Journal of Human Resource Management* dedicated this movement a special issue ("*Human resource management, Lean processes and outcomes for employees: towards a research agenda*"; Bamber *et al.* 2014). In fact, this circumstance demonstrates that the current focus area in lean research goes beyond OM boundaries and even arouses academic interest in other domains, such as HRM.

In comparison to the past, lean is a widely propagated concept now, finding adoption in various areas in- and outside of organisations. It is implemented both holistically and up to the enterprise level where stakeholders along the whole value stream, including suppliers and customers, are involved. Incorporating best practices of hard and soft lean, green, lean six sigma, agile, and industry 4.0, it has recently been noted that the term "lean" is increasingly being replaced with "enterprise excellence" (Hines and Butterworth 2019; Hines in Åhlström *et al.* 2021; Hines *et al.* 2021; Table 2.11).

Table 2.11 Chronicle changes in lean research

No.	Timeline	1980 to 1990	1990 to mid-1990	Mid-1990 to 2000	2000 to 2004	2004 to 2012	2012 onwards
1	Phase(s)	Awareness	Quality	Quality, cost, and delivery	Value system	Leadership and culture Performance phase	Enterprise excellence
2	Literature theme(s)	Dissemination of shopfloor practices Origin and development of the philosophy	Best practice movement and benchmarking leading to emulation	Customer satisfaction in terms of quality, cost, and delivery Lean enterprise Collaboration in the supply chain Lean dissemination begins at larger level (MIT IMVP study)	Capability at system	"Softer" elements of lean Leaders' practices Behaviours and mindsets Employee engagement and cultural transition Value creation and innovation	Socio-technical system development Integration of lean with green, six sigma, agile, and industry 4.0
3	Focus area(s)	Cost reduction and productivity improvement JIT techniques	Cost reduction and productivity improvement Training Promotion TQM Process reengineering	Cost reduction and productivity improvement Process-based to support flow	Value and cost Tactical to strategic Integrated to supply chain Lean consumption	People and culture Development of new principles	Holism
4	Key business process(es)	Manufacturing (shopfloor only)	Manufacturing Materials management	Order fulfilment	Integrated processes Lean expands up to enterprise level Order fulfilment Lean propagates into product development, marketing, sales, service, accounting, etc	Behaviour and engagement	Behavioural and strategy deployment Continuous improvement Leader standard work L&D
5	Industry sector(s)	Automotive vehicle assembly	Automotive (vehicle and component assembly)	Manufacturing in general (often focused on repetitive manufacturing)	High and low volume manufacturing Extension into service sectors	All sectors	All sectors

Source: Adapted from Hines *et al.* (2004); Bhamu and Sangwan (2014); Hines (in Åhlström *et al.* 2021); Hines *et al.* (2021)

2.4.3 Foundations of lean

In their literature review, Hines *et al.* (2004) examined the evolution of lean. Even confirmed a decade later by others (e.g., Bhamu and Sangwan 2014), they ascertained that there is a widespread confusion about what lean actually constitutes. Motivated by this circumstance, Hines *et al.* (2004) remedy and suggest "a framework for understanding the evolution of lean not only as a concept, but also its implementation within an organisation" (p. 994). Arguing that "[l]ean exists at two levels: strategic and operational" (Hines *et al.* 2004, p. 1006), they make a clear distinction between lean as a strategic thinking approach with a focus on the customer on all verticals of the business and the operational tools and techniques designed for shopfloor management. While the strategic level concerns the understanding of customer value considering the principles of lean, the operational level deals with its enhancement through the application of tools and techniques in order to identify and to eliminate waste along the value stream. Although their framework is linked to manufacturing contexts, Hines *et al.* (2004) note that this distinction still facilitates the understanding of lean as a whole. That is because most academic debates still take place on the shopfloor. In addition to this, specific tools that the authors mention can be perceived as examples that vitalise the terms at the framework's operational level.

Similarly, various other authors argue that lean can be either viewed through a philosophical or an operational lens (e.g., Womack and Jones 1996; Upton 1998; Shah and Ward 2003, 2007; Arlbjørn and Freytag 2013; Bortolotti *et al.* 2015; Piercy and Rich 2015). Aligning with Hines *et al.* (2004), Arlbjørn and Freytag (2013), for instance, developed a very similar lean framework. In their framework, they consider three levels, namely, (1) philosophy, (2) principles, and (3) tools and techniques. According to them, "philosophy" concerns what Hines *et al.* (2004) describe as (1) "understanding value" at the strategic level and (2) "eliminating waste" at the operational level. Although a different distinction is made by Arlbjørn and Freytag (2013), the parallels to Hines *et al.* (2004) are unmistakable because two separate levels associated with (1) principles to develop customer value and (2) tools and technique to reduce waste exist likewise (Table 2.12).

Guided by Hines *et al.*'s (2004) and Arlbjørn and Freytag's (2013) distinctions between the strategic and the operational level (or principles as well as tools and techniques), the following introduces the principles of lean, starting with its strategic aspects (i.e., understanding customer value), followed by an overview of its operational aspects (i.e., the tools and techniques for enhancing customer value).

Table 2.12 Lean frameworks

No.	Philosophy	"Lean – a framework" (Hines *et al.* 2004)		"Lean in three levels" (Arlbjørn and Freytag 2013)[a]	
		Level(s)	*Description(s)*	*Level(s)*	*Description(s)*
1	Understanding customer value Developing customer value	Strategic level	Value Value stream Flow Pull Perfection	Principles	Value Value stream Flow Pull Perfection
2	Eliminating waste Reducing waste	Operational level (tools and techniques)	Availability (e.g., total productive maintenance) Capacity (e.g., theory of constraints) Lean production (e.g., level scheduling, kanban, and takt time) Production control (e.g., enterprise resource planning and material requirements planning) Quality (e.g., total quality management) Responsiveness (e.g., agile) Variability (e.g., six sigma and statistical process control)	Tools and techniques	5S Bottleneck and constraint management Cause-and-effect analyses Group layout Information boards Kanban Kaizen Overall equipment effectiveness Performance management Production levelling ("heijunka") Pull production Reduced changeover time Takt time Total preventive maintenance Value stream mapping

Source: Author

Note(s): (a) Arlbjørn and Freytag's (2013) first out of three levels is "philosophy", followed by "principles" and "tools and techniques".

2.4.3.1 Strategic level

At the strategic level, lean deals with "lean thinking" where its five key principles are concerned (Hines *et al.* 2004). In their long-term study, Womack and Jones (1996) investigated 50 organisations across different industries, which had introduced TPS. Identifying similarities within these organisations, they concluded that lean relies upon five principles, namely, (1) value, (2) value stream, (3) flow, (4) pull, and (5) perfection (Table 2.13).

Table 2.13 Principles of lean

No.	Principle(s)	Description(s)
1	Value	Define value precisely from the perspective of the end customer in terms of a specific product with specific capabilities offered at a specific price and time
2	Value stream	Identify the entire value stream for each product or product family and eliminate waste
3	Flow	Make the remaining value creating steps flow
4	Pull	Design and provide what the customer wants only when the customer wants it
5	Perfection	Pursue perfection "by continually removing successive layers of waste as they are uncovered" (Hicks 2007, p. 236)

Source: Adapted from Womack and Jones (1996)

According to Womack and Jones' (1996) results, these five principles are also the consecutive steps when pursuing lean implementation. To provide more detail, each of these principles finds more explanation in the following.

Value. The first principle concerns value. The focus on value is an essential part of lean (Hines *et al.* 2004). According to Toyota's former chief engineer Ohno (1988), all corporate thinking has to reflect upon the distinction between value and waste. To distinguish value from waste, Monden (1993) suggests classifying all operational activities into three different categories, namely, (1) value-adding (VA) activities, (2) non-value-adding activities, and (3) necessary but non-value-adding (NNVA) activities.

Value is described as a product or service that "the customer is willing to pay for" (Hines *et al.* 2004, p. 997). In essence, value constitutes the difference between what the customer gets (e.g., a product) and what he or she has to sacrifice (e.g., paying the price; Hines *et al.* 2004). As the customer is the one who ultimately defines value (Bicheno and Holweg 2000), VA activities involve operations (e.g., processing of materials into a product) that are expedient to satisfy the customer requirements. In contrast, waste is anything unlike the absolute minimum resources needed to add value (Hay 1988). Accordingly, waste is an NVA activity, while NNVA activities comprise operations that are NVA but necessary to support the creation of value (Hines and Rich 1997).

In terms of NVA activities, Ohno (1988) identified seven types of waste that do not add value for the customer and "that the customer is not willing to pay for" (Karlsson and Åhlström 1996, p. 27), namely, (1) overproduction, (2) waiting, (3) transport, (4) overprocessing, (5) defects, (6) motion, and (7) inventory. In Table 2.14, each of the seven types of waste is explained in more detail.

Table 2.14 Seven wastes of lean

No.	Type of waste(s)	Description(s)
1	Overproduction	Overproduction occurs once operations proceed, although the demand is satisfied. It results in excessive inventory and storage times. In addition, it reduces the resource capacities that might be needed in other activities.
2	Waiting	Waiting is associated with queuing during the operations process. These idle times occur as soon as upstream activities are delayed. Waiting often results in overproduction.
3	Transport	As soon as materials are moved unnecessarily, transport is considered as wasteful. Ideally, transport should be kept at a minimum, as too much movement might also lead to damages and deterioration.
4	Overprocessing	Overprocessing simply involves extra operations that either occur due to defects, overproduction or too much inventory (e.g., rework and repair), or due to "overly complex solutions […] to simple procedures" (Hines and Rich 1997, p. 48).
5	Defects	Defects constitute finished products or services that do not meet the quality standard or the customer's expectation. Defects should be perceived as an opportunity for continuous improvement.
6	Motion	While waste in the form of transport has its focus on the material, motion considers unnecessary movements of operators, e.g., due to poor factory layouts or insufficient equipment that has to be borrowed. Motion is likely to lead to a poor morale amongst the workforce and thus to poor productivity, finally resulting in quality issues.
7	Inventory	Inventory that does not fulfil current customer orders is likely to increase lead time, to cause overprocessing through extra handling and to take up unnecessary space. In addition, it is associated with holding cost and capital tied up in stocks that decreases the competitiveness in turn.

Source: Adapted from Ohno (1988); Womack and Jones (1996); Hines and Rich (1997); Hicks (2007)

With an eye to Table 2.14, it becomes apparent that some types of waste might interact. For instance, while waiting may cause overproduction, overproduction may lead to excessive inventory. This, in turn, has an impact on the organisational performance. Accordingly, the seven types of waste are not necessarily exclusive and distinct but could rather cause one another.

Along these lines, lean seeks to identify these types of waste along the value stream of a product or service (Womack and Jones 1996) because (added) value is created by eliminating waste. In other cases, value can also be created via extra features, which the customer values. Notably, value creation is often confused with cost reduction; however, both they are not the

same. That is because value creation does not lose the focus on the customer once waste is reduced or fully eliminated, whereas cost reduction does (Hines *et al.* 2004).

Value stream. The second principle concerns the value stream. Every time there is a product or service for the customer, there is a value stream (Rother and Shook 1999). In essence, the value stream is a series of VA, NVA, and NNVA activities within the business that need to be undertaken to provide a particular product or service that the customer values (Womack and Jones 1996; Seth *et al.* 2008). Womack and Jones (1996) distinguish between three critical streams, namely, (1) product definition (from concept to launch), (2) information management (from order taking to shipment), and (3) physical transformation (from raw material to product).

Many organisations map their work streams to ensure that each activity creates value (Staats *et al.* 2011). It is suggested to consider both inter- and intracompany value streams because this involves a more focused and holistic approach for examining the value creation process (Seth *et al.* 2008; Staats *et al.* 2011). Tools and techniques, such as VSM, help to identify the value stream (Hines *et al.* 1999), and counteract "the lack of visibility along the value stream" (Hines and Rich 1997, p. 49). VSM is a specific benchmarking process (Hines *et al.* 1999) that sheds light on inefficiencies and miscommunication (Staats *et al.* 2011). Furthermore, it breaks down the functional silos within the organisation (Seth *et al.* 2008). However, VSM is not used for external but for internal comparison purposes to find out in which way a process could be better designed (Hines *et al.* 1999).

Flow. The third principle is flow. Flow designs processes along the value stream with the aim to make value creation as smooth as possible (Staats *et al.* 2011). Maximising the flow involves creating value as rapidly as possible. Ideally, this is a series of activities without interruption or downtimes between each activity (Womack and Jones 1996; Storch and Lim 1999). A particular example that lean is often associated with is the transformation from a batch-and-queue system towards a system with a continuous flow (JIT). Organisations that Womack and Jones (1996) studied experienced a productivity improvement that was as twice as high and a significant reduction in errors and scrap.

Storch and Lim (1999) raise the importance of "keep[ing] pace in a synchronised pattern so that uniform flow can be maintained" (p. 128). In case of overflow, non-uniform flow will cause bottlenecks and obstacles to continuous flow, which will result in a generation of waste in turn. Developing and sustaining a continuous and uniform flow of VA activities is therefore key to implementing lean successfully.

Pull. The fourth principle constitutes pull and involves that the customer "pulls" the product from the value stream, meaning that he or she determines the demand (Ohno 1988; Womack

and Jones 1996; Staats *et al.* 2011). Inspired by US supermarket practices in the 1950s, Ohno (1988) developed the pull system.

> "The tool used to operate the system is kanban, an idea I got from American supermarkets […] A supermarket is where a customer can get (1) what is needed, (2) at the time needed, (3) in the amount needed. […] The supermarket is a place where we buy according to need […] From the supermarket we got the idea of viewing the earlier process in a production line as a kind of store" (Ohno 1988, pp. 25-26).

In Japan, however, being assisted while doing the grocery shopping had been the typical practice back then.

His pull system is often referred to as "kanban" and is one method to achieve JIT. Through a focus on customer demand, organisations avoid waste, such as overproduction and excessive inventory. Calvasina *et al.* (1989), for instance, point out that this

> "system […] seeks to minimize raw materials and WIP [work-in-progress] inventories; control (eliminate) defects; stabilize production; continuously simplify the production process; and create a flexible, multi-skilled work force" (p. 41).

Perfection. The last principle is perfection. Striving for perfection means that lean is considered as a journey rather than a goal or final destination. Lean seeks constant efforts to meet customer needs and to achieve CI in any realm (e.g., time and cost; Womack and Jones 1996; Staats *et al.* 2011; Bicheno and Holweg 2016). Womack and Jones (1996) point out that all five principles of lean are consecutive steps as part of a virtuous circle. Those steps interact, and once change occurs in the definition of value, there is an impact on the value stream. Accordingly, "[a] more precise definition of value always challenges the steps in the value stream to reveal waste" (Womack and Jones 1996, p. 141).

2.4.3.2 Operational level

In order to operationalise the enhancement of customer value, tools and techniques help to identify and to eliminate waste (Hines *et al.* 2004). Sriparavatsu and Gupta (1997) report that TQM was enriched by this. When discussing these tools and techniques (e.g., 5S or VSM), the literature on lean often refers to "lean technical practices" (Hadid and Mansouri 2014; Hadid *et al.* 2016) or "hard lean practices" (Bortolotti *et al.* 2015; Danese *et al.* 2017, 2018; Sakthi Nagaraj *et al.* 2019). In this study, Bortolotti *et al.*'s (2015) term "hard lean practices" is operationalised.

Corresponding to this, Womack and Jones (2003) describe lean as a set of interlocked practices. The adoption of hard lean practices is conducive to reducing the usage of space, capital, and labour in order to meet the customer's demand (Swank 2003). Usually, hard lean practices consider a systematic approach and involve technical or analytical tools (e.g., setup time reduction, statistical process control or kanban; Hadid and Mansouri 2014; Bortolotti *et al.* 2015; Danese *et al.* 2017). Empirically evidencing their positive influence on performance improvement within manufacturing, Taylor and Wright (2006) demonstrated the relevance of hard lean practices. Similarly, Piercy and Rich (2009a) identified that the adoption of hard lean practices leads to savings in terms of time and cost, which further increases customer value.

Taking the varying nature of hard lean practices into account, Hadid and Mansouri (2014) classify hard lean practices into three different categories based on their purpose, namely, (1) waste identification, (2) waste elimination, and (3) complementary practices (Table 2.15).

Table 2.15 Types of hard lean practices

No.	Type(s)	Description(s)
1	Waste identification	Identification and expose of issues and waste within as-is processes but no elimination of issues and waste (e.g., VSM)
2	Waste elimination	Removal or reduction of identified waste within as-is processes (e.g., changing the physical layout of the facility)
3	Complementary practices	Neither identification nor elimination of waste but contribution to achieve both more efficiently (e.g., A3 report)

Source: Adapted from Hadid and Mansouri (2014)

First, hard lean practices of the first category seek to identify customer value along the value stream and visually separate VA activities from NVA ones (Hadid *et al.* 2016). For instance, organisations make use of VSM to get a better understanding of their current-state processes. Although VSM may unveil inherent waste along the value stream, it does not eradicate it (Hadid and Mansouri 2014). Second, waste-eliminating hard lean practices (e.g., changing the physical layout of the facility), which are part of the second category, assist waste-identifying hard lean practices (e.g., VSM) to rationalise the business processes along the value stream with the aim to increase the customer value (Hadid *et al.* 2016). Third, the last category concerns complementary practices. Complementary hard lean practices neither identify nor eliminate waste, but they still contribute to achieving both more efficiently. An A3 report, for instance, is a complementary hard lean practice. A3 reports facilitate a discussion around any form of waste and enable to take action by bringing useful information about an issue together. Such discussions help to select an appropriate hard lean practice to eliminate waste (Hadid and Mansouri 2014).

In their review of 214 articles, Hadid and Mansouri (2014) identified 37 different hard lean practices being applied in service environments. Classifying them into the aforementioned categories (Table 2.16), it becomes apparent that the majority of hard lean practices seek eliminating waste, whereas only a small number seek identifying waste or concerns a complementary practice. Moreover, Table 2.16 highlights that hard lean practices are not necessarily exclusive to one of the three categories. For instance, 5S and quality function deployment lead to both the identification and the elimination of waste.

Table 2.16 Classification of hard lean practices

No.	Hard lean practice(s)[a]	Type(s)		
		Waste identification	*Waste elimination*	*Complementary practices*
1	5S	•	•	
2	A3 report			•
3	Automation		•	
4	Change management			•
5	Continuous improvement			•
6	Eliminating loopbacks		•	
7	Group technology		•	
8	Changing the facility layout		•	
9	Just-in-time		•	
10	Kaizen blitz			•
11	Kanban		•	
12	Mistakes proofing (“poka-yoke”)		•	
13	Model cell, roll out			•
14	Outsourcing		•	
15	Point of use storage		•	
16	Policy deployment (“hoshin kanri”)			•
17	Process redesign		•	
18	Production levelling (“heijunka”)		•	
19	Pull system		•	
20	Quality circles			•
21	Quality function deployment	•	•	
22	Quick set-up time		•	
23	Root-cause analysis	•		
24	Segregating complexity		•	
25	Self-inspection		•	
26	Simplification		•	
27	Single-piece flow		•	
28	Small lots		•	
29	Standardisation		•	
30	Takt time			•
31	Total preventive maintenance		•	
32	Total quality	•	•	
33	Use of new technologies		•	
34	Value stream mapping	•		
35	Vertical information system		•	
36	Visualisation	•	•	
37	Workload balancing		•	

Source: Adapted from Hadid and Mansouri (2014)
Note(s): (a) Definitions available in Appendix 1.

It is true that Table 2.16 is not a comprehensive review of hard lean practices. That is because of the following two reasons. First, Hadid and Mansouri (2014) focused on hard lean practices being adopted in service firms. Second, Hines *et al.*'s (2004) lean framework shows tools beyond lean production (e.g., production control and variability, to mention a few) that are actually concerned likewise. That being said, Table 2.16 is supposed to be understood as an orientation of what hard lean practices comprise.

In summary, hard lean practices concern the operationalisation of lean thinking and help to realise value creation according to the five principles. In fact, any approach along with its tools and techniques can be integrated into a lean strategy as long as its objectives are not contradictory to enhancing customer value (Hines *et al.* 2004).

2.5 Lean diffusion

In essence, the term "lean diffusion" concerns the process by which lean is spread amongst social actors of a social system over time (Samuel 2011). More generally, it refers to the dissemination of lean beyond its origin in manufacturing environments.

In the past, several studies (e.g., Lillrank 1995; James-Moore and Gibbons 1997; Bowen and Youngdahl 1998; Piercy and Rich 2009a; Samuel 2011; Kumar *et al.* 2015) investigated how lean was diffused (inter)nationally across industries from a sector-level perspective. More recently, academics have increasingly taken a corporate-level perspective, examining multi-plant improvement programmes or a(n) (inter)national rollout of a set of lean practices across sites (e.g., Maritan and Brush 2003; Aoki 2008; Inkpen 2008; Yu and Zaheer 2010; Netland 2013; James and Jones 2014; Netland and Aspelund 2014; Netland and Ferdows 2014, 2016; Netland and Sanchez 2014; Netland *et al.* 2014; Boscari *et al.* 2016; Danese *et al.* 2017). Moving another level deeper, the literature on lean diffusion inside a single site, where lean is diffused from one functional area to another, is sparse, though.

The following sub-chapters describe where lean moved beyond manufacturing and points out particularities in non-manufacturing environments. The concept of the lean enterprise is then presented, which essentially calls for lean diffusion along the entire value stream.

2.5.1 Lean beyond manufacturing

Initially, the lean movement began at Toyota in Japan (Liker and Morgan 2006; Hines *et al.* 2008; Antony *et al.* 2017). Since then, lean has undergone an evolutionary development and found application in environments outside of manufacturing likewise as the value-stream concept had evolved (Hines *et al.* 2004; Stone 2012). In 1996, Womack and Jones (1996)

introduced the term "lean thinking" for this reason and encouraged research in the service sector (Piercy and Rich 2009b). Two years later, Bowen and Youngdahl (1998) coined the term "lean service". That is because service organisations were the first ones experimenting to implement lean outside of manufacturing, closely followed by public sector organisations (Hines *et al.* 2004; Bateman *et al.* 2014). In doing so, lean has moved beyond the shopfloor, finding application in white-collar offices and industries outside of manufacturing (Liker and Morgan 2006; Stone 2012), including the public sector (Holweg 2007; Bateman *et al.* 2014).

In service environments, common hard (e.g., VSM and problem-solving techniques) and soft (e.g., training and empowerment) lean practices turned out to be equally successful (Piercy and Rich 2009a, 2009b). Due to their equal focus on product flow, for instance, such hard lean practices could be easily transferred from manufacturing to non-manufacturing environments, such as retail (Bicheno 2004; Piercy and Rich 2009b). Even in pure service environments without a physical entity, recurring input-transformation-output activities are present where the customer flows through a value stream (Piercy and Rich 2009b).

In their literature review, Hadid and Mansouri (2014) list multiple benefits associated with lean service implementation (e.g., improvement in [1] capacity, [2] customer perception of quality, [3] customer satisfaction, [4] employees' satisfaction and their performance, [5] employees' understanding of the process, [6] operational efficiency, [7] process flexibility, [8] productivity, and [9] the organisation of work areas). In the meantime, several other authors have endorsed the application of lean outside of manufacturing (e.g., Bane 2002; Ehrlich 2006; Piercy and Rich 2009a, 2009b; Carlborg *et al.* 2013). For instance, Bane *et al.* (2002) argue that

> "non-manufacturing organizations can reap rewards from leading edge approaches if they look past the manufacturing-associated labels and utilize the underlying concepts" (p. 245) while Piercy and Rich (2009a) argue that "the lean approach can be relatively easily applied, with minimal investment in training, very rapidly generating major improvement gains for adoptive companies" (p. 72).

To this end, it is no surprise that also the academic interest in lean service has increased steadily since the turn of the millennium (Hadid and Mansouri 2014).

Importantly, non-manufacturing environments are not limited to non-manufacturing organisations, such as pure service firms, but also include white-collar departments within manufacturing organisations in which each functional area has an internal or external customer (Larsson 2008). In manufacturing organisations, for instance, administrative activities are a supporting service to operations (e.g., service-to-manufacturing departments) and often coordinate the core activities (Bicheno 2008; Chiarini 2012). Most organisations, however, still concentrate on manufacturing areas while efforts in other functional areas (e.g., HR or finance)

remain sparse (Boyle *et al.* 2011). This attitude, however, neglects essential parts of the value stream. That said, lean must not be perceived as a "manufacturing occurrence alone" (Bhasin 2012a, p. 405) as sometimes falsely perceived (Emiliani 2003; Womack *et al.* 2003) but as a

> "holistic approach that transcends the boundaries on the shop floor" (Bhasin 2012a, p. 422) instead.

Introducing lean to non-manufacturing environments becomes more relevant, though, once considering that administrative activities are often carried out in an inefficient way (Piercy and Rich 2009a; Bortolotti *et al.* 2010) while their lead times may make up 60 to 80% of overall lead times (Strategic Direction 2005). In the TPS, for instance, Toyota followed a holistic application along the value stream in which the underlying lean principles are embedded in both, manufacturing and non-manufacturing environments (Liker and Morgan 2006).

2.5.2 Lean service

Although lean implementation in non-manufacturing environments bears a huge potential to reduce excess activities along the value stream to cut internal cost and to shorten the lead time, it may require more efforts and commitment than in manufacturing environments (Strategic Direction 2005). Until today, many organisations have been seeing lean failing or lacking full adoption. At the same time, successes remain inconsistent across industries (Boyle *et al.* 2011). Not without reason, lean's universality has already been challenged a few times in the past (e.g., James-Moore and Gibbons 1997; Bartezzaghi 1999; Cooney 2002; Hines *et al.* 2004). Associated with its "'Japanese management' techniques" (Stone 2012, p. 120), the application of lean has often led to confusion and difficulties outside of manufacturing (Jørgensen and Emmitt 2008; Bhasin 2012a; Antony *et al.* 2017). In their systematic literature on lean services, Gupta *et al.* (2016) infer that transferring lean from manufacturing to services has certain limitations due to the nature of its operations. Issues relate to both its strategic *and* its operational level.

In manufacturing environments, for instance, it is simply much easier to trace waste than in administrative environments (Hines and Taylor 2000; Strategic Direction 2005; Baines *et al.* 2006; Liker and Morgan 2006; Found and Harrison 2012; Laureani and Antony 2012; da Silva *et al.* 2015) because materials undergo a physical transformation process. Service operations in administrative environments, however, mainly concern the processing of information, making it much more difficult to identify NVA activities (Larsson 2008; da Silvia *et al.* 2015). Second, customers cause high diversity, exacerbating the application to lean principles (Carlborg *et al.* 2013). Third, operations in service environments are often less repetitive than in manufacturing environments (Liker and Morgan 2006). Sometimes, however, administrative processes may

still be repetitive while having a low process variety and occurring in high volumes (Beckers 2015). Fourth, lean manufacturing principles lack transferability. By nature, for instance, services already feature a "pull" rather than "push" state (Åhlström 2004). In addition, "value" concerns a product's worth that a customer is willing to pay for while service value is more complex (Bicheno 2012; Resta *et al.* 2015). Fifth, office environments may be support functions (e.g., accounting in a manufacturing organisation) that do not deal with external customers. In some cases, this circumstance mitigates the urgency for improvements in such environments because there is no "market" from which their internal customers can select a better performing provider (Bicheno and Holweg 2016).

Due to its origin in manufacturing, there is also misunderstanding that lean is limited to shopfloor operations (Hines *et al.* 2004; Baines *et al.* 2006; Thirkell and Ashman 2014; Emiliani 2015; Gupta *et al.* 2016) and inapplicable in office environments (Strategic Direction 2005). In their literature review on "white-collar lean", however, Baines *et al.* (2006) conclude that

> "it is clear that lean can be applied […] to […] other sectors" (p. 1546).

Outside of manufacturing environments, lean is often falsely understood as a set of tools and techniques (hard lean practices) rather than a holistic approach likewise (Bhasin 2012a). These circumstances have led to confusion and difficulties about how to apply lean in non-manufacturing environments because many organisations merely attempt to imitate the tools, which had initially been developed and deployed in manufacturing environments. In service organisations, this way of thinking is often even enforced by workshops heavily focusing on hard lean practices but neglecting the key principles (Radnor and Osborne 2013), yet not all lean practices can be adopted in non-manufacturing environments (James-Moore and Gibbons 1997; Liker 2004; Radnor *et al.* 2006; Alsmadi *et al.* 2012; Gupta *et al.* 2016). As Hines *et al.* (2004) put it,

> "The customer-centred strategic thinking applies everywhere, the shop-floor tools do not" (p. 1006).

To that end, it is essential to distinguish between the strategic (guiding principles) and the operational level (set of tools) of lean (see Table 2.12; Hines *et al.* 2004; Shah and Ward 2007; Scherrer-Rathje *et al.* 2009) and to revert to the underlying lean principles (Hines *et al.* 2004, 2008; Liker and Morgan 2006).

> "Over reliance on lean tools without focusing on understanding the principle and development of lean thinking […] will not ensure the real success of lean implementation and end up as lean cosmetic" (Asnan *et al.* 2015, p. 315).

Although much of the discussion about lean remains manufacturing-focused (Hines *et al.* 2004), organisations have learnt over time that the lean principles (see Table 2.13) do also apply in non-manufacturing environments (Baines *et al.* 2006; Antony *et al.* 2017) because any kind of value stream contains waste and offers opportunities to improve efficiency (Womack and Jones 1996; Baines 2006; Liker and Morgan 2006; Antony *et al.* 2017),

> "Whenever there is a product for a customer, there is a value stream. The challenge lies in seeing it" (Rother and Shook 1998, p. 102).

To suit service operations and the specific needs of an organisation more accurately, though, the fundamental lean principles may require a review and some refinement (Åhlström 2004; Hines *et al.* 2004; Bateman *et al.* 2014). In the same vein, Maleyeff (2006) suggests determining a tailored set of principles guiding improvements in service systems.

In 2005, Womack and Jones (2005a) made already an attempt to translate lean manufacturing principles to lean service principles while referring to "lean consumption". In essence, their lean consumption principles focus on the total cost from a consumer perspective and suggest an optimisation of the consumption process (Table 2.17).

Table 2.17 Lean consumption principles

No.	Lean consumption principle(s)
1	Solve the customer's problem completely by ensuring that all the goods and services work and work together.
2	Don't waste the customer's time.
3	Provide exactly *what* [italics in original] the customer wants.
4	Provide what's wanted exactly *where* [italics in original] it's wanted.
5	Provide what's wanted where it's wanted exactly *when* [italics in original] it's wanted.
6	Continually aggregate solutions to reduce the customer's time and hassle.

Source: Womack and Jones (2005a)

In the lean service literature, however, there does not seem to exist consensus on a set of lean service principles. Despite different calls for an adoption of lean manufacturing principles to suit services, translations to service operations seem to remain sparse, though, (Carlborg *et al.* 2013) and seem to take predominantly place at the operational level.

Along these lines, Alsmadi *et al.* (2012) made an interesting finding. In their study, the authors found that

> "the manufacturing sector was found practicing hard [lean] practices" (p. 393) while "the service sector was outperforming in soft Lean practices" (p. 393), arguing that their "results seem logical when taking into consideration the unique characteristics of service operations" (p. 393) because "Lean practices need to be distilled and tailored to the specific features of each sector" (p. 393).

In their systematic literature reviews, Gupta *et al.* (2006) and Suárez-Barraza *et al.* (2012) confirm Alsmadi *et al.*'s (2012) findings. Gupta *et al.* (2006), for instance, note the following.

> "As services are delivered for people by people, hence the human variable turns out to be an important variable in the service sector. Authors […] have emphasized the importance of the human dimensions of motivation, empowerment, and respect for people. Alongside this, commitment is needed from the management as lean practice is not just a tool, but rather a strategic move towards cultural transformation" (p. 1037).

Moving from manufacturing to administrative processes, the literature on the definition of waste finds finally some more discussion. Taking a healthcare context into account, for instance, da Silva *et al.* (2015) proposed how the seven inherent wastes look like in an office environment in comparison to its manufacturing counterpart while referring to the term "lean office". The authors, however, admit that a transfer from manufacturing to office environments is not straightforward and requires a thoughtful elaboration. Bicheno and Holweg (2016) argue that overproduction and overcommunication of knowledge constitute the most occurring forms of waste in an office environment. In a meta-analysis of 60 service systems, Maleyeff (2006) analysed the suitability of lean in service organisations likewise and found significant commonalities between manufacturing and service organisations. Like da Silva *et al.* (2015) and Bicheno and Holweg (2016), they attempted to transfer the seven inherent wastes from the manufacturing to the service environment (Table 2.18).

Table 2.18 Inherent wastes of lean in an office environment

No.	Manufacturing environment	Office environment					
		da Silva et al. (2015)		*Maleyeff (2006)*		*Bicheno and Holweg (2016)*	
		Translation(s)	*Description(s)*	*Translation(s)*	*Description(s)*	*Translation(s)*	*Description(s)*
1	Overproduction	Overproduction	Box mail charged Information beyond what is necessary	Typically, "'overproduction' […] does not […] happen in internal service systems" (p. 683).		Overproduction of knowledge (wasteful communication)	Generating unnecessary knowledge, in the form of e-mails, reports, and slides leads to a twofold waste of time: preparation and delivery
2	Waiting	Delay	Approval signature for all documents, photocopy wait, hold on the phone Disorganised files Excess meetings Lack of training	Delays	Time wasted directly in queue (e.g., paperwork placed in an inbox) Waiting for information to be transmitted (e.g., late responding to a voicemail message)		
3	Transport	Transportation	Excessive use of systems in communications Unrelated database	Movement[a]	Physical transport of information, personnel or equipment that is unnecessary (e.g., traveling to attend a meeting to find the root cause of a mistake)		
4	Overprocessing	Processing no value	*Alignment of goals*: Is the energy expended by people working with unfocused goals Inadequate procedures or systems Lack of standardisation of documents *Strategic management*: When there is much difference between the company's organisational structure *Standardisation*: The energy expended because of a job not being done the best way possible, in such a way that each group wants to accomplish it your way *Strategy*: Is the value lost by implementing processes that meet short-term goals, but that does not add value to our stakeholders	Duplication	Activities that are done elsewhere in the system Activities that can be done more easily in another part of the system Activities that may be performed more than once (e.g., same data entered into a system at two different locations)	Indecision	Poor and unclear decision structures lead to many loopbacks and "cover my backside" communication Contributes to the overproduction of knowledge (wasteful communication)
				Processing inefficiency	Ineffective use of resources in performing a specific task (e.g., lack of standard processes)	Exceptions	By not sticking to the process, via exceptions or improvisation, unnecessary variability is introduced that permeates into waste elsewhere in the system

No.	Manufacturing environment	Office environment					
		da Silva et al. (2015)		*Maleyeff (2006)*		*Bicheno and Holweg (2016)*	
		Translation(s)	*Description(s)*	*Translation(s)*	*Description(s)*	*Translation(s)*	*Description(s)*
				Resource inefficiencies	Management of personnel, equipment, materials or capital in ways that are wasteful (e.g., holding meetings that do not result in enhanced value for customers)	Initiative overload	By being involved in too many processes, task switching between projects leads to a loss of productive time Lead times rise as an individual's capacity is reached
						Amplification of loopbacks	A different kind of whereby indecision and incompetence lead to repetition and rework Typical examples are "holding" messages and putting people in CC that should not be involved
5	Defects	Defect	*5S*: Resistance to change leads the organisation fail to reach the discipline. This fact is linked to non-compliance with procedures, system failures occurring. Incorrect determination of the service times Mistakes in the documentation	Mistakes	Errors and omissions causing disruption of normal activities and delay in other work activities Errors and omissions causing work to be redone Errors and omissions found by customers causing a loss of reputation or customer defection	Defects	As in manufacturing, producing a defect that leads to wasted effort
				Reviews	Inspecting work for errors or omissions (e.g., check for standard procedures or technical accuracy, or creating a presentation to obtain management approval)	Incompetence	Poor training and/or poor systems that leads to defects, rework, and loop-backs
6	Motion	Movement	Excessive movement of people No cell layout	Movement[a]	Physical transport of information, personnel or equipment that is unnecessary (e.g., traveling to attend a meeting to find the root cause of a mistake)		
7	Inventory	Inventory	Buffer overloaded	Typically, "internal service systems […] cannot inventory their service using excess capacity" (p. 683; e.g., generation of a customer quote).			

Source: Author

Note(s): (a) As a type of waste in office environments, "movement" has been allocated twice because it relates to both "transport" and "motion" in manufacturing environments.

Although such applications remain relatively scarce (Baines *et al.* 2006) and have received limited academic attention (Piercy and Rich 2009a; Thirkell and Ashman 2014), some examples from different service organisation can still be drawn from the literature. For instance, both Piercy and Rich (2009a, 2009b) and Laureani *et al.* (2010) examined the application of lean in call centres. Bruce *et al.* (2004) had a look at the retail sector while there are also some examples regarding its application in banking (e.g., Bortolotti and Romano 2012), financial services (e.g., Swank 2003), software services (e.g., Staats *et al.* 2011), and construction (Jørgensen and Emmitt 2008).

2.5.3 Lean enterprise

If lean is adopted in its most consequent form, an entity is either referred to as a "lean enterprise" (Smeds 1994; Womack and Jones 1994; Cooper 1995, 1996; Bhasin and Burcher 2006) or an "extended lean enterprise" (Hines *et al.* 2008, 2020). In the lean enterprise, lean is not only adopted within the entire organisation but also along the supply chain, including internal and external customers, suppliers, and multiple other stakeholders (Womack and Jones 1994; Baker 2002; Bhasin and Burcher 2006; Hines *et al.* 2008; Piercy and Rich 2009b). In doing so, lean principles are expanded end-to-end along the value stream (Liker 2004; Bhasin and Burcher 2006; Hines *et al.* 2008). In an article, Womack and Jones (1994) define the lean enterprise as

> "a group of individuals, functions, and legally separate but operationally synchronized companies. The notion of the value stream defines the lean enterprise. The group's mission is collectively to analyze and focus on the value stream so that it does everything involved in supplying a good or service (from development and production to sales and maintenance) in a way that provides maximum value to the customer" (pp. 93-94).

In a similar way, Karlsson and Åhlström (1996) came up with a formula to describe the lean enterprise.

> "Lean development + lean procurement + lean manufacturing + lean distribution = lean enterprise" (p. 26).

In theory, the lean enterprise ultimately aims at generating win-win situations for each focal organisation (i.e., the organisation itself and its stakeholders) within its network (Bozdogan 2010).

Constituting the ultimate extent of lean implementation, the lean enterprise requires long-term planning to be integrated along the entire value stream, while organisations are urged to

see the lean enterprise as a long-term strategy (Chase 1999; Bhasin and Burcher 2006). In their literature review, Bhasin and Burcher (2006) conclude the following.

> "Securing the full benefits of lean requires the need to concentrate on the whole value chain" (p. 62), and, "to work effectively, it needs to be adopted in its entirety, not piecemeal" (p. 62).

Likewise, any manager who anticipates evolving towards a lean enterprise needs to be aware of the conflicting needs amongst stakeholders, including staff, department, and other organisations, for instance (Womack and Jones 1994).

In 2001, the Engineering Employers' Federation (2001) report concluded, however, that only 33% of the UK organisations adopting lean, undertook a business-wide implementation (Bhasin and Burcher 2006). Taking the report's insights into account, it may be derived that less than 33% opt for a supply chain-wide implementation to move towards the lean enterprise. Considering the inefficient, administrative activities, which are often already present within the organisation itself (Strategic Direction 2005; Piercy and Rich 2009a; Bortolotti *et al.* 2010), Bicheno (1999) suggests that the lean enterprise approach may evolve to an even stronger source of competitive advantage as efficiencies as a consequence of lean are gained network-wide.

Until the mid-1990s, this holistic perspective and the networks, in which the organisation is acting, had been neglected. As lean had evolved, however, these perceptions had changed fundamentally (Hines *et al.* 2004; Stone 2012). First, the customer focus has enhanced, embracing multiple stakeholders while a distinct customer focus is retained. Second, the perception of eliminating waste with lean has evolved to the perception of creating value for these multiple stakeholders. Third, the soft side of lean become increasingly more important as L&D systems as well as knowledge sharing have become more relevant (Bozdogan 2010). In Table 2.19, a comparative overview is presented with more detailed information, illustrating the key characteristics of the traditional view of lean and the contemporary lean enterprise view.

Table 2.19 Lean enterprise

No.	Characteristic(s)	Basic lean enterprise	Contemporary lean enterprise
1	History	Since late 1940s Documented mostly in late 1970s to mid-1990s period	Since the mid-1990s
2	Goal	Deliver value to customers Increase production efficiency and profitability	Create and deliver value to multiple enterprise stakeholders Build dynamic network-wide capabilities for sustained competitive advantage
3	Core principles	Ensure long-term thinking, stability, and constancy of purpose Focus on the customer to deliver customer-pulled value Take an end-to-end value stream view of the enterprise Eliminate waste Create just-in-time production system Strive for perfect quality Achieve stability and continuous flow Pursue continuous improvement Enhance the capabilities of all people Establish long-term relationships based on mutual trust and commitment	Adopt a holistic view of the end-to-end networked enterprise Cultivate leadership stressing long-term thinking, stability, and constancy of purpose Construct robust value propositions and define value exchanges among stakeholders Eliminate waste with the goal of delivering customer-pulled value to multiple enterprise stakeholders Ensure synchronised flow throughout the networked enterprise Foster a culture of continuous improvement and learning towards the creation of long-term dynamic network-wide capabilities Develop collaborative relationships and mutually beneficial governance mechanisms Evolve an efficient, flexible, and adaptive networked enterprise
4	Focus	Core enterprise operations and workflow processes End-to-end value stream of the core enterprise Collaborative relationships throughout the value stream	Entire enterprise value stream (core enterprise, upstream supplier networks, downstream activities linking core enterprise to end-use customers) Enterprise operations at all scales (strategic, tactical, operational) Leadership processes, core business processes (product development, production, sustainment, supply chain management), and supporting infrastructure processes (e.g., human resources, customer services, information systems, contracting) Value exchanges among all enterprise stakeholders Managing both internal and external interdependencies
5	Implementation	*Value* – specify value as defined by the end customer *Value stream* – identify the value stream to eliminate all non-value-adding activities *Flow* – make the value adding steps for the specific products flow continuously *Pull* – let the customers pull value from the enterprise *Perfection* – pursue perfection through continuous improvement	Pursue enterprise transformation by adopting a holistic enterprise perspective, lean enterprise principles, conceptual frameworks, methods, and tools Plan and implement enterprise transformation by pursuing a structured process containing, for example, the following major building-block steps: (1) Initiate strategic preparedness and learning cycle (e.g., define strategic imperatives, engage leadership in transformation) (2) Develop enterprise transformation plan (e.g., define enterprise, understand current state, create future state vision, develop strategic and detailed implementation plan) (3) Create required infrastructure systems and capabilities (e.g., enabling policies, metrics, information systems, incentive mechanisms, training of change agents) (4) Execute transformation plan (e.g., identify, prioritise, initiate, and coordinate high-potential projects) (5) Monitor progress, take corrective action, and institutionalise systemic change process
6	Mode of change	Continuous incremental change	Systemic evolutionary change

Source: Bozdogan (2010)

2.6 Lean sustainability

Lean sustainability refers to a self-perpetuating CI process (Lucey *et al.* 2005). It is achieved as soon as the CI momentum is maintained after initial pilots and lean implementation capabilities are developed, driving employee-based improvement from the bottom up (Bessant and Caffyn 1997; Jørgensen *et al.* 2007; Costa *et al.* 2019). It is therefore no surprise "that there is a strong correlation between employee engagement and lean sustainability" (Lucey *et al.* 2005, p. 13). To put it another way, organisations striving for operational excellence will have to set their focus on internal conditions that keep up the organisational motivation to sustain the CI momentum (Bateman 2005; Jørgensen *et al.* 2007). After all, lean strives for ongoingly for perfection according to its fifth principle (Womack and Jones 1996).

However, the transformation of a business towards lean is anything but straightforward given the complexity of change that an organisation must undergo (Bhasin 2012b; Bhasin and Found 2021). For instance, there is a need for new ways of working, for new structures, and for new management systems (Bortolotti *et al.* 2018; Bhasin and Found 2021). Moreover, lean requires a new way of thinking by both leaders and staff (Hirzel *et al.* 2017; Bortolotti *et al.* 2018). After all, it calls for constant efforts from every member of the organisation so that improvements become part of everyone's daily work routines (Malik and YeZhuang 2006). This suggests that an organisation-wide change of behavioural patterns is necessary to achieve long-term success (Martínez-Jurado *et al.* 2013; Bhasin and Found 2021).

Whether or not organisations manage to achieve lean sustainability depends on their lean maturity. On that note, the following touches upon recognised lean maturity models to illustrate which different evolutionary stages such organisations had to undergo.

2.6.1 Lean maturity

Just like the aforementioned CI maturity models, lean maturity models (sometimes also referred to as "leanness" or "lean assessment" models; Maasouman and Demirli 2015) evolved over time. Lean maturity models aim to give some indication to what extent lean is advanced in an organisation. In practice, they help managers to understand the degree of lean transformation that has been achieved so far and to identify directions of travel (Urban 2015).

While some scholars attempted to measure lean maturity through reviewing the literature on lean practices followed by a survey design in order to gain a snapshot of the current state (e.g., Karlsson and Åhlström 1996; Doolen and Hacker 2005; Shetty *et al.* 2010; Vinodh and Chintha 2011a, 2011b; Pakdil and Leonard 2014; Wong *et al.* 2014; Pakdil *et al.* 2018), others pursued longitudinal approaches in which they took the development of the organisational

culture as their viewpoint (e.g., Hines *et al.* 2020). Taking performance measures (e.g., rate of performance improvement) into account is a third common method to do so (Netland and Ferdows 2014, 2016; Piercy and Rich 2015). After all, there are a variety of lean maturity models in the vast literature on lean. They do not only differ in nature (e.g., qualitative or quantitative; Maasouman and Demirli 2015; Narayanamurthy and Gurumurthy 2016) but also in their foci and perspectives (Jørgensen *et al.* 2007; Narayanamurthy and Gurumurthy 2016).

Despite their variety, Bhasin (2011) alludes that most literature still falls too short in developing an adequate model for measuring lean maturity. He argues that there seems to be a common misperception that performance measures indicate the degree of leanness. Similarly, many of the quantitative lean maturity models put too much emphasis on hard lean practices. In doing so, they either neglect (e.g., Karlsson and Åhlström 1996; Doolen and Hacker 2005) or underrepresent (e.g., Vinodh and Chintha 2011a, 2011b; Pakdil and Leonard 2014; Pakdil *et al.* 2018) the important role that human factors play when pursuing lean. Also, Urban (2015) criticises that most instruments for measuring lean maturity attempt to grasp the visible characteristics of lean (e.g., via checklists) whereas none of them considers organisational culture comprehensively.

Bicheno and Holweg (2016) remark that the five principles of lean (value, value stream, flow, pull, and perfection; see Table 2.13) do not make any reference to people, and argue that lean *thinking* is the actual indicator to be measured rather than the techniques. According to this, many lean maturity models consider the tangibles rather than the intangibles and take therefore merely the "tip of the iceberg" into account. Similarly, Jørgensen *et al.* (2007) highlight that

> "successful sustainable lean involves more than the use of tools and methods and efforts should be made to support development of a lean culture" (p. 377).

In comparison to Bicheno and Holweg (2016), Jørgensen *et al.* (2007) conclude that assessing lean requires a consideration of two different perspectives. On the one hand, they argue, a comprehensive assessment must address the technical perspective of lean; on the other hand, it must consider the organisational one in which human factors and culture are considered.

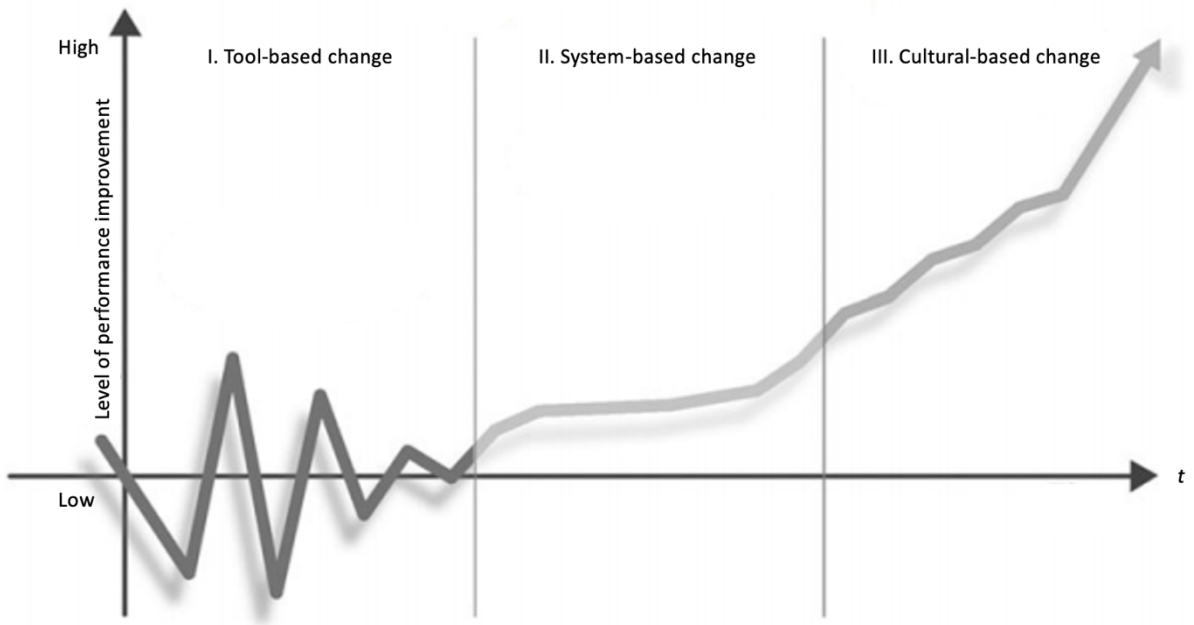
Arising thereby, it makes sense that a more considerate and holistic approach to lean maturity is purposeful. The reality, however, is that there is still no integrated model that measures lean maturity despite the various tools, techniques, and measures (Wan and Chen 2008). The fact that lean is polymorphic and lacks any definition (i.e., lean has a different meaning to different people) is problematic with any lean maturity model because it remains

virtually impossible to measure lean maturity uniformly. By implication, everyone uses different parameters to measure it (Hu *et al.* 2014; Samuel *et al.* 2015). In the following, four different lean maturity models are introduced, considering both a cultural and a performant perspective, accordingly.

2.6.1.1 "Lean maturity stages" (Hines et al. 2020)

To begin with, Hines *et al.* (2020) developed a simplified and less complex lean maturity model with three different stages, highlighting the development of cultural change over time, which leads in theory to sustainable success (Figure 2.5). In their longitudinal study, Hines *et al.* (2020) observed a Shingo Prize-awarded organisation over seven years and identified a series of distinct evolutionary stages that the business had undergone during its lean journey. Based on their findings, Hines *et al.* (2018) developed a model, which illustrates three different stages, namely, (1) tool-based change, (2) systems-based change, and (3) cultural-based change.

Figure 2.5 Lean maturity stages



Source: Adapted from Hines *et al.* (2020)

The first stage of their lean maturity model illustrates tool-based change and refers to the extensive use of hard lean practices (see Table 2.16). In this stage, organisations notice quick-wins indeed, but significant instability and variation in their improvement performance (Hines *et al.* 2020). While isolated hard lean practices may conflict with each other because of a lack of alignment with the overall strategy, Bicheno and Holweg (2016) further remark that "islands of excellence" (p. 26) may crystallise out.

The second stage, which is systems-based change, retains the application of hard lean practices, yet under consideration of management systems (e.g., strategy deployment system and CI system; Hines *et al.* 2020) that support an alignment with strategic objectives. In their study, Piercy and Rich (2009a) observed three financial services call centres in the UK during their lean transformation and identified what they call "paradigmatic shifts in organising logic" (p. 66).[4] They documented the management systems adopted before and after lean implementation. Their findings are summarised in Table 2.20 and convey a notion what systems-based change comprises.

Table 2.20 Management systems before and after lean implementation

No.	Workforce strategy	Management system(s)	
		Before lean implementation	*After lean implementation*
1	Decision-making	Management prerogative and deployed "top down"	Flat structure with shared goals and values and minimum status differentials
2	Organisational design	Functional by area of specialist repetitive activity	Delayered management structure with workers holding broad worker knowledge of processes and products Cross-skilling and flexible design
3	Key measures	Departmental budget performance and productivity through servicing as many customers as possible in the shortest time period	Value delivery measured at point of service (customer)
4	Design of work	Separated to functionally specialise and controlled by industrial engineering function	Customer "one stop" shop
5	Job design	Deskilled to tasks with customers routed to employee using information technology and advanced telephony systems Employees also controlled by "scripts" used to guide the conversation with the customer	Emphasis on whole task, flexible, use of teams Employees empowered to resolve customer issues, acting independently
6	Treatment of labour	Eliminate through automation and tolerate high attrition/ absenteeism	Treat as "value adding" resources Team activities with joint planning and problem-solving

[4] In the following, there will be more discussion around lean implementation in service contexts.

No.	Workforce strategy	Management system(s)	
		Before lean implementation	*After lean implementation*
7	Performance expectations	Time standards established per task with defined routines	Meet customer needs effectively (service) and reduce system failures
8	Rewards	Individual incentives, linked to job evaluation and "productivity"	Group incentives, with gain sharing, linked to skills and mastery of product processes
9	Employee participation	Narrow with high levels of initial training to ensure person is capable of working with customers then low levels of on-going training in non-product/task routines Repetition is preferred to employee reformulating work requirements	Encouraged at the team and interteam levels with widely shared business information Constant training in process improvement

Source: Piercy and Rich (2009a)

Regarding Hines *et al.*'s (2020) definition of lean, the last stage aims at developing a culture of improvement. In line with the second stage, the characteristics of the previous stages retain indeed, but a more sophisticated approach to the management of people enables to encourage behavioural change and the shaping of a CI mindset over time. Consistent with that, Liker (2004) stresses that the mere application of hard lean practices without striving for a lean mindset is far from becoming lean. Therefore, lean maturity constitutes cultural-based change, aligning behaviours with the corporate strategy and sustaining the CI momentum in the long-term. Although Hines *et al.* (2020) identified these three evolutionary maturity stages throughout the implementation of lean, it needs to be noted that they are not truly distinctive, but rather gradually merging into one another over time.

What Hines *et al.*'s (2020) lean maturity model has in common with some other CI maturity models (e.g., Bessant and Caffyn 1997) is the role of people in sustaining improvements. In fact, there are various similarities between the models. Jørgensen *et al.* (2007) emphasise that

> "in fact CI is a critical component in sustainable lean – and thus the model, with modifications to incorporate the specific characteristics of lean, should therefore be applicable to understanding how lean sustainability can be achieved through focus on capability development" (p. 373).

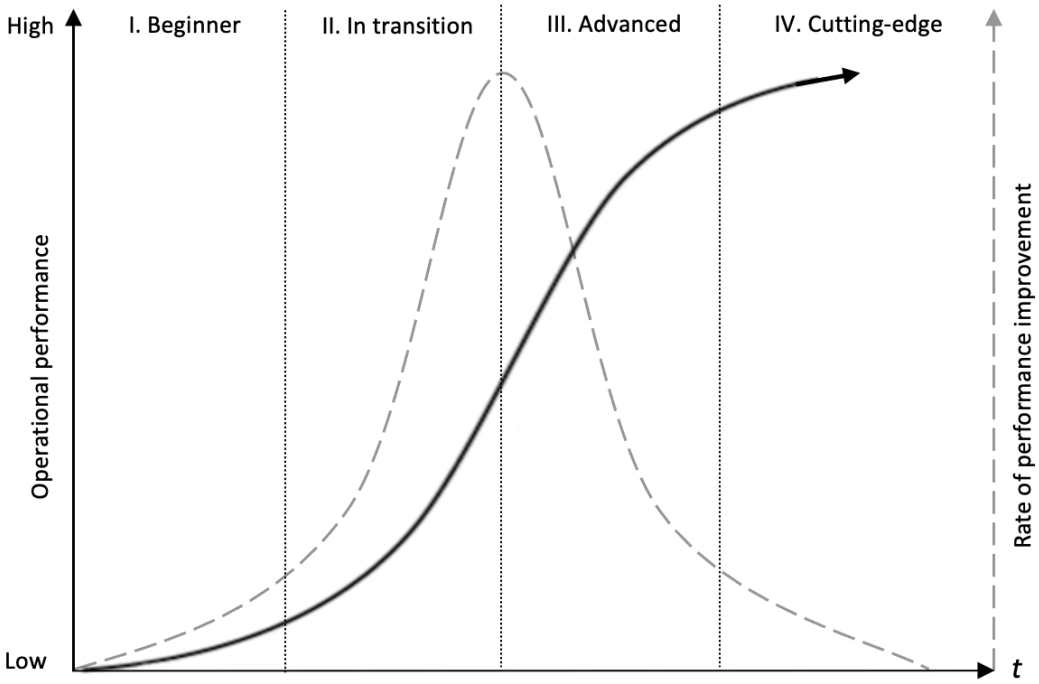
While Hines *et al.* (2020) emphasise gradual change towards a CI culture, Netland and colleagues (Netland and Ferdows 2014, 2016; Netland *et al.* 2014), Piercy and Rich (2015) as well as Bateman and David (2002; Bateman 2005) developed lean maturity models that concern the level of performance improvement in lean-adopting organisations. Neither

contradicting but rather complementing Hines *et al.*'s (2020) lean maturity stages, all three lean maturity models are introduced in the following likewise.

2.6.1.2 "S-curve theory" (Netland and Ferdows 2014, 2016; Netland et al. 2014)

Investigating the implementation of the Volvo Group's lean programme ("Volvo Production System"), Netland and colleagues (Netland and Ferdows 2014, 2016; Netland *et al.* 2014) empirically discovered an S-curve shape that depicts the pattern of change in plant performance along a Volvo plant's lean journey. Deriving from their findings at Volvo, they infer that organisations undergo four distinct stages when implementing lean, namely, (1) "beginner", (2) "in-transition", (3) "advanced", and (4) "cutting-edge" (Figure 2.6).

Figure 2.6 The pattern of change in plant performance



Source: Adapted from Netland and Ferdows (2014)

In each of the stages that organisations undergo, the rate of performance improvement and the overall plant performance vary. While the beginner stage is an explorative phase, during which an organisation becomes more familiar with lean principles due to experimentation, the following three stages are exploitative phases, during which the gains of lean are realised (Netland and Ferdows 2016). In Table 2.21, the characteristics and the managerial implication of each single stage is described in more detail.

Table 2.21 S-curve theory

No.	Evolution		Typical characteristic(s)	Managerial implication(s)
	Phase(s)	*Stage(s)*		
1	Explorative	Beginner	Pilot areas Organisational inertia and resistance towards change Regressing back after seeing some very good results (e.g., due to changes in management or failure to transfer learning to other areas)	Solve chronic problems Introduce best practices Share success stories Set modest performance improvement targets
2	Exploitative	In-transition	More thoroughly lean implementation than beginners Rapidly improving performance level (benefits from "low-hanging fruits") Palpable change of culture in the air	Solve chronic problems Introduce best practices Share success stories Set stretch performance improvement targets
3		Advanced	High performance level (e.g., delivery and quality or relatively high audit scores) Increased engagement (people begin to see the benefits) Lean culture evolves New focus on comprehensive improvement project with long-term results (as "low-hanging fruits" had been picked)	Be aware that the rate of improvement declines at this stage (fewer "low-hanging fruits") Provide more resources as big improvements require extensive projects Set less stringent stretch performance improvement targets
4		Cutting-edge	Top-performing plants (internally and industry-wide) High performance levels that improve less rapidly Most difficult to sustain a high rate of improvement	Be aware that performance improvements are small at this stage (may affect the willingness to sponsor resources) Set modest performance improvement targets Provide continued senior management support

Source: Adapted from Netland and Ferdows (2016)

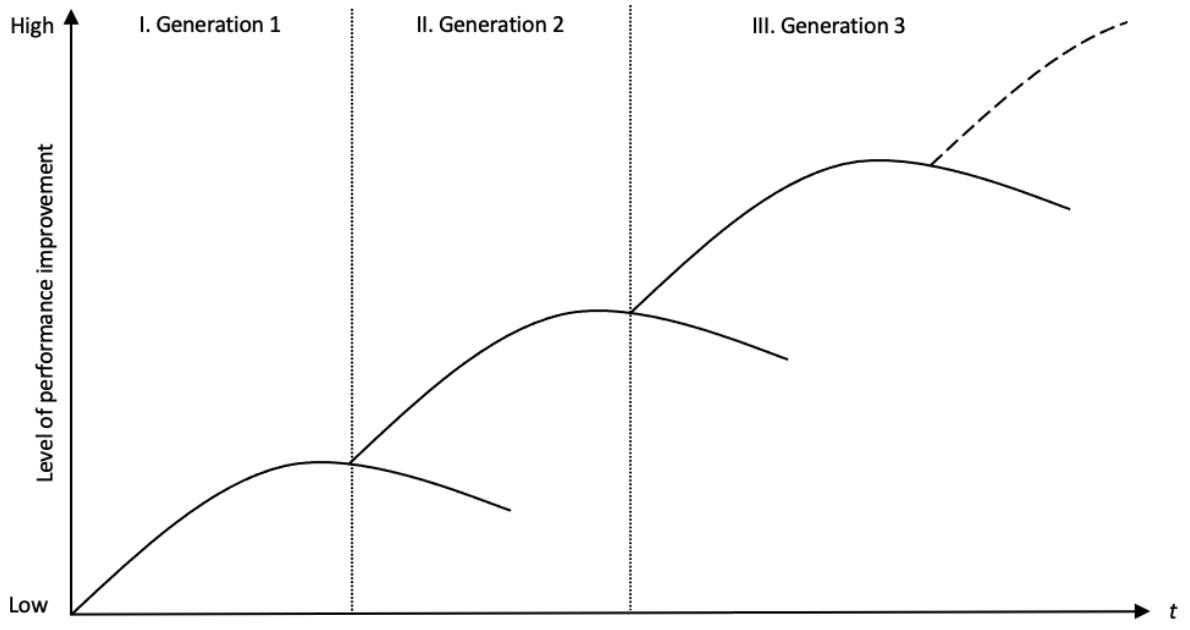
In a nutshell, the underlying assumption of Netland and colleagues' (Netland and Ferdows 2014, 2016; Netland *et al.* 2014) S-curve theory is that the more organisations proceed in their lean implementation, the higher becomes their plant performance. The rate of improvement, however, will decline once organisations transition to more advanced stages of lean implementation. That is because organisations can benefit from the "low-hanging fruits" (quick-wins) in the early stages indeed, but improvements become much more difficult to realise in more mature stages. Investigating manufacturing companies in an industrial cluster

in Brazil, the S-curve theory has recently been tested and confirmed in a study by Lopes Negrão *et al.* (2020).

2.6.1.3 "New product generations and performance improvement" (Piercy and Rich 2015)

A third lean maturity model was introduced by Piercy and Rich (2015). In their study, Piercy and Rich (2015) found that as long as organisations' products and associated production processes remain the same, they will only improve to a finite degree. That is because sticking to existing ways of working (e.g., materials, production requirements, etc) becomes a constraint over time. By implication, they argue that improvement can only be achieved, if existing products and their production processes experience major redesigns on a continuous basis. In other words, there will always remain space for improvement if products and associated production processes are cyclical replaced by a new generation. In practice, a product generation will phase out while clearing the way for a new generation. As lessons learnt are incorporated into new product designs and gradually increase from product generation to product generation, long-term CI is ensured (Figure 2.7).

Figure 2.7 New product generations and performance improvement



Source: Adapted from Piercy and Rich (2015)

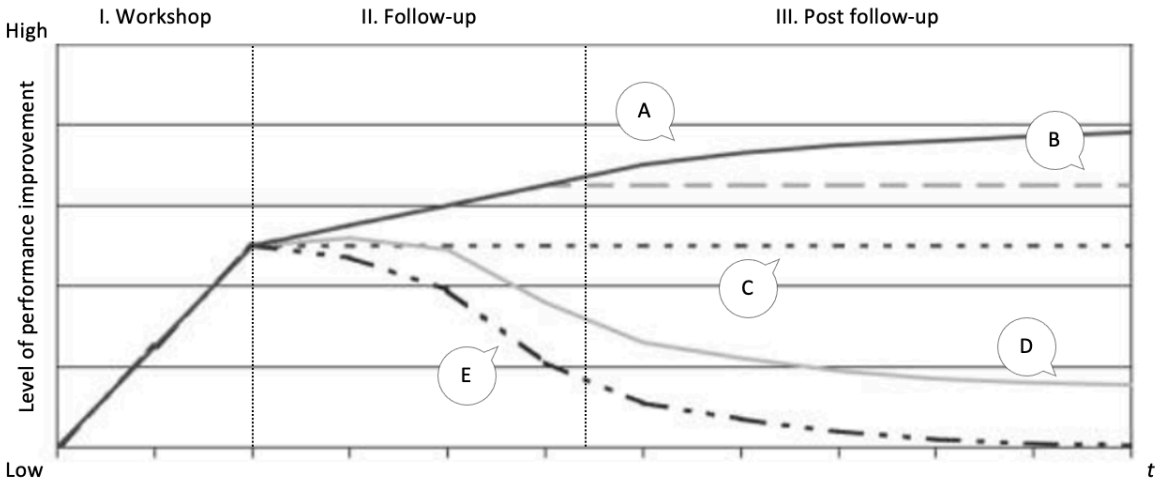
In fact, there are certain similarities between Piercy and Rich's (2015) model and the S-curve theory (Netland and Ferdows 2014, 2016; Netland *et al.* 2014). That is, the rate of performance improvement stalls over time. However, the S-curve theory (Netland and Ferdows 2014, 2016; Netland *et al.* 2014) theorises that it becomes much more difficult to sustain high rates of

improvement in more mature stages while Piercy and Rich (2015) demonstrate a way how organisations can maintain such rates by reinventing the way how they operate. After all, Toyota sustains high rates of quality-cost performance improvement in the same way.

2.6.1.4 "Model of sustainability" (Bateman and David 2002; Bateman 2005)

Taking the shopfloor cell level rather than the organisational level into account, a fourth model was developed by Bateman and David (2002) and further refined by Bateman (2005) three years later (Figure 2.8). Under consideration of four different conditions, namely, (1) improving in workshop, (2) maintaining new methods of working, (3) closing out actions and issues, and (4) applying tools to new problems within the cell to sustain CI, they developed a model to assess whether or not shopfloor cells are capable to sustain CI associated with a classification from best (Class A) to worst (Class E). It is true that this sustainability model is based on cells in factories; at the same time, however, it is also likely that such basic classifications may also apply beyond the shopfloor.

Figure 2.8 Model of sustainability



Source: Adapted from Bateman (2005)

In the Class-A case, a cell improves during a workshop, maintains the new methods of working, closes out actions and other technical issues, and applies tools to new problems in the cell to sustain CI. Since all conditions are fulfilled, this cell is capable of sustaining improvements and of continuously improving. Although a Class-B cell improves during a workshop, maintains new ways of working, and is capable of closing out further actions and technical issues, it fails to transfer the tools to new problems. In the long-run, its improvement momentum will stagnate. Maintaining the improvement and new ways of working, a Class-C

cell fails to close out actions and technical issues. This means that no post-workshop improvements will be achieved at all. In the Class-D case, improvements are gained in a workshop and technical issues are closed out; however, new methods of working are not maintained. Accordingly, the improvement momentum decreases rapidly. In the worst-case scenario, a cell classified as Class E will gain improvements during a workshop but will fail to maintain new procedures, to close out issues, and to apply tools to new problem (Table 2.22). In both latter cases, cells are not even capable of maintaining the improvements gained through the workshops (see Figure 2.8).

Table 2.22 Improvement classifications

No.	Characteristic(s)	Classification(s)				
		A	*B*	*C*	*D*	*E*
1	Improvement in workshop	•	•	•	•	•
2	Maintain new procedures and methods of working	•	•	•		
3	Close out actions and technical issues	•	•		•	
4	Apply tools to new problems in the cell (continuous improvement)	•				

Source: Adapted from Bateman and David (2002); Bateman (2005)

2.6.2 Lean sustainability issues

By definition, lean is a journey and requires continuous efforts (Womack and Jones 1996; Staats *et al.* 2011; Bicheno and Holweg 2016). That is because improvements will never reach a final destination. Instead, lean rather chases a moving target. Improvements, however, degrade over time and move back to their original state if they are not carefully managed (Rich and Bateman 2003; Bicheno and Holweg 2016). In the literature, this phenomenon is sometimes referred to as "backsliding" (Emiliani and Stec 2005; Bicheno and Holweg 2016; Leite *et al.* 2020a).

Although residual benefits may be retained due to implemented improvements (e.g., training; Holweg *et al.* 2018), the CI momentum degrades in this case, which will negatively affect an organisation's future CI capability (Bicheno and Holweg 2016). On that note, organisations often identify successes during the early stages in the form of guaranteed outcomes with minor efforts due to the application of lean tools and techniques but many still struggle with sustaining the CI momentum in the long-term and eventually gravitate back to their traditional way of operating (e.g., Bateman 2005; Mann 2005; Jørgensen *et al.* 2007; Poksinska *et al.* 2013; Jasti and Kodali 2015; Bicheno and Holweg 2016; Chakravorty and Hales 2016; Hirzel *et al.* 2017; Costa *et al.* 2019; Hines *et al.* 2020; Leite *et al.* 2020a). Despite several lean success stories, some UK studies reveal that no more than 10% managed to

introduce lean effectively in their organisation (Bhasin and Burcher 2006; Bhasin 2012b). In 2004, a survey (n = 999) by the Lean Enterprise Institute Inc. reported that only 4% assess their lean transformation as “advanced” (Emiliani and Stec 2005). This circumstance awoke attention and has led to debate concerning the factors that have an impact on the sustainability of CI initiatives.

In 2019, Secchi and Camuffo (2019) carried out a literature review on failure factors during the implementation of lean. A year later, Leite *et al.* (2020a) carried out a systematic literature review on inhibitors of the lean journey likewise. In their systematic literature review, they categorised over 20 years of literature thematically. The six themes they identified are (1) behavioural and cultural influence, (2) organisational strategy and alignment, (3) leadership commitment, (4) technical limitation, (5) process-based, and (6) resource constraints. While the first three themes are people-dependent (socio factors) and less visible elements, the last three themes concern tool-based aspects (technical factors), which are rather visible from the outside (Table 2.23).

Table 2.23 Failure factors during lean implementation

No.	Socio-technical dimension(s)	Theme(s)	Literature review(s)	
			Leite et al. (2020a)	*Secchi and Camuffo (2019)*
1	Behavioural and organisational aspects (people-dependent)	Behavioural and cultural influence	Backsliding to old ways of working	
			Bottom-up (improvement suggestions from shopfloor)	
			Cultural issues	
			Employee participation (buy-in)	Lack of employee engagement
			Fear of failure	
			Holistic approach	
			Job security	
			Lack of interest and commitment	
			Lean is driven by people	
			People-related issues	
			Personal conflicts	
			Resistance to change	Resistance of culture change
			Social-cultural barriers	
			Staff behaviour	
			Staff empowerment	
			Workforce involvement	
		Organisational strategy and alignment	A culture that involves everyone	
			Clarity of vision	
			Company strategy	
			Culture of continuous improvement and collaboration	
			Effective communication	
			Poor communication	Poor communication
			Inappropriate change process approach	
			Insufficient understanding of potential benefits	
			Improvement culture	
			Lack of alignment	Weak link between lean and strategic objectives
			Lack of long-term strategy	
			Lean viewed as a fad	
			Organisational barriers	
			Organisational culture	
			Organisational readiness	
			Organisational structure	
			Slow pace of change	
			Unclear goals and too many targets	
		Leadership commitment	Insufficient supervisory skills	
			Lack of skills to empower employees	
			Lack of awareness amongst managers	Lack of leadership skills and supportive leadership
			Lack of top management support and commitment	Lack of top management attitude, commitment, and involvement
			Leadership resistance to change	
			Leadership participation and availability	
			Loss of interest by top management	
			Managerial style	
			Management commitment and understanding	
			Middle management resistance	
			Pressure from top management	

No.	Socio-technical dimension(s)	Theme(s)	Literature review(s)	
			Leite et al. (2020a)	*Secchi and Camuffo (2019)*
2	Technical aspects (tool-based)	Technical limitation	Senior management commitment	
			Sponsorship for lean initiative	
			Benchmarking	
			Good practices from other sectors	
			Development of lean expertise	
			Education	Lack of training and education
			Insufficient know-how	
			Lack of lean experience	
			Lack of knowledge and expertise	
			Lack of methodology	
			Lack of workforce skills	
			Lean performance indicators	
			Lean terminology	
			Limited lean understanding	Narrow view of lean as a set of tools, techniques, and practices
			Technology-based	
			Training culture	
			Understanding of the lean tools	Wrong selection of lean tools
		Process-based	Complexity of the processes	
			Continual evaluation	
			Fragmented implementation	
			Lack of focus on customer and process	
			Lack of metrics	
			Lack of standardisation	
			Low supplier performance	
			Market factors	
			Operational hurdles	
			Performance evaluation	
			Poor supplier integration	
			Regulation polices (e.g., bureaucracy)	
			Transferring manufacturing concepts into another industry	
			Uncertainties in demand	
		Resources constraints	Budget constraints	
			Financial constraints	
			Financial capabilities	
			Funding constraints	
			HR policies to support lean	
			High cost of implementation	
			Insufficient external funding	
			Lack of equipment	
			Lack of human resources	
			Lack of internal funding	
			Resources constraints	
			Resources and capabilities	Lack of resources (financial, technical, human, etc)
			Time availability and investment	

Source: Author

Similarly, some scholars identified human resource (HR) mismanagement as a crucial factor for lean failure (Martínez-Jurado *et al.* 2013) while others found out that for some organisations CI initiatives are not successful at all due to a "focus on the work itself [rather than] on abstractions like 'participation' or 'culture'" (Beer *et al.* 1990, p. 159), due to an inability to adapt leadership (Mann 2005; Poksinska 2013) or due to a lack of management commitment and/or support (Beer 2003; Boyle *et al.* 2011; Liker and Convis 2011; Marodin and Saurin 2013; Holweg *et al.* 2018; Tortorella *et al.* 2020).

Consistent with that, Holweg *et al.* (2018) found that CI programmes are often perceived as a finite project, in which momentum often drops as soon as senior management priorities change. Introducing new initiatives then becomes increasingly difficult as apathy evolves because of "initiative fatigue" (p. 9). Apart from that, Holweg *et al.* (2018) recognised a desire for fast and visible results to be a common cause for lean sustainability failure. In their multiple cases (n = 204 lean projects), they observed that organisations set utmost importance on short-term metrics. This attitude, however, is then often associated with dissatisfying results, inducing organisations to abandon their lean programmes (Chakravorty and Hales 2016). Very often, there is too much emphasis on efficiency gains and results, whereas less attention is paid on developing the key pillars of lean sustainability, that is, cultural change (Liker 2004; Mann 2005; Bhasin and Burcher 2006; Jørgensen *et al.* 2007; Anand *et al.* 2009; Poksinska *et al.* 2013; Bhamu and Sangwan 2014; Glover *et al.* 2015; Hirzel *et al.* 2017; Hines *et al.* 2020), cross-departmental communication (Shah and Ward 2003; Longoni and Cagliano 2015), employee involvement (Longoni and Cagliano 2015), and employee empowerment (Beer 2003; Hirzel *et al.* 2017).

Jha *et al.* (1996) argue that CI should be seen as "a collection of activities that constitute a process intended to achieve improvement" (p. 22) rather than perceiving it as a sequence of isolated activities. This corresponds to scholars who report that lean is often only implemented "in bits" rather than integrally (Bateman 2005; Jørgensen *et al.* 2007; Jasti and Kodali 2015; Bicheno and Holweg 2016; Hines *et al.* 2020). Disregarding the necessity for cultural and behavioural change (Jørgensen *et al.* 2007; Liker and Rother 2011; Camuffo and Gerli 2018; Bicheno and Holweg 2016; Hines *et al.* 2020), many organisations fail to implement lean successfully due to an overemphasis on the tools and techniques (i.e., hard lean practices) that lean is associated with, "though these are only the surface artefacts of a deeper culture" (Netland *et al.* 2019, p. 543). In other words, a focus on hard lean practices alone will always lead to limited effects only and is not sufficient to sustain lean (Dombrowski and Mielke 2014; Netland *et al.* 2019).

Spear and Bowen (1999), for instance, reported how TPS is often misperceived as a series of tools and techniques that can be simplistically transferred to other organisational contexts. Associated with this, Bhasin and Burcher (2006) quote Repenning and Sterman (2001) who endorse that organisations

> "use initiatives almost as a fad and submit that whilst the, 'number of tools, techniques and technologies available to improve operational performance is growing rapidly, on the other hand, despite dramatic successes in a few companies most efforts to use them fail to produce significant results'" (p. 56).

In addition, Hines *et al.* (2020) point out the common misperception that the focus of lean lies on the removal of waste through a tool-based approach as often formulated in the early literature on lean. Elaborating on this, they argue that "such a mindset is likely to become an obstacle in its own right" (p. 403).

Although the root causes of backsliding vary, issues often refer to the human factor as being a creature of habit by nature (Bicheno and Holweg 2016; Gaiardelli *et al.* 2019; Leite *et al.* 2020a). Eventually, *human beings* tend to "revert back the 'old days'" (Bicheno and Holweg 2016, p. 97). Referring to a physical example, Bicheno and Holweg (2016) metaphorise the nature of lean with a "perpetuum mobile" (i.e., a utopian machine that operates without energy supply). Like "perpetual motion, there is no such thing as 'self-sustainability'" (Bicheno and Holweg 2016, p. 97) in lean, which ultimately calls for the need of energy supply in the form of an adequate change management in order to sustain the CI momentum.

In summary, lean is not limited to a set of hard lean practices in the form of tools and techniques but demands a consideration of people-related and behavioural aspects to flourish on an everyday basis (Liker 2004; Martínez-Jurado *et al.* 2013; Hadid and Mansouri 2014; Bortolotti *et al.* 2015, 2018; Bicheno and Holweg 2016; Hadid *et al.* 2016; Yadav *et al.* 2017). It is therefore important not to focus solely on structure and task but also on human behaviour (Lam *et al.* 2015). Taking account of lean sustainability requiring the development of lean implementation capabilities to drive employee-based improvement (Jørgensen *et al.* 2007; Costa *et al.* 2019), the human factor could undermine sustainable lean if it is mismanaged (Beale and Found 2006; Liker and Rother 2011).

2.7 Integrated socio-technical lean system

2.7.1 Respect for people

In line with this is the principle of "respect for people" which has always been an indispensable part of the TPS (e.g., Sugimori *et al.* 1977; Krafcik 1988; Ohno 1988; Womack *et al.* 1990; Monden 1993; Hines *et al.* 2004; Emiliani and Stec 2005; Bhasin and Burcher 2006; Womack 2008; Bhamu and Sangwan 2014; Emiliani 2015; Gupta *et al.* 2016; Lodgaard *et al.* 2016; Bortolotti *et al.* 2018; Coetzee *et al.* 2019; Magnani *et al.* 2019). In a broader sense, "people" includes all stakeholders, such as employees, customers, suppliers, investors, and the community. That is because businesses owe their existence to them (Ohno 1988; Emiliani and Stec 2005). In a narrower sense, "people" refers to the workforce.

Sugimori *et al.* (1977) were amongst the first to examine the employee-focused dimension of the TPS and identified "respect for people" as a central element, although this aspect did not receive nearly the same attention as at Toyota at that time (Browning and de Treville 2021). In practice, "respect for people" is manifested, for instance, by focusing on active employee participation (Sugimori *et al.* 1977), by leadership behaviours (Gupta *et al.* 2016), and by recognising employees' contributions and views (Bortolotti *et al.* 2018). The intention behind "respect for people" is to make each individual employee feel comfortable so that they are willing to share their views (e.g., improvement ideas or concerns) regardless of their position in the hierarchy (Krafcik 1988). Individuals are entrusted with responsibility and autonomy while being empowered to use their problem-solving capabilities through active participation at the same time (Sugimori *et al.* 1977; Coetzee *et al.* 2019; Magnani *et al.* 2019).

In stark contrast to "respect for people" is "*dis*respect for people". It is seen as "an integral feature in classical management" (Emiliani 2020, p. 5) and generates waste by missing improvement opportunities because issues are not raised but remain hidden and are never addressed.

2.7.2 Socio-technical systems theory

Although the literature lacks a universal definition, mutually agreed key characteristics of a systems approach include an aim or purpose (Deming 1994) and seeing entities as an interdependent whole rather than a series of isolated components (White 2000; Kalim *et al.* 2006; Waldman and Schargel 2006; Rich and Piercy 2013). Taking dependencies from in- and outside into account, a systems approach considers organisations in their entirety. To use Deming's (1994) words, a system is defined as

> "a network of interdependent components that work together to try to accomplish the aim of the system" (p. 50).

This enables to differentiate between symptoms and root causes of failure (Musa *et al.* 2005; Testa and Sipe 2006; Rich and Piercy 2013) and further suggests

> "that a failure at one point is influenced by and in turn influences other parts of the system – a systems approach therefore permits effective socio-technical improvements to be achieved" (Rich and Piercy 2013, p. 963).

Lean itself is a STS (Shah and Ward 2007; Danese in Åhlström *et al.* 2021; Shah in Åhlström *et al.* 2021). By definition, a STS considers that an organisation operates by means of social and technical parts while being open to its environment (Trist *et al.* 1963; Appelbaum 1997; Sahoo 2020). Manufacturing and service organisations, for instance, are STSs in which human beings interact with technical equipment. Ideally, social and technical parts should operate in harmony (Bicheno and Holweg 2016).

In virtually every organisation, operations and HR are closely interconnected (Boudreau *et al.* 2003). The STS theory postulates that superior performance can be achieved under careful consideration of both social and technical sub-systems (Emery and Trist 1960; Pasmore and King 1978; Trist 1981; Miner 2006; Kull *et al.* 2013; Hadid and Mansouri 2014). More precisely, STS theory considers that

> "organisational objectives are best met not by the optimisation of the technical system and the adoption of a social system to it, but by the joint optimisation of the technical and social system" (Cherns 1978, p. 63).

Against this background, Li *et al.* (2020) remark that the technical part may show certain potentials; the integration of the social part, however, determines an organisation's effectiveness and efficiency. Similarly, Waldman and Schargel (2006) underline the importance of the social system to counteract issues associated with change (e.g., via leadership).

In the case of lean, for instance, VSM is adopted to identify and eliminate NVA activities and bottlenecks. While certain waste may be even eliminated by an unskilled workforce, it could be presumed that an up- and multi-skilled workforce is more likely to identify more of such NVA activities as long as they are empowered. Similarly, an up- and multi-skilled workforce is more likely to operate more efficiently (Hadid and Mansouri 2014).

On the contrary, Bicheno and Holweg (2016) point out the challenges that come up when undertaking change in processes in which machines and individuals operate. Undertaking change in organisations, for instance, means changing somebody's work environment (Bicheno and Holweg 2016; Bhasin and Found 2021). Undertaking change in layouts and/or machines is considerably easy, whereas changing or replacing people is more difficult. Bicheno and Holweg (2016) highlight that technical change affects people who are involved in this process, at least to some extent; and, like machines, individuals could turn into the bottlenecks within processes (Boudreau *et al.* 2003; Bicheno and Holweg 2016). Hence, a neglect of managing change could lead to resistance and because of this

> "[i]t is aligning this 'social system' with the technical that is the challenge when implementing change" (Bicheno and Holweg 2016, p. 76).

Previously, Bessant *et al.* (2001) already noted that CI is insufficiently understood in the sense that its management is often limited to the outcomes rather than "to the process through which these can be achieved" (p. 75). In the same vein, Dibia and Onuh (2010) argue that "the effective combination of human resource and automation is very important to ensure continuous quality improvement" (p. 4).

In a lean context, STS theory emphasises therefore the need to achieve excellence in a (production) system's social and technical dimension via joint optimisation. Consequently, an effective implementation of lean requires a rethinking from the isolated application of hard lean practices towards an integral approach that embraces the social dimension of an organisation likewise (Jørgensen *et al.* 2007; Shah and Ward 2007; Bortolotti *et al.* 2015; Hirzel *et al.* 2017; Bhasin and Found 2021; Shah in Åhlström *et al.* 2021). After all, a consideration of human factors is increasingly emphasised in the recent literature on lean (Liker 2004; Shah and Ward 2007; van Dun and Wilderom 2012; Hadid and Mansouri 2014; Bortolotti *et al.* 2015; Hadid *et al.* 2016; Magnani *et al.* 2019; Shah in Åhlström *et al.* 2021).

The importance of people during the adoption of lean is particularly underlined by the eighth type of waste that has become increasingly evident in the literature over time. While Ohno (1988) touched upon the traditional seven types of waste, various other authors identified another source, which involves people in the form of NVA behaviours or unused human talent (e.g., Imai 1986; Womack and Jones 1996; Pavnaskar *et al.* 2003; Emiliani and Stec 2004; Hicks 2007; Nicholas 2011; Bicheno and Holweg 2016). For instance, Deming (1986) argues that

"[t]he greatest waste […] is failure to use the abilities of people" (p. 52). Similarly, Hicks (2007) refers "to the underutilisation of people and in particular their ideas and creative input for improving the processes and practices" (p. 237).

Although Ohno (1988) did not particularly point towards untapped human talent within his seven types of waste, he remarked that TPS's main objective was "to create thinking people" (Ohno 1988 quoted in Bicheno and Holweg 2016, p. 21), which eventually relates to the eighth type of waste that other authors brought up. This eighth form of waste (underutilised human factors) can affect the sustainability of lean if it is not carefully managed during the initial stage of lean implementation (Liker and Rother 2011).

2.7.3 Soft lean practices

In the lean literature, managing and optimising this social dimension of a STS is often associated with so-called "soft lean practices" (e.g., Bortolotti *et al.* 2015; Costa *et al.* 2019). While hard lean practices involve tools and techniques that mainly help to identify and to eliminate waste (process-focused; e.g., 5S or VSM), soft lean practices address human factors and social relations (employee-focused; e.g., via training, recognition, and leadership) within this STS (Fotopoulos and Psomas 2009; Calvo-Mora *et al.* 2014; Hadid and Mansouri 2014; Bortolotti *et al.* 2015; Costa *et al.* 2019; Sakthi Nagaraj *et al.* 2019; Cadden *et al.* 2020; Sahoo 2020; Bouranta *et al.* 2021). It is obvious that soft lean practices are less tangible and less observable than hard lean practices (Bortolotti *et al.* 2015). Paying attention to soft lean practices promotes organisational change towards a lean-thinking culture (Martínez-Jurado *et al.* 2013; Martínez-Jurado and Moyano-Fuentes 2014; Cadden *et al.* 2020) and is often suggested to be central to lean performance (Samson and Terziovski 1999; Shah and Ward 2003; Jørgensen *et al.* 2007; Hadid and Mansouri 2014; Bortolotti *et al.* 2015; Zeng *et al.* 2015; Magnani *et al.* 2019; Sakthi Nagaraj *et al.* 2019) whereas a lack of attention to soft lean practices is reported to undermine the long-term success with lean (Liker and Rother 2011; Martínez-Jurado *et al.* 2013; Costa *et al.* 2019).

Along with an under-exploration of the concept (Samuel *et al.* 2015; Bouranta *et al.* 2021), some aspects within the literature on the soft side of lean are still in somewhat nebulous. To begin with, the terminologies to describe soft lean practices vary in the literature (Table 2.24).

Table 2.24 Terminologies for the soft side of lean

No.	Terminologies[a]	Reference(s)
1	HR practices	Martínez-Jurado *et al.* (2013)

No.	Terminologies[a]	Reference(s)
2	HRM practices	Shah and Ward (2003); Matsui (2007)
3	Lean social practices	Hadid *et al.* (2016)
4	Lean soft practices	Costa *et al.* (2019)
5	Lean supportive practices	Hadid and Mansouri (2014)
6	Soft (lean) management practices	Alieva and Powell (2022)
7	Soft lean practices	Bortolotti *et al.* (2015); Danese *et al.* (2018); Gaiardelli *et al.* (2019); Sakthi Nagaraj *et al.* (2019); Sahoo (2020); Bouranta *et al.* (2021)
8	Soft practices	Danese *et al.* (2017)

Source: Author
Note(s): (a) In alphabetic order

For instance, Shah and Ward (2003), Matsui (2007), and Martínez-Jurado *et al.* (2013) simply refer to HR or HRM practices while others refer to lean supportive practices (Hadid and Mansouri 2014), lean social practices (Hadid *et al.* 2016), lean soft practices (Costa *et al.* 2019). or to soft lean practices (Bortolotti *et al.* 2015) like this study does. Despite that, there is no consensus on whether soft lean practices constitute a basic part of lean. While authors like Shah and Ward (2003), Hadid and Mansouri (2014) and Bortolotti *et al.* (2015) perceive they are, Pettersen (2009), for instance, does not agree but still acknowledges the important role that HRM plays.

In a systematic literature review, Bouranta *et al.* (2021) present the most common themes associated with human factors in lean. Ranked by order, they include (1) training, (2) leadership, (3) culture, (4) participation, (5) HR department role, (6) commitment, (7) job design, (8) teamwork, (9) communication, (10) impact on employee, and (5) resistance to change. Drawing on empirical work (Hadid and Mansouri 2014; Bortolotti *et al.* 2015; Hadid *et al.* 2016; Netland 2016; Costa *et al.* 2019), Table 2.25 extracts soft lean practices reported to be significant and most influential. These soft lean practices are grouped according to their nature to highlight their overlap. In their initial reviews, Hadid and Mansouri (2014) and Costa *et al.* (2019) mapped out soft lean practices that are conducive to implementing lean and separated them from hard lean practices while Bortolotti *et al.* (2015) merely consolidated soft lean practices from six different articles. In contrast to this, Netland (2016) ranked 24 success factors for lean implementation, which he identified from a sample size of 432 practitioners from 83 factories of two multi-national firms. From these 24 success factors, one ("use lean tools and techniques") relates to hard lean practices and was excluded for this review, accordingly. The analysis indicates that the success of lean seems to be particularly associated with soft lean practices relating to training, leadership, communication, and employee involvement.

Table 2.25 Soft lean practices

No.	Soft lean practice(s)	Reference(s)				*f*
		"Soft lean practices" (Bortolotti, et al. 2015)[a]	*"Lean supportive practices" (Hadid and Mansouri 2014)* *"Lean social practices" (Hadid et al. 2016)*[b]	*"Critical success factors for implementing lean production" (Netland 2016)*[c]	*"Lean soft practices" (Costa et al. 2019)*[d]	
1	Training	Training employees	Training	Educate employees Educate managers	Training	4
2	Leadership		Leadership Obtaining management support	Lead actively Participate personally	Leadership Top-management commitment	3
3	Communication		Effective communication system	Communicate, inform, and discuss	Communication	3
4	Employee involvement		Employee involvement	Involve and support employees	Bottom-up approach	3
5	Teamwork	Small-group problem-solving			Teamwork Kaizen events ("jishuken")	2
6	Commitment and engagement		Employee commitment		Employee engagement	2
7	Empowerment		Employee empowerment		Job empowerment	2
8	Performance management		Performance measurement system	Set targets and follow-up		2
9	Culture	Continuous improvement (as the guiding principle)		Integrate lean in everyday business		2
10	Recognition		An appropriate rewarding system			1
11	Customer involvement	Customer involvement				1
12	Supplier partnership	Supplier partnership				1
13	Human resources			Dedicate human resources		1
14	Vision			Develop vision and roadmap		1

Source: Author

Note(s): (a) In their study, Bortolotti *et al.* (2015) analysed six soft lean practices of which five were found to be used more often in successful lean plants rather than unsuccessful ones (n = 317 plants); (b) In their empirical research, Hadid *et al.* (2016) build upon Hadid and Mansouri's (2014) conceptual framework of lean service reporting 17 soft lean practices from which they used ten. Out of these 10 soft lean practices, 9 ones were found to improve both operational and financial performance (n = 99 UK for-profit service firms); (c) Under consideration of contingencies (corporation, factory size, lean maturity stage and national culture), yet suggested as "essential […] for implementing lean production *in any plant* [italics in original]" (p. 2441), Netland (2016) identified 24 critical success factors of which one ("use lean tools and techniques") relates to a hard lean practice. In this review, the top ten are considered from the 23 residual success factors (n = 432 practitioners from 83 factories of two multi-national firms); (d) In a systematic literature review, Costa *et al.* (2019) identified 24 soft lean practices that influence lean implementation and lean sustainability. Out of 14 soft lean practices, they eventually analysed empirically, eight were found to be most influential (n = 15 Certified Six Sigma Master Black Belts from 12 organisations). In their study, however, "training and job empowerment" were considered as one factor while being separated in Table 2.25, accordingly.

As identified by Hadid and Mansouri (2014), training enhances the quality of employees as their capabilities will be improved. In the early stages, in particular, training for both managers and employees often includes awareness creation and the conveyance of lean principles (Netland 2016; Costa *et al.* 2019). It enables employees to perform multiple tasks to increase the flexibility of the organisation (Bortolotti *et al.* 2015; Hirzel *et al.* 2017; Costa *et al.* 2019). Moreover, training aimed at managers qualifies them to become coaches (Netland 2016). That is because lean implementation requires active lean leadership to close cultural gaps in the organisation (Costa *et al.* 2019) and to ensure sustained promotion to drive change (Beer *et al.* 1990; Rother 2010; Netland 2016; Reynders *et al.* 2022).

Taking this into account, a successful lean implementation requires managers to develop a clear narrative, which is in line with the organisational objectives. Holweg *et al.* (2018), for instance, advise leaders to guide meaningful improvements and to call attention to the associated benefits because improvements become relevant and of personal interest for those involved in the process once "pain points" are resolved and felt needs addressed (e.g., work simplification). A lean leader further provides training for his or her employees, involves them in change and finally empowers them to undertake change (Beer *et al.* 1990; Netland 2016). Involving individuals in decision-making increases their commitment to the lean programme (Rother 2010; Bortolotti *et al.* 2015). An employee is engaged and committed once he or she regularly contributes to the redefinition of standard operating procedures for the better (Costa *et al.* 2019).

Communication is necessary to inform and discuss lean implementation and to explain why change is needed (Netland 2016; Costa *et al.* 2019). Communication, however, does not only concern the flow of information but also active listening. Via coaching and mentoring, lean leaders further promote regular engagement and inspire employees. Accordingly, management commitment concerns managers' enthusiasm for the lean programme and the degree to which these leadership behaviours are exhibited (e.g., the drive, the level of effort they dedicate, and the level of support they provide to employees, including emotional support and resources). The latter is often characterised by their physical presence and personal participation (Holweg *et al.* 2018; Costa *et al.* 2019). In their reviews, Marodin and Saurin (2013; n = 102 articles) and Netland (2016; n = 14 systematic literature reviews) identified that most articles refer to managerial commitment and support once critical success factors of lean implementation are discussed.

2.7.4 Interplay between hard and soft lean practices

In this STS, lean is conceived as an interplay between hard lean practices and soft lean practices (Shah and Ward 2007; Hadid and Mansouri 2014; Bortolotti *et al.* 2015; Hadid *et al.* 2016; Danese *et al.* 2017, 2018; Wickramasinghe and Wickramasinghe 2020). In fact, soft lean practices positively impact hard lean practices and contribute to the success of lean programmes (Bortolotti *et al.* 2015; Zeng *et al.* 2015; Magnani *et al.* 2019). Though, they are not "standalone" practices but complement hard lean practices (Fotopoulos and Psomas 2009). In this regard, Hadid *et al.* (2016) discovered the positive synergistic effect on operational and financial performance when accompanying hard lean practices with soft lean practices. Similarly, Dal Pont *et al.* (2008) identified that soft lean practices have a positive but indirect impact on the organisational performance because they facilitate the implementation of hard lean practices. In addition, Bortolotti *et al.* (2015) identified that successful lean-adopting organisations make more use of soft lean practices than unsuccessful ones and could not ascertain a significant difference regarding the utilisation of hard lean practices. Similarly, Samson and Terziovski (1999) argue that soft lean practices are more reliable predictors of operational performance than hard lean practices. Although hard lean practices have a positive influence on performance improvement within manufacturing (Taylor and Wright 2006), there are still superior effects once hard lean practices are accompanied by soft lean practices (Matsui 2007; Furlan *et al.* 2011).

Due to not giving equal importance to hard lean practices and soft lean practices (Liker and Rother 2011), organisations sometimes neglect the potential to create a breeding ground for hard lean practices through soft lean practices (Furlan *et al.* 2011; Bortolotti *et al.* 2015). After all, soft lean practices are seen to assist in removing NVA activities from the value stream. Similarly, Cua *et al.* (2001) argue that soft lean practices aim at developing a work environment in which hard lean practices are implemented. Connecting lean and organisational learning, Hu *et al.* (2011, 2016) demonstrate how soft lean practices may foster organisational learning. Conversely, hard lean practices (e.g., 5S or VSM), they argue, may also facilitate the operationalisation of organisational learning. Thus, the use of soft lean practices is indispensable when aiming to achieve superior performance with lean and for sustaining the CI momentum. In fact, recent literature emphasises the importance of managing people by adopting soft lean practices, complementing their technical counterpart (Hines *et al.* 2004; Hadid and Mansouri 2014; Bortolotti *et al.* 2015, 2018; Hadid *et al.* 2016).

2.8 Lean management[5]

In essence, lean management bridges the gap between the strategic and the operational level of lean (Jackson 1996; Mann 2009; Bortolotti *et al.* 2015) and concerns the administration to run an organisation according to the principles of lean thinking, including aspects related to strategy deployment and its operationalisation as well as leadership (Slack *et al.* 2010; Bortolotti *et al.* 2015; Bouranta *et al.* 2021). More generally, Jackson (1996) describes lean management as follows.

> "Lean management […] invites vertical, horizontal, and diagonal bands of cross-functional coordination and cooperation [and] helps a company realign its pathways of authority. […] It aligns company functions to compete not against each other but against the firm's competitors, and also against […] organizational inertia" (p. 7).

Taking into consideration that lean itself is a STS (Shah and Ward 2007; Danese in Åhlström *et al.* 2021; Shah in Åhlström *et al.* 2021), Bortolotti *et al.* (2015) define lean management as

> "a managerial approach for improving processes based on a complex system of interrelated socio-technical practices" (p. 182) [while] "generally considered as an interrelated system of soft and hard practices" (p. 183).

In the following, several elements of lean management are discussed. Initially, a number of change management frameworks are presented. Then, organisational learning and the learning organisation are introduced. Subsequently, two lean management frameworks and a framework for policy deployment termed as "hoshin kanri" (HK) associated with its X-matrix are introduced while the discussion shifts towards the role of leadership later.

2.8.1 Change management frameworks

In the context of lean, change management is about how to deal with the changes needed to implement lean (Manos *et al.* 2006). In the literature, "change" is "identified as the behavioural shift of 'the organization as a whole, from one being to another'" (Al Manei *et al.* 2018, p. 1161), while "change *management*" is referred to as a structured approach that aims to foster the transition of individuals, groups, or organisations from a current to a desired future state

[5] In November 2020, a few parts of the following sub-chapters have been accepted for publication (see Reynders, P., Kumar, M. and Found, P. 2022. '*Lean* on me': an integrative literature review on the middle management role in lean. *Total Quality Management & Business Excellence* 33(3/4), pp. 318-354). In this journal article, the author and his co-authors reviewed the literature on the middle management role in lean.

(Manos *et al.* 2006; Hadid and Mansouri 2014; Al Manei *et al.* 2018). Implementing lean is not associated with a single event, after all (Tortorella *et al.* 2015).

In practice, lean implementation often starts as a top-down change initiative. In the long-run, however, it aims to go beyond that by developing a culture that drives continuous change from the bottom up (Pearce and Pons 2017; Hines *et al.* 2020). Top-down change initiatives are usually understood as planned change. That is because they are episodic and involve discrete events. In contrast, bottom-up change initiatives are emergent. They are dynamic, on-going, and self-sustaining. Until the 1980s, planned approaches to change dominated for about 30 years. After that, however, the focus shifted to emergent approaches as deeper and more sustainable change was sought (Pearce and Pons 2017).

Over time, a number of change management frameworks have evolved which guide and assist organisations in managing change and transitioning (Brisson-Banks 2010; Asnan *et al.* 2015). In line with soft lean practices required for lean to be sustainable, several of those emphasise the importance of soft factors to conduce change.

> "Lean tools and techniques are not rocket science, but the human side of lean is not as easy to manage. The human side includes both change management and teamwork" (Alukal 2006, p. 8).

This is essentially in line with the STS theory, postulating that superior performance can only be achieved once social and technical sub-systems operate in harmony (Cherns 1978; Bicheno and Holweg 2016). With this in mind, most change management frameworks share the assumption that an organisation and its members' behaviours are manageable (Al Manei *et al.* 2018), while the social sub-system is much more complex to optimise, though. The change management frameworks presented in the following once again underline the importance of soft factors in initiating change.

2.8.1.1 "Prosci ADKAR model" (Hiatt 2006; Prosci 2022)

The Prosci ADKAR model is considered as a social process model focusing on change at the individual level (Hiatt 2006; Welch *et al.* 2016; Al Manei *et al.* 2018; Prosci 2022). It is based on the empirical data of eight different studies conducted in private- and public-sector organisations over a period of twenty years (Welch *et al.* 2016) and theorises that change can only occur once individuals change (Prosci 2022). This is, in fact, in contrast to the definition of change management given above which sees change management as a transformation of groups or whole organisations in addition to individuals.

Hiatt (2006) who developed the Prosci ADKAR model argues that successful change is rooted in *facilitating* change within an individual by addressing roadblocks along the way.

> "The secret to successful change lies beyond the visible and busy activities that surround change. Successful change, at its core, is rooted in something much simpler: How to facilitate change with one person" (p. 1).

In his book, he refers to five factors that need to be developed in sequence to realise successful change, namely, (1) "awareness", (2) "desire", (3) "knowledge", (4) "ability", and (5) "reinforcement" (Table 2.26).

Table 2.26 Prosci ADKAR model

No.	Phase(s)	Dimension(s)	Description(s)
1	Current	Awareness	Awareness of the need for change
		Desire	Desire to support and participate in the change
2	Transition	Knowledge	Knowledge of how to change
		Ability	Ability to implement required skills and behaviours
3	Future	Reinforcement	Reinforcement to sustain the change

Source: Adapted from Hiatt (2006); Al Manei *et al.* (2018); Prosci (2022)

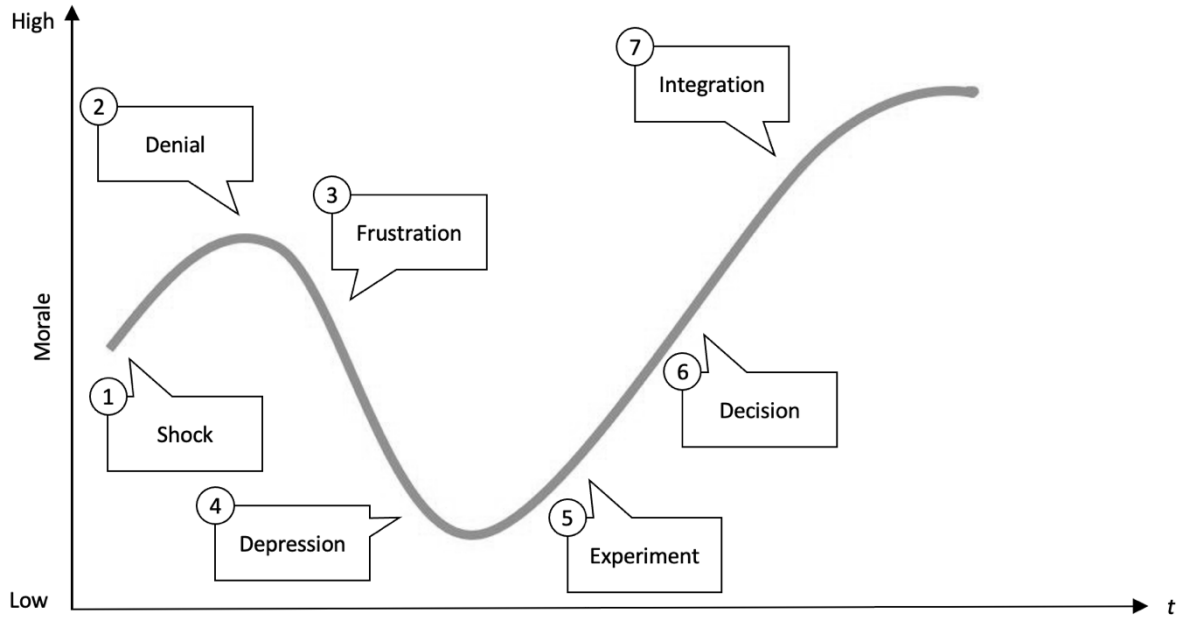
First, "awareness" must be raised. That is because individuals need to know why change is necessary. Moreover, they must learn about the consequences of not changing. Second, "desire" represents an individual's willingness to participate and engage in change. Third, "knowledge" equips an individual with the information and education necessary to realise change. Fourth, "ability" involves the process of performing change by putting "knowledge" into practice. Fifth, "reinforcement" enables sustaining change (Hiatt 2006).

In practice, however, change intentions do not always work out as planned. According to Kotter (2012), for instance, only 30% of change programmes, such as lean implementation, succeed. It should therefore come as no surprise that only organisations with an appropriate change strategy that promotes a CI culture will be successful with lean implementation (Alukal 2006; Bhasin 2013).

2.8.1.2 "Kübler-Ross change curve" (Kübler-Ross 1969)

An example that illustrates the challenges associated with change at the individual level involves the Kübler-Ross (1969) change curve developed by Kübler-Ross (1969) more than 50 years go (Figure 2.9).

Figure 2.9 Kübler-Ross (1969) change curve



Source: Adapted from Kübler-Ross (1969)
Note(s): See Table 2.27 for more detailed information.

Although her model is relatively old, it is still widely accepted in the change management literature. It illustrates the different stages individuals undergo when changing and

> "describes how an individual's confidence, morale and effectiveness levels may vary as a change process, such as [lean] implementation, unfolds" (de Almeida *et al.* 2019, p. 1).

In her work, Kübler-Ross (1969) argues that the way people respond to change is similar to the way they react to grief. In doing so, individuals undergo different stages of change, starting from denial where change is refused towards integration where change is accepted and incorporated into daily routines (Table 2.27).

Table 2.27 Kübler-Ross (1969) change curve

No.	Phase(s)	Description(s)
1	Shock	Surprise or shock at the event
2	Denial	Disbelief Looking for evidence that it is not true
3	Frustration	Recognition that things are different Sometime angry
4	Depression	Low mood Lacking in energy
5	Experiment	Initial engagement with new situation
6	Decision	Learning how to work in the new situation Feeling more positive
7	Integration	Changes integrated A renewed individual

Source: Adapted from Kübler-Ross (1969)

In lean research, the Kübler-Ross (1969) change curve has been used, for instance, to identify key factors that constrain lean implementation in the aviation sector (Kumar *et al.* 2015) or to explain leader behaviours during different stages of lean implementation (de Almeida *et al.* 2019).

2.8.2 Organisational learning and the learning organisation

2.8.2.1 Organisational learning

It is widely accepted that organisational learning conduces the delivery of change (Tsang 1997; Elliott 2020). At the same time, it is true that sustaining lean requires constant change for the better, which works best once a culture driving CI from bottom up is in place (Liker 2004; Hines *et al.* 2020). As lean encourages individuals to constantly perform better (Ballé and Régnier 2007) by continuously questioning and improving current-state operations, it speaks for itself that CI is associated with organisational learning (Hines *et al.* 2004; Bessant and Francis 1999; Mohd-Zainal *et al.* 2011), which is defined as

> "the process of improving action through better knowledge and understanding" (Fiol and Lyles 1985, p. 803).

If no learning takes place, old ways of working are likely to prevail, which is why lean sustainability via CI conditions a strong commitment to learning (Garvin 1993).

Improving operations as result of continuous learning has also very close ties with Wright's (1936) learning curve theory on which Netland and colleagues' (Netland and Ferdows 2014, 2016; Netland *et al.* 2014) S-curve theory and several previously presented lean maturity models root. The concept of "competitive continuous improvement" (p. 34) concerns the ability to develop and maintain responsiveness and adaptiveness to changes in the market and customer demand (Kaye and Dyason 1995). This implies that those who want to remain competitive need to change faster by learning faster.

In their work, Bessant and colleagues (Bessant and Francis 1999; Bessant *et al.* 2001) refer to "the learning organisation" (where learning is captured and shared and where CI becomes the dominant way of life) as the final evolutionary stage of CI maturity (see Table 2.8). It should therefore come as no surprise that the literature suggests that lean is a learning system seeking to maximise everyone's learning opportunities (Hines *et al.* 2004; Liker 2004; Ballé and Régnier 2007; Bicheno 2008; Netland and Powell 2017; Powell and Coughlan 2020).

2.8.2.2 The learning organisation

"The learning organisation" is a concept originally introduced by Senge (1990). He describes learning organisations as organisations that promote continuous learning and argues that such organisations are more successful in the long-run because they are able to constantly reinvent and develop themselves. Senge (1990) attributes five characteristics to learning organisations, namely, (1) personal mastery (i.e., striving for personal growth), (2) mental models (i.e., openness for changing assumptions and norms), (3) shared vision, (4), team learning, (5) and systems thinking (i.e., recognising complex interrelationships).

The best-known example of a learning organisation directly associated with lean is most likely the TPS. Spear and Bowen (1999) describe how Toyota's employees are encouraged to solve problems by generating and testing hypotheses following the scientific method. In this way, Toyota's employees are given the freedom to deepen their knowledge of their own work through experimenting. Becoming a learning organisation requires appropriate leadership (Liker 2004) and an appropriate infrastructure, though.

2.8.3 Lean management frameworks

2.8.3.1 "3P framework" (Womack 2006, 2008; Anand et al. 2009; Netland et al. 2021)

In the literature, designing a CI infrastructure often associated with the purpose-process-people (3P) framework (Womack 2006, 2008; Anand *et al.* 2009; Found *et al.* 2009; Netland *et al.* 2021). In essence, the 3P framework is a general approach to management (Bartlett and Ghoshal 1994, 1995). It considers

> "*people* [italics in original] as knowledge resources and encourage[s] their participation in the discovery of better ways to execute *processes* [italics in original] in order to accomplish broader organizational *purposes* [italics in original]" (Anand *et al.* 2009, p. 446).

This conditions that processes must be well aligned with the organisational purpose. At the same time, an organisation's people must be engaged in its purpose and be given the CI capabilities required to constantly evaluate the value stream (i.e., processes they execute) upon its alignment with the purpose (Womack 2006, 2008). If people are closely engaged in a purpose and made responsible for their processes, CI is enabled.

Impacting on a CI initiative's sustainability, management decisions upon "purpose", "process", and "people" are therefore seen as the essence of a CI infrastructure in the literature and must be equally addressed (Anand *et al.* 2009; Womack 2006, 2008; Found *et al.* 2009).

> "First, infrastructure decisions in the purpose category cover the formulation and communication of organizational and project goals for CI. Second, the achievement of CI purpose requires organizational support for implementation of the CI initiative, mainly in the form of the adoption of uniform methods for the discovery and execution of improvements. These decision areas are grouped under the *process* [italics in original] category. Finally, adequate training and motivation of employees are required to promote CI and to enable participation. Infrastructure decision areas related to this objective come under the *people* [italics in original] category" (Anand *et al.* 2009, p. 449).

In the past, academics, such as Anand *et al.* (2009) and Netland *et al.* (2021), have identified several patterns in empirical research (Table 2.28). What sticks out is that the "purpose" and "people" dimensions are employee-focused and closely relate to soft lean practices, whereas the "process" dimension solely concerns the process itself associated with improvements as well as waste identification and elimination. Womack (2006, 2008) argues that many organisations fail to develop capabilities for sustained CI. That is because either their purpose is insufficiently defined, their processes are insufficiently specified, or their people are insufficiently engaged. Using STS terminology, such an attitude, however, disregards the social sub-system.

Table 2.28 3P framework

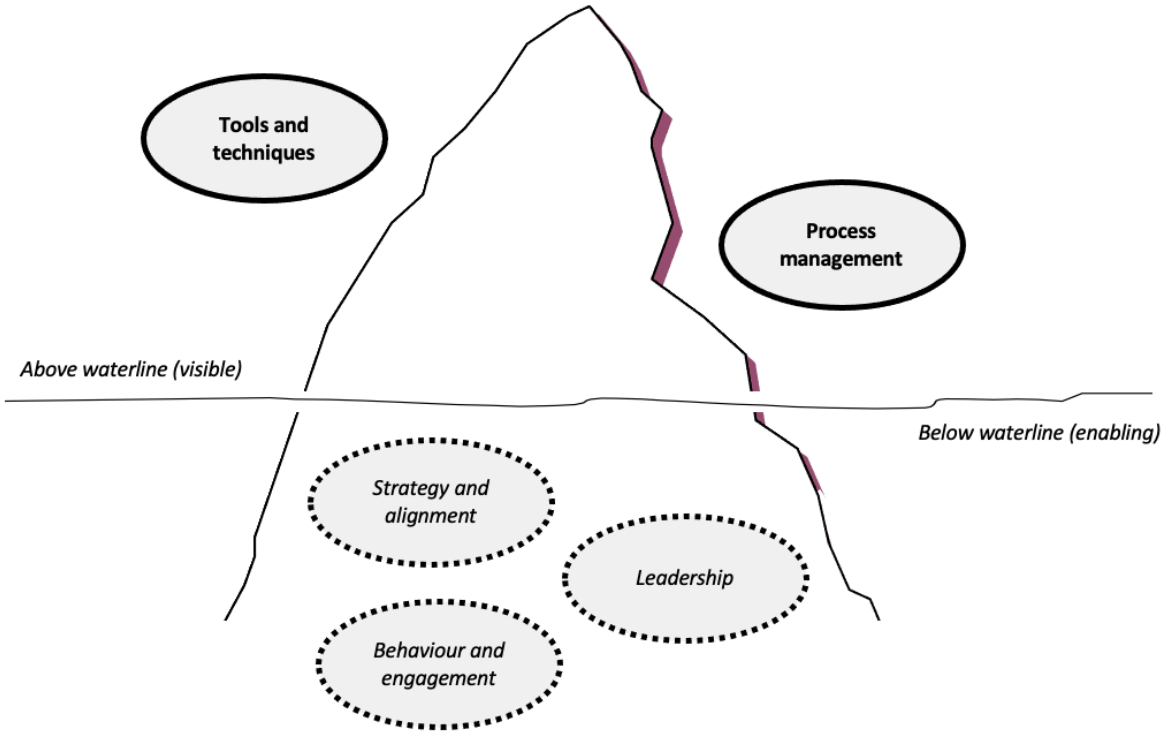
No.	3P framework		Infrastructure decision area(s)			*f*
	Dimension(s)	*Description(s)*	*Womack (2006, 2008[a])*	*Anand et al. (2009)*	*Netland et al. (2021)*	
1	Purpose	"Determine multilevel goals while maintaining unified strategic outlook" (Anand *et al.* 2009, p. 450)	Clearly defined purpose to encourage engagement	Organisational direction and continuous improvement goals	Lean programme recognised as a strategic goal	3
			Improvement goals			
			Visionary leadership		Area managers held responsible for lean programme	2
					Top-management team owns the lean programme	
			Customer value			1
				Balanced innovation and improvement		1
					Programme communication	1
2	Process	"Institute practices and structures gearing implementations towards *purpose* [italics in original]" (Anand *et al.* 2009, p. 450)	Pursue the purpose with brilliant processes	Standardised processes		
			Strong horizontal focus on value flow			2
			Value stream			
				Standardised improvement method	Standard improvement method	2
			Waste management			1
				Constant-change culture		1
				Parallel participation structures		1
					Benchmarking other factories	1
					Codification of tacit knowledge	1
					Internal audits	1
					Physical space for kaizen	1
					Physical space for training	1
					Pilot/project-based approach	1
					Whole factory involved	1
3	People	"Invest in resources towards achieving *purpose* [italics in original]" (Anand *et al.* 2009, p. 450)	Knowledge capture and career paths	Training and career paths	Structured lean training programme	3
			Encourage engagement via lean management and lean leadership		Dedicated lean programme manager/team/champions	2
			Respect for people			1
			Value-stream management			1
				Information technology support		1
					Evidence of scientific mindset	1
					Hired external lean expert	1
					Use of external consultants	

Source: Author
Note(s): (a) Some information is extracted from Found *et al.* (2009)

2.8.3.2 "Lean iceberg" (Found et al. 2007)

In the literature, lean sustainability is associated with the analogy of an iceberg (Found *et al.* 2007; Hines *et al.* 2008). Usually, an iceberg consists of a smaller visible ("tip of the iceberg") and a larger invisible bottom part (Figure 2.10).

Figure 2.10 Lean iceberg



Source: Adapted from Found *et al.* (2007)

In line with that, Found *et al.* (2007) argue that the visible part concerns hard lean practices, including (1) tools and techniques as well as (2) processes, which only make up about 30% of the whole system. At the same time, they believe that the invisible part below the waterline concerns soft lean practices ([1] strategy and alignment, [2] leadership, and [3] human aspects of behaviours and engagement), which make up the larger and more important part as they constitute the enabling factors of a successful lean implementation. In Hines *et al.*'s (2008) words,

> "[i]t's not what you see, it's generally what you don't see that's more important" (p. 8). For this reason, "[t]he sustainable Lean thinker needs to learn to see and act below the waterline as well as above it" (p. 9).

In practice, hard lean practices are easier to discover than soft lean practices and entice imitation and emulation. In many cases, however, a sole focus on hard lean practices disregards

the social sub-system of a STS by failing to see the efforts that successful organisations put into institutionalising the underwater enablers to achieve lean sustainability. Insufficient attention to soft lean practices will cause that employees revert back to their old ways of working (Found *et al.* 2007).

2.8.4 Policy deployment ("hoshin kanri")

2.8.4.1 Introduction to hoshin kanri

Although there is confusion regarding its actual translation (Witcher and Butterworth 1999), the Japanese term "HK" refers somewhat to "targets-and-means management" and concerns strategy deployment (Tennant and Roberts 2001a; Witcher *et al.* 2008). Originated in Japan during the 1960s, HK – a framework for strategic management – emerged because statistical quality control and management by objectives developed from standalone approaches to an integrated management system in Japan, which was labelled as total quality control and got better known as TQM in western countries (see Table 2.3; Witcher and Butterworth 1999; Cowley and Domb 2012). Nomi (1991) reports that HK was initially utilised as a corporate control system for the cross-functional management of corporate objectives with the aim of aligning functional activities with the corporate strategy because it translates corporate objectives into aligned measures within the whole organisation. Akao (1991) defines HK as

> "all organizational activities for systematically accomplishing the long and mid-term goals as well as yearly business targets which are established as the means to achieve business goals. In many cases it is used for yearly targets" (p. 47).

Through a simultaneous vertical and horizontal alignment, the corporate vision develops breakthrough objectives for the firm to derive aligned targets for each individual, so that the entire workforce focuses on the corporate objectives and thus on the same vision (Dombrowski and Mielke 2014; Bicheno and Holweg 2016). Following this, HK is an organisation-wide management system for planning and control that involves the entire workforce through a systematic breakdown of the vision into aligned targets for each individual (Bicheno and Holweg 2016).

> "A 'hoshin' is an annual statement of a top-level policy that includes a brief context, a desired objective and outlines of possible strategies (or guidelines) to achieve the objective" (p. 183), while "'[k]anri' refers to the management of hoshins. The full meaning *hoshin kanri* [italics in original] signifies a methodology for managing direction and alignment" (Chau and Witcher 2008, p. 183).

In view of the PDSA cycle (see Table 2.7), HK drives CI on an annual basis (Tennant and Roberts 2001a, 2001b; Jackson 2006; Witcher *et al.* 2008; Thürer *et al.* 2019). With reference to this, Akao (1991 quoted in Tennant and Roberts 2001a) conceives HK as "[t]he means by which both the overall control system and TQM are deployed" (p. 263). While Witcher *et al.* (2008) summarise the nature of HK with the FAIR cycle (focus, alignment, integration, and review), which essentially corresponds to the PDSA cycle, Tennant and Roberts (2001b) outline four primary purposes of HK similarly (Table 2.29).

Table 2.29 Hoshin kanri FAIR cycle

No.	FAIR cycle	PDSA cycle	Description(s)
1	Focus	Act	To provide a focus on corporate direction by setting, annually, a few strategic priorities
2	Alignment	Plan	To align the strategic priorities with local plans and programmes
3	Integration	Do	To integrate the strategic priorities with daily management
4	Review	Study	To provide a structured review of the progress of the strategic priorities

Source: Adapted from Tennant and Roberts (2001b); Witcher *et al.* (2008); Thürer *et al.* (2019)

Senior management elaborate hoshins and distribute them to all functional areas of the business so that measures and timelines can be derived (Akao 1991; Netland *et al.* 2019). The design of hoshins depends on the nature of the firm (Witcher *et al.* 2008), yet they usually relate to future customer expectations (Tennant and Roberts 2001b; Jackson 2006; Dombrowski and Mielke 2014), the development of capabilities, and the achievement of growth (Jackson 2006; Witcher *et al.* 2008). Hoshins are of paramount importance as they often constitute breakthrough objectives, whereas other objectives are secondary and must therefore be subordinated. Accordingly, the fundamental idea of HK is to get the entire organisation involved in reaching these breakthrough objectives through orchestrating and consolidating organisational capabilities (Tennant and Roberts 2001a; Witcher *et al.* 2008). Imai (1986) notes that hoshins often relate to innovativeness and creativity so that employees are encouraged to question and reconsider their daily operations to achieve CI. To focus on a few key objectives that drive crucial progression, firms usually do not exceed six hoshins (Witcher *et al.* 2008).

Including corporate objectives into the daily operations through HK is one reason why Japanese CI is a catalyst for operational effectiveness (Lillrank 1995; Cole 1998; Witcher *et al.* 2008). In Japanese firms, HK usually considers the QCDE scheme developed at Toyota and Komatsu. It is short for (1) quality, (2) cost, (3) delivery, and (4) education. While quality refers to customer concerns, cost concerns efficiency and finances. Plus, delivery relates to processes,

supply chain, and innovation, while education deals with matters centred around HR development, morale, and safety (Witcher *et al.* 2008). Although it is considered as a hard lean practice (Hadid and Mansouri 2014; see Table 2.16), certain perspectives (e.g., driving training and development in the entire organisation) illustrate that HK helps to develop soft lean, which was found to result in positive effects for the organisation (e.g., Matsui 2007; Dal Pont *et al.* 2008; Furlan *et al.* 2011; Bortolotti *et al.* 2015; Hadid *et al.* 2016).

The "review" stage of the FAIR cycle comprises an internal audit, also termed as "top-executive audit". In this review, senior management audit both the operational and the strategic effectiveness itself (Witcher *et al.* 2007). In comparison to other widespread operational excellence models, including the EFQM Excellence Framework and the Baldrige Quality Criteria, HK emphasises the involvement of the senior management at the operational level, aiming "to facilitate top level involvement with operational competences" (Witcher *et al.* 2008, p. 547). This review of operational processes establishes a connection between senior management and other parts of the organisation (de Holan and Mintzberg 2004). In addition, senior managers familiarise themselves with operational activities that contribute to the overall strategy, while their presence also underlines the relevance of the audit indeed (Witcher *et al.* 2018). Corresponding to this, Witcher *et al.* (2008) report that a lack of interaction between the senior management and the operational level was found to be a major reason for strategy disconnect. In the same vein, Tennant and Roberts (2001a) note that, in the UK, the absence of senior management during audits was found to increase the complexity between strategic alignment and operational effectiveness.

Finally, HK constitutes a fundamental framework for strategy deployment and requires constant reviews and adjustments to sustain the CI momentum (Giordani da Silveira *et al.* 2018). It aims at policy focus and deployment, developing a vision and roadmap, and monitoring and auditing. At the same time, there is evidence for its relatedness to the soft side of lean (see Table 2.25).

2.8.4.2 Hoshin kanri X-matrix

In essence, HK makes use of the "'outcome, what, how, how much, and who' framework" (Bicheno and Holweg 2016, p. 114) and covers thus five perspectives, namely, (1) results, (2) aims, (3) projects, (4) delivery, and (5) accountabilities (Table 2.30). As shown in Table 2.30, each single dimension gives an answer to a key question around the breakthrough objectives of the organisation to be achieved.

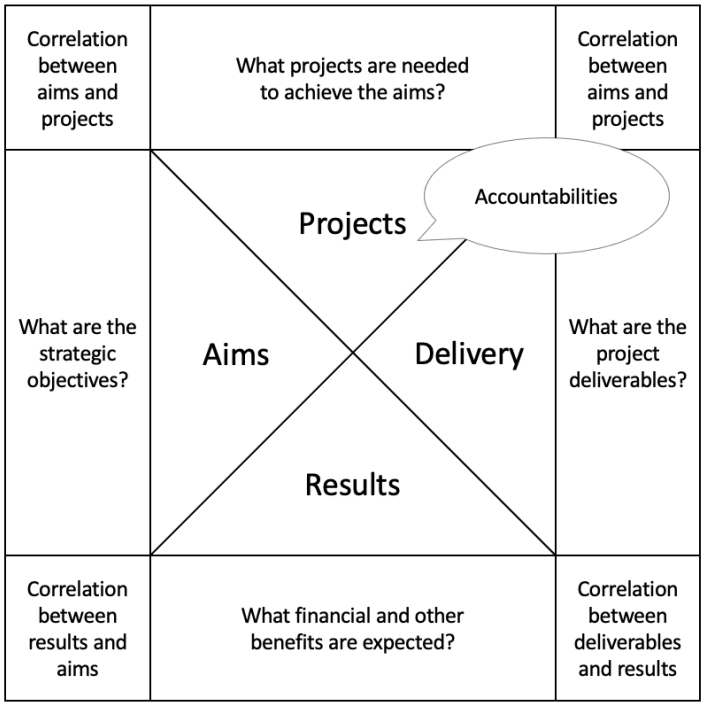
Table 2.30 Five perspectives of hoshin kanri X-matrix

No.	Dimension(s)	Description(s)	Interrogative(s)
1	Results	Long-term breakthrough objectives	Outcome
2	Aims	Annual objectives	What?
3	Projects	Improvement priorities	How?
4	Delivery	Metrics to measure	How much?
5	Accountabilities	Resources and ownership	Who?

Source: Adapted from Bicheno and Holweg (2016)

In view of these five perspectives, HK is often associated with an X-matrix for its deployment (Figure 2.11). The X-matrix constitutes a correlation matrix visualising the relationship between objectives and measures (Giordani da Silveira *et al.* 2018). It visualises strategy on a document accessible to anyone in the organisation and constitutes a key advantage of HK. It usually tracks decisions made in the past and fosters discussions.

Figure 2.11 Hoshin kanri X-matrix



Source: Adapted from Bicheno and Holweg (2016)

Moreover, the X-matrix illustrates a roadmap that considers both the big picture as well as the interdependencies between different functional areas in the organisation and brings them in accordance with bottom-line results to be achieved. HK is thus considered as an instrument for managing means, which develop competitive capabilities that will ultimately result in profitability (Jackson 2006; Bicheno and Holweg 2016).

2.8.4.3 Hoshin kanri catchball process ("nemawashi")

Integrating both ways, HK is both a top-down *and* a bottom-up initiative. It is associated with a long-term improvement vision by placing a substantial focus on processes that set challenging but still realistic targets for deployment (top-down) while such processes condition the willingness to seek both bottom-up and cross-functional feedback (bottom-up; Tennant and Roberts 2001a).

Top-down and bottom-up approaches differ in two ways, that is, (1) the origin of the initiative and (2) the sequence of events in terms of intentions, actions, and outcomes (Kim *et al.* 2014). Kim *et al.* (2014) argue that

> "[t]op-down strategy is triggered by top management's intentions and manifests in the performance outcomes of stipulated actions. Bottom-up strategy is initiated by lower managers' actions representing their own interpretations of the company's directions, which may partially differ from top management's *prior* [italics in original] intentions" (p. 464).

Despite their difference in nature, it is suggested that top-down and bottom-up strategy are fully integrable (ibid).

In line with traditional top-down approaches (e.g., management by objectives), senior management initially deploy goals for middle management while middle management deploy means in turn to reach the goals set by senior management. Implementation plans are finally devised at lower management levels (Bicheno and Holweg 2016; Netland *et al.* 2019).

In the strategic management literature, a distinction is made between three different planning-and-control levels, namely, (1) strategic management, (2) tactical management, and (3) operational management. Key activities of each level involve planning and control, that is, deploying and reviewing (Anthony 1965). While senior management deploy goals and create policy, middle management are responsible for deploying means and for reviewing to what extent strategy is translated at the operational level. That is, implementation plans are devised at the operational level while being monitored daily by lower management (Bicheno and Holweg 2016). In this way, middle management constitute the intermediary between the plant and first-line management, supporting senior management to achieve strategic goals (Nonaka 1994; Holmemo and Ingvaldsen 2016). In Table 2.31, critical planning-and-control activities per management level are summarised.

Table 2.31 Corporate structure

No.	Top-down policy deployment ("planning and control")		Management		
	Level(s)	*Activities*	*Level(s)*	*Role(s)*	*Description(s)*
1	Strategic management	Deploy goals Create policy Review means of tactical management	Senior management	Managing director	Chief executive Highest in organisational hierarchy Most decision power
				Senior managers	C-suite executive Highest in hierarchy of division/business unit
2	Tactical management	Deploy means Review actions of operational management based on means	Middle management	Plant managers	General manager of the plant Translating strategy set by senior management into action
				Department managers	Highest in departmental hierarchy Intermediary between site management and first-line management Translating strategy set by the site and senior management into action
3	Operational management	Devise implementation plans Review actions on a day-to-day basis	Lower management	First-line managers	Lowest management level in the hierarchy Management of non-managerial staff

Source: Adapted from Anthony (1965); Bicheno and Holweg (2016); Netland *et al.* (2019); Reynders *et al.* (2022)

Although certain similarities exist (Cowley and Domb 2012), the difference to traditional management approaches lies in HK's bottom-up nature (Tennant and Roberts 2001a). Unlike HK, traditional top-down approaches (e.g., management by objectives; Table 2.32) are not conducive to bottom-up communication and limit the potential for organisational learning (Wright and Snell 1998; Tennant and Roberts 2001a). At the same time, however, both bottom-up and cross-functional feedback play an essential role to achieve CI (Tennant and Roberts 2001a) and result in employee commitment (Bicheno and Holweg 2016).

Table 2.32 Hoshin kanri vs management by objectives

No.	Criteria	Policy deployment approach(es)	
		Hoshin kanri	*Management by objectives*
1	Vision	Long-term	Short-term
2	Focus	Processes	Targets
3	Implementation	Prioritise	Troubleshoot
4	Measures	Realistic	Incentives
5	Review	Improvement	Failure
6	Communication	Deployment of targets	Job evaluation
7	Feedback	Top-down and bottom-up	Top-down

Source: Adapted from Tennant and Roberts (2001a)

Involving employees in strategy deployment has always been a challenge in western countries, yet HK aims at solving this issue through the "catchball" process ("nemawashi" in Japanese; Bicheno and Holweg 2016), integrating strategy and TQM principles (Tennant and Roberts 2001b; Giordani da Silveira *et al.* 2018). To put it in Kondo's (1998) words,

> "the discussion of top-down targets focuses mainly on the necessity of achieving the targets in order to satisfy customer requirements, secure profits, or increase market share" (p. 429) while "the discussion of bottom-up targets focuses mainly on the possibility of achieving them – finding the best methods of achieving them, identifying possible obstacles to their achievement, and finding ways of eliminating such obstacles" (p. 429).

Following this, senior management issue policy proposals to each department, which will be reviewed. In this, each department evaluates its proposal, including employees from the tactical and operational level (Kondo 1998; Netland *et al.* 2019). Information flows vertically as well as horizontally (Bicheno and Holweg 2016) while cross-functional discussions on the policy proposal with other departments ensure alignment and provide a better understanding of the policies in other parts of the organisation (Kondo 1998). More importantly, these discussions seek consensus on the deployment of targets and means (Tennant and Roberts 2001b; Netland *et al.* 2019). Importantly, Bicheno and Holweg (2016) point out that an agreement must be

achieved through consensus and negotiation, rather than through authority. As Devine (quoted in Bicheno and Holweg 2016) puts it,

> "If people help to plan the battle, they are less likely to battle the plan" (p. 103).

Then, feedback and suggestions for optimisation are fed back to senior management. Kondo (1998) underlines that this way of strategy deployment is an effective motivator for individuals to achieve their targets.

2.8.5 Lean leadership

Several scholars report that successful lean implementation requires cultural change (Liker 2004; Mann 2005; Bhasin and Burcher 2006; Jørgensen *et al.* 2007; Anand *et al.* 2009; Poksinska *et al.* 2013; Bhamu and Sangwan 2014; Glover *et al.* 2015; Hirzel *et al.* 2017; Hines *et al.* 2020; Reynders *et al.* 2022). To do so, adequate leadership is necessary (Schein 2010; Poksinska *et al.* 2013).

In the literature, there are different conceptualisations of leadership, but some commonalities can be identified. First, leadership is a process. Second, it involves influence. Third, it takes place within a social setting. Fourth, it follows a goal (Northouse 1997; Poksinska *et al.* 2013). Nevertheless, there is controversy whether a manager and a leader constitute the same (e.g., Kotter 1990; Yukl 1997; Poksinska *et al.* 2013). Kotter (1990), for instance, perceives that managers rather control and coordinate activities while leaders introduce and encourage change. In line with that, Yukl (1997) and Poksinska *et al.* (2013) see managing and leading as two distinct activities. These activities, however, are not necessarily carried out by different individuals.

In lean, leadership essentially relates to the lean-orientated involvement of employees to conduce lean implementation and its sustainability, characterised by a set of leadership behaviours that inspire and enthuse organisational members with CI (Emiliani 1998; Spear 2004; Found and Harvey 2007; Rother 2010; Netland *et al.* 2019). In doing so, lean leaders are transformational and behave according to cultural expectations ("lean ideals"), disseminating the lean principles in the entire organisation (Emiliani and Stec 2005; Suresh *et al.* 2012; Tortorella *et al.* 2018, Holmemo *et al.* 2022). Acting as "'culture carriers' to implement the Lean programme" (Poksinska *et al.* 2013, p. 896), lean leaders act as role models (Dombrowski and Mielke 2014). In their study, Poksinska *et al.* (2013) describe that, especially during the beginning of the lean evolution, implementation activities highly depend on "managerial push" (p. 898) while employee pull will set in once a cultural change is achieved.

Indeed, organisations aim to achieve CI with lean initiatives. In many cases, however, engaging employees becomes often challenging (Netland *et al.* 2019). According to Liker and Convis (2011),

> "the biggest gap in capabilities in the lean movement, and the root cause of failure in many lean programs, is in leadership" (p. xiii).

Implementing lean arouses expectations in view of leaders' behaviours (House *et al.* 2004; Poksinska *et al.* 2013; Tortorella and Fogliatto 2017), defined as "specific observable verbal nonverbal actions of managers" (van Dun *et al.* 2017, p. 175) during organisational interactions with their subordinates.

In their systematic literature review, van Dun *et al.* (2017) scanned 515 articles and one relevant book (Liker and Convis 2011). They found that engaging employees in CI is the lean leadership behaviour most referred to, yet Netland *et al.* (2019) limit this capability to "good lean leader[s]" (p. 550). In Table 2.33, van Dun *et al.*'s (2017) findings are listed according to their frequencies (*f*) in the literature.

Table 2.33 Systematic literature review of lean leadership behaviours

No.	Lean leadership behaviour(s)	*f*
1	Engaging employees	5
2	Celebrating and recognising success	4
3	Designing and coaching teams	4
4	Getting and giving information	4
5	Visiting the work floor ("gemba walk")	4
6	Building trust	3
7	Structuring and controlling	3
8	Committing to self-development	3
9	Creating a vision and goals	3
10	Intellectual stimulation	3
11	Listening to employees	3
12	Long-term orientation	3
13	Visibly apply lean	3
14	Supporting daily continuous improvement	3
15	Continuous improvement	2
16	Developing clear strategies	2
17	Experimenting	2
18	Individual consideration	2
19	Monitoring and evaluating	2

Source: Adapted from van Dun *et al.* (2017)
Note(s): In Table 2.33, van Dun *et al.* (2017) list the items that were mentioned by two or more of their 22 separate, content-analysed sources.

Apart from "engaging employees", "celebrating and recognising success", "designing and coaching teams", "getting and giving information", and "visiting the work floor" are represented frequently and seem of high relevance.

According to Tortorella *et al.* (2020), lean leadership behaviours are universal and can be practiced in the same way in any organisational context. In fact, Poksinska *et al.*'s (2013) research backs this claim to some extent as they found overlap how lean leadership is experienced in manufacturing and healthcare. However, usually being communicated in the form of a generic list, the literature on lean leadership lacks precision which lean leadership behaviours apply at which levels in the organisational hierarchy. Netland *et al.* (2019), for instance, criticise that

> "general advice for lean leaders […] is often obvious or unrealistic" (p. 543) and "lists of lean leadership practices […] are too general to be useful in operational day-to-day situations" (p. 544).

In cases where no difference is made between the different hierarchical levels, issues may arise at times (Roth 2006; Lodgaard *et al.* 2016; Netland *et al.* 2019).

Depending on the hierarchical level, such lean leadership behaviours vary and require adaption, accordingly (Hines *et al.* 2004; Mann 2009; Holmemo and Ingvaldsen 2015; Netland *et al.* 2019). "Demystifying lean leadership" (p. 543), what they refer to, Netland *et al.* (2019) propose a six-point framework associated with lean leadership practices that determine roles and responsibilities at each different management level. These lean leadership practices involve (1) go and see, (2) daily layered accountability, (3) structured problem-solving, (4) CI, (5) coaching, and (6) strategy deployment. In Table 2.34, they are described in more detail.

Table 2.34 Lean leadership framework

No.	Lean leadership practice(s)	Kaizen hierarchy and responsibilities at each management level		
		Senior management	*Middle management*	*Lower management*
1	Go and see	Conduct weekly, bi-weekly, or monthly gemba walks depending on the size and lean maturity of the firm Dedicate the visit to a few visible areas on a rotating basis and use it to increase the motivation for lean transformation Identify specific challenges and areas of improvement together with middle and front-line managers Focus on one or a few issues that are needed to meet the target situation in the visited area Promote the underlying lean principles and culture rather than the tools and techniques Coach middle managers Encourage critical thinking in the organisation Recognise wanted behaviour and help to improve unwanted behaviour A plant manager visits the shopfloor at least once a week (most dedicated plant managers are on the shopfloor at least once a week)	Conduct daily or weekly, structured gemba walks in the area of responsibility more frequently depending on the size, lean maturity and practicality Instil support, motivation, and levers to support the lean transformation	Almost always on the shopfloor No need for specific gemba walks as a separate lean leadership routine Take part in gemba walks of the middle managers (use the opportunity to walk and observe different areas of the company) Involvement in observation and coaching
2	Daily layered accountability	Participate in short stand-up meetings to become familiar with the current condition of the operations (where the plant manager is in effect the CEO, apply daily stand-ups across the board) Weekly meetings at senior management level (weekly video conferences are a suitable alternative to stand-up meetings)	Participate in short stand-up meetings to become familiar with the current condition of the operations Only non-conformance issues are escalated to the senior management level	Participate in short stand-up meetings to become familiar with the current condition of the operations Only non-conformance issues are escalated to the middle management level
3	Structured problem-solving	Apply structured problem-solving Help to identify improvements Sponsor improvement implementations	Apply structured problem-solving Ensure a minimum of standard operating procedures and product quality checks Test and improve the current standard	Apply structured problem-solving Test and improve the current standard

No.	Lean leadership practice(s)	Kaizen hierarchy and responsibilities at each management level		
		Senior management	*Middle management*	*Lower management*
4	Continuous improvement	Engage employees in continuous incremental improvement Sponsor lean initiative Assume proactive role in change management through participation Mentor middle managers by constantly and encouraging to reflect on the current condition and to develop and test alternatives for the next target condition	Engage employees in continuous incremental improvement Sponsor lean initiative Assume proactive role in change management through participation Participate in kaizen meetings with front-line managers in an "obeya" ("big room" in Japanese)	Engage employees in continuous incremental improvement Present the kaizen boards at shopfloor stand-up meetings
5	Coaching	Increase the improvement capability of people Coach at the gemba "Train-the-trainer" (be able to coach the subordinate level) Focus more on developing lean leadership capabilities among subordinates	Increase the improvement capability of people Coach at the gemba "Train-the-trainer" (be able to coach the subordinate level) Focus more on developing lean leadership capabilities among subordinates	Increase the improvement capability of people Coach at the gemba "Train-the-trainer" (be able to coach the subordinate level) Be more concerned with coaching for on-the-job training in addition to operational problem-solving skills
6	Strategic alignment	Define long-term (five-year or more) strategic plans and annual strategic goals ("hoshin kanri") Initiate an annual strategy planning process ("catchball" process) Cascade strategic goals throughout the organisation	Respond with tactical goals ("catchball" process) Upon consensus, communicate goals to the front-line management In response to the strategic goals of senior management, define tactical goals and annual actions plans in the area of responsibility	Respond with operational goals ("catchball" process) Help to realise the annual actions plans at the operational level

Source: Adapted from Netland *et al.* (2019)

2.8.6 Middle management

2.8.6.1 Introduction to middle management

According to Mann (2009), 80% of the lean efforts relate to *changing* leaders' behaviours, their practices, and their mindsets, while at most 20% of them concern the adoption of hard lean practices. Hence, lean requires a strengthening of the leadership role (Netland *et al.* 2019) due to the crucial role leaders play in embedding an underlying culture of principles that sustains lean in the long-run (Hines *et al.* 2004; Bhasin and Burcher 2006; Shook 2010; Tortorella and Fogliatto 2017). In line with a number of other academics (e.g., Netland *et al.* 2019; Ali and Johl 2021), Holmemo *et al.* (2022) state that

> "leadership is consistently found to be the main success factor for lean transformations" (p. 1).

This being the case, some refer to the importance of leaders at the middle management level in particular (e.g., Emiliani 2008; van Dun *et al.* 2017).

Being described as "the missing link" (p. 16) in lean practice and research (Mann 2009), lean leadership is most important at the middle management level because responsibilities often reside right there (Tortorella *et al.* 2017; van Dun *et al.* 2017). That is, middle management are

> "usually responsible for translating corporate strategy into operational routines; lean initiatives then often fall upon middle managers" (Tortorella *et al.* 2017, p. 868).

Also, middle managers are tasked with effectuating top-down mandates through shopfloor operationalisation (Nonaka 1994; Lam 1996; Holmemo and Ingvaldsen 2016; van Dun *et al.* 2017).

In most cases, a middle manager is defined as "any manager two levels below the CEO and one level above line managers" (Huy 2001, p. 73). In the strategic management literature, plant managers are considered as middle managers as well (Smith *et al.* 2009). On the contrary, a "'senior manager' is defined as a member of a team of individuals […] who, at the highest level of organisational management, [has] the day-to-day responsibilities of managing a corporation instead of the day-to-day activities of managing the business" (Found *et al.* 2009, pp. 4-5). A special feature of middle managers is their access to senior management and their knowledge of day-to-day operations (Wooldridge *et al.* 2008).

In a survey, Sohal and Egglestone (1994) found that most companies perceive that senior management (66%) and middle management (57%) are still the drivers for change. Likewise, Netland's (2016) review on success factors for improvement initiatives suggests that "management commitment and involvement" is the most critical one while he found that "lead

actively" is seen as the most critical success factor for lean implementation by far. In fact, senior as well as middle management play a crucial role in driving organisational change (Huy 2002).

Plus, improvement initiatives start generally at the top of the organisation (Oakland 2011; Holweg *et al.* 2018) because senior managers determine general policies (Bamford and Forrester 2003) and provide a vision that guides the formulation of objectives at lower management levels (Nonaka 1988; Anand *et al.* 2009). In line with that, Holweg *et al.* (2018) argue that senior management set directions and provide incentives indeed, yet middle managers are the ones who lead or champion change initiatives. Moreover, Bamford and Forrester (2003) point out that middle managers are ultimately the ones who are majorly involved in the daily challenges (e.g., due to continuous interactions with internals and externals or due to supervision). Tying on this, previous research already evidenced that middle managers have the most direct contacts inside and outside their own department. This suggests that their role is more cross-functional than ever in modern organisations (Huy 2001; Bamford and Forrester 2003). Depending on the degree of their commitment, middle managers are thus the ones who either facilitate or inhibit the implementation of lean, as they are the ones who are supposed to get the rest of the organisation involved (Oakland 2011).

In any case, middle managers are emotionally closer to staff as opposed to senior managers and have a better understanding of individual needs during organisational change, which makes them crucially important for sustaining the change momentum (Huy 2001). Huy (2001) argues that middle managers are the ones managing

> "the tension between continuity and change […] keep[ing] the organization from falling into extreme inertia […] or extreme chaos" (p. 73). He concludes that they "may be the most effective allies of corner-office executives when it's time to make a major change in a business" (p. 73).

As intended when managing lean (Jackson 1996), it becomes obvious that middle managers occupy a crucial role when competing against organisational inertia (Huy 2001).

Investigating the creation of information in Japanese firms, Nonaka (1988) introduces the concept of compressive (also termed as "middle-up-down"; Camuffo and Gerli 2005) management, which describes the management of contradictions and gaps between the visionary and the existing as part of the role of middle managers.

> "The essential logic of compressive management is that top management creates vision or dream, and middle management creates and implements concrete concepts to solve and transcend the contradictions arising from gaps between what exists at the moment and what management hopes to

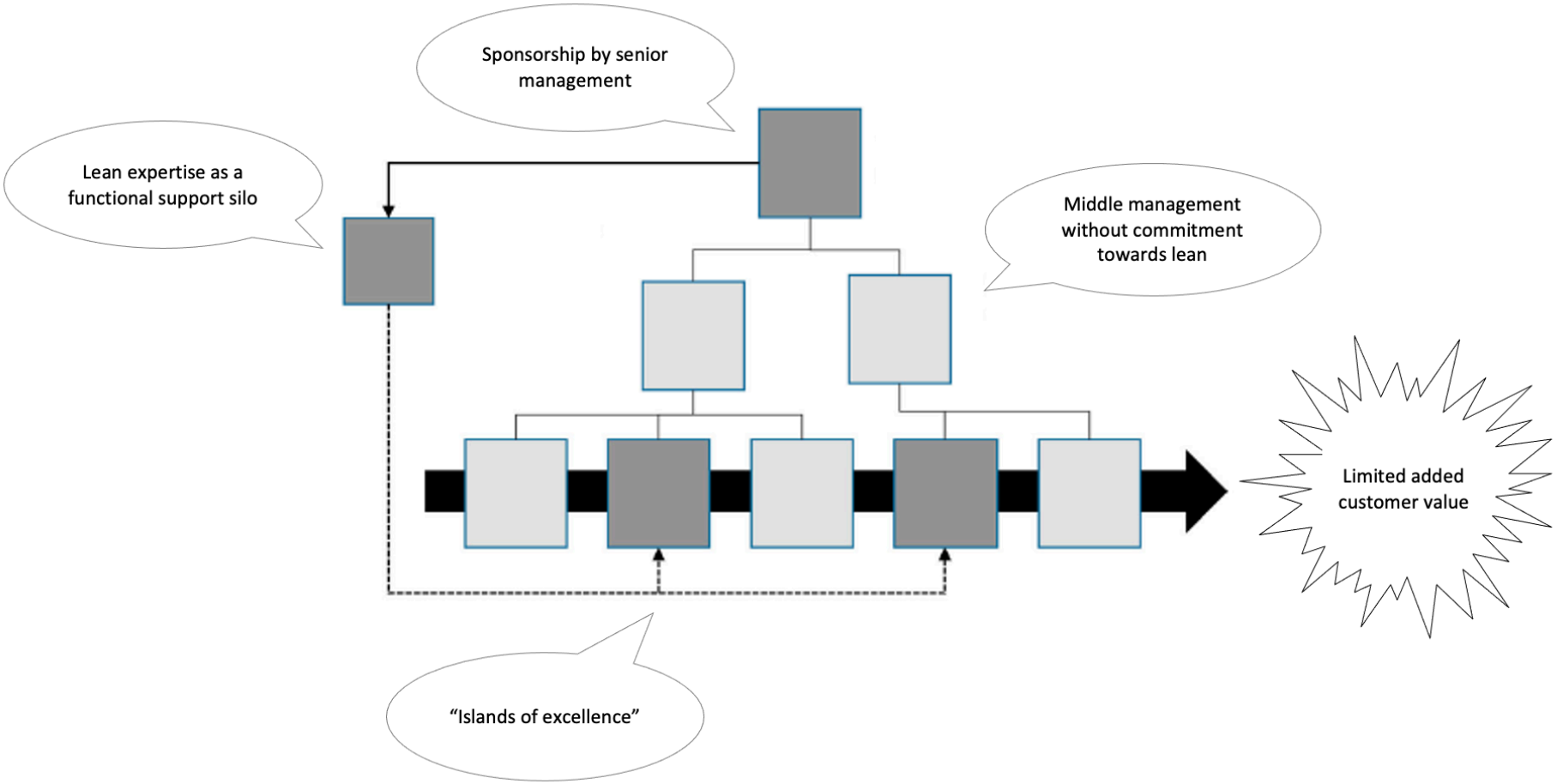
> create. In other words, top management creates an overall theory, while middle management creates a middle-range theory and tests it empirically within the framework of the entire organization" (p. 17).

That being said, Nonaka (1988) points towards the ability of middle managers to reconcile strategic matters with daily challenges of the organisation, being therefore the vital link between senior management and staff due to having exclusive knowledge centred around strategy and operations. Similarly, Floyd and Wooldridge (1996, 1997) suggest that middle management are aligning strategic and operational decision-making, while Westley (1990) advocates that middle management constitute a crucial source for discussing strategic matters. In their study, Wooldridge and Floyd (1990) even found that middle managers often feel that they are "in a better position to initiate and assess alternative courses of action" (p. 240) than senior management. As noted by Holmemo and Ingvaldsen (2016), involving middle management thus improves the quality of decision-making and enables the negotiation of consensus on change between the parties concerned. Likewise, Wooldridge and Floyd (1990) suggest that strategic involvement of middle managers increases the quality of decision-making, which leads to improved organisational performance.

2.8.6.2 Middle management bypass

In view of Figure 2.12, it becomes more evident why an involvement of middle managers is crucial. As illustrated by Holmemo and Ingvaldsen (2016), organisations often install isolated lean experts (or lean facilitators) who are supposed to convey the fundamentals of lean to the operational level. Although presumably well-intentioned, this approach, however, bypasses middle managers and may result in "islands of excellence" (p. 26; see Figure 2.12) as termed by Bicheno and Holweg (2016). Bypassing middle managers entails a lack of commitment on the part of the middle management level, which may rub off on the operational level and ultimately implicate a limited customer value. By implication, employees at the operational level may struggle to be granted additional time to dedicate themselves to CI projects, if middle management are not taken into confidence by lean experts.

Figure 2.12 Middle management bypass



Source: Adapted from Holmemo and Ingvaldsen (2016)
Note(s): Change agents in dark grey

In their study, Holmemo and Ingvaldsen (2016) identified six characteristics that organisations, which bypass the middle management level, have in common. Complementing Figure 2.12, Holmemo and Ingvaldsen's (2016) findings are illustrated in Table 2.35 and further substantiate the necessity for middle management involvement.

Table 2.35 Characteristics of middle management bypass

No.	Characteristic(s)	Description(s)
1	Senior management's praise of lean	Senior management sponsor the lean campaign and proudly present positive results externally and internally Senior management barely change their own management practice
2	"Lean is tools and methods"	Lean is perceived to be mainly about tools and methods applicable to the organisation's core production Lean experts are concerned about the lack of strategic commitment
3	Step by step to somewhere	Lean interventions are performed sequentially in selected units, from the first pilots to a broader range of units
4	Keeping the old structure	Changes in work routines happen within the existing organisational structure Lean does not lead to changes in organisational structure or governance systems
5	Lean silo	Internal lean experts form a separate functional line, supporting senior management and operational management on demand Internal lean experts have no formal authority
6	Absence of middle management	Middle management do not take an active part in the change processes Even when they are positive and supportive of lean, they see no relevance in taking part

Source: Holmemo and Ingvaldsen (2016)

In a later study, Holmemo *et al.* (2018) criticised the limited effectiveness of lean consultants that organisations with no or little lean experience bring in. Lean consultants take on the roles of internal lean experts but bypass the middle management level in the same way. In addition to this, Holmemo *et al.* (2018) report that engaging the services of lean consultants has no or limited effects on the soft side of lean, as their findings show that lean consultants have indeed an influence on the awareness-raising of soft lean, yet implementations remain tool-focused. The reasons behind this are down to the fact that lean consultants are not managers. In other words, lean consultants cannot yet integrate the soft side of lean, such as participation and leadership, into their business model. That is not to say that lean consultants are pointless at all because they can be particularly useful during the early stages of the lean journey (Netland 2016; Holmemo *et al.* 2018) but, as Rother (2010) accentuates, the soft side of lean evolves best because of internal efforts and commitment from line managers.

2.9 Summarisation of literature review

In retrospect, this literature review touched upon multiple aspects of lean. Initially, a general introduction to quality management and umbrella terms, including TQM and CI, outlined the broad academic domain in which lean is located. Moving forward from there, it was elaborated on the literature on lean more extensively, including its historical development, its fundamental principles, its application within and beyond manufacturing towards the lean enterprise, and issues arising concerning its sustainability (Figure 2.13).

Insights deriving from this exercise are multi-fold. First, lean is insufficiently defined, while a general definition does not exist. However, a distinction must be made between its strategic level along with its principles and its operational level along with its hard lean practices to reduce and eliminate waste. Inherently, lean is universal and applicable in any environment. In practice, however, difficulties arise, which is why lean may require some translation to suit local conditions. If lean is limited to its operational level and merely associated with its hard lean practices, incompatibilities are inevitable. Second, embracing the entire organisation and the network (e.g., suppliers and customers) it operates in, the lean enterprise constitutes the most consistent form of lean implementation. It addresses the entire value stream and is therefore the evident way to generate competitive advantage with lean. Third, lean sustainability concerns maintaining the CI momentum from the bottom up. In fact, several change (e.g., Prosci ADKAR model) and lean management frameworks (e.g., 3P or lean iceberg) exemplify the important role played by the human factor. At the same time, however, issues relating to lean sustainability often arise because the human factor is insufficiently taken into account. In the world of STSs, this means that social and technical sub-systems are misaligned and do not operate in harmony so that superior performance can be achieved, as it should ideally be the case. The S-curve theory shows that different ways of management are needed along the S-curve. In addition, it shows that the rate of improvement depends on the lean maturity stage.

In summary, the literature review provided an extensive overview of lean implementation to date, its application in different environments, and challenges along the journey associated with its transfer to environments beyond manufacturing and its sustainability. At the same time, however, several research gaps remain as extensively articulated during the introduction already. First, most academic research has only looked at specific focus areas (e.g., either manufacturing *or* service; Danese *et al.* 2018) to date, while most research has undoubtedly focused on manufacturing operations on the shopfloor (Danese *et al.* 2018; Åhlström *et al.* 2021). Intraorganisational analyses, however, mainly remain overlooked. In 2013, for instance,

Marodin and Saurin (2013) reported that only 2% of the studies about lean production systems covered manufacturing and service areas at the same time. Such an attitude, however, neglects an organisation's entirety and disregards major parts of the value stream that the lean enterprise calls for (Fullerton *et al.* 2014; Jasti and Kodali 2015). Second, diffusions of lean have merely been researched from a corporate point of view in multi-site contexts (e.g., Maritan and Brush 2003; Aoki 2008; Inkpen 2008; Yu and Zaheer 2010; Netland 2013; James and Jones 2014; Netland and Aspelund 2014; Netland and Ferdows 2014, 2016; Netland and Sanchez 2014; Netland *et al.* 2014; Boscari *et al.* 2016; Danese *et al.* 2017). Interesting, however, is to see how lean evolves intraorganisationally within a single-site context and what challenges are encountered along the way. Under consideration of the empirical background, which is introduced more closely in the next chapter, the following research question is proposed to fill this void.

RQ1. How can lean be diffused from manufacturing operations to the wider organisation?

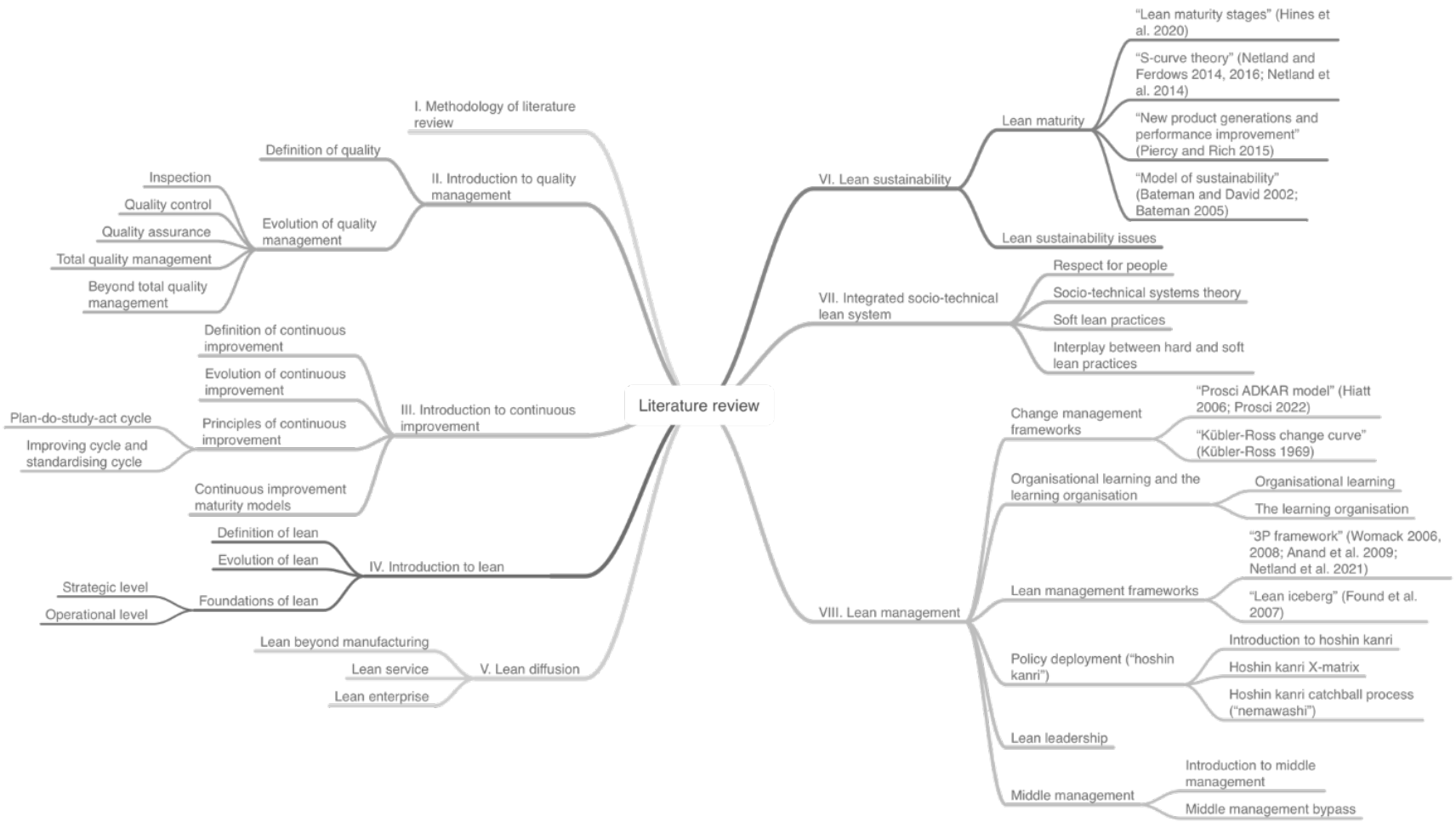
In organisations, dynamics are not equally experienced at each hierarchical level (Lodgaard *et al.* 2016). The literature review demonstrated the special role played by middle managers. First, they are culture carriers (Poksinska *et al.* 2013; Holmemo and Ingvaldsen 2016; Reynders *et al.* 2022). Second, they are the intermediary between the strategic and the operational level (Nonaka 1988; Westley 1990; Floyd and Wooldridge 1996, 1997; Engle *et al.* 2017; Tortorella *et al.* 2017). Third, they have the largest social network in- and outside their area of responsibility (Bamford and Forrester 2003), enabling them to influence in all directions (Floyd and Wooldridge 1994; Dutton *et al.* 1997; Harrington and Williams 2004).

In their position between the strategic and the operational level, this study suggests that middle managers possess the most valuable knowledge to draw from so that lean can be sustained when diffusing it from manufacturing operations to the wider organisation. In other words, this study suggests that middle managers know best about the dysfunctions in the existing system and the improvements needed. Inferring from the insights of the literature review, the following research question is proposed.

RQ2. What are the lessons learnt from the experiences of middle management during the diffusion of lean from manufacturing operations to the wider organisation so that lean can be sustained?

The methods that were adopted to answer these two research questions are introduced in the following chapter, accordingly.

Figure 2.13 Structure of literature review



Source: Author

3. Methods

In the previous chapter, the literature review provided an overview of the current state of knowledge in lean research, identified gaps in the existing literature, and derived two research questions to be answered in this study. To give adequate answers to the research questions, a well-elaborated research design in necessary, addressing the logic of inquiry (de Vaus 2001). To recall, the research questions are as follows (Table 3.1).

Table 3.1 Research questions

No.	Research question(s)
RQ1.	How can lean be diffused from manufacturing operations to the wider organisation?
RQ2.	What are the lessons learnt from the experiences of middle management during the diffusion of lean from manufacturing operations to the wider organisation so that lean can be sustained?

Source: Author

This chapter depicts the research methodology that was adopted in this study. At the same time, decisions on the research methodology are justified. The structure of this chapter follows an adapted version of Saunders and Lewis' (2012) "research onion" and commences with the outermost layer, which is the research philosophy, concerning the ontological and epistemological world view (Table 3.2).

Table 3.2 Research design

No.	"Research onion" layer(s)	Selection(s)
1	Research philosophy	Critical realism
2	Research approach	Abduction
3	Research strategy	In-depth single-case study
4	Methodological choice	Mono-method qualitative study
5	Time horizon	Longitudinal
6	Techniques and procedures	Interviews Direct (non-participant) observations Internal document reviews and archival records
7	Data analysis	Template analysis
8	Reliability and validity	
9	Research Ethics	

Source: Adapted from Saunders and Lewis (2012)

In doing so, this chapter situates this research project within the paradigm of "critical realism" and presents it first as the underpinning research philosophy. Second, the abductive research approach underlying this study is introduced. Third and fourth, the research strategy and the methodological choice that were deployed are justified. More specifically, the author highlights the necessity for carrying out a qualitative in-depth single-case study. Fifth, the selection of a longitudinal versus a cross-sectional time horizon is explained. Sixth, the methods of data

collection are described in detail. In this section, the author also reflects on the strengths and weaknesses of his research design. Towards the end, this chapter depicts on how data were analysed and how reliability and validity were ensured. Finally, it rounds off with ethical considerations to meet the ethical standards of modern research.

3.1 Research philosophy: Critical realism

In research philosophy, ontology can be referred to as "the study of being" (Gray 2013, p. 19) or as the nature of reality (Saunders *et al.* 2012). In essence, ontology concerns

> "claims and assumptions that are made about the nature of social reality, claims about what exists, what it looks like, what units make it up and how these units interact with each other" (Blaikie 1993, p. 6).

Alongside ontology, epistemology refers to grounds of knowledge. It concerns ways of knowing about social reality (Carson *et al.* 2001) and asks about what acceptable knowledge constitutes (Saunders *et al.* 2012).

To understand critical realist research, it is necessary to be aware of the differences between two diverging ontological stances beforehand, namely, (1) objectivism and (2) subjectivism. In essence, objectivity supposes a single reality independently of human consciousness, whereby research aims at exploring an "objective" truth. As opposed to this, subjectivism neglects such an objective truth external to individuals and poses multiple realities instead where the social world is socially constructed as individuals attribute evolving meanings to their social environment by means of social interactions with social actors (Saunders *et al.* 2012; Gray 2013).

Under both ontological stances reside different theoretical perspectives (epistemologies; Gray 2013). In social science, however, researchers often encounter the limitations, if they stick to one or another extreme along the ontological continuum (Figure 3.1).

Figure 3.1 The ontological continuum

Source: Adapted from May (1999)

In most cases, positivist stances, mainly associated with quantitative methods, tend to neglect social dimensions (Abubaker and Bagley 2016; Vincent and O'Mahoney 2018). Sayer (2000), for instance, argues that

> "the amount of times we can empirically observe an event does not help us understand what causes it" (p. 14).

At the same time, subjective stances, mainly associated with qualitative methods, are limited in their generalisability as they tend to picturise the social world as a single phenomenon based on a unique situation (Abubaker and Bagley 2016). In short, being on either extreme of the ontological continuum is associated with flaws.

An alternative to overcoming these drawbacks in organisational research is seen in a philosophical stance called "critical realism" because it provides an opportunity to play off such methodological dilemmas against each other (Edwards *et al.* 2014; Abubaker and Bagley 2016). That is because critical realism embraces both the subjective and the objective reality (Bhaskar 2010), enabling to inform individuals about mechanisms that determine the meanings they attribute to their social world. In doing so, critical realism is focused on understanding rather than being descriptive about the social reality (Vincent and O'Mahoney 2018) and postulates a single reality; however, there is no immediate access to an objective truth, as multiple interpretations of reality are possible.

> "Reality is assumed to exist but to be only imperfectly apprehendable because of basically flawed human intellectual mechanisms and the fundamentally intractable nature of phenomena" (Guba and Lincoln 1994, p. 110).

Ontologically, critical realism supposes that the social world exists external to individuals (i.e., rooted in a realist ontology). Epistemologically, however, it suggests that reality cannot be entirely grasped through perceptions; theory, however, may assist in unveiling what is imperceptible (i.e., subjectivist epistemology). In practice, this means that things can exist regardless of whether they are known to individuals or not (Vincent and O'Mahoney 2018).

In his book, Bhaskar (1975) has thus defined reality as ontologically stratified with three different domains, including (1) "the empirical", (2) "the actual", and (3) "the real" (Table 3.3).

Table 3.3 Three domains of stratified ontology

No.	Domain(s)	Description(s)
1	The empirical	Observations and experiences Visible
2	The actual	Events and actions (In)visible
3	The real	Underlying structures and mechanisms underpinning "the actual" and "the empirical" Invisible

Source: Adapted from Bhaskar (1975); Clark *et al.* (2008)

First, “the empirical” represents the observations and experiences that are visible to the individual firsthand. Second, “the actual” includes the events and actions that do actually take place. While these could potentially all be experienced by the individual, they may also remain inexperienced or unobserved. Third, “the real” refers to the underlying structures and mechanisms that cause or inhibit events from happening. These are invisible to the individual (Clark *et al.* 2008; Bhaskar 2010). That being said, only parts of reality are often experienced, resulting in a limited understanding of the overall picture of reality. In other words,

> “our perceptions and attempts to understand reality are always imperfect and limited and that a theory that fits for most things will always have exceptions and require revision” (Jones 2019, p. 52).

In previous research on lean, for instance, critical realist stances found adoption to examine how lean operations generate positive performance across multiple dimensions of corporate social responsibility (Piercy and Rich 2015) or to investigate why lean implementations are often poorly sustained (Hines *et al.* 2020).

In *this* research, a critical-realist stance is considered as highly adequate likewise. In light of the research questions, critical realism enables the unfolding of the underlying mechanisms that impact the success with lean. In the case of middle managers, in particular, a critical realist stance enables identifying underlying causes responsible for shaping a middle manager’s social reality. Notably, critical realism recognises the fragility of knowledge as

> “participants may be unaware of or (consciously or otherwise) misrepresent the social formations of which they are a part” (Vincent and O’Mahoney 2018, p. 2).

In this regard, middle managers’ subjective views on how they perceive lean implementation can be compared and evaluated against a more objective reality using established theory. To put simply, the existing body of knowledge can be consulted where appropriate to identify con- or divergencies. In addition, Abubaker and Bagley (2016) remark that, effectively,

> “we are seeking a *still point* [italics in original] in a world of change, which over time, will itself be subject to modification as the social reality it reflects undergoes change” (p. 2).

Considering this, a critical realist stance is also justified by the longitudinal nature of this study. That is because lean-adopting organisations undergo gradual change, while social actors’ individual meanings attributed to their social environment may alter over time. In fact, there are several other reasons why a longitudinal time horizon seems appropriate. In one of the following sections (see section 3.5), an extensive explanation is provided.

3.2 Research approach: Abduction

Aligning with a critical realist stance, a research approach referred to as "abductive reasoning" is adopted in this study. In comparison to deductive and inductive reasoning (Table 3.4), abductive reasoning concerns an iteration between the data and theory (Dubois and Gadde 2002) and seeks suitable explanations for empirical observations by means of existing knowledge (Taylor *et al.* 2002). In simple words, abductive reasoning is a cyclical sensemaking process (Steiner Sætre and van de Ven 2021).

Table 3.4 Deductive, inductive, and abductive reasoning

Reasoning	Deduction	Induction	Abduction
Nature(s)	Logical	Empirical	Generative
Process(es)	Moving from general to specific Theory-driven Hypothesis-testing	Moving from specific to general Data-driven Theory-building	Moving from the unexplained towards plausible explanations Iteration between deductive and inductive reasoning Theory-building and/or theory-modifying
Method(s)	Mainly quantitative	Mainly qualitative	Qualitative Quantitative
Contribution(s)	Theory verification or falsification	Theory-building	Theory-building
Outcome(s)	Logical validity "True or false"	Empirical truth "Is actually true"	Plausibility "May be true"

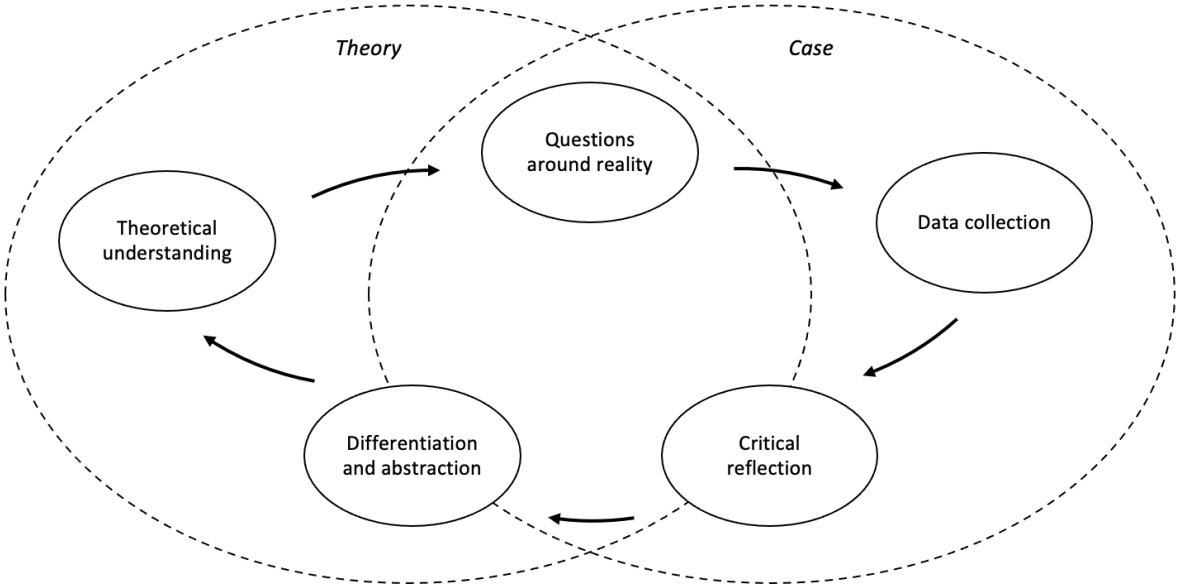
Source: Adapted from Kovács and Spens (2007); Steiner Sætre and van de Ven (2021)

In the abduction process, researchers study the data and develop hypotheses to confirm or disconfirm up to the point where a most plausible interpretation is achieved (Kovács and Spens 2007; Teddlie and Tashakkori 2009). Such a process aims at both exploring and explaining (Kovács and Spens 2007). Making a comparison between abduction and deduction, Steiner Sætre and van de Ven (2021) suggest that "plausibility [as inferred via abduction] replaces validity when evaluating new explanations" (p. 31).

In this study, the way how the researcher made sense of the data is best described by Kubicek's (1977) heuristic frame of reference (Figure 3.2). Initially, the researcher began with reviewing the literature to establish a (1) theoretical understanding of lean implementation in manufacturing and beyond, as well as the middle management role in lean. If no theoretical knowledge had been acquired prior to going into the field, it may have been the case that the researcher would have presented meaningless descriptions (Hartley 1994). Instead, this acquired knowledge then informed (2) questions around reality, and (3) the data collection

process. Then, collected data were (4) critically reflected upon, (5) differentiated, and abstracted, enriching the author's theoretical understanding and interpretation of the case.

Figure 3.2 Heuristic frame of reference



Source: Adapted from Kubicek (1977)

Implementing lean varies from organisation to organisation and, due to its dependence on organisational context (Hasle *et al.* 2012; Marodin and Saurin 2015; Netland 2016; Antony *et al.* 2020; Netland *et al.* 2021), an abductive approach seems quite appropriate in this study because the reasons why lean succeeds or not differ likewise and require explanation by going back to theory.

3.3 Research strategy

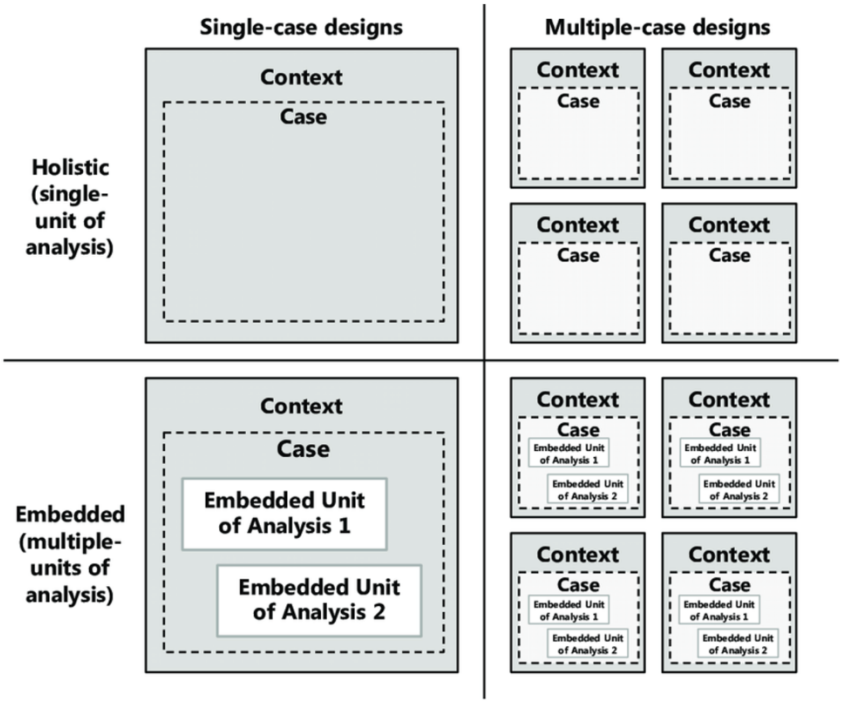
3.3.1 Case-study method

In this research project, an in-depth single-case-study approach was adopted to explain *how* (Eisenhardt 1989; Pratt 2009; Yin 2014) lean can be diffused from manufacturing operations to functional areas in the wider organisation and *how* middle managers had been experiencing this process. Taking this into account, the research objectives have both an exploratory (*RQ1*) and some explanatory character (*RQ2*). In general, case-study research concerns

> "a history of a past or current phenomenon, drawn from multiple sources of evidence. It can include data from direct observation and systematic interviewing as well as from public and private archives" (Leonard-Barton 1990, p. 249).

It is particularly useful once the knowledge of a particular phenomenon is limited (Saunders *et al.* 2012), allows a richer understanding (Silverman 2013), helps to understand the organisational dynamics (Eisenhardt 1989), and enables to unveil complex constructs (Voss *et al.* 2002; Barratt *et al.* 2011). In critical-realist research, in-depth case studies are the most popular and useful form to derive causal mechanisms from empirical observations (Vincent and O'Mahoney 2018). At the same time, case studies generate new ideas and sharpen existing theories by matching patterns. Their strength roots in describing, interoperating, and explaining and are thus much more adequate to unveil deeper structures in social settings (Bluhm *et al.* 2011; Yin 2014; April *et al.* 2019).

Figure 3.3 The basic types of designs of case studies



Source: Yin (2014)

In regard to the type of case-study design (Figure 3.3), this research built upon an embedded (multiple-units of analysis) single-case design (Yin 2014). On the one hand, this research project attempts to identify how organisations diffuse lean from manufacturing operations to the wider organisation. In this case, the case organisation itself constitutes the first unit of analysis. On the other hand, this study also explores how the middle management layer experiences such substantial change initiated by their organisation. In this instance, middle managers are the second unit of analysis.

In the literature, several scholars describe how organisational contexts constitute a natural setting where its social actors (i.e., organisational members) attach certain meaning and values

to their surrounding environment (Denzin and Lincoln 1994; Meredith 1998; Barratt *et al.* 2011; Gioia *et al.* 2012; Creswell 2013; Silverman 2013). In Yin's (1984) words, a case study is an

> "empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used" (p. 23).

That being the case, rich qualitative data in the form of interviews and observations, for instance, can be collected from individuals directly involved (Barratt *et al.* 2011; Yin 2014), such as middle managers.

A significant advantage of single-case studies is that they enable to examine a phenomenon that is *currently* taking place (Yin 2014). In his book, Yin (2009) also refers to having access to "*extreme* [italics in original] […] or […] *unique* [italics in original] case[s]" (p. 47). In fact, it would be naïve to assume that a diffusion of lean from manufacturing operations to the wider organisation, as the case was here, could be observed in any organisation at any time. First, because not every organisation is embarking on such a journey, exploring this phenomenon becomes a rare opportunity. Second, it would be practically difficult to identify organisations that are *currently* in the process of diffusing lean from one business area to another. At the same time, a single-case study ensures that potentially interfering factors are more or less stable (e.g., organisational culture; Netland *et al.* 2015). It is true indeed that such a case-study design is associated with a limited generalisability (Yin 2014). However, the research project does not intend to make grand and generalisable claims but aims to gain an in-depth understanding of the phenomena to be examined instead (Rubinstein 1981). That is, a case study is empirically valid and has the power to induct theory (Eisenhardt 1989; Eisenhardt and Graebner 2007) while generalisability may be tested deductively in the same or even other contexts later to increase its robustness (Eisenhardt 1989; Eisenhardt and Graebner 2007; Pratt 2009; Teddlie and Tashakkori 2009; Barratt *et al.* 2011).

Its in-depth character is often associated with access to much more data than multiple-case designs (Barratt *et al.* 2011). This does not only mean that researchers do not have to ration their resources (e.g., making sure equal time is spent in all organisations to be studied), but it also concerns the type of data collected because nearly any type of data (both quantitative and qualitative) can be useful for further analysis. While not intentioned, case studies could technically even be solely based on quantitative data (Yin 2014). In his book, Yin (2009)

accentuates that single-case studies are particularly useful if longitudinal phenomena are being studied.

3.3.2 Case selection and access

It is beyond question that a case organisation had to be selected that corresponds to the research objectives to fulfil the postulate of purposeful sampling (Locke 2001). As organisations to be studied are usually selected by researchers, this was not the case here. The selection of the case organisation occurred as a result of a larger cooperation between Cardiff University and two funding bodies, including the ESRC and a multi-national medical manufacturing organisation with a local UK plant. Accordingly, a case organisation was already preselected prior to the start of the research project. Over a series of meetings with senior representatives, a research focus had been negotiated that met the case organisation's needs and academic relevance. In this way, the central idea of purposeful sampling did not remain unsatisfied.

As part of an agreement with the researcher and Cardiff University, flexible access to the case organisation was granted, accordingly. At any time, the researcher was allowed to visit the site for the purpose of collecting data. This enabled to maintain a long-term perspective on the phenomena studied.

3.3.3 Case profile

The research was undertaken in a non-unionised UK subsidiary of a multi-national manufacturing organisation. This multi-national manufacturing organisation operates in three different business divisions, with medical manufacturing making up the largest one regarding revenues (approximately 75%). Across all entities, the organisation reported a turnover of around €6b (≈ £4.9b) in 2016. By comparison, its UK subsidiary, where the research took place, reported a turnover of approximately £35m (≈ €42.9m) in the same year.[6] Under consideration of currency exchange rates to date, this is less than 1% of the total turnover. In total, this UK subsidiary employed around 300 employees at that time.

The UK site's (hereinafter referred to as "OpCo") core competencies are twofold, including a manufacturing (internally referred to as "Operations" and abbreviated in the following as "OPS") and a research-and-development (internally referred to as "Research & Development" and abbreviated in the following as "R&D") practice with a focus on surgical energy products. Both OPS and R&D are supported by two more departments, namely, (1) Regulatory Affairs

[6] The average currency exchange rate for the year 2016 (i.e., £1 = €1.2242) was used to convert the figures.

& Quality Assurance ("RAQA") and (2) Selling, General & Administrative Expenses ("SGAE"). Under each of these four main departments are several smaller sub-departments. In total, five directors manage these four main departments while the executive managing director is responsible for the plant as a whole and reports to the parent organisation located in the European Union (Table 3.5).

Table 3.5 Functional organisation

No.	**Operations ("OPS")**	**Regulatory Affairs & Quality Assurance ("RAQA")**	**Research & Development ("R&D")**	**Selling, General & Administrative Expenses ("SGAE")**	
	Director of Operations	*Director of Quality Assurance & Regulatory Affairs*	*Director of Research & Development*[a]	*Director of Finance & Information Technology*	*Director of Human Resources*
1	Production Management	Product Evaluation	Mechanical Engineering	Environment, Health & Safety, and Facilities	Human Resources
2	Purchasing	Quality Engineering	Process Engineering	Finance	
3	Manufacturing Engineering	Quality Systems	Research Management	Information Technology	
4	Sustaining Engineering	Regulatory Affairs	Research & Development Management (Project Management)		
5			Software & Electronics Development		

Source: Author

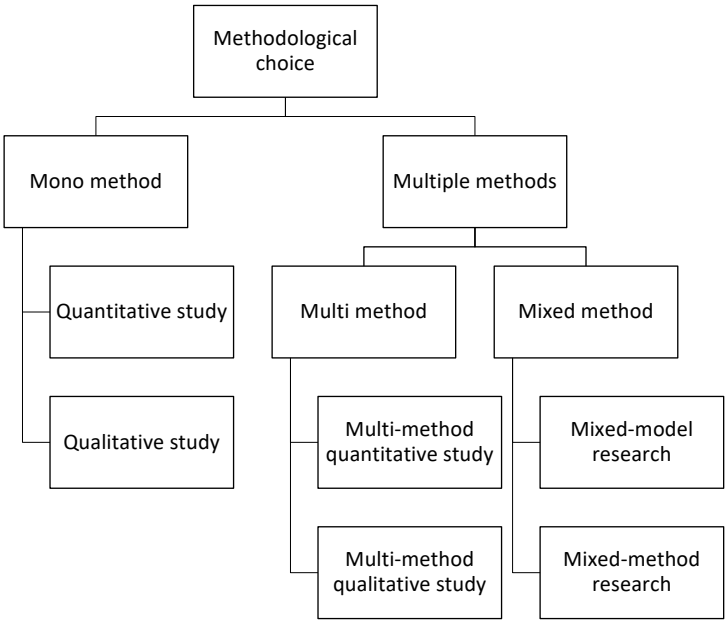
Note(s): (a) This senior manager was 18 months on leave. Note that this information will be more relevant during the results and discussion chapter.

In 2008, the case organisation was acquired by its current parent organisation. Until then, it had been an independent and family-owned business. Following its acquisition, the case organisation had undergone several structural changes to suit its parent organisation's strategic needs. In particular, several structural changes had been undertaken in OPS, including a replacement of the production management. Throughout, new leaders ranging from the shopfloor to the senior management level had been gradually hired, joining the department from 2013 onwards. In 2014, operations managers in leading functions initiated the implementation of lean in the case organisation's manufacturing environment. A year later, a decision was made to diffuse lean to non-manufacturing environments with the aspiration to transform into a lean enterprise some day in the future. At that point of time, this research project had begun to evolve.

3.4 Methodological choice: Mono-method qualitative study

In this study, a mono-method qualitative study was employed. The methodological choice concerns the distinction between a qualitative and a quantitative research design, as well as between mono- and multiple-method studies (Saunders *et al.* 2012; Figure 3.4).

Figure 3.4 Methodological choices



Source: Adapted from Saunders *et al.* (2012)

The difference between quantitative and qualitative research designs lies in the nature of the data. Usually associated with statistical techniques, a quantitative research design is often referred to as collecting and analysing numerical data ("closed-ended"). With 66.29%,

quantitative research designs are, in fact, dominating in research on lean manufacturing (Jasti and Kodali 2014). As opposed to this, a qualitative research design is referred to as collecting and analysing non-numerical data ("open-ended"; Creswell and Plano Clark 2011; Saunders *et al.* 2012). Studies adopting either way with a single way of collecting and analysing data are mono-method studies. Hence, multiple methods concern a research design that considers more than a single way of collecting and analysing data. This includes purely quantitative (multi-method quantitative study) and purely qualitative approaches (multi-method qualitative study) as well as a mix of the two (mixed-model research or mixed-method research; Mills *et al.* 2010).

In this study, employing a qualitative method helped to focus on organisational members and human interactions while paying attention to local dynamics on an everyday basis. Indeed, a quantitative method would neglect such social dimensions as described earlier (Sayer 2000; Abubaker and Bagley 2016; Vincent and O'Mahoney 2018).

3.5 Time horizon: Longitudinal

The time horizon describes the point(s) of time when data are collected. While cross-sectional studies have a "snapshot" character (i.e., data are collected at a specific point of time), longitudinal studies have a "diary" character (i.e., data are collected in a series of events over a given time period). While this means that longitudinal studies enable to capture change over time (Saunders *et al.* 2012; Gray 2013), they also have

> "the ability to get closer to theoretical constructs [which] is particularly important in the context of longitudinal research that tries to unravel the underlying dynamics of phenomena that play out over time" (Siggelkow 2007, p. 22).

Several lean maturity models (e.g., Bateman and David 2002; Bateman 2005; Netland and Ferdows 2014, 2016; Netland *et al.* 2014; Piercy and Rich 2015; Hines *et al.* 2020) accentuate lean's long-term perspective towards perfection associated with change in the sense of a gradual evolution. At the same time, lean conditions long-term commitment (Bhasin and Burcher 2006; Jasti and Kodali 2014). In practice, however, researchers have often overlooked lean's long-term perspective, limiting their research to cross-sectional data (Jasti and Kodali 2014; Gaiardelli *et al.* 2019). In 2014, for instance, Jasti and Kodali (2014) reported already about a lack of studies on lean manufacturing adopting a longitudinal approach. Presumably, this has to do with the circumstance that longitudinal studies are much more resource-consuming than cross-sectional ones (Rindfleisch *et al.* 2008; Jasti and Kodali 2014; Netland

and Ferdows 2016). By nature, however, longitudinal studies embrace a longer period of time and are thus more likely to produce a richer picture than cross-sectional studies. In the literature, longitudinal studies are highly encouraged, after all.

> "[O]ur review reveals a clear interest towards the investigation of the effects of lean on social aspects, thus we encourage longitudinal studies for a better understanding of the hard and soft practices needed to sustain lean outcomes over years" (Danese *et al.* 2018, p. 597).

In particular, single-case studies are reported to be useful for longitudinal research (Voss *et al.* 2002; Barratt *et al.* 2011). Given the research objectives associated with their focus on the process of adopting lean, it speaks for itself that equal attention has to be given to longitudinal approaches to fully understand how lean evolves (Jasti and Kodali 2014; Gaiardelli *et al.* 2019).

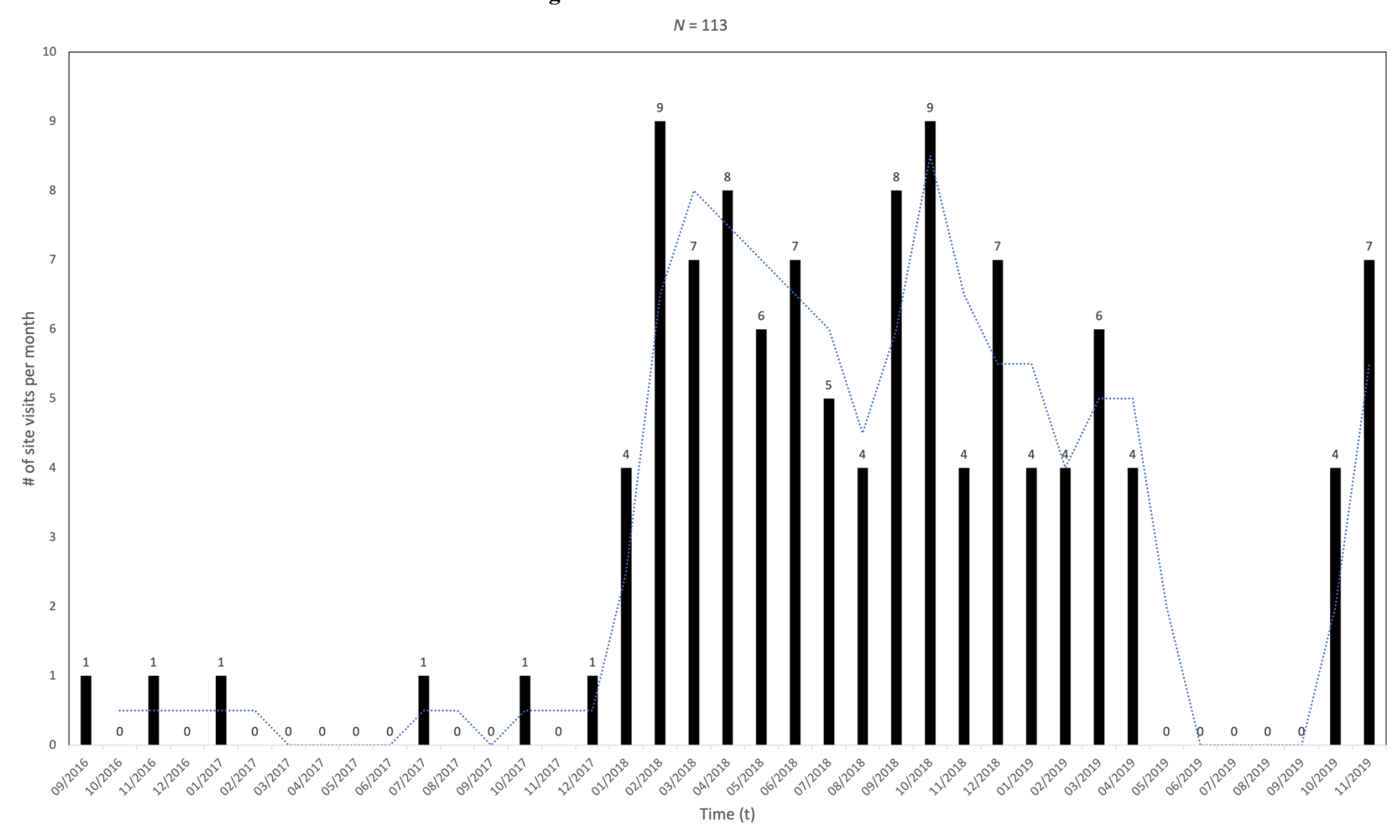
Accordingly, a longitudinal time horizon was adopted in this mono-method qualitative study in which data had been collected in a series of numerous site visits. In total, the researcher had been visiting the case organisation's UK site 113 times over a time period of 38 months between 20 September 2016 and 26 November 2019. In Figure 3.5, these site interactions and their distribution are illustrated in detail. As the researcher attended the MSc Social Science Research Methods at Cardiff University, a low interaction level is recorded until 15 January 2018. More intense interactions occurred between 15 January 2018 and 09 April 2019 over a period of 15 months. In total, 96 interactions took place during this time period. On average, this amounts to 6.4 visits per month and 1.5 visits per week.[7] After that, between 09 April 2019 and 23 October 2019, no interactions had taken place for five months. That is mainly because the initial set of data had been analysed during this time period. From 23 October 2019 until 26 November 2019, another eleven interactions occurred. In these two months, the researcher collected a second set of data. Finally, the data collection was closed on 26 November 2019.

3.6 Techniques and procedures

In case-study research, interviews, observations, internal documents reviews, and archival records remain the preferred choice when it comes to data collection techniques (Barratt *et al.* 2011; Yin 2014). Equally, this case study adopted all these techniques (Table 3.6). That is because a combination of all of them led to a richer set of qualitative data, which increases the validity of the research results in turn (Glesne and Peshkin 1992). Accordingly, the following depicts more closely on the different techniques and procedures adopted in this study.

[7] Note that bank holidays are not subtracted out in this rough estimate. In reality, the average figures are therefore even slightly higher.

Figure 3.5 Distribution of site visits



Source: Author

Table 3.6 Six sources of evidence

No.	Source(s) of evidence	Characteristic(s)		Case example(s)
		Strength(s)	*Weakness(es)*	
1	Interviews	Case-focused Insightful	Bias (response bias or due to poorly constructed questions Inaccuracies due to poor recall Interviewee provides what the interviewer wants to hear	65 face-to-face interviews Five group interviews
2	Direct observations	Realtime Covers context of event	Resource-intense (time and cost) Selectivity	Body language in face-to-face interviews Factory tour Interviews Meetings Presentations Social interactions
3	Participant observation	Realtime Covers context of event Insightful into interpersonal behaviour and motives	Resource-intense (time and cost) Selectivity Reflexivity (events may be influenced due to researcher's presence)	None
4	Documentation	Can be reviewed repeatedly Not created as a case-study result Broad coverage (e.g., events over a timespan)	Access and can be difficult to find Biased selectivity, if incompletely collected Creator's bias	Internal protocols around lean implementation Intranet information Handbooks
5	Archival records	Can be reviewed repeatedly Not created as a case-study result Broad coverage (e.g., events over a timespan) Precise and usually quantitative	Access and can be difficult to find Biased selectivity, if incompletely collected Creator's bias	Survey data Organisation charts
6	Physical artefacts	Insightful into cultural features and technical operations	Selectivity Availability	Visual management Suggestions boxes Leaflets

Source: Adapted from Yin (2014)

3.6.1 Interviews

In this study, a combination of both semi- and unstructured face-to-face interviews was adopted. Individual and group interviews had been undertaken. The research questions have both an exploratory (i.e., questions around "how"; Eisenhardt 1989; Yin 2014) and some explanatory character, which is why in-depth interviews were considered as highly adequate (Saunders *et al.* 2012) to develop an understanding (1) *how* the case organisation diffuses lean from manufacturing operations to the wider organisation and (2) *how* this process is experienced by middle managers and which lessons learnt can be taken away. Unlike quantitative research designs, a qualitative case-study design alongside with such types of interviews enabled to unveil deeper dynamics around lean within the case organisation, including their social actors, and to find out how these dynamics had been evolving over time (Bluhm *et al.* 2011).

3.6.1.1 Semi-structured interviews

Vaguely, the latter summed already up for what reasons interviews had been conducted. To answer the first research question, a first wave of 45 face-to-face interviews had been undertaken between 12 June 2018 and 05 February 2019 to explore and understand what was actually going on inside the case organisation. In other words, the past and current state of the organisations had to be grasped in an explorative way (Flick 2006). As such, single interviews were seen appropriate to enhance the richness of data (Voss *et al.* 2002) and helped to create the bigger picture of the case organisation's lean implementation. As the researcher was provided with an organisation chart by HR, he was enabled to make sure that individuals from each single functional area across all departments were covered in the first interview wave and had their say to broaden perspectives. In this way, a holistic picture of the organisation was attempted and could be maintained. Interviewing multiple individuals helped to overcome single respondent bias (Bowman and Ambrosini 1997).

In this first interview wave, interviewees at the operational level (non-managerial employees) had mostly been picked randomly. Merely, the shopfloor operators to be interviewed had been suggested by a production manager upon their experience. Apart from this, the middle management layer was intended to be interviewed throughout. At that point, there were 15 different middle managers and each of them was invited to participate in this research. After 15 middle managers had been approached for interviews, only 13 of them were available. Neglecting these two, the other 13 middle managers constituted the "entire" middle management layer in this study. In comparison to both the middle management and the

operational level, senior managers had not been interviewed as part of the explorative semi-structured interviews.[8] All potential interviewees had either been approached via e-mail or in person. In the case of participation, the interview had been recorded via field notes in a bullet-point manner upon their consent (Appendix 2). Serving the purpose of exploration, these interviews followed a semi-structured protocol with just a tiny set of broad and open-ended questions around the way of the working ("How would you describe the way of working here?"), how improvement is embedded ("How is improvement embedded in the organisation?"), how innovation comes to light ("Where do new ideas come from?"), and general impressions of their lean implementation ("What is your view of the lean programme in the organisation?"). Where appropriate, the researcher asked probing and follow-up questions to make sure he followed their narrative and logic correctly and to enrich the dataset. In doing so, these interviews evolved in most cases to a natural and casual conversation (Rubin and Rubin 2012; Bryman 2016).[9]

In a second and more formal wave of 16 face-to-face interviews between 23 October 2019 and 26 November 2019, the researcher delved deeper into understanding how the organisation's diffusion of lean from manufacturing operations to the wider organisation is experienced by middle managers and what lessons learnt can be taken away. To answer this question adequately, it was important to interview middle managers in particular. That was because only *they* could explain the root causes for their behaviours (Frohmann 1990; Harrington and Williams 2004) in regard to lean implementation. At the same time, this was an opportunity to extend and validate the results from the previous interviews (Voss *et al.* 2002).

In doing so, all middle managers who participated already in this research as part of the first interview wave were willing to be reinterviewed. In addition to this, two newly appointed or promoted middle managers also agreed to participate. Same as before, potential interviewees had been approached via e-mail or in person. Yet again, the sample did not embrace the entire middle management layer because the same two middle managers were unavailable. Regarding the relative department sizes, a quite fair balance could still be maintained despite the two

[8] That is because regular project-update meetings were held between the researcher, his supervisory team, and two senior managers, which served to continuously exchange information about the research project. Under "group interviews", these meetings are covered. In addition, a few unstructured interviews had been carried out with senior managers. They are covered under "unstructured interviews".

[9] Indeed, research designs are usually worked out in advance; in this particular case, however, the research design evolved organically and had changed by the time of the first-wave interviews. That is mainly because the initial findings indicated a shift in the case organisation's agenda. Over a series of meetings with senior representatives, a new research focus had been negotiated that met the case organisation's needs and academic relevance.

middle managers who were seemingly unwilling to be interviewed (Table 3.7). Indeed, these interviews followed a semi-structured protocol likewise but with a large set of pre-defined and open-ended questions this time. Like the previous interviews, the researcher made use of probing and follow-up questions (Rubin and Rubin 2012; Bryman 2016).

Indeed, it is true that not everyone amongst those 16 interviewees as part of the second wave held a middle management role. First, there was the production support facilitator who functioned as the lean facilitator and was thus resourceful in undertaking this research, providing much additional and insightful information around lean implementation. Second, there were two unstructured interviews with senior managers, which are touched upon in the next section. All 14 interviewees as part of the semi-structured interviews agreed to be recorded. Upon their consent (Appendix 3), voice records were transcribed verbatim to enable a facilitated data analysis later on (Bryman 2016).

As Table 3.7 shows, semi-structured interviews constituted the dominating interview technique. Guiding interview questions ensured that a certain agenda was followed and avoided that the interview runs off the track at the same time (Saunders *et al.* 2012; Yin 2014; Bryman 2016). Due to being open-ended, they also enabled to receive relatively longer and insightful responses from interviewees, as the case would be with closed-ended interview questions (Rubin and Rubin 2012). While interviewees had much more leeway on how to respond, an opportunity was given to thematise topics that have a certain relevance to them (Bryman 2016). With 85.48 months (≈ 7.12 years) in total, the average tenure was quite high, which is an indicator that the average interviewee had already undergone certain experiences in the case organisation likely to be relevant and useful for this research project.

Table 3.7 Interviewee profiles

No.	Interviewee(s)[a]	Department(s)				Management level(s)			Tenure[b]	Descriptive interview information						*f*[j]
		OPS	*RAQA*	*R&D*	*SGAE*	*SM*[c]	*MM*[d]	*NM*[e]		*Type(s)*		*Format(s)*		*Minutes*	*Date(s)*[a]	
										SS[f]	*US*[g]	*FN*[h]	*TS*[i]			
Inducting interviews (between 30 October 2017 and 08 December 2017)																
1	Director of Human Resources				•	•			25		•	•		31	30.10.2017	2
2	Production Support Facilitator	•						•	32		•	•		62	30.10.2017	3
3	Operations Manager	•					•		54		•	•		61	30.10.2017	3
4	Mechanical Engineering Manager			•			•		96		•	•		72	08.12.2017	3
	Sub-total	*2*	*0*	*1*	*1*	*1*	*2*	*1*	*207*	*0*	*4*	*4*	*0*	*226*		
	Sub-ratio	*50%*	*0%*	*25%*	*25%*	*2%*	*50%*	*25%*	*51.75*	*0%*	*100%*	*100%*	*0%*	*56.5*		
Interview wave #1 (between 12 June 2018 and 05 February 2019)																
5	Production Support Facilitator	•						•	39	•		•		74	12.06.2018	3
6	Operations Manager	•					•		60	•		•		58	18.06.2018	3
7	Production Manager 1	•					•		60	•		•		92	25.07.2018	2
8	Production Manager 2	•					•		42	•		•		61	25.07.2018	2
9	Production Manager 1	•					•		60		•	•		73	30.07.2018	2
10	Purchasing Manager	•					•		228	•		•		25	25.09.2018	1
11	Buyer Expeditor	•						•	120	•		•		31	02.10.2018	1
12	Quality Systems Technical Assistant 1		•					•	252	•		•		39	11.10.2018	1
13	Senior Quality Systems Engineer 1		•					•	77	•		•		64	11.10.2018	1
14	Senior Quality Systems Engineer 2		•					•	84	•		•		46	11.10.2018	1
15	Quality Systems Engineer		•					•	24	•		•		55	11.10.2018	1
16	Quality Systems Inspector		•					•	84	•		•		32	15.10.2018	1
17	Quality Systems Technical Assistant 2		•					•	126	•		•		27	15.10.2018	1
18	Contract Quality Systems Inspector		•					•	24	•		•		46	15.10.2018	1
19	Quality Systems Technician Team Leader		•					•	252	•		•		29	15.10.2018	1
20	Information Technology Helpdesk Support				•			•	30	•		•		60	23.10.2018	1
21	System Support Analyst				•			•	13	•		•		35	23.10.2018	1
22	Human Resources Advisor				•			•	10	•		•		42	23.10.2018	1
23	Human Resources Coordinator				•			•	4	•		•		40	23.10.2018	1
24	Quality Systems Technician		•					•	60	•		•		40	29.10.2018	1
25	Financial Controller				•		•		4	•		•		46	29.10.2018	2
26	Information Technology Manager				•		•		28	•		•		105	29.10.2018	2
27	Cost Accountant				•			•	132	•		•		54	30.10.2018	1
28	Network Systems Administrator				•			•	96	•		•		55	30.10.2018	1
29	Learning & Development Business Partner				•		•		11	•		•		82	05.11.2018	2
30	Manufacturing Team Member 1	•						•	72	•		•		29	27.11.2018	1
31	Manufacturing Team Member Trainer 1	•						•	84	•		•		23	27.11.2018	1
32	Manufacturing Team Member 2	•						•	156	•		•		20	03.12.2018	1
33	Manufacturing Team Member 3	•						•	60	•		•		44	03.12.2018	1
34	Manufacturing Team Member Trainer 2	•						•	108	•		•		21	04.12.2018	1
35	Senior Quality Engineer		•					•	60	•		•		54	10.12.2018	1
36	Quality Engineer		•					•	54	•		•		75	11.12.2018	1
37	Product Evaluation Manager		•				•		240	•		•		46	11.12.2018	2
38	Quality Systems Manager		•				•		198	•		•		51	11.12.2018	2

No.	Interviewee(s)[a]	Department(s)				Management level(s)			Tenure[b]	Descriptive interview information						*f*[j]
		OPS	*RAQA*	*R&D*	*SGAE*	*SM*[c]	*MM*[d]	*NM*[e]		*Type(s)*		*Format(s)*		*Minutes*	*Date(s)*[a]	
										SS[f]	*US*[g]	*FN*[h]	*TS*[i]			
39	Quality Engineering Manager		•				•		144	•		•		66	12.12.2018	2
40	Director of Operations	•				•			50		•	•		121	12.12.2018	2
41	Process Development Engineer 1	•						•	52	•		•		29	17.12.2018	1
42	Production Support Engineer			•				•	84	•		•		56	17.12.2018	1
43	Senior Product Development Engineer			•				•	108	•		•		62	20.12.2018	1
44	Mechanical Engineering Manager			•			•		108	•		•		52	20.12.2018	3
45	Project Manager			•				•	22	•		•		56	20.12.2018	1
46	Process Development Engineer 2	•						•	132	•		•		45	21.12.2018	1
47	Senior Design Engineer			•				•	168	•		•		47	21.12.2018	1
48	Manufacturing Engineering Manager	•					•		60	•		•		56	28.01.2019	2
49	Research Manager			•				•	132	•		•		38	05.02.2019	1
	Sub-total	*16*	*14*	*6*	*9*	*1*	*13*	*31*	*4,012*	*43*	*2*	*45*	*0*	*2,302*		
	Sub-ratio	*36%*	*31%*	*13%*	*20%*	*2%*	*29%*	*69%*	*89.16*	*96%*	*4%*	*100%*	*0%*	*51.16*		
Interview wave #2 (between 23 October 2019 and 26 November 2019)																
50	Information Technology Manager				•		•		40	•			•	74	23.10.2019	2
51	Operations Manager	•					•		76	•			•	132	23.10.2019	3
52	Manufacturing Engineering Manager	•					•		69	•			•	57	29.10.2019	3
53	Production Manager 2	•					•		57	•			•	99	31.10.2019	2
54	Procurement Manager	•					•		50	•			•	30	31.10.2019	2
55	Financial Controller				•		•		16	•			•	51	05.11.2019	1
56	Quality Engineering Manager		•				•		156	•			•	36	05.11.2019	2
57	Production Support Facilitator	•						•	56	•			•	80	05.11.2019	3
58	Quality Systems Manager		•				•		209	•			•	64	06.11.2019	2
59	Software & Electronics Development Manager			•			•		29	•			•	42	06.11.2019	1
60	Product Evaluation Manager		•				•		251	•			•	75	06.11.2019	2
61	Mechanical Engineering Manager			•			•		118	•			•	63	07.11.2019	2
62	Director of Human Resources[k]				•	•			49		•	•		57	07.11.2019	2
63	Director of Operations[k]	•				•			61		•	•		63	13.11.2019	2
64	Learning & Development Business Partner				•		•		24	•			•	105	26.11.2019	2
65	Production Manager 1	•					•		76	•			•	57	26.11.2019	2
	Sub-total	*7*	*3*	*2*	*4*	*2*	*13*	*1*	*1,337*	*14*	*2*	*2*	*14*	*1,085*		
	Sub-ratio	*43.5%*	*19%*	*12.5%*	*25%*	*12.5%*	*81.5%*	*6%*	*83.56*	*87.5%*	*12.5%*	*12.5%*	*87.5%*	*67.81*		
	Total	*25*	*17*	*9*	*14*	*4*	*28*	*33*	*5,556*	*57*	*8*	*51*	*14*	*3,613*		
	Ratio	*38%*	*26%*	*14%*	*22%*	*6%*	*43%*	*51%*	*85.48*	*88%*	*12%*	*78%*	*22%*	*55.58*		

Source: Author

Note(s): (a) In chronological order; (b) in months (when the interview took place); (c) senior management; (d) middle management; (e) non-managerial; (f) semi-structured; (g) unstructured; (h) field notes; (i) transcription; (j) frequency of how often an interviewee was interviewed in total; (k) individual and unstructured project-update interviews

3.6.1.2 Unstructured interviews

In this case study, a few unstructured interviews had been undertaken likewise, which had all been emerging organically out of unforeseen situations. As opposed to semi-structured interviews, which had all been scheduled upon the interviewees' availabilities in advance, unstructured interviews only amount to eight out of 65 individual interviews in total.

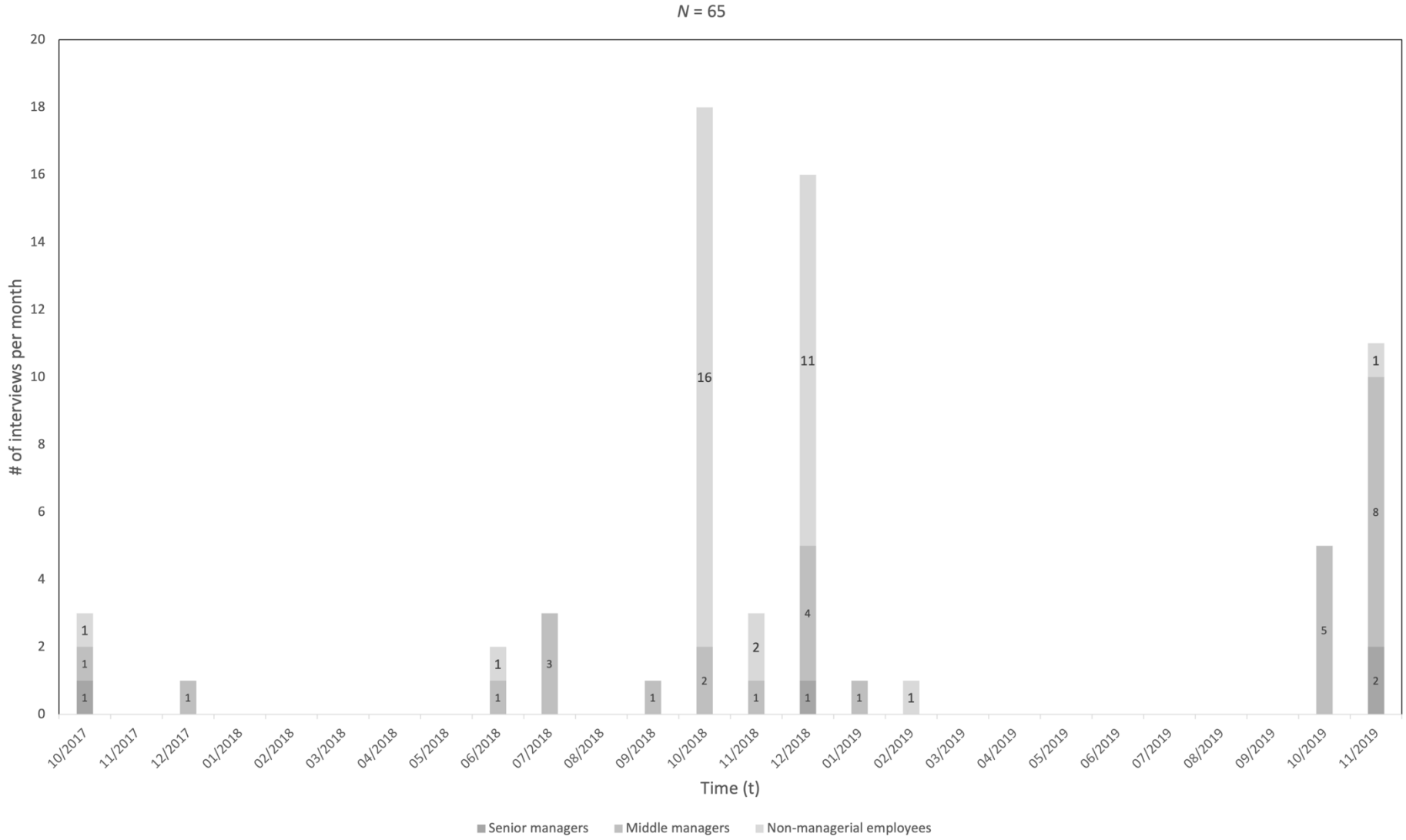
Unstructured interviews, as their name already indicates, did not come along with a certain structure, such as a pre-determined set of questions guiding the interview (Minichiello *et al.* 1990). Instead, the researcher entered the interview as questions were generated in response as part of a conversation (Zhang and Wildemuth 2009). In doing so, it was rather the case that interviewees spoke freely about the given context. This is not to say that unstructured interviews were random or non-directive because

> "the intention of an unstructured interview is to expose the researcher to unanticipated themes and to help him or her to develop a better understanding of the interviewees' social reality from the interviewees' perspectives" (Zhang and Wildemuth 2009, p. 2).

In 2017, this was particularly the case during two site-induction days when being made familiar with the case organisation's business and being introduced to a few business areas by four different employees. Further "unforeseen" situations from which unstructured interviews had been emerging include (1) a shopfloor tour in which the researcher was taken to one of the cleanrooms and introduced to recent process improvements on the production lines and (2) three intense conversations with two different senior managers around the case organisation's lean implementation and its progress. Plus, several other conversations had been taking place with organisational members across all hierarchies during the 113 site visits. Though, the majority of them had been very brief social interactions in an informal way (e.g., chats and queries) rather than formal interviews (Åhlström and Karlsson 2000).

Including both, semi- and unstructured interviews, 3,613 minutes (≈ 60.22 hours) of interview data had been recorded in total, either via field notes (2,665 minutes ≈ 44.42 hours) or via voice records associated with verbatim transcriptions (948 minutes = 15.8 hours). Illustrating the "waves" and, hence, complementing Table 3.7, Figure 3.6 depicts on the distribution of interviews over time.

Figure 3.6 Distribution of interviews per management level



Source: Author

3.6.1.3 Group interviews

Apart from interviews with single interviewees, data were also collected collectively by means of face-to-face group interviews. In essence, group interviews are interviews with two or more interviewees at a time. In comparison to interviews with single interviewees, group interviews contain an element of group dynamics (Saunders *et al.* 2012). To serve the major purpose of giving semi-annual updates about the latest research insights, such group interviews had also been emerging organically as a result of senior management's interest in the research project and had merely been taking place in the form of formal meetings between two senior management representatives (with the HR director and the OPS director) and the researcher accompanied by his supervisory team (Table 3.8).

The way how these group interviews were undertaken differed from the approach used in the other interviews to some extent. Unlike the interviews with single interviewees, the researcher presented his preliminary results at first, while senior management representatives commented on them. In line with focus groups' characteristics, both senior managers extended and responded to each other's comments as interaction data had been generated (Morgan *et al.* 2013). In this joint process, senior managers co-created a shared picture of the current dynamics within their organisation (Arskey 1996). Indeed, Saunders *et al.* (2012) remark that certain interviewees may take a more dominant role over time. Due to the circumstance that both senior managers were hierarchically at the same managerial level with similar work experience, this concern could be counteracted to some extent, even so it became obvious that the OPS director had much more experience with lean implementation.

A key difference to focus group discussions is that both senior managers had rather been interviewees than participants because the discussion was predominantly directed between the interviewer and the interviewees rather than between the participants themselves. Unlike focus groups, the interviewer did not function as a facilitator in an interview but had much more control over the data generation process (Boddy 2005). That being said, a few interview questions (e.g., to verify data or to close data gaps) had been driving the interview, besides discussions about preliminary results. In this way, these group interviews were also very useful to test and to verify the preliminary results. In addition, collecting further evidence to support the analysis entailed an improvement of the data accuracy and enriched the set of data (Voss *et al.* 2002; Marodin and Saurin 2015).

In practice, such group interviews are associated with some pitfalls, one of them being the extent to which each individual participant truly shares his or her own story. Motivated to avoid

this, individual face-to-face interviews were conducted likewise to take advantage of the benefits of either type of interview.

Table 3.8 Group interviews and non-participant observations

No.	Focus area(s)	Medium		Participant(s)		Descriptive interview information			
		Meeting	*Presentation*	*Case organisation*	*Academic*	*Method(s)*	*Format(s)*	*Minutes*[a]	*Date(s)*[b]
1	Company profile Toyota principles Kaizen practices in office areas[c]		•	Director of Operations Manufacturing Engineering Manger Operations Manager Production Manager 1 Production Manager 2 Production Support Facilitator	Researcher Supervisor 1	Non-participant observation	Field notes	120	20.09.2016
2	Company profile Lean programme		•	Director of Operations	Researcher Supervisor 1	Non-participant observation	Field notes	45	30.11.2016
3	Project update	•		Director of Human Resources Director of Operations	Researcher Supervisor 1 Supervisor 2	Group interview	Field notes	60	25.01.2017
4	Ideal behaviours		•	Product Development Engineer Temporary employee[d]	Researcher	Non-participant observation	Field notes	60	13.03.2017
5	Project update	•		Director of Human Resources Director of Operations	Researcher Supervisor 1 Supervisor 2	Group interview	Field notes	60	17.07.2017
6	Project update	•		Director of Human Resources Director of Operations	Researcher Supervisor 1 Supervisor 2	Group interview	Field notes	60	30.10.2017
7	Process improvements	•		Operations Manager Production Manager 2 Production Support Facilitator	Researcher	Non-participant observation	Field notes	30	09.02.2018
8	Project update	•		Director of Human Resources Director of Operations	Researcher Supervisor 1 Supervisor 2	Group interview	Field notes	60	11.04.2018
9	Project update	•		Director of Human Resources Director of Operations	Researcher Supervisor 1 Supervisor 2	Group interview	Field notes	60	15.11.2018

Source: Author

Note(s): (a) These figures are estimates based on past calendar entries; (b) in chronological order; (c) presentation by a visiting scholar at Cardiff University and a Toyota employee; (d) job title unknown

3.6.2 Direct (non-participant) observations

Apart from "asking questions", a method where data about people are collected involves making observations. Primarily, observations are made to see what individuals do. In this regard, making observations conditions that phenomena to be observed are overt (Wildemuth 2009).

In the literature, a distinction is made between two types of observations, namely, (1) direct (or *non*-participant) and (2) participant observations. In direct observations, the researcher occupies a detached perspective external to the phenomenon being studied, whereas he or she is an "insider" in participant observations (Wildemuth 2009; Yin 2014). In other words, the researcher becomes part of the phenomenon being studied in participant observations by *participating*. Several other differences between direct and participant observation are illustrated in the following (Table 3.9).

Table 3.9 Direct (non-participant) vs participant observations

No.	Criteria	Direct (non-participant) observations	Participant observations
1	Role	"Outsider" Passive observer Detached perspective	"Insider" (ethnographic character) Special mode in which the researcher is not merely a passive observer but employs a functional role
2	Focus	Frequency and/or intensity of specific behaviours	Uncovering the cognitive elements, rules, and norms that underlie the observable behaviours
3	Structure	Structured	Unstructured
4	Interaction	Not necessary	Interactive
5	Strengths	Useful in providing additional information (complemental evidence) Add new dimensions for understanding the context or the phenomenon being studied Resource-friendly	Access to events or groups that are otherwise inaccessible Perceive reality from the viewpoint of someone "inside" (or "native") Invaluable in producing an "accurate" portrayal of the case study phenomenon Ability to manipulate minor events
6	Weaknesses	Surrounding social actors' behaviour may be influenced by researcher's presence Insufficient access to "inside" information (social distance to social actors)	Less ability to work as an external observer may have to assume positions or advocacy roles contrary to the interests of good social science practice Being likely to follow a commonly known phenomenon and become a supporter of the group or organisation being studied Too much attention relative to the observer role may be required (e.g., insufficient time to take notes) If the organisation or social group being studied is physically dispersed, it may be

No.	Criteria	Direct (non-participant) observations	Participant observations
			difficult to be at the right place at the right time Resource-intense (e.g., initially, the researcher needs to be culturally accepted by the social group being studied) Interpretation of some observations may be subjective

Source: Adapted from Guest *et al.* (2013); Yin (2014)

Alongside various interview techniques, only direct on-site observations had been made during the 113 site visits as appropriate for case-study research (Flynn *et al.* 1990; Yin 2014). This enabled the researcher to experience the everyday organisational life firsthand and to align his understanding of reality what was *really* going on (Ciesielska *et al.* 2018). In a diary format, such observations had been recorded with field notes in a bullet-point manner.

In this process, the role of the observer was being "'inside' the community and analyzing it from the 'outside'" (Ciesielska *et al.* 2018, p. 39). In simple terms, the researcher was not part of the organisation per se, but yet he was embedded as part of his research project (i.e., "fly on the wall"). For instance, he was even provided with an own desk in OPS. In his role, he only had an academic role and was not involved in administration, operations, or any other business activities at all (i.e., "non-participant"), as is usually expected of consultants. Instead of intervening, his responsibility apart from carrying out research consisted of passing on his latest findings to two senior representatives. Brief social interactions with organisational members took place on an everyday basis, though (Åhlström and Karlsson 2000; Mills *et al.* 2010; Ciesielska *et al.* 2018). This "fly-on-the-wall" approach was associated with some disadvantages, though (see Table 3.9). First, it cannot be ruled out that the behaviours of surrounding social actors were influenced by the researchers' presence in their immediate environment. Second, in his passive role with a detached perspective, the researcher maintained a certain social distance throughout the research project, which may have prevented him from obtaining inside information (e.g., no access to events or groups that are otherwise inaccessible). It should be noted that the researcher did not intend to intervene anyway, as otherwise the results would have been manipulated and probably falsified. The disadvantages of direct observations should therefore rather be seen as "a natural price to pay".

Taking this circumstance into consideration, Ciesielska *et al.* (2018) find researchers "partially participating" (p. 40) if they remain still socially involved. In the literature, however, there is no consensus on whether non-participant observations may involve human interactions

in the field. Ciesielska *et al.* (2018) make a clear distinction between (1) completely, (2) partially, and (3) *non*-participating (no human interaction at all). On the contrary, Mills *et al.* (2010) argue that non-participant observations *can* include human interaction but "at its most extreme, the non-participant observer has no contact whatsoever with the researched" (p. 2). Although both definitions differ in the way to what extent non-participant observations entail human interaction, there is no general disagreement whether or not a researcher can be socially involved in the setting when conducting observations, as the case was here.

In the case organisation, the author's role as a researcher was openly communicated and known to most individuals. Where not being the case, he made his role directly obvious by approaching potential research participants as soon as they entered the field. In doing so, covert observation had not been taking place at any time (Mills *et al.* 2010; Saunders *et al.* 2012).[10]

In research on lean, observations within longitudinal case studies are not unusual. In their study on lean production, Åhlström and Karlsson (2000) show that observations may even help to identify causal relationships once a longitudinal time horizon is adopted.

> "If the ability to generalise is the weakness of the research design, the strength is the ability to observe causal relationships. […] Through our real time and longitudinal case study, we were able to better observe causal relationships than we would have been able to, had we used a retrospective and cross-sectional research design" (p. 1272).

In practice, however, such observations came along with certain limitations. That is because the researcher was located in OPS most of the time. This had the effect that observations were relatively limited to this environment. At the same time, cleanrooms could not be easily accessed due to strict hygiene regulations. Also, the site was separated into two main buildings.

While such observations took rather place in informal settings, more formal and purely non-participant observations were made during a number of presentations, meetings, or mixes of both (Table 3.10).

3.6.3 Internal document reviews and archival records

At the same time, some access was granted to internal documents and archival records documents around lean implementation. On site, the researcher was provided a computer by the case organisation, with which he was able to access their network drive where such data

[10] In the research ethics section, this aspect finds some more elaboration as ethical considerations (e.g., consent) play a crucial role.

were located. Relevant documents had been reviewed on site and field notes that had been made were used as an additional data source (Table 3.10).

In particular, this data was quite beneficial to complement interview data in regard to the case organisation's lean implementations or to obtain data from the periods when the researcher was not present in the organisation (Åhlström and Karlsson 2000). For instance, documents around lean workshops helped to close gaps while they also served as cues for second-wave interviews. It is still likely, however, that such data may be biased (Scott 1965). For this reason, this data had also been cross-checked by means of interviews whenever possible (Åhlström and Karlsson 2000).

Table 3.10 Internal documents and archival records

No.	Focus area(s)	Document(s)	Descriptive document information			Value
			Format	*Data*[a]		
				Creation	*Collection*	
1	Lean deployment	Vision and strategy for OpCo	PPT file	01.12.2016		Corporate profile Strategic direction
2		Visual management board templates	PPT file	May 2017[b]	22.05.2018	Example of what visual management looks like in practice
3		Masterclass #1 – Deepening of business excellence and strategy deployment	PPT file	07.12.2017		Lean deployment between December 2017 and February 2018
4		The OpCo Production System handbook	PDF file		29.01.2018	Overview of the production system
5		Masterclass #2 – Learning & Development	PPT file	26.02.2018		Lean deployment between February 2018 and May 2018
6		Behavioural deployment	DOC file		13.03.2018	Background information on ideal behaviours deployment
7		Policy deployment matrix (2018-19)	XLS file	30.03.2018		Visualisation of policy deployment
8		Masterclass #3 – Continuous improvement	PPT file	21.05.2018		Lean deployment between May 2018 and October 2018
9		Manufacturing excellence project	PPT file	19.07.2018		Retrospective information on lean implementation in manufacturing
10		Masterclass #4 – Cultural enablers	PPT file	08.10.2018		Lean deployment between October 2018 and February 2019
11		Shingo Insight Assessment #2 survey results	Hyperlink (external)		12.12.2018	More detailed Shingo Insight Assessment results for further evaluation
12		Lean maturity assessment summary	PPT file		26.11.2018	Retrospective information on lean implementation in manufacturing Lean implementation summary in manufacturing
13		Masterclass #5 – Leader standard work, culture, and progress	PPT file	11.02.2019		Lean deployment between February 2019 and June 2019
14		Masterclass feedback	XLS file		12.02.2019	Wider leadership group's views on masterclasses
15		Masterclass #6 – Direction and leadership	PPT file	17.06.2019		Lean deployment between June 2019 and October 2019
16		Values and new behaviours mapping	XLS file	September 2018[b]	18.09.2019	Relationship between ideal behaviours and corporate core values
17		Masterclass #7 – Wider leadership group session: Barriers and solutions	PPT file	15.10.2019		Lean deployment between October 2019 and November 2019
18	Organisation charts	Organisation chart 1	Hard-copy printout		12.10.2017	Overview of potential interviewees
19		Organisation chart in quality systems	Hard-copy printout		09.10.2018	Overview of potential interviewees in quality systems
20		Organisation chart 2	Hard-copy printout		12.12.2018	Overview of potential interviewees
21		Organisation chart 3	Hard-copy printout		22.10.2019	Overview of potential interviewees
22		Middle management chart	Hard-copy printout		22.10.2019	Distinction between middle managers and wider leadership group members
23	Miscellaneous	"Your Voice 2013" survey	Hard-copy printout	2013[b]	08.12.2017	Retrospective information on organisational dynamics
24		UK site profile	Intranet (internal)		01.02.2018	Company profile Descriptive information
25		Team brief example	Hard-copy printout		25.07.2018	Example of how recognition is communicated in the organisation's internal newsletter
26		Training matrix	Hard-copy printout		30.07.2018	Visualisation of how skill development is managed

Source: Author

Note(s): (a) In chronological order (a data collection date was not always recorded, which is why the data creation date was considered); (b) no specific date available

3.7 Data analysis: Template analysis

On 26 November 2019, the data collection was closed. Prior to the analysis, interview transcripts, field notes, and all other supplementary data had been reviewed. To analyse and produce an understanding of the set of data, the researcher adopted a template analysis.

3.7.1 Introduction to template analysis

In a nutshell, a template analysis is a data-analysis technique that uses abductive (i.e., deductive and inductive at the same time) reasoning to thematically analyse qualitative data (Saunders *et al.* 2012). In template analyses, a list of codes is developed to discover different themes emerging from the data (King 1998; Saunders *et al.* 2012). By means of hierarchical coding, data are segmented and organised in a meaningful way to produce a template (data structure) that represents the data as a whole (Reynolds 2003; Brooks *et al.* 2015).

> "The discipline of producing the template [requires] to take a well-structured approach to handling the data, which can be a great help in producing a clear, organized, final account of a study" (King 1998, p. 133).

Until the template is finalised, the data-analysis process is associated with reinterpretation, continuous revision, and therefore changes in the hierarchical data structure (King 2004; Brooks *et al.* 2015).

In comparison to a grounded theory approach where coding is supposed to derive from a "clean theoretical slate" being purely inductive (Glaser and Strauss 1967; Eisenhardt 1989; Saunders *et al.* 2012), template analyses allow a priori coding prior to the actual data analysis (Voss *et al.* 2002; Saunders *et al.* 2012). This means that previous knowledge acquired from reading and writing (e.g., through a literature review, as the case was here) can be considered during the initial coding process; anyway, it seems quite impractical to start off with the coding process without having any previous knowledge about a certain topic as often criticised in the literature (Ketokivi and Choi 2014). Moreover, researchers are granted more flexibility as they are not limited to a maximum number of hierarchical levels when it comes to the data aggregation (Symon and Cassell 2012; Brooks *et al.* 2015). At the same time, they are encouraged to discover themes more extensively where rich data associated with the research questions are observed (Brooks *et al.* 2015).

In the literature, the basic steps in conducting a template analysis are roughly described as follows (Table 3.11).

Table 3.11 Template-analysis procedure

No.	Procedural step(s)
1	Familiarise with the data to be analysed
2	Preliminary data coding
3	Organise the emerging themes into meaningful clusters Begin to define how they relate to each other within and between these groupings
4	Define an initial coding template
5	Apply the initial template to further data Modify as necessary
6	Finalise the template Apply it to the full data set

Source: Adapted from Brooks *et al.* (2015)

3.7.2 Analysis

In a number of cases where longitudinal studies employed a template analysis, data are presented as a whole (e.g., Lips-Wiersma and Hall 2007; Corsaro and Snehota 2011). King and Brooks (2017), however, criticise that such studies overlook to capture the data's temporal dimension. Taking into account that this study also seeks to capture a temporal dimension to find out how lean evolves over time, data had been dated with a timestamp upon collection in most cases to classify data in time, unlike the aforementioned studies.[11] Merely, some internal documents and archival records missed a timestamp upon collection but yet had been assigned a timestamp according to the point of time when a file was contemporary (e.g., date when a presentation was delivered; see Table 3.10). This did not only counteract that data from specific time periods get mixed up but also enabled to recognise changing patterns (Pettigrew 1990; King and Brooks 2017).

Integrating multiple data sources, triangulation was adopted to increase the internal validity of this research (Jick 1979). In this study, field notes of internal documents and archival records about the case organisation's lean programme helped to support statements and claims made in interviews. In particular, such kind of data eased a chronological classification of different events with more precision. In other words, they helped to identify when a certain event took place. In the coding process, interview and triangulation data were used to reconstruct the case organisation's lean evolution. By means of timestamps, "temporal" a priori themes had been developed gradually so that codes could be classified into the specific timeframe they belonged to. These timeframes evolved over time as the author carried out the research. Hereby, the first timeframe (i.e., "November 2014 to October 2015") describes the period in which lean implementation initiated in the manufacturing environment while the second one (i.e.,

[11] The timestamps only consider when the data was collected and disregard the point of time an interviewee reflected upon. In this research, this was a major challenge indeed and is touched upon later in more detail.

"October 2015 to December 2017") covers the time period when lean started to roll out organisation-wide without middle managers being involved yet (Table 3.12). In all other cases, the timeframes were defined by the quarterly time periods between each single masterclass event about the case organisation's lean programme. This distinction was found suitable to classify the case organisation's lean implementation into different phases.

Then, data in transcripts (e.g., a relevant quote) and field notes had been assigned first-order codes. Using the data analysis software NVivo 12, a list of broad a priori codes had been developed prior to the analysis (e.g., "lean practices", "barriers to lean implementation", or "middle managers") that were expected to identify themes to be highly relevant to answer the research questions (King 1998; Reynolds 2003). Apart from a priori codes and "temporal" a priori themes, the researcher did *not* make use of "textual" a priori themes (not obligatory; Brooks *et al.* 2015). Instead, NVivo 12 enabled him to thematically group a priori codes together in a hierarchical order. In brief, codes had been classified into second-order categories and aggregated to themes later. Where data were rich, categories with deeper hierarchical levels (third-, fourth-, fifth-order categories, etc) were used. These hierarchical groups, which contained several codes, had been ongoingly modified over several months, adjusted as NVivo 12 was fed with additional data, and finally served as the categories and emerging themes (Saunders *et al.* 2012). If new codes emerged empirically, they were included in the list of codes and mapped to a relevant category or simply became part of a new one. In doing so, themes had been emerging organically over time (King 1998).

It is true that the template did not emerge purely inductively as it would be, for instance, the case in a grounded theory approach (Glaser and Strauss 1967) but rather in an abductive way where both deductive and inductive approaches found a parallel and iterative application. That being said, it is quite complex indeed to reconstruct how the data structure emerged in template analyses because abductive reasoning occurred organically. As time passed, the researcher had been continuously reinterpreting the data during the analysis process while revising the template, as appropriate for template analyses (King 2004; Brooks *et al.* 2015). At the same time, empirical data had often been compared with existing literature, sometimes impacting how codes and categories had been organised (Reynolds 2003; King 2004). Another challenge that appeared quite frequently was that interviewees reflected on the past. In order to capture their retrospective perspectives, such data had to be recategorised into a different timeframe other than their initial timestamp because they did not reflect upon the presence.

In Table 3.12, an example of how the template analysis was conducted and how the last-order categories of the data structure look like is illustrated. Being emerged through the

template analysis, these last-order categories significantly guide the structure of the results chapter. In Table 3.13, a more fine-grained example of the template analysis is illustrated. It is an extension of Table 3.12, in which the overarching theme constitutes “visual management boards”. Under this fourth-order category (or last-order category in the context of Table 3.12), “issues” (third-order category) with visual management are concerned. Below that, the different kinds of visual management issues are listed (second-order categories). Under each of these different second-order categories, the first-order codes are organised, which resonate with one or more datapoints in the form of a statement made by interviewees in the dataset. As encouraged by Brooks *et al.* (2015), this, in fact, also constitutes an example with comparatively rich data when discovering themes more extensively made sense.

Table 3.12 Template analysis: last-order categories

No.	Time period	Last-order category
1	Introducing lean manufacturing (November 2014 to October 2015)	Lean manufacturing model Manufacturing excellence projects
2	Behavioural deployment (October 2015 to December 2017)	Diffusion of lean from manufacturing operations to the wider organisation Involving a consultancy Development of a purpose statement and ideal behaviours Lean maturity assessment Introduction of visual management
3	Strategy deployment (December 2017 to February 2018)	Wider leadership group involvement Introduction of business excellence masterclasses Breakthrough objectives and policy deployment Lean maturity assessment Delegation of lean to the wider leadership group
4	Learning & Development and progress (February 2018 to May 2018)	L&D system Refinement of ideal behaviours New recognition scheme
5	Continuous improvement and progress (May 2018 to October 2018)	Alignment of the new corporate core values with the ideal behaviours Continuous improvement system Audits of visual management board New recognition scheme (proposal)
6	Cultural enablers and progress (October 2018 to February 2019)	Continuous improvement systems across departments Audits of visual management board (update) Corporate core values and ideal behaviours aligned New recognition scheme (proposal and go-live) Shingo Insight Assessment #2 Countermeasures against low "cultural enablers" scores L&D system (update)
7	Leader standard work (1) and progress (February 2019 to June 2019)	Policy deployment matrix update Visual management boards (new assessment approach) Management by objectives for non-operational staff Countermeasures against low "cultural enablers" scores (update) Lean maturity assessment
8	Leader standard work (2) and progress (June 2019 to October 2019)	Leadership improvement necessary Voice of the Customer (surgeon access) Interdepartmental relationships and cross-functional activities Reward and recognition system (post-launch review) Visual management boards (post-relaunch review)
9	Failure factors (October 2019 to November 2019)	Failure factor #1 – Meaningfulness, sensemaking, and belief Failure factor #2 – Vision, strategy, and deployment Failure factor #3 – Leadership Failure factor #4 – Knowledge and understanding Failure factor #5 – Resources and priorities

Source: Author

Table 3.13 Template analysis: fine-grained data structure example

No.	Time period	Categories			First-order code(s)
		Fourth-order	*Third-order*	*Second-order*	
1	Continuous improvement and progress (May 2018 to October 2018)	Audits of visual management board	Issues	Audit and assessment	Auditors do not have an idea about the nature of the departments they audit
2					Box-ticking instead of engagement
3					Challenge to assess, to measure, and to derive actions
4					Do not add value to reviewer's work
5					No feasibility checks
6					No gemba walks (neither a manager nor a director audits)
7					No standard criteria
8					Scores drive wrong behaviour due to a focus on good audit scores
9					Scores lead to internal competition between departments
10				Awareness and understanding	Lack of mindset
11					"Not useful" in identifying areas of improvement
12					Not sure about the value
13					Perception that employees do not know the value
14					Perception that some areas see the visual management boards as a reporting tool rather than a management tool
15					Some employees seem to see that lean is just the visual management boards
16					"Wallpaper"
17				Engagement	Disinterest of others in own visual management board perpetuates low engagement
18					Lack of involvement
19					No actions from other visual management boards received for the last three months
20					No engagement with visual management boards besides audit
21					No interest is shown in the information on own visual management board
22					Perception that administrative departments are less proactive with the visual management boards than departments who are related to the production
23				Job nature and relevance	Alienation of job
24					Interest in own visual management board only
25					Lack of relevance to own department and nature of department matters
26					Different views of good and bad metrics

No.	Time period	Categories			First-order code(s)
		Fourth-order	*Third-order*	*Second-order*	
27				Metrics and key performance indicators	Lack of experience with developing metrics
28					Metrics are not feasible in all areas (difficulty to development meaningful metrics)
29					Metrics “overkill”
30					No commercial element (“bottom line”)
31					No interest in the metrics at all
32					No relevance of metrics because the focus is on a project
33					Non-value-adding metrics (redundant or irrelevant)
34					Not all metrics hit the same goal
35					Not always the right metrics in place
36					Only limited influence of other department’s metrics on own department
37					Perception that some areas are more metric-driven than others
38					Too much focus on metrics
39				Visualisation and technical structure	Confusion about the visual management board hierarchy (main boards vs project boards)
40					Difficulty to understand other visual management boards due to information overload
41					Lack of clear and concise communication of the visual management board
42					Lack of focus (visual management board covers too much)
43					Lack of structure
44					Quality of visual management boards
45				Workload associated with visual management	Perception that some areas see the visual management boards as something else that has to be done (extra workload)
46					Sometimes visual management board updates require data, which you have to chase from others
47					The amount of work that goes into the preparation of the visual management boards does not reflect as much value as it should
48					Time-consuming
49					Too much paperwork

Source: Author

3.8 Reliability and validity

The quality of a case study's research design can be validated by four different tests (Yin 2014). They include (1) reliability, (2) construct validity, (3) internal validity, and (4) external validity. In his book, Yin (2014) recommends several case-study tactics to address each of those tests. In the following, they are discussed in more detail (Table 3.14).

Table 3.14 Case-study tactics for four design tests

No.	Test(s)	Definition(s)	Case-study tactic(s)	Adoption(s)
1	Reliability	Demonstrating that the operations of a study can be repeated, with the same results	Use case-study protocol	○
			Develop case-study database	•
2	Construct validity	Identifying correct operational measures for the concepts being studied	Use multiple sources of evidence	•
			Establish chain of evidence	•
			Have key informants review draft case-study report	○
3	Internal validity[a]	Seeking to establish a causal relationship, whereby certain conditions are believed to lead to other conditions, as distinguished from spurious relationships	Do pattern matching	•
			Do explanation building	Inappropriate
			Address rival explanations	Inappropriate
			Use logic models	Inappropriate
4	External validity	Defining the domain to which a study's findings can be generalised	Use theory in single-case studies	•
			Use replication logic in multiple-case studies	

Source: Adapted from Yin (2014)

Note(s): (•) Yes; (○) to some extent; (a) according to Yin (2014), internal validity mainly concerns explanatory and causal studies and is not for descriptive or exploratory studies, as the case was largely here

3.8.1 Reliability

To begin with, "'reliability' refers to the absence of random error" (Gibbert *et al.* 2008, p. 1468) and concerns the extent to which a study is replicable. Its goal is to minimise errors and biases (Yin 2014). Research has a high reliability as soon as the results are reproduced by using the same data-collection methods and analysis technique(s), if the study was repeated (Gibbert *et al.* 2008; Saunders *et al.* 2012; Yin 2014). Therefore, Guba and Lincoln (1994) describe reliability as "the sense of stability" (p. 114). Taking this into account, reliability is often associated with transparency likewise.

A higher transparency can be achieved with a case-study database, as the case was here, including all relevant notes and documents that would facilitate a replication (Yin 1994; Gibbert *et al.* 2008). Another similar way to strengthen a study's reliability is to develop a case-study protocol (Yin 2014).

> "A case study protocol is a record (normally a document) that contains the methods, procedures and general rules that will be followed in using instruments of data collection. It is used to improve the reliability of case study results" (Rahim and Baksh 2003, p. 32).

Usually, a case-study protocol is rather a formal project management document indeed (Yin 2014); however, methods and procedures how the research associated with the data collection was carried out are presented in the current chapter in detail and serve the purpose of transparency likewise.

In qualitative research, however, reliability is a central issue. Voss *et al.* (2002), for instance, refer to case studies as being limited in their sample sizes. Also, quantitative researchers often criticise that qualitative research lacks reliability (Bryman and Bell 2011). A counterview is offered by Saunders *et al.* (2012) and Silverman (2013) who argue that such measures contradict the basic idea of qualitative research as its strength is to explore and unfold complex structures in the social world, as the case was here. To ensure a higher degree of reliability, though, multiple instances were taken, as suggested by Gray (2013). Similarly, Eisenhardt (1989), Voss *et al.* (2002), and Yin (2003) suggest looking at data in various ways. This avoided that claims were drawn from single observations. By interviewing *all* middle managers willing to participate, the data addressing the second research question can be considered as reliable because there is no additional sample that would cause a variation in the data.

3.8.2 Validity

3.8.2.1 Construct validity

In science, the construct validity constitutes an assessment of the operational procedure. In essence, it asks the question whether the construct measures what it is supposed to measure (Gibbert *et al.* 2008; Saunders *et al.* 2012; Yin 2014). If a study has no or a low construct validity, it is likely to miss its actual research objectives.

To counteract low construct validity, Yin (2014) advises considering multiple data sources, as the case was here. Using a within-case analysis, a significant countermeasure to overcome difficulties with construct validity was to employ triangulation. In the literature, a distinction is made between four different types of triangulations, including (1) data triangulation, (2) investigator triangulation, (3) theory triangulation, and (4) methodological triangulation (Patton 2002; Yin 2014). In Table 3.15, their differences are described more closely.

Table 3.15 Triangulation

No.	Type(s)	Description(s)	Adoption(s)	Case example(s)
1	Data triangulation	Triangulation of data sources	•	65 face-to-face interviews Five group interviews Direct observations Internal protocols around lean implementation Survey data
2	Investigator triangulation	Triangulation amongst different evaluators		None
3	Theory triangulation	Triangulation of perspectives to the same dataset	○	Socio-technical system theory S-curve theory[a]
4	Methodological triangulation	Triangulation of methods	•	Semi-structured interviews Unstructured interviews Direct observations Documentation Archival records (e.g., quantitative survey data)

Source: Adapted from Patton (2002)
Note(s): (•) Yes; (○) to some extent; (a) Netland (in Åhlström *et al.* 2021) himself describes the S-curve theory as a part of "specific lean theories" (p. 10); however, although it is acknowledged in the research field, it remains unclear whether it may be considered as a standalone theory

In doing so, multiple data sources had been included in the data analysis (Jick 1979; Voss *et al.* 2002; Barratt *et al.* 2011; Yin 2014). By aggregating different sources of verification, triangulation increases the robustness and persuasiveness of the researcher's judgmental accuracy (Flynn *et al.* 1990; Siggelkow 2007). In research on lean, triangulation is nothing new but remains surprisingly scarce. Jasti and Kodali (2014), for instance, report that only 10.67% of the studies on lean manufacturing triangulated data but to build theory rather than to verify it.

Multiple sources of evidence further imply having multiple research participants. It may be case, for instance, that research participants gave the researcher answers that they believe the researcher expected. Where possible, anonymised data and their interpretations had also been taken to research participants and to their colleagues to comment on (Merriam 1988; Krueger *et al.* 2014). At the same time, interim results had been presented to senior representatives or other key informants, including employees and academic supervisors, for validation, as suggested by Yin (2014).

There is no doubt that various data sources lead to a multitude of difference evidence. To increase the construct validity, sources are provided to give proof from where evidence was derived. This is useful for establishing a chain of evidence (Yin 2014). It should be noted, though, that data were anonymised where ethically necessary.

3.8.2.2 Internal validity

In case studies, a first major criticism regarding validity concerns their internal validity. Likely to be more often associated with quantitative studies or explanatory case studies, internal validity refers to causal relationships between two variables (Gibbert *et al.* 2008; Saunders *et al.* 2012; Yin 2014). In Meredith's (1998) words, internal validity validates "the correctness of our conclusion of a relationship" (p. 447). In regard to case studies, it means whether a plausible argument about the phenomena had been developed that may explain the case-specific dynamics (Gibbert *et al.* 2008).

In the literature, there are several countermeasures ensuring to strengthen the internal validity of case studies. They include (1) triangulation, (2) member checks, (3) long-term on-site observations, (4) peer examination, (5) participatory modes of research, and (6) researcher's bias (Merriam 1988; Krueger *et al.* 2014). In Table 3.16, those countermeasures are described more closely. In addition, Table 3.16 shows which measures had been undertaken to strengthen this case study's internal validity.

Table 3.16 Internal validity

No.	Countermeasure(s)	Description(s) where appropriate	Adoption(s)
1	Triangulation	Multiple researchers to (dis)confirm the results Multiple data sources to (dis)confirm the results Multiple methods to (dis)confirm the results	•
2	Data checks	Taking data and/or their interpretations to research participants to countercheck accuracy	•
3	Long-term on-site observations		•
4	Peer examination	Taking data and/or their interpretations to research participants' peers (e.g., colleagues) to comment on	•
5	Participatory modes of research	Involving research participants in designing and carrying out the research	Inappropriate
6	Researcher's bias	Clarifying researcher's core assumptions prior to the study	•

Source: Adapted from Merriam (1988); Krueger *et al.* (2014)

As suggested by Yin (2014), another countermeasure was making use of pattern matching. It is used to determine whether propositions align with patterns reported in previous research (Eisenhardt 1989; Lewis 1998). In this process of moving between data and theory, the degree to what propositions overlap with previous research usually determines the quality of the case study (Eisenhardt 1989). At the same time, contradicting results are explicitly elaborated on and provided with a plausible explanation (Yin 2014).

3.8.2.3 External validity

In case studies, a second major criticism regarding validity concerns their external validity. It addresses the extent to which the research findings are generalisable and whether similar results may be extrapolated to settings outside the case (Gibbert *et al.* 2008; Barratt *et al.* 2011; Saunders *et al.* 2012; Yin 2014). Involving a major criticism of single-case studies (Yin 2014), this research took place in a single organisation and certainly lacks generalisability. No doubt, the external validity is low (Saunders *et al.* 2012); however, generalisability is not what this study sought. Rather, the nature of this case study is to *explore* how middle managers experience the diffusion of lean from manufacturing operations to functional areas of the wider organisation and what lessons learnt can be taken away. Consistent with that, Barratt *et al.* (2011) argue that a "lack of generalizability […] is not of a main concern" (p. 332). Instead, they argue, it is the contextual data that case studies generate to verify or falsify theory.

Using theory in single-case studies, Yin (2014) argues, helps to increase the external validity, as the case was here. The study employs the STS theory. In addition, it attempts to explain its results by going back to the existing body of knowledge. Furthermore, Yin (2014) suggests performing replications. Although this was not the case here, it would have helped to see whether the results are consistent with the ones from other cases. Such a procedure is certainly worthwhile to perform in future studies building on this one.

3.9 Research ethics

In science, research ethics concern "the moral equivalent of the 'true professions'" (Emmerich 2016, p. 2) and ethical principles researchers are expected to adhere to (Yin 2014). In many cases, research institutions elaborate on their own ethics framework for this reason.

In relation to this study, Cardiff University (2021) and the ESRC (2021) have both their own ethical principles this research project is expected to meet. In the literature, Bryman and Bell (2007) refer to ten points researchers are advised to ethically consider once human beings are involved. In Table 3.17, these have been aligned with the dimensions of the ESRC's ethical framework.

Table 3.17 Research ethics

No.	Bryman and Bell (2007)	The Economic and Social Research Council (2021)
1	Research participants should not be subjected to harm in any ways whatsoever.	Research should aim to maximise benefit for individuals and society and minimise risk and harm.
2	Respect for the dignity of research participants should be prioritised.	The rights and dignity of individuals and groups should be respected.
3	Full consent should be obtained from the participants prior to the study.	Wherever possible, participation should be voluntary and appropriately informed.
4	The protection of the privacy of research participants has to be ensured.	
5	Adequate level of confidentiality of the research data should be ensured.	
6	Anonymity of individuals and organisations participating in the research has to be ensured.	
7	Any deception or exaggeration about the aims and objectives of the research must be avoided.	
8	Affiliations in any forms, sources of funding, as well as any possible conflicts of interests have to be declared.	Independence of research should be maintained and, where conflicts of interest cannot be avoided, they should be made explicit.
9	Any type of communication in relation to the research should be done with honesty and transparency.	Research should be conducted with integrity and transparency.
10	Any type of misleading information, as well as representation of primary data findings in a biased way, must be avoided.	
11		Lines of responsibility and accountability should be clearly defined

Source: Adapted from Bryman and Bell (2007); Economic and Social Research Council (2021)

In line with Cardiff University's ethics code of practice, the researcher sought ethical approval from the business school's ethics committee by submitting an ethics approval form. As research participants are entitled to be informed about the researcher's intentions prior to the data collection (Saunders *et al.* 2012; Creswell 2013; Silverman 2013; Yin 2014), consent forms and informed consent declarations had been submitted to the ethics committee. Considering that semi-structured interviews had been carried out in two waves, ethical approval was sought twice.

A senior manager introduced the researcher to various departments during a two-day induction period. This set the scene that the researcher was on site for carrying out a research project. Upon ethical approval by the business school, consent forms and informed consent declarations had been handed out to potential participants. In doing so, the researcher ensured that everyone who was in his surrounding environment knew about his role in the case organisation so that covert research was not occurring at any time. Potential participants got informed that their participation was entirely voluntary and that they could opt out any time if they wished to. In addition, confidentiality was guaranteed. First, prior to the ethical approval, a non-disclosure agreement was signed between the researcher and the case organisation. Second, data were stored on servers provided by Cardiff University. To maintain participants' anonymity and to protect everyone's privacy (Saunders *et al.* 2015), the researcher sought removing attributes (e.g., job titles) he collected that may identify an individual when quoting or referring to them. This also included an individual's gender. Since research participants could be identified by their gender, only the masculine pronoun (i.e., he, his, him, himself, etc) was considered in the following chapter when referring to an individual in the third person singular.

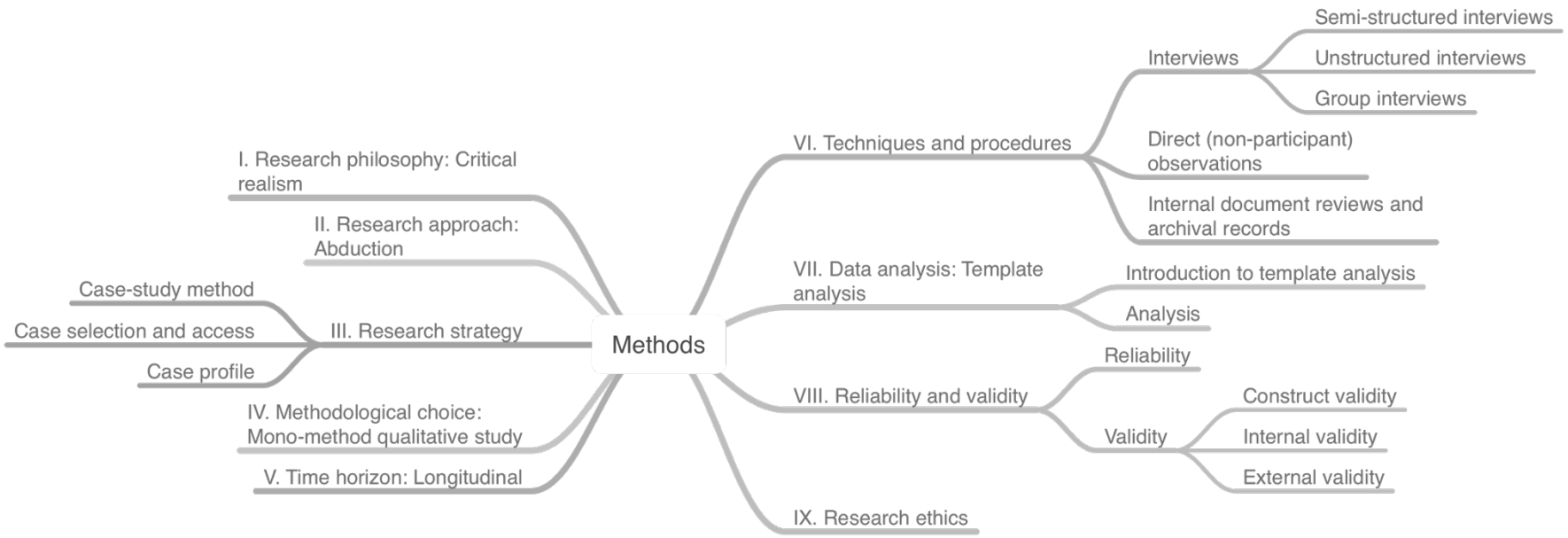
At no time, a research participant was subject to harm or put at risk. In Appendices 2 and 3, all relevant documents on research ethics submitted to and approved by Cardiff University are provided. These documents describe how the researcher ensured adherence to ethical standards, as illustrated above, and how consent was sought in more detail.

3.10 Summarisation of methods

This chapter presented the research design deployed in this study (Figure. 3.7). Following a critical realist stance, this study adopted a longitudinal in-depth single-case study to answer the research questions. In doing so, qualitative data in the form of various types of interviews (i.e., semi- and unstructured face-to-face interviews with individuals and groups), direct (non-participant) observations, internal documents, and archival records were collected. In this

process, the researcher adhered to ethical standards defined by Cardiff University and the ESRC. Such data were then analysed by employing a template analysis. The template arising from this analysis informs the structure of the subsequent chapter, in which the results are presented. To increase the robustness of this study, several reliability and validity tests were undertaken.

Figure 3.7 Structure of methods



Source: Author

4. Results

The following chapter introduces the research findings by illustrating the diffusion of lean from manufacturing operations to wider functional areas of a medical manufacturing organisation's UK plant labelled as "OpCo". In doing so, this chapter familiarises with the case organisation and describes its lean evolution over a period of more than five years in a chronological order until 26 November 2019.

The structure of this chapter derived from the template analysis and is divided into different sub-chapters following the case organisation's lean evolution (Table 4.1). More specifically, the case organisation's lean evolution can be categorised into nine distinct phases, in which 15 main activity streams were identified. Between almost every phase, a senior management-led workshop about the case organisation's lean implementation took place where the management community came together to discuss the case organisation's lean implementation, to decide upon the next steps to undergo, and to review the progress made so far.

Each individual phase is dealt with in a separate sub-chapter and represents the activities carried out of a respective activity stream at a particular point of time. Table 4.1 serves as a guide for the presentation of the results. It clearly shows that multiple activities of different activity streams were carried out simultaneously over a certain period of time, which is why the presentation of the results follows a longitudinal approach so that evolutionary change from one phase to another is captured.

In this regard, the following introduces the background and characteristics of each single phase more extensively using data collected from interviews, meetings, observations, archives, and other sources. Along with that, some relevant material is attached to the appendix for a better understanding. It is true that the researcher only entered the field in September 2016 (see Figure 3.5). All data prior to that date were provided by interviewees with a respective tenure or with respective knowledge, and from internal protocols that recorded the case organisation's lean journey. Triangulation enabled verifying data resulting from retrospectives.

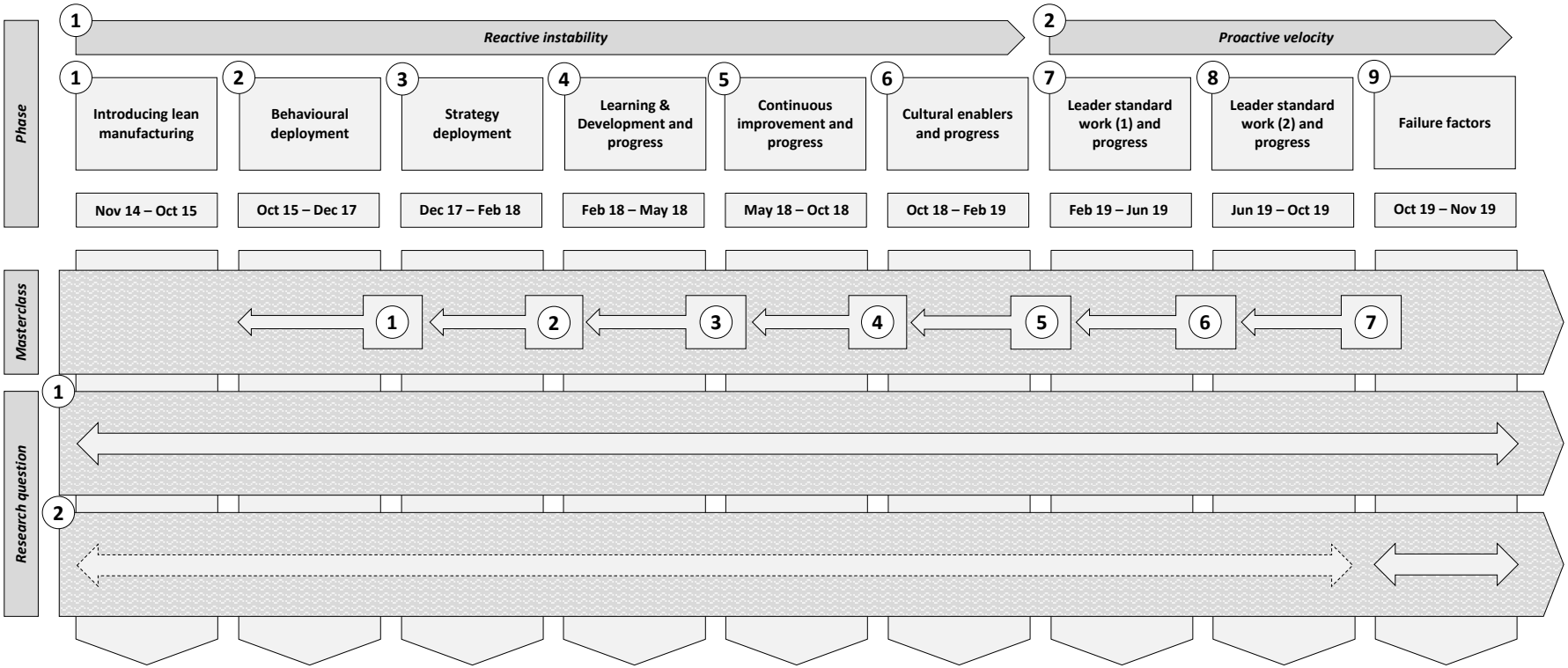
Investigating the case organisation's lean evolution, the first research question is answered throughout this chapter, accordingly, while these insights inform answers regarding the second research question towards the end of this chapter (Figure 4.1). In the last sub-chapter, the key findings are extracted and briefly summarised.

Table 4.1 Lean evolution chronicle

No.	Evolutionary phase(s) of lean implementation									*f*
	Reactive instability						*Proactive velocity*			
	I. Introducing lean manufacturing	*II. Behavioural deployment*	*III. Strategy deployment*	*IV. Learning & Development and progress*	*V. Continuous improvement and progress*	*VI. Cultural enablers and progress*	*VII. Leader standard work (1) and progress*	*VIII. Leader standard work (2) and progress*	*IX. Failure factors*	
	November 2014 to October 2015	*October 2015 to December 2017*	*December 2017 to February 2018*	*February 2018 to May 2018*	*May 2018 to October 2018*	*October 2018 to February 2019*	*February 2019 to June 2019*	*June 2019 to October 2019*	*October 2019 to November 2019*	
1	Lean manufacturing model									1
2	"Manufacturing excellence": Tackling the low-hanging fruits	Diffusing lean from manufacturing operations to the wider organisation								2
3		Involving a consultancy								1
4		Developing a purpose statement and ideal behaviours		Revisiting ideal behaviours	Aligning corporate core values and ideal behaviours	Aligning corporate core values and ideal behaviours: Update				4
5		Measuring lean maturity: Annual progress review Shingo Insight Assessment #1	Measuring lean maturity: Annual progress review			Shingo Insight Assessment #2 Improving on cultural enablers	Measuring lean maturity: Annual progress review Improving on cultural enablers: Update			4
6		Introducing "business excellence" boards			Auditing visual management: Assessment status	Auditing visual management: Assessment status	Auditing visual management: Assessment criteria update	Auditing visual management: Post-relaunch review		5
7			Involving the "wider leadership group" Delegating lean and future expectations on the wider leadership group				Improving on leadership	Improving on leadership: Update		3
8			Introducing "business excellence" masterclasses							1
9			Breakthrough objectives and policy deployment ("hoshin kanri")				Policy deployment ("hoshin kanri"): Update			2
10				L&D		L&D system: Update				2
11				Recognition and celebrating success	Proposing a new R&R system	Proposing a new R&R system: Update		R&R system: Post-launch review		4
12					Inspiring with continuous improvement in OPS	Implementing continuous improvement systems across departments				2
13								Voice of the Customer: Accessing surgeons		1
14								Breaking down silos: Improving cross-functional relationships		1
15									Identifying failure factors	1

Source: Author

Figure 4.1 Structure of results



Source: Author

Note(s): Under "research question", a solid line means that a research question is answered in a respective evolutionary stage whereas a dotted line means that the research question is answered in parts. More specifically, this means for the second research question that it is answered mainly towards the end of this chapter.

4.1 Introducing lean manufacturing (November 2014 to October 2015)

4.1.1 Lean manufacturing model

The initial spark of the case organisation's lean journey goes back to 2014. Prior to embarking on lean, some notable leadership changes had been undertaken in the organisation. These changes included the appointments of several new hires in OPS. In mid-2013, a new operations manager joined the organisation who had begun to initiate major changes in OPS. Driven by the need for OPS to improve, the existing production management was replaced, as reported by the current managers in OPS. At the same time, two new production managers and new team leaders were hired. Merely two team leaders had remained in the company after restructuring.

> "If you look at operations or production, […] that has included some really quite painful changes. For example, […] we removed all of the managers. If you think of managers with a 'small M', production managers, and team leaders out of the whole organisation – we replaced them which was extremely painful, but extremely necessary. […] This was driven by the need for operations to get better." (Middle Manager 1, OPS)

In November 2014, a new OPS director was appointed who set out a departmental three-year plan as part of his "first-90-days" activities back then, involving not just production management but also the other functional areas within OPS (e.g., purchasing and manufacturing engineering). Inspired by a site visit at the case organisation's affiliated Japanese branch, he[12] introduced the "lean manufacturing model", incorporating ideal states that relate to principles, process, and people (Table 4.2).

Table 4.2 Lean manufacturing model

No.	Dimension(s) of the lean manufacturing model	Description(s)
1	Principles	Lean/TPS-based
		One-piece flow
		Continuous improvement culture
2	Process	Paperless production
		Relevant automation
		Data driven
3	People	Competence-based
		Knowledge-based
		High engagement

Source: Adapted from OpCo (2015)

[12] Please note that only the male pronoun (i.e., he, his, him, himself, etc.) is used for the third person singular in the following to maintain anonymity. By revealing the gender, research participants could be identified (see section 3.9).

In essence, the lean manufacturing model aimed at optimising the production by developing and engaging the workforce while pursuing a CI-orientated culture. Along with the lean manufacturing model, goals to be achieved until March 2018 have been set out in OPS. These goals focused on health and safety (e.g., no recordable injuries), efficiency (e.g., one-piece flow), quality improvements (e.g., by reducing yield and rework), and better service delivery rates. These goals could also be observed on credit card-sized information material distributed to every employee working in OPS.

4.1.2 "Manufacturing excellence": Tackling the low-hanging fruits

To pursue those goals, two projects labelled as "manufacturing excellence" (MX) 1 and MX 2 had been introduced. In doing so, the MX1 project concerned relaying production lines to promote flow, whereas the MX2 project focused more on efficiency improvements and automation on one-piece-flow production lines.

With approximately 120 years totalling up, the case organisation was not inexperienced with improvement methodologies at all. Overall, it employed one Certified Six Sigma Black Belt and four Certified Six Sigma Green Belts, as stated in internal documents. Utilising this experience back then, first attempts were undertaken to achieve one-piece flow by adopting lean practices on each of the high-volume production lines. In doing so, eight production lines were relayed over two years in a three-month rhythm. In each three-month timeframe, waste was reduced and/or eliminated under consideration of three aspects as far as time allowed. First, creating U-shaped cells was aimed for so that operators could gain more flexibility in terms of having a station-to-station situation across the cells when being surrounded by lines. In addition, U-shaped cells were seen to be more visible for line managers and to encourage the communication between operators. Second, it was aimed at moving away from batch production to increase the flow. Third, a reduction in transportation was projected. Under these circumstances, the business increased its efficiency by 20 to 30% within three years of time. Even if a one-piece-flow production could not be fully achieved at that time due to a still-existing lot of batches, both MX projects were associated with several other non-monetary benefits likewise (Table. 4.3).

Table 4.3 Manufacturing excellence project benefits

No.	Key benefit(s)	Description(s) where necessary
1	Efficiency improvements	Reduction and elimination of waste
2	Space improvements	
3	Ease of operation	Management of the bottleneck for output on a flow line

No.	Key benefit(s)	Description(s) where necessary
		Visual signal when stock requires replenishment with kanban system
4	Product quality	Reduced risk of reconciliation errors Reduced risk of product damage Highlights product quality concerns as they happen Reduced risk of batch errors
5	One-piece flow will support identification of next improvement	
6	Ensures in-line/ahead progression of other sites	
7	Improvements in line with the production system	

Source: OpCo (2018)

Apart from that, labour could be reduced by 25%. This lower labour rate, however, was not attributable to an introduction of automation but rather to a reduction of temporary operators of which the organisation made extensive use before, as stated by two managers in OPS. Along with early successes, a basic CI infrastructure had been emerging over time. For instance, the use of some basic lean practices, such as 5S, kanban, and total productive maintenance, solidified to a daily routine in the production areas.

By all accounts, the MX projects had a very positive impact on the business. Within OPS, the important role of people had become more obvious and turned out to be a critical success factor for achieving excellence. That is, people prove necessary for a successful implementation of CI due to their daily involvement along the value stream. Indeed, operators were thus highly encouraged to always come up with ideas, but daily practice at the case organisation had shown that a widespread lack of CI mindset had remained present.

4.2 Behavioural deployment (October 2015 to December 2017)

4.2.1 Diffusing lean from manufacturing operations to the wider organisation

In 2013, the "Your Voice 2013" survey around organisational climate (to be filled out across all entities worldwide) was conducted. The survey itself was web- and paper-based, containing 47 questions (5-point Likert scale) with some supplemental questions for the local plant. Denoting a very high response rate, the survey results indicated a potential for optimisation in areas, such as employee engagement and performance enablement.

In fact, these areas showed a considerably limited part of positive responses. Much of the critical feedback related to communication, listening, reacting to employee views and customers' feedback, the reward and recognition (R&R) scheme, and opportunities. At the

same time, the survey also indicated a lack of strategy comprehension. In various areas, the survey even showed that the local plant performed worse than their (inter)national counterparts.

As a result of these insights, the case organisation reviewed different models to frame strategy as they were looking for ways to engage their workforce. A decision was eventually made for adopting the Shingo model. This was due to various reasons. First, the Shingo model could frame the entire company. Second, the Shingo Prize could function as a proxy and a quantifiable target. Third, many other frameworks they explored were quite technical rather than culturally focused.

> "We did look at the Toyota stuff from a pure lean perspective. We looked at some of the stuff that Deming has done in the past around lean as well and it was felt that that was, again, really quite transactional and operational rather than that culture piece, which is what we were after." (Middle Manager 2, OPS)

Another side benefit was seen in the Shingo model's origin because it suited the case organisation's Japanese heritage.

In early 2015, the organisation decided to diffuse its lean efforts by turning the basic idea of MX into an organisation-wide lean programme. Including all departments outside of OPS, an organisation-wide lean programme aimed at introducing principles of excellence to all functional areas of the business.

> "As an organisation, we are looking for ways to benchmark good and excellent. And the business excellence initiative started as an operations target and a journey and then was picked up by the whole organisation […] and then it became an organisational initiative and objective to try and reach the Shingo Award but more importantly about the journey on the way to get there to introduce improvements." (Middle Manager 3, OPS)

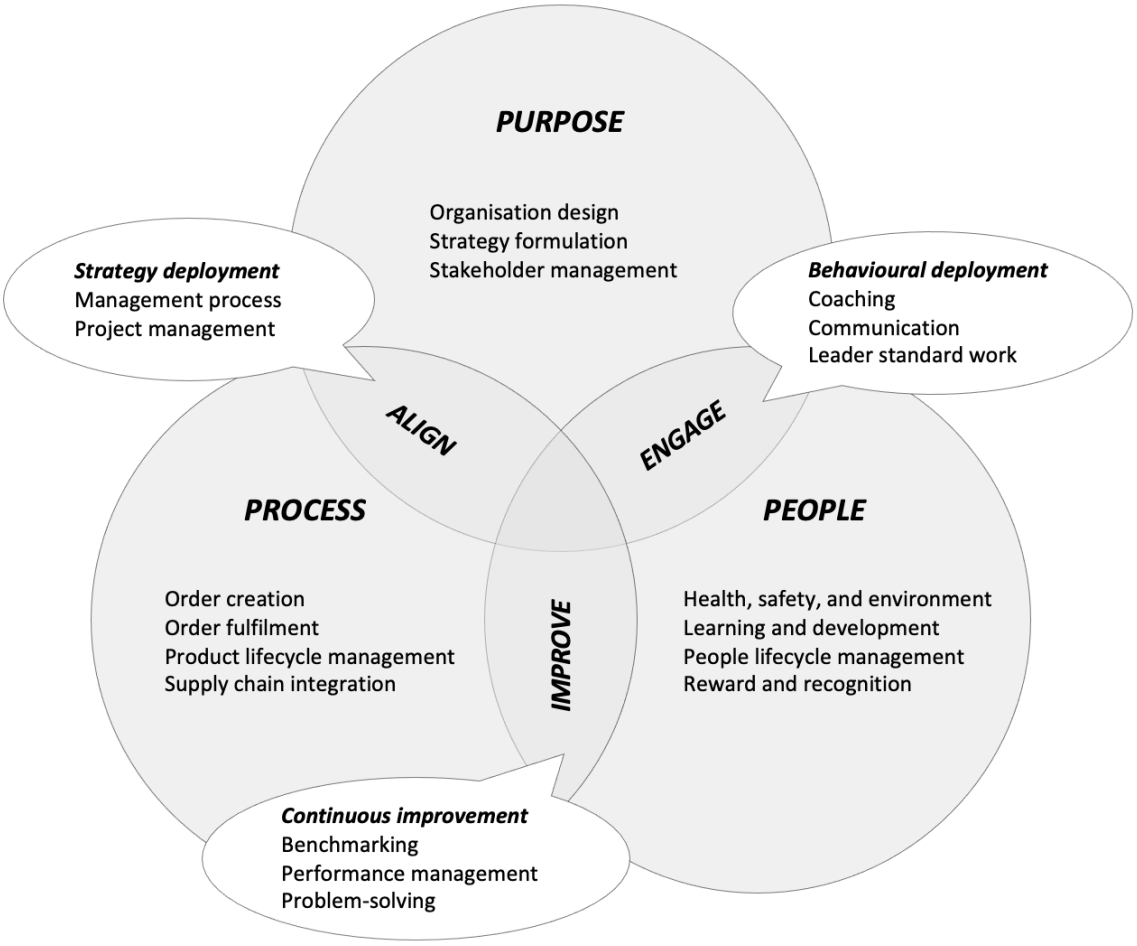
In doing so, a working group (hereinafter referred to as "lean taskforce"), including the OPS director, the former HR director[13], the operations manager, the quality systems manager, and one production manager, planned to set out how lean would be rolled out as an organisation-wide initiative. Apart from the HR director, this working group was heavily dominated by individuals associated with manufacturing operations.

[13] The former HR director had already left the organisation before this research was carried out.

4.2.2 Involving a consultancy

In the following weeks, the organisation decided to source an external consultancy that would be able to support them with implementing lean. Inviting a Shingo-certified consultant by the end of the same year, the organisation felt it could benefit from the consultants' multi-case lean-transformation experience. While the external consult helped the lean taskforce to develop a better understanding of the Shingo model, he further provided some input into planning, the vision, and around the evolvement of a future CI infrastructure. To illustrate how a lean management system functions, he presented a three-dimensional model, including (1) purpose, (2) process, and (3) people. In addition to that, he presented how these dimensions relate to each other and which systems are needed to enable a lean transformation (Figure 4.2).

Figure 4.2 Consultancy's integrated lean management system



Source: Adapted from Womack (2006, 2008); Anand *et al.* (2009); S A Partners (2021)
Note(s): This model's dimensions are also relevant to understand the case organisation's annual lean maturity assessments.

It is true that the consultancy's integrated lean management system, as seen in internal protocols, had some parallels with the lean manufacturing model (i.e., principles, process, and people) used in OPS, which had already been in place for a while at this time. Their origins were independent, though.

Internally labelled as "business excellence", the organisation-wide lean programme launched alongside the ongoing activities in the MX projects within OPS. The name "business excellence" was selected because the organisation intended to avoid that employees outside of OPS make an association that lean is limited to manufacturing.

> "We decided to call it '*business* excellence' because we thought that '*operational* excellence', as it is known in general theory, may cause people who don't work in operations to view it as an operations thing." (Middle Manager 2, OPS)

In other words, a more general term was preferred to frame lean and perceived as being more suitable to also engage departments outside of OPS so that the entire organisation is addressed.

4.2.3 Developing a purpose statement and ideal behaviours

Indeed, the case organisation's organisation-wide lean programme was fundamentally based on the Shingo model whereby the Shingo model functioned as the cornerstone on which all local CI activities were supposed to root, incorporating guiding principles, systems, tools, and results that develop a CI culture characterised by CI-orientated behaviours, as explained by the operations director. In particular, the Shingo model emphasised the important role of behaviour to support sustainable improvements based on three underlying notions (Table 4.4).

Table 4.4 Underlying assumptions about behaviours

No.	Underlying assumption(s) about behaviours
1	Ideal results require ideal behaviours
2	Purpose and systems drive behaviour
3	Principles inform ideal behaviour

Source: Adapted from Shingo Institute (2020)

Initiated by the lean taskforce and guided by the consultancy, notable changes had been made at the normative level. First, the lean taskforce elaborated a new purpose statement. Inspired by a popular TED talk by Simon Sinek (2009)[14], the organisation's new purpose statement was subdivided into three components, namely, (1) the "*what*", (2) the "*how*", and (3) the "*why*".

[14] See Sinek, S. 2009. How great leaders inspire action. *TED (Technology, Entertainment, and Design) Talk*. Available at: ted.com/talks/simon_sinek_how_great_leaders_inspire_action.

In essence, the "*why*" formulated a purpose. At the same time, the "*how*" concerned the ways in which the organisation would realise the "why" whereas the "*what*" described the outcomes of pursuing the "why" (Table 4.5).

Table 4.5 Purpose statement

No.	Purpose statement
What	
	We will become the partner of choice for the design and manufacture of energy-based surgery systems.
How	
	By…
1	…providing *innovative* procedure enabling products, which address patient/user needs.
2	…creating value for all our current and future *stakeholders*.
3	…supplying safe and reliable products *on time*.
4	…delivering *projects* to the defined requirements of cost, quality, and time.
5	…promoting a culture of teamwork, respect, and empowerment that makes us the employer of choice through developing the *best people*.
6	…engaging all employees in a world-class continuous *improvement culture* to enable profitable growth.
7	…adopting a *zero-harm* philosophy for our people and the environment.
Why	
	In order to improve the lives of our patients, our partners, and our people.

Source: OpCo (2016)

Second, the lean taskforce elaborated ideal behaviours in addition to this, aiming at achieving ideal results once instilled and further complementing the new purpose statement. In the beginning, however, these ideal behaviours majorly addressed organisational members in leading positions (Table 4.6).

Table 4.6 Ideal behaviours

No.	Ideal behaviour(s)
We will…	
1	Consistently hold people to account by making expectations explicit and regularly reviewing performance.
2	Motivate others through leading by example and creating an expectation that our colleagues do the same.
3	Provide both timely positive and negative feedback.
4	Understand our customers' needs and deliver on our agreed commitments, managing both risk and value to provide an optimum solution.
5	Communicate clear goals, objectives, consequences, and timeframes for everyone.
6	Develop a right first-time approach to everything.
7	Foster respect, openness, collaboration, and trust.
8	Empower and equip our people to take responsibility.

Source: OpCo (2016)

In fact, the purpose statement associated with its ideal behaviours was displayed on the walls throughout the site so that every employee was reminded of it every day.

4.2.4 Measuring lean maturity: Annual progress review

4.2.4.1 Shingo Insight Assessment #1

Towards the end of 2015, the case organisation conducted a first Shingo Insight Assessment in association with the consultancy. Prior to the data collection, the consultancy helped the case organisation to elaborate a set of questions that suited the organisation's needs. In total, around 100 to 120 face-to-face interviews and multiple focus groups had been conducted internally, including all functional areas of the organisation. It was the consultancy then that evaluated the data and came up with a report. According to a production manager, key insights from that survey concerned (1) a tool-centric approach to lean, (2) being reactive rather than proactive in terms of problem-solving, (3) having some non-sustainable improvements, and (4) a culture legacy being present due to being taken over in 2008.[15]

> "Culturally, we were still having a lot of hangovers from the old [former company name] world as opposed to [OpCo]." (Middle Manager 2, OPS)

In the report, the consultant pointed towards some gaps to world class. Analysing the case organisation's lean maturity with consultancy-developed instruments, a tool-centric approach and "reactive instability" were diagnosed (Appendix 4). Insufficient attention was paid to the "underwater" enablers (see Found *et al.* 2007), inhibiting the development of a CI culture. Incorporating the consultant's input, a shift from solely focusing on key performance indicators (KPI) around output, scrap, and efficiencies towards a consideration of soft lean practices was anticipated.

4.2.4.2 Scorecard

To measure the case organisation's lean maturity quantitively, the consultancy provided a lean maturity scorecard (Table 4.7). This scorecard built essentially on the consultancy's lean management model (see Figure 4.2) and a series of criteria provided by the consultancy likewise.

[15] There was no access to the official executive summary but only to interviewee reports.

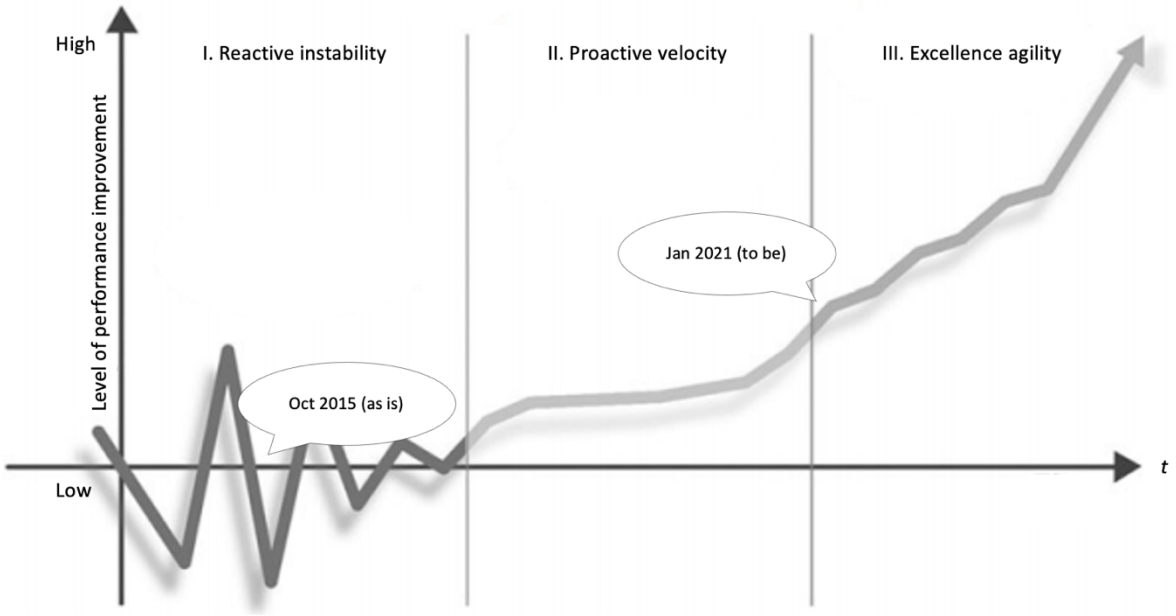
Table 4.7 Lean maturity scorecard (October 2015)

No.	System(s)	Ideal	October 2015	January 2021 target
1	Purpose	3	0.75	2
2	Engage	3	0.67	2
3	People	3	0.69	2
4	Improve	3	0.50	2
5	Process	3	0.80	2
6	Align	3	0.58	2
	Total	*3*	*0.66*	*2*

Source: Adapted from OpCo (2017)

In October 2015, the case organisation was classified as "reactive instability" again based on internal survey feedback by senior and middle managers. Moving forward from there, it had the ambition to reach "excellence agility" (see Appendix 4) by January 2021 (Figure 4.3).

Figure 4.3 Journey towards excellence agility (October 2015)



Source: Adapted from Hines *et al.* (2020)

4.2.5 Introducing "business excellence" boards

4.2.5.1 Visual management

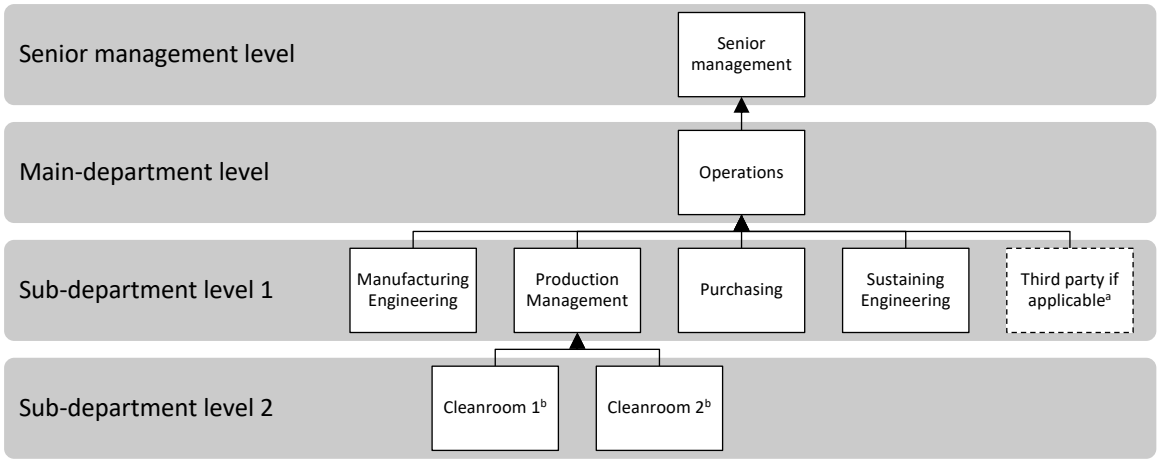
In 2017, the lean taskforce dictated each department and their respective sub-departments to introduce visual management boards (VMB; internally referred to as "business excellence boards"), which had been running in OPS already for a while and proved beneficial. By making variation more visible, it was believed that VMBs are the way to get the instability in the organisation under control and to enable focused improvements. In the same way, methods were sought so that staff would engage with this data by questioning and understanding their meaning to drive improvements. Ideally, the idea was that process owners would meet in front

of their boards, engage with individuals involved to understand their data (i.e., "how" and "why" something occurs) and to discuss together how to tackle emerging issues. In other words, a shift away from solely tracking money was sought.

To facilitate the introduction of visual management, the lean taskforce prepared VMB templates that included four different sections to be covered, namely, (1) purpose, (2) process, (3) people, and (4) improvement. First, the purpose section covered normative elements around the organisation's purpose and their ideal behaviours. Second, the process section concerned a set of KPIs with data around local processes. Third, the people section centred around employee-orientated matters, including team development and recognition for (1) generating savings, (2) great ideas, and (3) exceptional efforts. Fourth, the improvement section tracked and recorded improvements.

In total, 25 different VMBs were set up. Most of them were located in functional areas and funnelled up to feed a main-department board. In turn, essential data from main-department boards were funnelled up to senior management's board. In OPS, for instance, the basic VMB structure was as follows (Figure 4.4).

Figure 4.4 Visual management board structure in Operations



Source: Author
Note(s): (a) In OPS, for instance, two functional areas of RAQA, namely, (1) quality engineering and (2) quality systems, were linked to their visual management board; (b) in production, there are two cleanrooms, which have separate visual management boards

In OPS, the VMBs accommodated two sub-departments of RAQA likewise, including quality engineering and quality systems. That was because they often reacted towards matters imposed on them by OPS.

> "The business excellence board in operations involves quality engineering, quality systems, production, sustaining engineering management, manufacturing engineering management, and operations management." (Middle Manager 1, RAQA)

Depending on the level within the VMB structure (i.e., from senior management down to each functional area), different board owners were assigned. In OPS, for instance, production managers had their production boards in the cleanrooms, which fed the production management board located in a meeting room in the OPS office. The production management board as well as the production process board, the purchasing board, and the sustaining engineering board were owned by the middle manager responsible for the respective functional area. As was observed, all these boards fed the OPS board with essential data located in the OPS meeting room ("obeya"). This board was owned by the OPS director. All department boards, like the OPS board in this case, fed the senior management board located in the senior management meeting room, giving senior management a concise overview about the performance in each single department within the organisation.

4.2.5.2 Audits

Apart from the VMB structure, the lean taskforce introduced an audit system, attempting to ensure that the VMBs will be attached to the wall and reviewed (Appendix 5). In theory, the audit system aimed at supporting the PDSA cycle across all levels in the organisation both horizontally and vertically. In the audit processes, two random managers, including senior managers, would come to review a VMB by giving scores against a set of criteria while managers whose functional area was under review would be encouraged to make sure that all subordinates are part of a board review every month.

Importantly, all four areas (purpose, process, people, and improvement) had to be covered. First, in the purpose area, the case organisation's purpose statement and their ideal behaviours had to be displayed. In addition, it was important that internal customers and their respective needs are known. Second, in the process areas, measures defining the operational performance had to be in place (e.g., value, delivery, cost, quality, and health and safety). Using a traffic-light code, the colours red, amber, and green had to indicate the range in which a key figure moves in comparison to the optimum. Third, in the people section, meeting agendas and meeting attendances had to be recorded. Moreover, current skill levels associated with training needs and recent recognition for good saves (preventive actions), great ideas, and exceptional efforts (where individuals "went above and beyond") had to be added. In the improvement

section, improvement activities in line with the case organisation's strategic priorities had to be defined while actions (e.g., escalated issues) and deadlines agreed upon had to be recorded likewise. To increase their gains, improvements had to be captured on the VMBs for communication purposes. After a VMB audit, a VMB owner would receive a final score. Action plans resulting from the review had to be recorded in the improvement section likewise.

4.3 Strategy deployment (December 2017 to February 2018)

4.3.1 Involving the "wider leadership group"

The first two phases of the case organisation's lean journey were born under the star of getting more familiar with lean and enhancing self-awareness of the actual state of the organisation, as expressed by a senior manager. In the third phase, senior management initiated the strategy creation process based on previous explorations and lessons learnt. In comparison to the first two phases, the whole senior management layer had been increasingly more involved from then on and decided to involve the rest of the leadership team located at the local plant likewise. Emphasising the importance of this group to effect change, leaders below them (with a direct report), they argued, establish the link between the strategic and the operational level. In addition, they are their "mouthpiece" and "develop stars". In view of these aspects, senior management sought this leadership group's commitment to the lean programme. As one middle manager put it,

> "It started as a project group within the senior management and a few other employees. The project group could develop the tools but struggled with the buy-in of the rest of the organisation. [Involving the wider leadership group is] more successful than an isolated project group to deploy business excellence with less support." (Middle Manager 3, OPS)

Internally, the organisation referred to the so-called "wider leadership group" (WLG) who was anyone with a direct report to one of the five directors ("senior managers"). In total, the WLG consisted of fourteen managers of functional areas who received reports themselves ("middle managers"), five project managers, two research managers, and one product manager who did not receive any reports.[16] Indeed, project managers did not have a direct report to a director; however, they led project teams daily and were responsible for performance development reviews (PDR; Table 4.8).

[16] In two cases, managers have either been replaced or decided to change their role (see Table 4.8). This means that the total number of WLG members is not 22 but 20.

Table 4.8 Management structure

No.	Management		Department(s)	Title(s)	*f*
	Level(s)	*Role(s)*			
1	Senior management	Plant management		Executive Managing Director	1
		Department management		Director of Finance & Information Technology	5
				Director of Human Resources	
				Director of Operations	
				Director of Quality Assurance & Regulatory Affairs	
				Director of Research & Development[a]	
2	Wider leadership group	Middle management	Selling, General & Administrative Expenses ("SGAE")	*Finance, Information Technology, and Environment, Health & Safety, and Facilities*	3
				Environment, Health & Safety, and Facilities Manager[b]	
				Financial Controller	
				Information Technology Manager	
				Human Resources	1
				Learning & Development Business Partner	
			Operations ("OPS")	Manufacturing Engineering Manager	4
				Operations Manager	
				Procurement Manager[c]	
				Purchasing Manager[c]	
			Regulatory Affairs & Quality Assurance ("RAQA")	Product Evaluation Manager	3
				Quality Engineering Manager	
				Quality Systems Manager	
			Research & Development ("R&D")	Mechanical Engineering Manager	3
				Process Engineering Manager[b]	
				Software & Electronics Development Manager[d]	
		Product management		Product Manager 1	1
		Project management		Project Manager 1	5
				Project Manager 2	
				Project Manager 3	
				Project Manager 4	
				Project Manager 5[e]	
		Research management		Research Manager 1	2
				Research Manager 2[e]	

Source: Author

Note(s): (a) 18 months on leave; (b) no participation in this research; (c) in late 2019, the purchasing manager was replaced while the job title changed from purchasing manager to procurement manager; (d) joined the organisation in mid-2018; (e) in 2019, one project manager changed job role to research manager

4.3.2 Introducing "business excellence" masterclasses

Intending to increase the involvement of the WLG in lean, senior management and the remaining members of the lean taskforce had begun to design tailored workshops (internally referred to as a "business excellence masterclass"). Accordingly, from December 2017 onwards, the WLG was invited to attend masterclasses being held on a quarterly (usually in three- or four-month rhythm) basis thenceforth. Introducing such masterclasses did not only aim at engaging the WLG and at informing them about business priorities but also at educating them so that they develop capabilities to be able to drive lean in their own functional areas.

In the first masterclass, the focus was set on the fundamental idea of lean and why it is necessary. To this event, a consultant of the consultancy was invited to help to guide the lean transformation. That being said, contents centred around the principles, the gaps to becoming world class, the nature and future of strategy deployment ("HK"), and the next steps to be undertaken in order to drive the lean programme organisation-wide. In a classroom style, this on-boarding process involved awareness-creating activities attempting to bring everyone in the WLG up to the same level of knowledge. That was because the majority of the WLG was not involved in the knowledge-building process, whereas senior management and the remaining members of the lean taskforce saw the opportunity to share the knowledge they had been acquiring about lean over the last couple of years. From the WLG, only middle managers working in OPS had some experience with lean implementation (e.g., gained internally through the MX projects).

With the consultant's help, senior management stressed seeing the lean programme as a new way of thinking with a focus on enhancing customer value and the elimination of waste rather than just another initiative, further accentuating that it does not constitute a cost-reduction programme or set of tools and techniques, such as "charts on walls", but rather

> "the delivery of world-class performance in all aspects of our business that delights our customers and stakeholders; and engages us all in a journey of continuous improvement".

Tying on this, they pointed out together the importance of the intangibles to make lean sustainable, referring to softer elements, including (1) strategy and alignment, (2) leadership, and (3) behaviours and engagement.[17] In doing so, they intended to accentuate that lean must not be limited to its visible elements but also includes efforts less visible. In correspondence to this, senior management recalled their purpose statement associated with its ideal behaviours

[17] See "lean iceberg" by Found *et al.* (2007)

and emphasised how they link to the Shingo model and how important they are to engage the organisation in achieving excellence.

4.3.3 Breakthrough objectives and policy deployment ("hoshin kanri")

Largely pre-set by their parent organisation's five-year corporate strategic plan (2016-21) and aligned with several stakeholders, senior management introduced the long-term breakthrough objectives ("hoshins") for the following financial years (2018-21) from top down.

> "[The long-term breakthrough objectives were] developed at the senior management level. […] So, the direction is set by the directors – that's good. The clue is in the name." (Middle Manager 1, OPS)

Addressing their purpose statement, these included (1) new product launches, (2) increasing sales and operating income, and (3) increasing quality (e.g., by reducing customer complaints and increasing the service level), to mention a few. In Table 4.9, it is illustrated how most breakthrough objectives fed into their purpose statement.

Table 4.9 Breakthrough objectives ("hoshins")

No.	Purpose statement(s) ("*how*")[a]	Breakthrough objective(s)
1	Providing innovative procedure enabling products, which address patient/user needs	Six ideas onto product roadmaps
2	Creating value for all our current and future stakeholders	Achieving sales of £56m Achieving an operating income of 21%
3	Supplying safe and reliable products on time	Mature quality culture in place 30% reduction in reportable events 30% reduction of customer complaints Delivering a service level of 97%
4	Delivering projects to the defined requirements of cost, quality, and time	
5	Promoting a culture of teamwork, respect, and empowerment that makes us the employer of choice through developing the best people	Become a "top 50%" Top Employers Institute organisation
6	Engaging all employees in a world-class continuous improvement culture to enable profitable growth	Shingo Prize winner
7	Adopting a zero-harm philosophy for our people and the environment	Mature health and safety management system in place Achieve ISO14001 certification

Source: Adapted from OpCo (2018)
Note(s): (a) See Table 4.5

Taking this as the basis, senior management had been developing annual objectives and improvement priorities associated with metrics to measure and accountabilities over the last couple of months. In doing so, they developed a policy deployment matrix for the upcoming financial year (2018-19). In their policy deployment matrix, their annual plan goals were linked

to the breakthrough goals, their major improvements and improvement themes to the annual plan, measures (i.e., milestones and KPIs) to improvements, and owners who were accountable for improvement activities. As WLG members were not involved in this process, they felt that they have not been given the opportunity to challenge the policy deployment matrix.

4.3.4 Measuring lean maturity: Annual progress review

4.3.4.1 Scorecard

As part of this first masterclass in December 2017, senior management decided to measure their lean maturity level against the same criteria they were assessed on more than two years ago again. The feedback was provided by senior managers and the WLG (Table 4.10).

Table 4.10 Lean maturity scorecard (December 2017)

No.	System(s)	Ideal	October 2015	December 2017	January 2021 target
1	Purpose	3	0.75	1.03	2
2	Engage	3	0.67	1.01	2
3	People	3	0.69	0.91	2
4	Improve	3	0.50	0.81	2
5	Process	3	0.80	1.06	2
6	Align	3	0.58	1.18	2
	Total	*3*	*0.66*	*1.00*	*2*

Source: Adapted from OpCo (2017)

Indicating a trend, the results showed that the organisation had been moving a little in the last two years, but not much. That is because time was taken to explore and determine the actual state to deploy a strategy, as justified by a member of the lean taskforce.

4.3.4.2 Best-practice review

Apart from this quantitative self-assessment survey, a qualitative survey was carried out likewise. In a following exercise, everyone was encouraged to share the best practices they found to be explaining the improvement in their scorecard results. Equally, everyone was asked to share where they see gaps and improvement opportunities (Appendix 6).

To mention a few striking improvements, several leaders in the management community found a Voice-of-the-Customer (VoC) exercise that they had been recently carrying out quite helpful to get more awareness of their internal and external customers' needs. Second, having ideal behaviours was generally welcomed and widely perceived as a move forward. Ideal behaviours, however, had been developed in cooperation with the lean taskforce and another working group. Hence, they were not owned by the wider workforce at this stage. Third, WLG members found that the communication had significantly improved, as already criticised in the

"Your Voice 2013" survey in 2013. Several new communication channels enabled better communication, including off-site meetings (e.g., masterclasses and townhall meetings) and the team brief (an internal monthly newsletter with relevant news and figures about the business). A lack of cross-functional communication as well as a lack of consistency and timeliness left space for improvement, though. Fourth, although not functioning perfectly well, many appreciated management's focus on more recognition and found it to be moving in the right direction. The current R&R system, however, made it difficult to pinpoint recognition. In many cases, for instance, recognition had been perceived as being untransparent.[18] Fifth, a meeting structure with daily layered accountabilities was reported to be working quite well in OPS. In practice, this particularly fostered having regular discussions on current and strategic matters. Such a structure, however, was missing in many other departments. Sixth, visual management was seen as a success, as it increased the visibility of the business. To be precise, however, this was mainly perceived in OPS, whereas other departments had widely been struggling to incorporate the VMBs into their daily practice. In particular, the strict format to be adhered to was not equally suitable in every environment.[19]

4.3.5 Delegating lean and future expectations on the wider leadership group

Moving forward from there, senior management delegated lean implementation to the WLG and formulated some future expectations. In doing so, senior management sought the WLG's commitment to lean and urged them to spread the message in their respective teams. Alongside this, senior management gave the WLG a few tasks to take along. From now on, WLG members were supposed to lead by example and to champion lean (Table 4.11).

Table 4.11 Future expectations on the wider leadership group

No.	Task(s)	Description(s)
1	Lead	Championing business excellence
		Communicating to next level(s) in organisation where appropriate
		Personal commitment to lead by example
2	Improve	Checking with your team members the effectiveness of strategy deployment on a regular basis
		Delivering improvement plans in all areas
3	Coach	Conducting timely and meaningful performance development reviews and mid-year performance development reviews
		Ensuring that all of your staff have meaningful 1-to-1s on a regular basis
4	Review	Making sure that your visual management board is always up to date
		Ensuring that all of your staff are part of a monthly board review

[18] See section 4.4.3 for more details.
[19] See section 4.6.2 for more details.

No.	Task(s)	Description(s)
		Seeking out learnings from other visual management board owners about what works well

Source: Adapted from OpCo (2017)

4.4 Learning & Development and progress (February 2018 to May 2018)

4.4.1 Learning & Development

Aiming at delivering key considerations to a future state of L&D, senior management felt that this would improve the people assets by growing skills and capabilities via different ways of L&D (e.g., experimenting on-the-job, education, and knowledge-sharing). Investing in staff was perceived as being essential in driving engagement at all levels to deliver greater customer results. A recent benchmark against other participating organisations by the Top Employer Institute evidenced that the case organisation's performance in L&D was well below the industrial average. Therefore, much emphasis was put on raising the WLG's awareness about the role of L&D in enabling individuals to be more motivated and productive to drive organisational performance. It had become obvious that L&D was not solely seen as a HR responsibility, but rather as a cross-functional responsibility.

To achieve such cultural change in the long-run, senior management recognised the vital role that the WLG plays in that. In a group interview, a senior manager underlined this with the following.

> "You can't outsource leadership and management." (Senior Manager 1)

For this reason, senior management had begun to embed several leadership development programmes and to encourage leaders across the business to take more ownership for their teams' and their own development (Table 4.12).

Table 4.12 Leadership development programmes

No.	Management level(s)	Leadership programme(s)		
		Business excellence masterclasses	*Corporate Leadership Academy*[a]	*INFLUENCE*[b]
1	Senior management	•	•	
2	Wider leadership group	•	•	
3	First-line management			•
4	High potentials			•

Source: Author

Note(s): (a) The Corporate Leadership Academy is a leadership programme at the corporate level that every manager with more seniority in the organisation must undergo; (b) INFLUENCE is a modular six-month management-development programme improving first-line managers' and developing high potentials' leadership skills

In a discussion, the management community had further been debating the needs for a future L&D system. Deriving from that, a working group within HR was formed to conceptualise a potential L&D system within the upcoming months to be embedded across the organisation.

In a few functional areas, including OPS and R&D, a certain L&D structure (e.g., skills matrices and personal development programmes for technicians) had already been in place at that time. In OPS, for instance, the basic idea behind that was to have fully autonomous and multi-skilled teams in the manufacturing area and to upskill teams so that they are capable of supporting the CI process. Toyota Kata, for instance, was taught as an approach to adopting and coaching scientific problem-solving, although it did not find much application in practice. In workshops that had already been taking place in OPS for a while, it was recognised that learning, associated with its contents to be taught, must be meaningful and relevant for an employee rather than disconnected from the daily job, otherwise employees would struggle to apply the learnings in their local environment.

4.4.2 Revisiting ideal behaviours

In the meantime, the ideal behaviours had been reviewed and finetuned alongside the organisation's purpose statement by a designated working group. This time, however, cross-functional representatives who involved their teams in turn had some input into the review so that the entire organisation can own the ideal behaviours.

In a first step, the existing set of ideal behaviours was reorganised and realigned into two dimensions to reflect the (1) culture that was needed and (2) the performance that was expected to be delivered. In its current form, the working group further perceived that the existing set of ideal behaviours was too complex and required some simplification. In consequence, they came up with a new shortened set of the ideal behaviours (Table 4.13).

Table 4.13 Refined ideal behaviours

No.	Ideal behaviour(s)		Dimension(s)	
	Before	*After*	*Culture*	*Delivery*
We will…				
1	Understand our customers' needs and deliver on our agreed commitments managing both risk and value to provide an optimum solution	Understand our customer needs		•
2	Communicate clear goals, objectives, consequences, and timeframes for everyone	Communicate clear goals, objectives, and timeframes		•
3	Empower and equip our people to take responsibility	Empower and equip our people to take responsibility	•	
4		Deliver on our agreed commitments		•
5	Develop a right first-time approach to everything	Encourage a right first-time approach to everything	•	
6	Foster respect, openness, collaboration, and trust	Foster respect, openness, collaboration, and trust	•	
7	Motivate others through leading by example and creating an expectation that our colleagues do the same	Motivate others through leading by example	•	
8	Provide both timely positive and negative feedback	Provide both timely positive and negative feedback		•
9	Consistently hold people to account by making expectations explicit and regularly reviewing performance	Consistently hold ourselves and others to account		•

Source: Author

4.4.3 Recognition and celebrating success

Two years before, a R&R system was non-existent. In their current, relatively new (but non-revamped) R&R system at that time, anybody could nominate anyone organisation-wide (peer recognition). To nominate somebody, a form needed to be filled out. Then, nominees were mentioned on the VMB with their respective performance, the point of time, and the name of whom nominated that person. After that, the line manager decided upon whether these nominations were worth being reported to senior management. Nominations being forwarded to senior management were then discussed upon their appropriateness for being recognised within a monthly management meeting. In the best case, a recognised nominee would receive a picture in the stairway and a £200 cash prize, while any nominee would be mentioned in the team brief.

In the previous masterclass, senior management touched upon the necessity to recognise ideal behaviours in their teams. Indeed, some elements of R&R were, in fact, already embedded in their VMBs (i.e., recognition for good saves, great ideas, and exceptional efforts); it was felt, however, that there is room to improve. In a mutual discussion, senior management and the WLG thematised their current effectiveness and asked themselves whether they were driving the right behaviours.

Interviewing managers below senior management and staff, many flaws within the existing R&R system had become apparent. First, good performances were sometimes achieved by a whole team, but only a single person got rewarded.

> "Recognition is hard to pinpoint here. Many people work on a single project – some with part-time and some with full-time involvement." (Associate 1, RAQA)

In other words, an imperfect balance was perceived where single employees received a praise while others were left out, leading to dissatisfaction within teams. Instead of individual ones, there was some traction for having team rewards, ranging from food buffets to increase the moral (middle manager's feedback) to events with complimentary drinks (operator's feedback), in the workforce.

Second, there were different standards for being recognised and rewarded. This included leaders' threshold of recognising and rewarding, and the criteria what is perceived as recognisable. For instance, one employee mentioned that

> "people got recognised, but they created chaos in the first place". (Middle Manager 1, SGAE)

Likewise, it was consensually argued quite often that individuals were recognised for doing their job or something that was expected from them, anyway. In fact, fourteen interviewees brought that up when asking them how the organisation's R&R system works. A contractor reported the following.

> "People don't get recognised for what they should get recognised for. I was shocked that somebody got recognised for taking on their safety glasses. It's disheartening." (Associate 2, RAQA)

Due to lack of standardisation in the R&R system and the large number of employees in particular departments, recognition was more prevalent in certain functional areas than in others. The high frequency of recognition in some functional areas gave one member of staff the impression that

> "some departments have to have an event as a PR exercise for themselves". (Associate 3, RAQA)

In an extreme case, a member of staff reported that he had never seen somebody being recognised in his office since he had joined the company more than two years ago. Some other interviewees argued that the extent of recognition depends on the line manager.

> "Managers here don't reward but others do easily in other departments." (Associate 1, SGAE)

A WLG member complained that existing practices decreased the value and principle of being recognised and that they are demoralising for other individuals. There was consensus that only people who go above and beyond and who do exceptional work should receive recognition instead.

Third, judgements upon recognition by senior management were contested. That was because senior management had usually limited information about what people actually did.

> "Senior management handpicks a winner […] but there is no evidence and no data […] unsettled by the fact that they picked people by less information." (Middle Manager 2, RAQA)

Moreover, there was a consensus that a personal "thank you" from senior managers for having done a good job would feel appreciative and esteeming.

Although negative opinions prevailed, there were also a couple of less critical voices across departments and hierarchical levels not having experienced any downsides of the existing R&R system at all but perceiving the R&R system as quite positive.

> "I've been on the board six to seven times this year. […] I feel happy then." (Associate 4, RAQA)

More generally, one member of staff expressed that he perceives recognition as very positive in the organisation because his former employer did not recognise at all. Overall, criticism remained dominant, though. As a result of this, a small working group was tasked with defining an improved R&R system to be reported back in the next masterclass.

4.5 Continuous improvement and progress (May 2018 to October 2018)

In the fifth phase, the focus was set on CI. Inviting the WLG, senior management aimed at delivering a greater understanding of CI accompanied by examples from OPS where CI was already embedded to a considerably large extent. Alongside this, smaller updates were presented by several working groups that concerned ideal behaviours, strategy deployment, and the L&D and R&R systems.

4.5.1 Aligning corporate core values and ideal behaviours

Initially, another update was provided regarding their set of ideal behaviours. Additional feedback received by the cross-functional working group and their teams was incorporated. In a newer version, urgency and innovation were captured, whereas the "feedback" behaviour was amended. At the same time, more attention was paid to ensuring that behaviours can be adopted at all levels across the organisation (Table 4.14).

Table 4.14 Reworded ideal behaviours

No.	**Ideal behaviour(s)**	
	Before	*After*
We will…		
1	Understand our customer needs	Understand our customer needs
2	Communicate clear goals, objectives, and timeframes	Communicate clear goals, objectives, and timeframes
3	Empower and equip our people to take responsibility	Embrace empowerment
4	Deliver on our agreed commitments	We do what we say we will
5	Encourage a right first-time approach to everything	Encourage a right first-time approach to everything
6	Foster respect, openness, collaboration, and trust	Foster respect, openness, collaboration, and trust
7	Motivate others through leading by example	Motivate others through leading by example
8	Provide both timely positive and negative feedback	Engage in constructive feedback
9	Consistently hold ourselves and others to account	Consistently hold ourselves and others to account
10		Strive to improve and innovate

Source: Author

Although senior management and the WLG elaborated on finalising their ideal behaviours, the case organisation's parent organisation introduced a set of corporate core values associated with core behaviours that each subsidiary had to comply with from June 2018 onwards (Table 4.15).

Table 4.15 Corporate core values

No.	Corporate core value(s)	Corporate core behaviour(s)
1	Integrity	We are trustworthy and act in good faith
2	Empathy	We care about all our stakeholders
3	Long-term view	We look beyond the present to deliver future value
4	Agility	We challenge the status quo with open minds, focus, and speed
5	Unity	We are strongest when we work together as a team

Source: Adapted from OpCo (2018)

The corporate core values aimed at uniting everybody as a global organisation, providing orientation, prioritisation, and reinforcing the organisation's profile and their external impact, as documented in internal protocols. At the individual level, the corporate core values were supposed to act as a source for role modelling, mentoring, and feedback, as well as a criterion for selecting and hiring new employees. According to senior management, the newly introduced set of corporate core values had to be examined for congruency with the existing set of ideal behaviours. For this reason, a working group was tasked with analysing the similarities and differences between both sets in more detail.

4.5.2 Inspiring with continuous improvement in operations

By October 2018, senior management intended to have CI systems launching in all functional areas of the organisation. In their respective masterclass, the WLG was sensitised to what CI constitutes. It became obvious that CI was a relatively new thing for all departments outside of manufacturing, whereas OPS had already a CI system in place, which was used to inspire how such a system may look like in practice.

In OPS, for instance, there was a three-level CI structure with (1) top priority projects initiated by senior management, (2) value-stream improvements managed within the value stream amongst process engineers, technicians, and team leaders, and (3) small incremental improvements to be driven by operators on the shopfloor (Table 4.16). While first- and second-level projects had been running well, OPS sought more ideas coming from operators to feed third-level projects. At that time, OPS had around two to three third-level ideas per week. These, however, were generally generated by the production managers in the cleanrooms or by an operations manager. Despite a limited generation of third-level ideas by operators, OPS

could sustain the CI momentum locally through the regular input of their local leadership team during gemba walks on the shopfloor.

Table 4.16 Improvement activity levels in Operations

Level(s)	Type(s)	Project characteristic(s)				Example(s)
		Size(s)	*Resource(s)*	*Lead(s)*	*Duration(s)*	
1	Top priority project	Large	High	Director of Operations	Several months	Automation and customer change requests
2	Value stream improvement	Medium	Medium	Operations Manager	Six or twelve weeks	Yield and line improvements
3	Small incremental improvement	Small	Low	Production Manager	A few days	Workplace organisation and production maintenance

Source: Adapted from OpCo (2018)

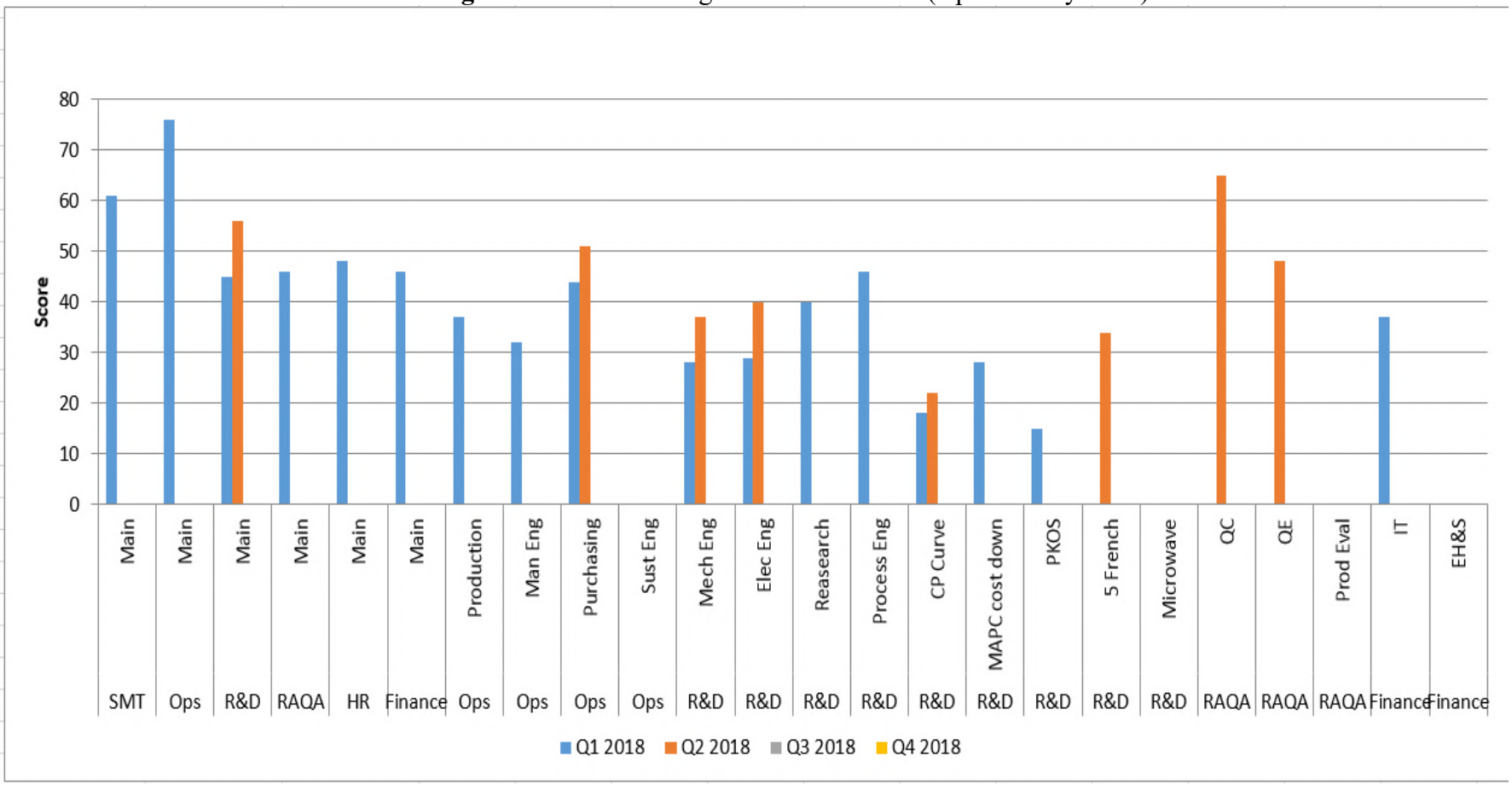
Important for second-level projects was that ideas should not only be limited to technical aspects but rather embrace anything that could need an improvement, guided by data to decide upon the priority in the project pipeline. Usually, a second-level project was given six or twelve weeks. Attempting to accomplish as much as possible within that given timeframe, one project was being focused on at a time before moving on to the next one (e.g., MX projects). Apart from that, the WLG members from OPS informed their WLG peers about how improvement ideas are generated, where they take them from (e.g., VMBs, strategic direction, daily issues as well as yield and breakdown data), how they prioritise and structure (DMAIC) their projects, and how resources are allocated to these.

Inspired by the CI system in OPS as an example, departments outside of OPS were encouraged to develop and implement tailored CI systems that suit the needs of their own functional areas.

4.5.3 Auditing visual management: Assessment status

Alongside this, the assessment criteria for the VMB audits had been revised. Numerous changes were introduced, including technical and logical issues, such as the removal of duplications (e.g., service level vs backorder). More input into their revision, however, was encouraged to further refine the assessment criteria. At the same time, an update was given to what extent the VMB audits had been really carried out by managers. The sobering result was that only eight were completed until 21 May 2018, although 16 reviews were scheduled between April and May 2018. In addition, VMBs had even remained uninstalled in some functional areas (Figure 4.5).

Figure 4.5 Visual management board audits (April to May 2018)



Source: OpCo (2018)

4.5.4 Proposing a new reward and recognition system

In the previous quarter, a working group had been elaborating a new R&R system. Their proposal was collectively discussed, accordingly. With the aim to ensure fairness, clarity, and consistency, the new R&R system aimed at (1) recognising contributions and behaviours on a daily basis and (2) honouring with monthly awards. First, day-to-day recognition aimed at encouraging managers to develop a culture of effective communication and recognition of staff for worthwhile contributions but daily. Second, monthly awards were designed to recognise individuals or teams who (1) consistently demonstrate the organisational values, (2) deliver exceptional results in line with departmental goals, or (3) showcase attitudes, behaviours, and actions that increase their pride in their work (Table 4.17).

Table 4.17 Reward and recognition scheme proposal

No.	Type(s)	Description(s)	Categories
1	Day-to-day recognition	"Thank you" culture (in person or handwritten note) Immediate recognition of positive behaviours and a good job Consistent recognition Individual and team basis	Living the organisational values A one-off piece of work well done Excellent customer feedback Extra effort to achieve a particular goal Going above or beyond for a customer or colleague Taking ownership of and resolving an issue
2	Monthly awards	Nomination for a monthly award in any category if meeting criteria Up to three awards will be made each month Individual and team basis	Take initiative to solve problems and improve work situations without being prompted Positively influence others to build consensus in group, departmental, or organisational settings Consistently go above and beyond without fanfare Deliver a consistently high quality of service to their internal and/or external customers Take the initiative to improve the value and efficiency of the services they provide Create new, cost-effective, and/or innovative methods for performing day-to-day operations Help others by sharing knowledge of practices and resources or job-related skills Create a positive attitude and atmosphere, positively influencing others by their example Demonstrate reliability, perseverance, and focus on results Take a proactive and innovative approach towards findings sustainable solutions to business challenges

Source: Adapted from OpCo (2018)

Associated with monthly awards, anybody in the organisation would be able to take ownership of the new R&R system in two ways. First, each employee may nominate individuals or teams for an award. Second, nominees would then be shortlisted and circulated via the team brief while each employee could cast a vote for their choice of candidate(s). An Awards Committee would count all votes to determine the three winners for that month. Individuals and teams would be recognised on display boards, receive a trophy for the month, and enjoy a buffet together with the other awardees. In addition to this, a senior manager or managerial representative would thank everyone in person.

Many aspects aimed at counteracting the criticism from the previous R&R system, such as not having a standardised set of criteria to adhere to and senior management decisions upon suitability for recognition despite a limited factual basis. Increasing the workforce's involvement in decision-making instead, much more ownership and control over the whole process would be granted by putting the new proposal in practice. Until the next masterclass, however, the R&R system proposal needed some more refinements based on some feedback given by senior managers and other WLG members. This, for instance, included more clarity of who would be part of the Awards Committee.

4.6 Cultural enablers and progress (October 2018 to February 2019)

In the sixth phase, the lean taskforce and senior management presented the results of the second Shingo Insight Assessment during the fourth masterclass. Alongside this, brief updates on CI implementation in each department were given. Minor updates on VMB audits, the alignment between ideal behaviours and corporate core values, the R&R system proposal, and the L&D system were given likewise.

4.6.1 Implementing continuous improvement systems across departments

Some progress had been achieved in departments outside of OPS. Inspired by the three improvement activity levels in OPS (see Table 4.16), all departments except for a part within SGAE had been implementing an own CI system in the meantime. Nearly each department determined sources encouraging idea generation that may feed into their improvement activities (Table 4.18).

Table 4.18 Continuous improvement system

No.	Department(s)[a]	Idea and activity generation	Improvement activity plan(s)
1	Human Resources	Corporate and local projects Daily issues and situations	Human Resources priority

No.	Department(s)[a]	Idea and activity generation	Improvement activity plan(s)
		Strategic direction	
		Survey data	
		Visual management boards	
		Voice of the Customer	
2	Operations	Brainstorming	Operations priority
		Breakdown data	
		Daily issues and situations	
		Efficiency	
		Lean initiatives	
		Strategic direction	
		Visual management boards	
		Voice of the Customer	
		Yield data	
3	Quality Assurance & Regulatory Affairs	Complaints	Corrective and preventive action plan
		Non-conformance reports	
		Visual management boards	
		Voice of the Customer	
4	Research & Development	Brainstorming	Medium-term development plan
		Lessons learnt	Project management office
		Voice of the Customer	Technical development plan

Source: Adapted from OpCo (2018)

Note(s): (a) No data for department of Finance, Information Technology, and Environment, Health & Safety, and Facilities

4.6.2 Auditing visual management: Assessment status

Between July and September 2018, several VMB audits were supposed to be carried out. This time, only 13 out of 22 audits were completed. In Table 4.19, it becomes evident that managers from both layers had not been attending their assessments regularly. Amongst the WLG members who had completed their audits, this circumstance had led to negative reactions.

> "Do other people go and review other people's boards? I would doubt it. […] People will walk past the boards." (Middle Manager 1, SGAE)

In total, four out of six senior managers, with one having two audits overdue, and seven out of 20 WLG members, with four ones having two audits overdue, did not carry out their audits. To be fair, however, the OPS director was not able to carry out his audit. As observed by the researcher, that was because the VMB to be reviewed has never been set up despite of being in the process for a while. Another senior manager was on an 18-month leave, making it essentially three out of six senior managers who have not completed their audits.

Table 4.19 Overdue assessments

No.	Level(s)		Department(s)		Auditor(s)								
	Main	*Sub*	*Main*	*Sub*	*Senior management*					*Wider leadership group*			
					EMD[a]	*OPS*	*RAQA*	*R&D[b]*	*SGAE*	*OPS*	*RAQA*	*R&D*	*SGAE*
1	•		Senior management							1*			1
2	•		Finance									2*	
3	•		Information Technology							1*		1*	
4		•	Finance	Environment, Health & Safety, and Facilities		1						1*	
5		•	Operations	Purchasing								1	
6		•	Regulatory Affairs & Quality Assurance	Production Evaluation					1*			1*	
7		•	Research & Development	Electrical Engineering	1						1		
8		•	Research & Development	Process Engineering			1						
9		•	Research & Development	Research Management					1*			1*	
	Total				*1*	*1*	*1*	*0*	*2*	*2*	*1*	*7*	*1*
	Ratio				*20%*	*20%*	*20%*	*0%*	*40%*	*18.18%*	*9.09%*	*63.64%*	*9.09%*

Source: Author

Note(s): (a) Executive Managing Director; (b) 18 months on leave; (*) individual(s) with two overdue assessments

In OPS, one middle manager had two overdue assessments. In an interview, he justified it with the following.

> "The business excellence project does not play a special role for my job. It is rather for the production." (Middle Manager 4, OPS)

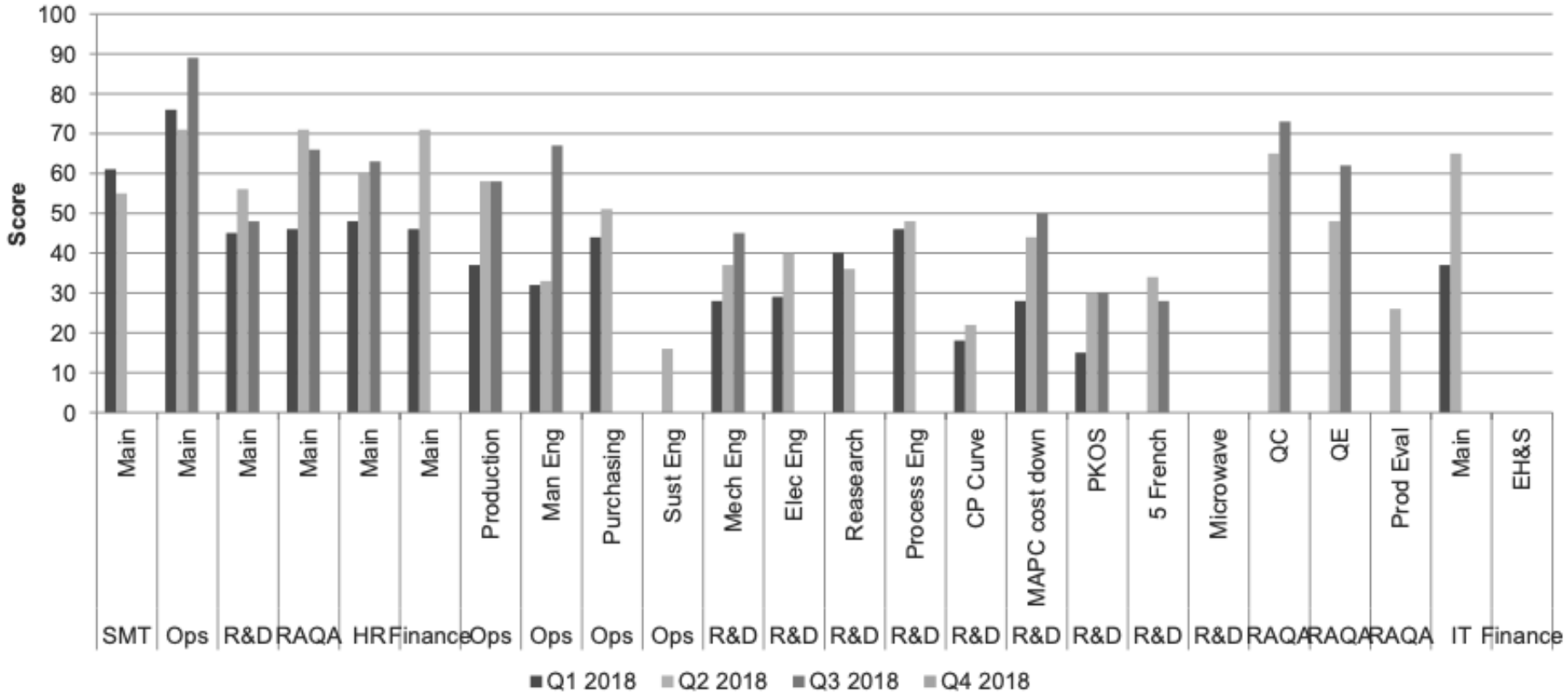
In the same way, the middle manager from SGEA, who had an overdue assessment, perceived lean to be more beneficial in departments other than his own one. He expressed the following.

> "I see advantages in other departments. […] It is more beneficial in other departments." (Middle Manager 2, SGAE)

Overall, OPS, RAQA, and SGAE had only a single WLG member with overdue assessments each, whereas R&D had already four different WLG members with seven overdue assessments in total. In eight of nine cases, though, where an assessment was overdue, either an auditee or an auditor belonged to R&D. That was because several WLG members belonging to R&D tried to escape from the audits because they felt that the VMBs associated with the audits were not suiting their work ethos.

In the 13 assessments conducted, a score of 57% was achieved on average. Indicting relatively similar results to the previous audits, Figure 4.6 shows that OPS had been leading the way in the previous quarter again. Closely linked with OPS, quality control remained the second strongest functional area. In most departments, however, a general trend towards achieving better scores was recognisable. In a few functional areas, however, VMBs had still not been set up yet.

Figure 4.6 Visual management board audits (July to September 2018)



Source: OpCo (2018)

In the whole workforce, however, a lot of criticism had been emerging over time. At the middle management and the operational level, in particular, a general rejection of the VMBs had been widely expressed. The underlying reasons for that varied indeed, but still found overlap to a certain extent. Overall, they can be categorised into (1) “audit-related”, (2) “awareness-related”, (3) “engagement-related”, (4) “KPI-related”, (5) “job nature-related”, and (6) “structural” reasons, as well as (7) “associated extra work” (Table 4.20).

Much of the feedback given by employees at the operational level confirmed that lean had not yet reached the bottom of the organisation. In most cases, it had become obvious that their understanding of lean was limited to the VMBs and often associated with time-consuming extra work. That circumstance was reinforced by the fact that several employees at the operational level who were unfamiliar with lean were made responsible to gather the data needed to keep the VMBs up-to-date.

Table 4.20 Issues associated with visual management

No.	Negative feedback and relevant comments on visual management	Management level (*f*)				*f*
		SM[a]	*MM*[b]	*FM*[c]	*NM*[d]	
I. Audit and assessment						
1	Auditors do not have an idea about the nature of the departments they audit		1			1
2	Box-ticking instead of engagement		1			1
3	Challenge to assess, to measure, and to derive actions	1	1		1	3
4	Do not add value to reviewer's work				1	1
5	No feasibility checks		1			1
6	No gemba walks (neither a manager nor a director audits)			1[20]		1
7	No standard criteria		1		1	2
8	Scores drive wrong behaviour due to a focus on good audit scores		5[21]		5[22]	10
9	Scores lead to internal competition between departments				2	2
II. Awareness and understanding						
10	Lack of mindset			1		1
11	Not sure about the value				3	3
12	Perception that employees do not know the value		1	1	1	3
13	Perception that visual management boards are not useful in identifying areas of improvement				2	2
14	Perception that some areas see the visual management boards as a reporting tool rather than a management tool		2[23]			2
15	Some employees seem to see that lean is just the visual management boards		1	1		2
16	"Wallpaper"		1	1[24]	1	3
III. Engagement						
17	Disinterest of others in own visual management board perpetuates low engagement				1[25]	1

[20] "Nobody from the managers comes and sees it [i.e., an audit is not always conducted by a manager or director]." (First-line Manager 1, RAQA)

[21] "It is driving wrong behaviours at the moment – rather going through audits than helping the business." (Middle Manager 3, SGAE); "Wrong short-term behaviour to polish the scores." (Middle Manager 3, OPS); "Some departments want their figures to look nice. For example, one department locked their office door for a while to think about how the figures can look nicer." (Middle Manager 2, SGAE); "Don't push graphs but rather tell me your customer." (Middle Manager 3, RAQA)

[22] "People are just doing it to get scores. They should not see it as a point-scoring exercise." (Associate 1, SGAE); "People are striving for the point – not the big thing." (Middle Manager 1, SGAE); "How can I fix the slide to get a better score?" (Associate 2, SGAE)

[23] "Some areas seem to just fill it out, but it is a tool to help to manage rather than a thing you have to do." (Middle Manager 3, SGAE)

[24] "A lot of people think it's filling space rather than saying what's going on." (First-line Manager 1, RAQA)

[25] "I am responsible for updating the board, but I don't see the point when nobody has a look at it." (Associate 1, OPS)

No.	Negative feedback and relevant comments on visual management	Management level (*f*)				*f*
		SM[a]	*MM*[b]	*FM*[c]	*NM*[d]	
18	Lack of involvement			1[26]	2[27]	3
19	No actions from other visual management boards received for the last three months			2[28]		2
20	No engagement with visual management boards besides audit		1			1
21	No interest is shown in the information on own visual management board		1		3	4
22	Perception that administrative departments are less proactive with the visual management boards than departments who are related to the production		1		1	2
IV. Job nature and relevance						
23	Alienation of job		1			1
24	Interest in own visual management board only				1[29]	1
25	Lack of relevance to own department and nature of department matters		2[30]		6[31]	8
V. Metrics and key performance indicators						
26	Different views of good and bad metrics				1	1
27	Lack of experience with developing metrics		1[32]		1[33]	2
28	Metrics are not feasible in all areas (difficulty to development meaningful metrics)		3[34]	1[35]	2[36]	6
29	Metrics "overkill"		1	4	5[37]	10
30	No commercial element ("bottom line")				1[38]	1

[26] "Nobody below middle management goes to the business excellence workshops and there is confusion that there is no involvement of staff level – also no communication." (First-line Manager 2, RAQA)

[27] "Managers use it but not MTMs [Manufacturing Team Members]." (Associate 2, OPS); "Mainly my manager fills the board and holds meetings to follow up business excellence tasks. I am only responsible for the data gathering." (Associate 3, SGAE)

[28] "We issue actions but don't receive any." (First-line Manager 3, RAQA)

[29] "I don't look at other boards – I look at mine." (Associate 4, SGAE)

[30] "The business excellence project does not play a special a role in my job – it is rather for production." (Middle Manager 4, OPS)

[31] "[Business excellence] means nothing to me because it has nothing to do with what we are doing." (Associate 2, RAQA); "Feels like it is more for other departments." (Information Technology Helpdesk); "It's a distraction at the engineering front – drop it!" (Associate 1, R&D)

[32] "No workshop discussed the definition process of KPIs." (Middle Manager 1, RAQA)

[33] "Some did not have KPIs on their fingertips before business excellence." (Middle Manager 1, SGAE)

[34] "R&D struggle to develop metrics centred around quality, cost and time – not same integrity." (Middle Manager 3, OPS); "How do you measure R&D outcomes? How do you measure benefits?" (Middle Manager 1, R&D)

[35] "Are all metrics meaningful? It's sometimes problematic." (First-line Manager 1, R&D)

[36] "You don't know what you don't know until you find out [research context]." (Associate 2, R&D)

[37] "They got KPI-mad." (Associate 1, SGAE)

[38] "I look at the board but don't see where we make money." (Associate 4, SGAE)

No.	Negative feedback and relevant comments on visual management	Management level (*f*)				*f*
		SM[a]	*MM*[b]	*FM*[c]	*NM*[d]	
31	No interest in the metrics at all				1	1
32	No relevance of metrics because the focus is on a project				1[39]	1
33	Non-value-adding metrics (redundant or irrelevant)		2	2	5[40]	9
34	Not all metrics hit the same goal		2[41]		1	3
35	Not always the right metrics in place		1		2	3
36	Only limited influence of other department's metrics on own department				1	1
37	Perception that some areas are more metric-driven than others		1		2	3
38	Too much focus on metrics				1	1
VI. Visualisation and technical structure						
39	Confusion about the visual management board hierarchy (main boards vs project boards)				1	1
40	Difficulty to understand other visual management boards due to information overload		1			1
41	Lack of clear and concise communication of the visual management board				1	1
42	Lack of focus (visual management board covers too much)		1[42]		2[43]	3
43	Lack of structure				1[44]	1
44	Quality of visual management boards				1	1
VII. Workload associated with visual management						
45	Perception that some areas see the visual management boards as additional work (extra workload)		1		1	2
46	Sometimes visual management board updates require data, which you have to chase from others			1		1
47	The amount of work that goes into the preparation of the visual management boards does create the value it should		1		2[45]	3
48	Time-consuming		3	1	9[46]	13
49	Too much paperwork		1	1		2

Source: Author

Note(s): (a) Senior management level; (b) middle management level; (c) first-line management level; (d) non-management level (associates)

[39] "It is not important for me on a daily basis." (Associate 2, R&D)

[40] "Is [the metric] relevant or important?" (Associate 4, RAQA)

[41] "It is not as central as it should be in the initiative." (Middle Manager 1, RAQA)

[42] "The board is over-engineered." (Middle Manager 2, SGAE)

[43] "Mish mash – not visible, but I find what I need." (Associate 2, OPS); "The board covers too many areas and should be broken down into different sections." (Associate 5, RAQA)

[44] "The company is not structured enough yet to know how to run the board." (Associate 1, RAQA)

[45] "Putting much time in but don't get out what the effort is." (Associate 6, RAQA)

[46] "It is time-constraining to put it onto the graphs. There are different sources and systems. It is a lot of effort to get the data." (Associate 5, SGAE); "When it's busy, I have no time to stand in front of it." (Associate 2, OPS); "The boards are a distraction." (Associate 4, R&D)

4.6.3 Aligning corporate core values and ideal behaviours: Update

Over the past few months, the organisation's ideal behaviours had been revised the third time to align with the corporate core values launched in June 2018 (Appendix 7). Implementing those values and their according behaviours, senior management emphasised the essential role that leaders and the wider workforce play again. It was pronounced that leaders act as role models for living these values, hold their teams accountable for living up to them, and are responsible for developing the organisational culture together with their team. At the same time, any employee, they argued, is an ambassador to amplify leaders' messages and to cherish the corporate core values and ideal behaviours in their respective area of responsibility.

Although respect is part of the set of behaviours, it had never really been an issue in the case organisation. Instead, everyone praised the familial environment, where everyone respected their colleagues. Interestingly, however, several managers reported how employees' other behaviours had been evolving. In parts, this was justified by the fact that employees were much more inclined to adhere to the standards of behaviour that *they* set *themselves*. In other words, employees had much more ownership in the ideal behaviours, although they had only changed to a minimum as compared to the set that was centrally developed. In the same way, it was much easier to challenge peers as soon as they did not adhere to the *consensually* agreed ideal behaviours because, after all, they were being owned by peers likewise. Such challenges included, for instance, delivering to agreed commitments. In the Information Technology Helpdesk, the local middle manager encouraged his team to pursue a "right-first-time" approach to reduce internal customers' waiting time until their problem is resolved. Hence, leaders played a special role in encouraging ideal behaviours likewise.

4.6.4 Proposing a new reward and recognition system: Update

Following several refinements, the proposal was mutually signed off and decided to be launched in the upcoming weeks. The previous R&R system proposal contained two types of recognition, namely, (1) day-to-day recognition and (2) monthly awards. Initial suggestions made regarding day-to-day recognition had pretty much remained; though, a small change was made in what ways managers were supposed to recognise individuals. This included a verbal "thank you" and handwritten notes extended by an e-mail and a message via instant messenger to make recognition genuine and more personal.

In contrast, a few more changes were made regarding monthly awards. First, the number of monthly awards was increased from three to five. Second, the categories on what to be recognised for were simplified and aligned with the corporate core values. Third, although

ownership upon pre-selecting five suitable candidates for the monthly awards was granted to the Our OpCo team,[47] senior management decided to reserve the right for making a final decision as opposed to the previous R&R system proposal (Appendix 8).

4.6.5 Shingo Insight Assessment #2

In July 2018, the case organisation conducted a second Shingo Insight Assessment to compare their behaviours against the guiding principles within each dimension of the Shingo model (Appendix 9). In this survey, to which the researcher had access, behaviours were measured across three hierarchical levels, namely, (1) leaders (senior management), (2) managers (individuals with subordinates), and (3) associates (individuals without subordinates). In total, 78% of the organisation participated in the survey, including temporary employees (Table 4.21).

Table 4.21 Survey details of Shingo Insight Assessment #2

No.	Management level(s)	Total # of employees	Completed surveys	
			# of employees	*% of employees*
1	Senior managers	6	7[a]	117%[a]
2	Managers	45	38	84%
3	Associates (permanent)	165	121	73%
4	Associates (temporary)	52	44	85%
	Total	*268*	*210*	*78%*

Source: Adapted from OpCo (2018)
Note(s): (a) It seems that one senior manager filled out the survey twice by mistake.

Overall, the case organisation scored 7.3 out of 10. According to the feedback by the Shingo Institute, this was a very typical score aligning with other organisations that had been using this benchmark instrument before. Taking "cultural enablers" into account, they concern the employee-focused dimension (soft lean practices) within the Shingo model and performed worst (Table 4.22).

Table 4.22 Shingo Insight Assessment #2 results per dimension

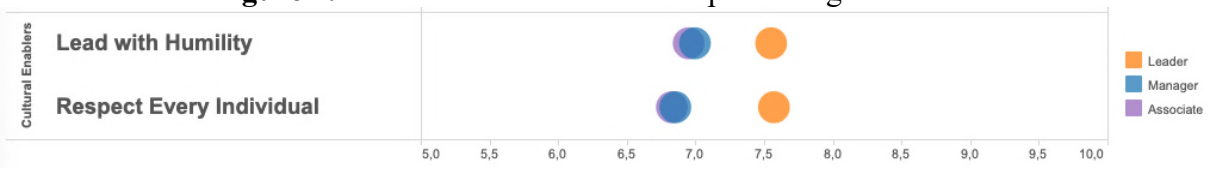
No.	Dimension(s)	Score(s) out of 10
1	Results	7.4
2	Enterprise alignment	7.6
3	Continuous improvement	7.3
4	Cultural enablers	7.0
	Average	*7.3*

Source: Adapted from Shingo Institute (2018)

[47] The Our OpCo team is a group of volunteers that organises social company events (e.g., Christmas parties).

In the Shingo model, they comprise two principles, namely, (1) “lead with humility” and (2) “respect every individual” (Appendix 10). Indeed, conducting the survey showed senior management that there was a necessity to improve on soft lean practices; at the same time, however, its results revealed that senior management perceived cultural enablers as being much more present and positively embedded in the organisation than managers and staff whose score overlap (Figure 4.7).

Figure 4.7 Scores of cultural enablers per management level



Source: Shingo Institute (2018)

In Table 4.23, a more detailed view of each element of the cultural enablers is provided per department. Notably, 66.5% of the participants were from OPS, of which 46.31% belonged to production. As the site’s biggest department by far, the survey data were therefore significantly influenced by prevalent circumstances in OPS’ functional areas. In fact, eleven out of 14 scores relating to cultural enablers within the production area were below the organisational average despite of a range of positive survey responses from temporary employees. Equally, the scores rubbed off on the overall results of OPS and the organisation as a whole.

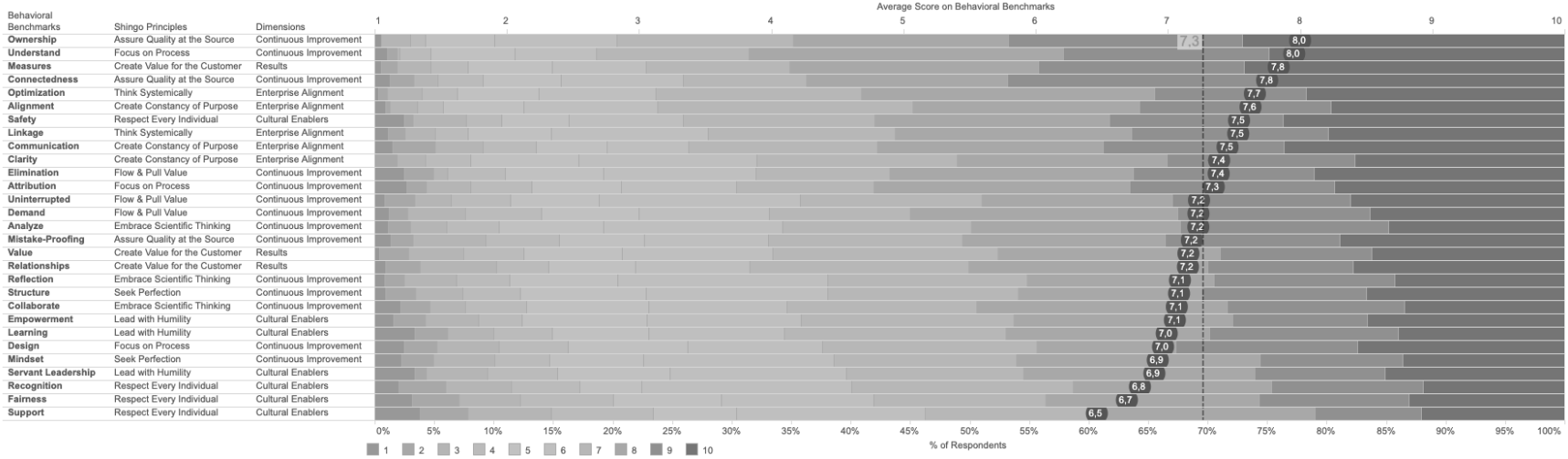
Table 4.23 Detailed view of cultural enablers

No.	Sample(s)			"Lead with humility"						"Respect every individual"								Ratio
	Department(s) and sub-department(s)	*n*[a]		*Empowerment*		*Learning*		*Servant leadership*		*Fairness*		*Recognition*		*Safety*		*Support*		
		M	*A*	*M*	*A*	*M*	*A*	*M*	*A*	*M*	*A*	*M*	*A*	*M*	*A*	*M*	*A*	
1	*Finance, Information Technology, and Environment, Health & Safety, and Facilities*	*3*	*7*	*8.0*	*6.8**	*8.2*	*7.3*	*7.4*	*7.2*	*5.9**	*6.5**	*7.3*	*7.0*	*6.7**	*7.1**	*6.2**	*6.2**	*4.93%*
1.1	Finance[b]	2	4	6.7*	6.6*	7.7	7.1	6.0*	7.0	4.5*	6.2*	6.3*	6.3*	5.0*	7.0*	5.0*	6.3*	2.96%
1.2	Information Technology	1	3	10.0	7.2	9.3	7.7	9.5	7.5	8.7	6.9	9.5	8.2	10.0	7.3*	8.5	6.2*	1.97%
2	*Human Resources*	*0*	*2*	–	*6.3**	–	*9.0*	–	*8.0*	–	*5.3**	–	*8.0*	–	*8.5*	–	*10.0*	*0.99%*
2.1	Human Resources	0	2	–	6.3*	–	9.0	–	8.0	–	5.3*	–	8.0	–	8.5	–	10.0	0.99%
3	*Operations*	*23*	*112*	*6.9**	*7.1*	*6.8**	*6.6**	*6.8*	*6.8**	*6.6**	*6.6**	*6.7**	*6.6**	*7.7*	*7.4**	*6.0**	*6.4**	*66.5%*
3.1	Manufacturing Engineering[c]	4	13	7.3	7.8	7.4	7.8	8.3	6.7*	6.7	7.4	6.6*	7.6	8.0	8.0	7.3	6.8	8.37%
3.2	Production[d]	8	86	7.1	6.9*	6.5*	6.3*	6.4*	6.7*	6.7	6.5*	6.7*	6.4*	7.8	7.2*	4.8*	6.3*	46.31%
3.3	Production Management and Production Support	2	4	6.8*	8.2	7.7	7.3	7.8	7.1	7.3	6.2*	7.8	7.3	7.5*	8.5	7.3	8.2	2.96%
3.4	Purchasing	1	3	8.0	4.6*	7.0	5.3*	6.0*	4.5*	6.3*	4.9*	7.0	5.3*	7.0*	5.3*	6.5	5.3*	1.97%
3.5	Stores and Dispatch	6	4	5.8*	8.6	5.9*	8.0	5.7*	8.3	6.3*	8.2	5.9*	7.8	7.3*	8.8	5.3*	6.9	4.93%
3.6	Sustaining Engineering	2	2	8.5	8.0	8.0	8.0	8.0	8.0	6.7	8.2	8.5	9.5	8.3	9.0	9.0	8.0	1.97%
4	*Regulatory Affairs & Quality Assurance*	*4*	*21*	*8.4*	*6.8**	*8.6*	*7.5*	*7.9*	*7.4*	*7.2*	*6.7*	*8.0*	*7.0*	*9.1*	*8.2*	*7.9*	*6.9*	*12.32%*
4.1	Product Evaluation	0	7	–	7.2	–	8.2	–	8.2	–	7.2	–	8.1	–	8.5	–	8.4	3.45%
4.2	Quality Engineering	1	4	9.0	6.6*	9.0	7.0	8.0	6.7*	6.0*	7.4	7.0	6.9	8.5	7.4*	9.0	6.6	2.46%
4.3	Quality Systems[e]	3	5	8.2	5.5*	8.4	6.8*	7.8	5.7*	7.6	5.1*	8.3	5.4*	9.3	7.5	7.5	5.1*	3.94%
4.4	Quality Systems[f]	0	5	–	7.8	–	7.9	–	8.6	–	7.5	–	7.6	–	9.0	–	7.0	2.46%
5	*Research & Development*	*8*	*23*	*6.6**	*7.2*	*6.6**	*7.6*	*6.1**	*6.8**	*6.9*	*6.8*	*6.6**	*6.6**	*6.9**	*7.6*	*6.6*	*6.2**	*15.27%*
5.1	R&D[g]	5	16	6.5*	7.2	6.3*	8.0	6.3*	7.2	6.7	7.4	6.9	7.2	7.7	8.1	6.4	6.8	10.34%
5.2	R&D Process Engineering[h]	3	5	6.8*	7.1	7.1	6.3*	5.8*	5.8*	7.2	5.2*	6.2*	5.1*	5.7*	6.0*	7.0	3.8*	3.94%
5.3	R&D Project Management and Innovation	0	2	–	7.5	–	7.5	–	6.5*	–	6.5*	–	6.0	–	8.5	–	7.8	0.99
	Average	*38*	*165*	*7.1*	*7.0*	*7.1*	*6.9*	*6.8*	*6.9*	*6.7*	*6.7*	*6.9*	*6.7*	*7.6*	*7.5*	*6.3*	*6.5*	*100%*

Source: Author

Note(s): (a) In departmental data, senior management were excluded; (b) includes Environment, Health & Safety, and Facilities; (c) includes engineers, technicians, engineering team members, admin, and apprentices; (d) includes team members and team leaders; (e) includes Document Control, Quality Systems Engineering, and Regulatory Affairs; (f) includes inspectors, technicians, and team leaders; (g) includes Mechanical Engineering and Electronics & Software Development; (h) includes toolroom; (*) scores below the organisational average

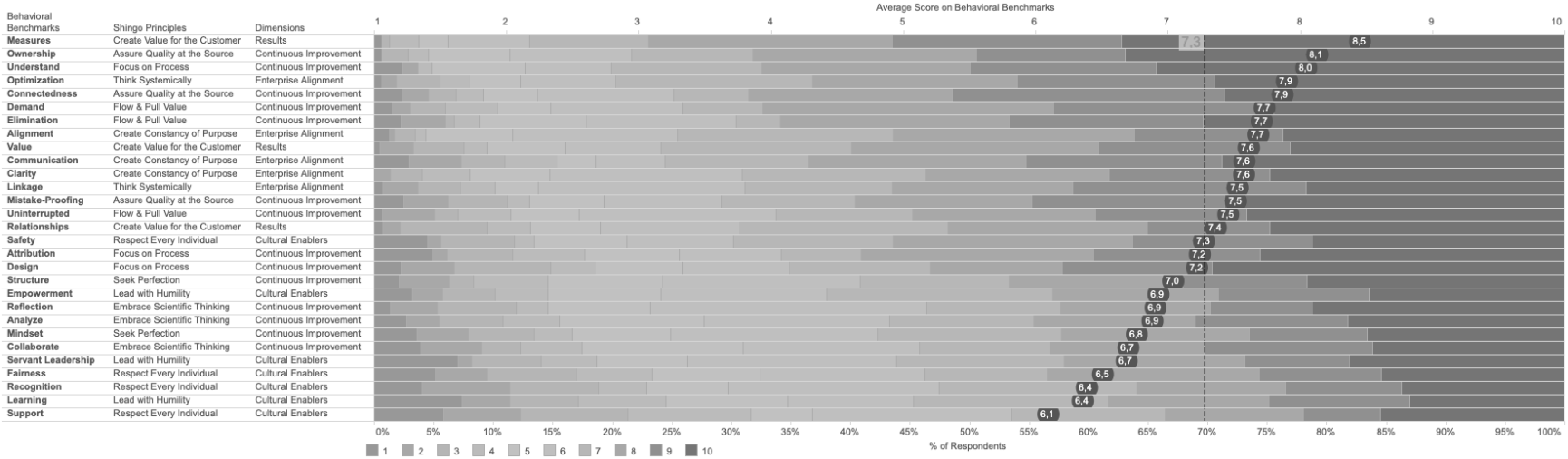
Figure 4.8 Behavioural benchmarks organisation-wide



Behavioral Benchmarks	Shingo Principles	Dimensions	Average Score
Ownership	Assure Quality at the Source	Continuous Improvement	8,0
Understand	Focus on Process	Continuous Improvement	8,0
Measures	Create Value for the Customer	Results	7,8
Connectedness	Assure Quality at the Source	Continuous Improvement	7,8
Optimization	Think Systemically	Enterprise Alignment	7,7
Alignment	Create Constancy of Purpose	Enterprise Alignment	7,6
Safety	Respect Every Individual	Cultural Enablers	7,5
Linkage	Think Systemically	Enterprise Alignment	7,5
Communication	Create Constancy of Purpose	Enterprise Alignment	7,5
Clarity	Create Constancy of Purpose	Enterprise Alignment	7,4
Elimination	Flow & Pull Value	Continuous Improvement	7,4
Attribution	Focus on Process	Continuous Improvement	7,3
Uninterrupted	Flow & Pull Value	Continuous Improvement	7,2
Demand	Flow & Pull Value	Continuous Improvement	7,2
Analyze	Embrace Scientific Thinking	Continuous Improvement	7,2
Mistake-Proofing	Assure Quality at the Source	Continuous Improvement	7,2
Value	Create Value for the Customer	Results	7,2
Relationships	Create Value for the Customer	Results	7,2
Reflection	Embrace Scientific Thinking	Continuous Improvement	7,1
Structure	Seek Perfection	Continuous Improvement	7,1
Collaborate	Embrace Scientific Thinking	Continuous Improvement	7,1
Empowerment	Lead with Humility	Cultural Enablers	7,1
Learning	Lead with Humility	Cultural Enablers	7,0
Design	Focus on Process	Continuous Improvement	7,0
Mindset	Seek Perfection	Continuous Improvement	6,9
Servant Leadership	Lead with Humility	Cultural Enablers	6,9
Recognition	Respect Every Individual	Cultural Enablers	6,8
Fairness	Respect Every Individual	Cultural Enablers	6,7
Support	Respect Every Individual	Cultural Enablers	6,5

Source: Shingo Institute (2018)

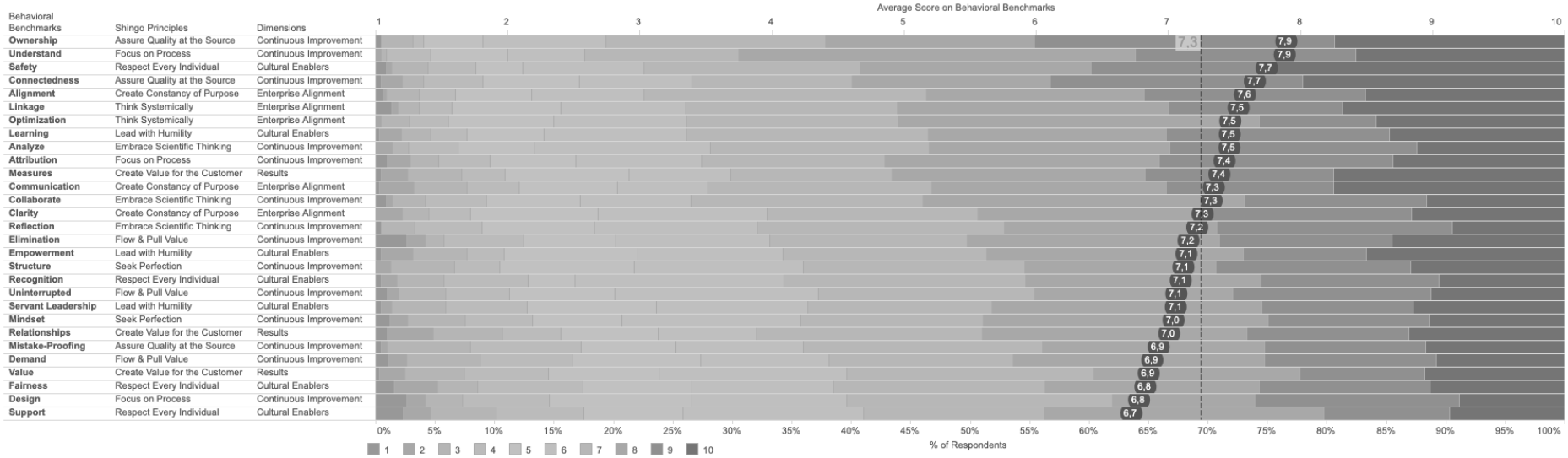
Figure 4.9 Behavioural benchmarks in production



Behavioral Benchmarks	Shingo Principles	Dimensions	Average Score
Measures	Create Value for the Customer	Results	8,5
Ownership	Assure Quality at the Source	Continuous Improvement	8,1
Understand	Focus on Process	Continuous Improvement	8,0
Optimization	Think Systemically	Enterprise Alignment	7,9
Connectedness	Assure Quality at the Source	Continuous Improvement	7,9
Demand	Flow & Pull Value	Continuous Improvement	7,7
Elimination	Flow & Pull Value	Continuous Improvement	7,7
Alignment	Create Constancy of Purpose	Enterprise Alignment	7,7
Value	Create Value for the Customer	Results	7,6
Communication	Create Constancy of Purpose	Enterprise Alignment	7,6
Clarity	Create Constancy of Purpose	Enterprise Alignment	7,6
Linkage	Think Systemically	Enterprise Alignment	7,5
Mistake-Proofing	Assure Quality at the Source	Continuous Improvement	7,5
Uninterrupted	Flow & Pull Value	Continuous Improvement	7,5
Relationships	Create Value for the Customer	Results	7,4
Safety	Respect Every Individual	Cultural Enablers	7,3
Attribution	Focus on Process	Continuous Improvement	7,2
Design	Focus on Process	Continuous Improvement	7,2
Structure	Seek Perfection	Continuous Improvement	7,0
Empowerment	Lead with Humility	Cultural Enablers	6,9
Reflection	Embrace Scientific Thinking	Continuous Improvement	6,9
Analyze	Embrace Scientific Thinking	Continuous Improvement	6,9
Mindset	Seek Perfection	Continuous Improvement	6,8
Collaborate	Embrace Scientific Thinking	Continuous Improvement	6,7
Servant Leadership	Lead with Humility	Cultural Enablers	6,7
Fairness	Respect Every Individual	Cultural Enablers	6,5
Recognition	Respect Every Individual	Cultural Enablers	6,4
Learning	Lead with Humility	Cultural Enablers	6,4
Support	Respect Every Individual	Cultural Enablers	6,1

Source: Shingo Institute (2018)

Figure 4.10 Behavioural benchmarks excluding production



Behavioral Benchmarks	Shingo Principles	Dimensions
Ownership	Assure Quality at the Source	Continuous Improvement
Understand	Focus on Process	Continuous Improvement
Safety	Respect Every Individual	Cultural Enablers
Connectedness	Assure Quality at the Source	Continuous Improvement
Alignment	Create Constancy of Purpose	Enterprise Alignment
Linkage	Think Systemically	Enterprise Alignment
Optimization	Think Systemically	Enterprise Alignment
Learning	Lead with Humility	Cultural Enablers
Analyze	Embrace Scientific Thinking	Continuous Improvement
Attribution	Focus on Process	Continuous Improvement
Measures	Create Value for the Customer	Results
Communication	Create Constancy of Purpose	Enterprise Alignment
Collaborate	Embrace Scientific Thinking	Continuous Improvement
Clarity	Create Constancy of Purpose	Enterprise Alignment
Reflection	Embrace Scientific Thinking	Continuous Improvement
Elimination	Flow & Pull Value	Continuous Improvement
Empowerment	Lead with Humility	Cultural Enablers
Structure	Seek Perfection	Continuous Improvement
Recognition	Respect Every Individual	Cultural Enablers
Uninterrupted	Flow & Pull Value	Continuous Improvement
Servant Leadership	Lead with Humility	Cultural Enablers
Mindset	Seek Perfection	Continuous Improvement
Relationships	Create Value for the Customer	Results
Mistake-Proofing	Assure Quality at the Source	Continuous Improvement
Demand	Flow & Pull Value	Continuous Improvement
Value	Create Value for the Customer	Results
Fairness	Respect Every Individual	Cultural Enablers
Design	Focus on Process	Continuous Improvement
Support	Respect Every Individual	Cultural Enablers

Source: Shingo Institute (2018)

In Figures 4.8, 4.9, and 4.10, the strong influence of the production area becomes even more obvious. Indeed, cultural enablers were the weakest principle throughout the organisation (Figure 4.8) and in production itself (Figure 4.9). Considering the results to the exclusion of production, however, a new picture emerges. As soon as the production area becomes isolated from the survey results, cultural enablers remain weak indeed, but not as weak as in the overall scores. At the same time, there was some further evidence that CI seemed to be embedded deeper in production (Figure 4.10).

In their feedback report, the Shingo Institute argued that low scores around cultural enablers relate to issues around training and development or fairness and recognition. They further pointed towards many participants who preferred to avoid divulging their age or gender (Appendix 11). Although the Shingo Institute explained this circumstance with trust issues, senior management argued that this could have also been due to smaller populations in some departments where respondents could have felt that they can be traced back. In fact, individuals divulging their age and/or gender gave lower scores than individuals who provided this information.

Investigating the qualitative element of the survey confirms many points that the Shingo Institute raised (Appendix 12). In fact, organisational members across all hierarchical levels felt that there was a potential for optimisation when it comes to training and personal development. Likewise, much of the feedback given at the associate level led to believe that permanent employees were better off compared with temporary ones, yet average scores given by temporary employees were significantly more positive in nearly all areas than the ones from permanent employees. Both the Shingo Institute and senior management interpreted this circumstance as temporary employees seeking permanent employment. Another reason a senior manager thought of was whether temporary workers are used to tougher work environments and appreciate the way of working at the case organisation more than a permanent employee who has never experienced working in another environment.

Other themes worth mentioning concerned resource issues. More precisely, employees at all levels of the organisation expressed difficulty in delivering on time. Furthermore, many employees believed that potential synergies in the organisation had not been realised yet, such as a closer collaboration between different departments. In terms of pay and benefits, it became apparent that employees at the associate level preferred to see pay rises and more flexible work hours. Similarly, the desire to include all employees in the bonus scheme was expressed. At the associate level, being listened to and having more input in change was of interest likewise.

4.6.6 Improving on cultural enablers

In response to such dissatisfying scores, senior management decided to go into more detail and had a look at the lowest scoring survey items to enable counteraction. In doing so, five out of six survey items concerned cultural enablers relating to (1) learning, (2) fairness, and (3) support (Appendix 13). Induced by that, senior management and the WLG developed a set of countermeasures, which had either been already started or which had been in the pipeline at that time (Appendix 14).

In an interview, a senior manager referred to a few key points he and other senior managers considered as promising to counteract the cultural enablers scores, some of which had simply not been implemented at this time. With the expectation to show significant changes in a new future survey, these included (1) a site-wide bonus, (2) the revised R&R system, (3) the new "thank you" culture, and (4) L&D opportunities. Apart from that, a fifth point concerned a decision being made to review the salary structure of permanent employees within the manufacturing areas. That was because a considerable number of operators had been working at the case organisation for several years, receiving non-capped pay rises every single year up to the point where differences of approximately £8,000 where not unusual as opposed to other operators doing the same job while the average pay was around £19,000.

> "To engage people, you need fairness. We had people sitting next to each other, doing the same job who were earning about £8,000 difference, bearing in mind, they earn about £19,000. Somebody was up on £20,000-something and somebody was on £17,000. And if I want to engage my guys in being part of the company, having that discrepancy doesn't help. If we are a good organisation and we value our people, then we will pay people the right amount for the job they do." (Middle Manager 1, OPS)

In April 2019, the salary band in production was narrowed based on the national living wage and pay rates of comparable jobs in the local industry. As changes took effect, about 85% of the operators were either brought up or stayed where they were while the salaries of the remainder 15% were cut down. Of these 15%, many did not accept the pay cut and decided to leave the organisation.

4.6.7 Learning & Development: Update

In the previous quarter, the HR department had been elaborating a comprehensive L&D roadmap with milestones from 2017-18 to 2020-21. The three focus areas concerned (1) leadership development, (2) talent management, and (3) development and performance

(Appendix 15). First, to drive leadership development, the intention was to engage leaders in skill-enhancing programmes so that they will become coaches in the future. Second, talent management referred to a competency framework to be used in all functional areas to develop and retain employees in business-critical roles. Third, development and performance concerned the establishment of organisation-wide PDRs to review each employee's job performance and to identify training and development needs driven by business requirements.

4.7 Leader standard work (1) and progress (February 2019 to June 2019)

4.7.1 Improving on leadership

Several leaders within the management community recognised positive behaviours and had begun to introduce regular team meetings, 1-to-1s, and PDRs. In the seventh phase, the focus was set on LSW with the aim of institutionalising and strengthening such leadership practices. Apart from that, the policy deployment matrix received an update and progress on improving cultural enablers was reviewed.

4.7.2 Policy deployment ("hoshin kanri"): Update

During the fifth masterclass, senior management informed the WLG about an updated policy deployment matrix to be launching soon. The breakthrough objectives ("hoshins") defined by senior management remained the same as in the previous year, whereas the annual objectives received an update. To develop these annual objectives, however, senior management encouraged the WLG this time to make proposals for new annual improvement priorities. While this was a new procedure with the aim of increasing the WLG's involvement and ownership in the site's strategy as opposed to before, WLG members outside of OPS had still the feeling that they were insufficiently involved. That is because they were only given a few minutes to develop improvement ideas as part of a small masterclass exercise.

> "We had 15 minutes to come up with those improvement ideas – that was it. […] This year, […] the middle management [were] asked to define the improvement objectives […] for this financial year. Like I said, we had 15 minutes to do that in a meeting and we weren't given any advance notice. […] That was it. It was 15 minutes to work on it." (Middle Manager 1, R&D)

In OPS, however, no concerns had been raised. Instead, middle managers reported how the OPS strategy, which they had been developing over the years and which they had been working towards, fed into the policy deployment matrix. Over the year, the OPS director kept his middle managers extensively involved in strategic discussions. Therefore, his middle managers

perceived to be much more involved. This time, even employees down to the supervisory level on the shopfloor had been included in his communication on strategic planning. In doing so, he aimed at mitigating the risk of a perceived lack of involvement despite the fact that the parent organisation had imposed several annual improvements.

4.7.3 Auditing visual management: Assessment criteria update

The management community's low participation in VMB audits prompted two WLG members to challenge their peers about how they would determine whether CI was operating effectively. Answering their rhetoric question, they emphasised the need for LSW and gemba walks.

> "Leaders with sub-boards should be regularly visiting these boards to ensure the process is working and is understood. In other words, go and look, ask, and find out. In the world of Shingo, this is leader standard work and gemba." (Middle Manager 1, OPS)

In retrospect, the figures in the previous masterclass indicated indeed that the audit process was not functioning, as initially expected by senior management and the lean taskforce. The decreasing participation in the audits had even led to some frustration at the senior management level and raised the question of whether the WLG would like to keep carrying on with the assessments or whether they would like to drop them. In an open discussion, a mutual decision was made to keep the audits but to drop the scores. That is because the scores were not driving the behaviours as anticipated but wrong ones instead.

> "I think the intention was right, but we then introduced an audit for the boards, and you have to go around and assess other people's boards, and it became much more of a, 'I have to get a good score on the audit,' rather than the boards adding value to what we do in the workplace. So, again, we've ditched the audit because it just drove the wrong behaviours." (Middle Manager 1, R&D)

Instead, audits were merely perceived as an annoying "tick-box exercise" with the aim to score sufficiently enough while business priorities had become secondary. In other situations, some kind of competition had even been emerging between different functional areas.

> "They took away the scoring system from the auditing. [That] made a massive difference because […] chasing the highest audit score went on between departments. I think that there were people who were ignoring business priorities, because it had an impact on the metrics that went on their business excellence board. And I hope that that's not happening anymore. […] You know, it's more about the cultures and the behaviours rather than the business board." (Middle Manager 5, OPS)

In line with the desire to run the VMBs more effectively, the way how to audit the VMBs had to be revamped. In this regard, a new approach based on LSW principles had been developed in the last couple of months and was proposed as part of this masterclass on LSW.

> "The leader standard work behind that then is where the management team […] are going to actually act to support the process and encourage the process rather than auditing the process." (Associate 3, OPS)

In doing so, the scores had been rejected whereas line managers were held accountable for monitoring and supervising the VMBs in their areas of responsibility from now on (Appendix 16). More precisely, line managers were made responsible for ensuring that their VMBs adhere to the core structure and that they contain all relevant data. A standardised question catalogue had been developed to encourage a discussion in front of the VMBs. It also ensured that no criteria were missed out so that auditees were equally challenged. In several interviews with WLG members, it had become obvious that the most important part involved to know who the internal or external customers are and whether they were performing towards their needs.

4.7.4 Management by objectives: Including non-operating staff

In the Shingo Insight Assessment #2, many staff expressed the desire to be considered in a bonus scheme (see Appendix 12). Associated with this employee feedback, senior management decided to include non-operating staff to their "MBO" (management by objectives) scheme after consultation with the WLG (Table 4.24).

Table 4.24 Bonus schemes

No.	Criteria	"Management by objectives"	"Bonus"
1	Target group(s)	"White-collar" employees	"Blue-collar" employees
2	Management level(s)	Senior management Middle management Lower management Non-operating staff (non-managerial staff excluding operators)	Operators (including agency staff)
3	Measurement level(s)	Individual performance	Organisational performance
4	Assessment basis	Annual targets (e.g., project closures)	Operational performance (e.g., turnover and profit)
5	Incentive(s)	Performance-dependent pay	Discretionary bonus (fix pay)

Source: Author

Including agency staff, a decision was made to keep the "one-off" bonus each year based on the organisational performance only for operators.

> "Somebody like me has a bonus based on individual targets. […] If I do that well enough, I will get a bonus regardless of how bad the company has done whereas, at the [operator] level and that hourly paid staff across the business, their bonus is based on the company achievement, really. Because if you're sitting on the line, bolting things together for 40 hours a week, you really haven't got time to go off and do a project but you're doing your part to support the business, right?" (Middle Manager 2, OPS)

In practice, however, some flaws regarding the new bonus scheme were immediately expected, including a lack of transparency and varying performance levels amongst operators.

> "I think they would like to know they're going to get a bonus. So, if the company makes £45 million profit this year, they will get £1,000. If we make £50 million profit, they will get £1,200. I think they would like to see something structured and tiered like that. […] And I think that's some of the problem with trying to give them individual goals as well. You may work harder than somebody else all year and then end up with the same money or no money, depending on what's happening. It's difficult." (Middle Manager 2, OPS)

In addition, senior management anchored core values and ideal behaviours in employees' annual targets so that their demonstration was more relevant for everyone. According to different reports, they made up between 10% and 40% of the annual bonus. Towards the end of the financial year, middle managers would determine during a PDR whether or not an employee will be granted the bonus.

4.7.5 Improving on cultural enablers: Update

Given the WLG's feedback, both senior management and the WLG reviewed the progress of the improvement activities again, attempting to counteract the low scores from the second Shingo Insight Assessment. In most cases, improvement activities had either already been in place or under development. In fact, a feedback survey conducted during a townhall meeting in which all employees participated, proved that some of the improvements had a positive impact on the morale at the staff level within the wider organisation (Appendix 17).

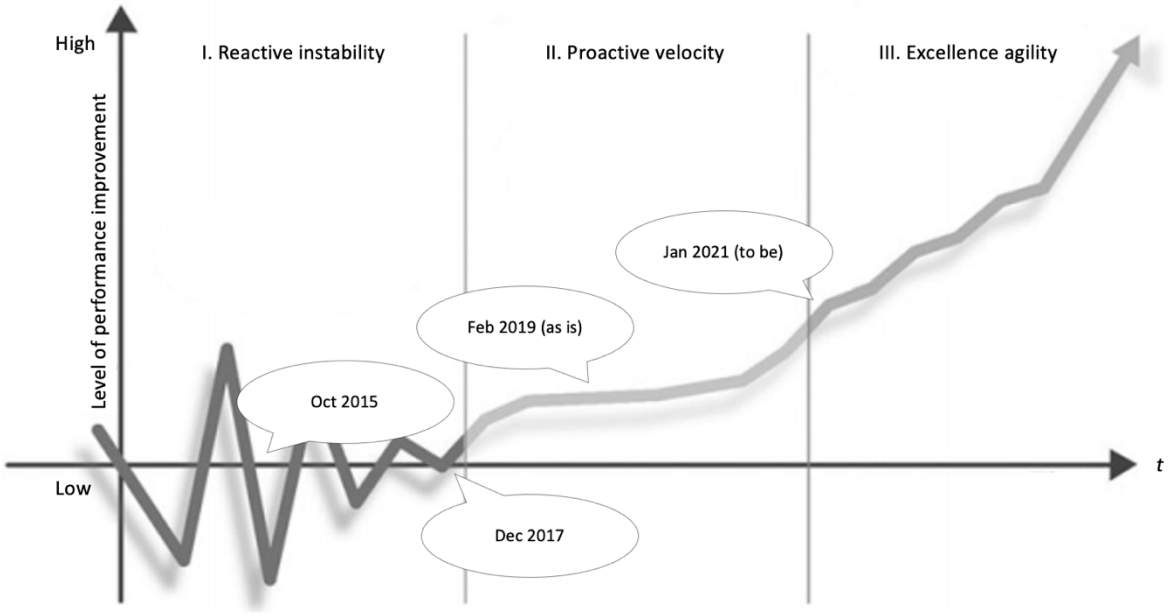
Some of the key changes included the following. First, personal development programmes, including the INFLUENCE programme for the management community and the ABC programme for process and quality engineers, were well perceived. Initiatives around developing coaching skills had also been in place. However, they were effective in pockets only. Further HR matters, such as career development plans, wellbeing initiatives, and workplace optimisations, had also been initiated but had shown no or moderate effects until

then. Second, the new ways of communication between senior management and the rest of the organisation were welcomed and appreciated. Third, improving the recognition culture had only been working in some departments until then, while the new recognition system replacing the existing one had not been implemented yet. Fourth, in the past, better UK surgeon access was desired to gain more awareness about the VoC. Improving on this, however, had not been actioned so far. Fifth, more visibility from senior management was desired. Improvement plans, however, were still to be confirmed at that point of time. Overall, many of the improvements had already been initiated and actioned; their effects varied and ranged from no effects at all over limited effects to positive effects (see Appendix 14).

4.7.6 Measuring lean maturity: Annual progress review

In early 2019, the organisation conducted another lean maturity assessment. In doing so, feedback from the entire management community was sought once again to mutually classify the case organisation's lean maturity level. In comparison to previous annual progress reviews, senior management and the WLG found their lean implementation to be matured to "proactive velocity" (Figure 4.11).

Figure 4.11 Journey towards excellence agility (February 2019)



Source: Adapted from Hines *et al.* (2020)

4.7.6.1 Scorecard

According to the lean maturity scorecard, progress was achieved in almost each single area to be scored. Only the "process" dimension, considering aspects related to (1) order creation, (2)

product lifecycle management, (3) order fulfilment, (4) asset lifecycle management, and (5) supply chain integration, was perceived as being stagnating (Table 4.25).

Table 4.25 Lean maturity scorecard (February 2019)

No.	Principle(s)	Ideal	October 2015	December 2017	February 2019	January 2021 target
1	Purpose	3	0.75	1.03	1.47	2
2	Engage	3	0.67	1.01	1.17	2
3	People	3	0.69	0.91	1.56	2
4	Improve	3	0.50	0.81	1.16	2
5	Process	3	0.80	1.06	1.06	2
6	Align	3	0.58	1.18	1.42	2
	Total	*3*	*0.66*	*1.00*	*1.30*	*2*

Source: Adapted from OpCo (2017)

4.7.6.2 Best-practice review

In the qualitative element of the lean maturity scorecard, the WLG identified various opportunities to improve. In this gap analysis, best practices and opportunities were identified for all the other areas likewise (see Appendix 6).

Reviewing the improvement opportunities, it becomes evident that the case organisation made many positive experiences with conducting VoC exercises and managing stakeholders. The VoC exercises, for instance, did not only create much more awareness of different customers' needs within each functional area, but also increased the understanding of other departments' responsibilities. This, in turn, led to more informed and educated comments about departments outside the own one. Individuals' perceptions of the HR department, for instance, had changed fundamentally, as reported by a senior manager (Table 4.26).

Table 4.26 Awareness evolvement of human resource department's responsibilities

Year(s)	Perception(s) of human resource department's responsibilities
2016	Recruitment
	Travel booking
2017	Recruitment
	Some travel booking
	Ad-hoc advice
2018	Recruitment
	L&D
	Employee wellbeing
	A bit of travel booking
	Ad-hoc advice

Source: Author

Measures to improve cultural enablers, such as better communication and training programmes, had also been welcomed by the WLG and shown first successes, although their overall

effectiveness had still to be observed more closely in the upcoming months. Despite some positive changes, prevailing conditions, such as a high inventory, slow-moving stock, persistent barriers between departments, and a limited CI engagement, indicated that lean had not been sufficiently embedded yet. At the same time, a lack of external customer alignment and supplier relationship management provided evidence that an integration of lean principles along the entire values stream was limited likewise.

4.8 Leader standard work (2) and progress (June 2019 to October 2019)

In the eighth phase, senior management encouraged a discussion about the WLG's leadership behaviours accompanied by several sub-topics, including progress in a few key activities derived from their townhall meeting (i.e., access to surgeons, cross-functional activities, and recognition) and an update on the VMBs.

4.8.1 Improving on leadership: Update

Several insights had recently evidenced some potential for optimising how leadership was practiced. They particularly suggested a need to improve the demonstration of core value and ideal behaviours by leaders (Table 4.27). That is, some leaders at both the senior and middle management level did not fully adhere to the core values and ideal behaviours. On an everyday basis, for instance, this was characterised by breaking agreed commitments or a lack of communication and recognition. Motivated by this, senior management accentuated the strong influence that the WLG has on everyone again, underlined how important they are to conduce change in the organisation, and asked them to adhere more closely to the corporate values in the future while reflecting upon their behaviour.

Table 4.27 Insights on leadership

No.	Criteria	"Shingo Insight Assessment" #2	"Global Corporate Values" survey	"INFLUENCE" programme
1	Date(s)	July 2018	February 2019	Between October 2018 and March 2019
2	Owner(s)	Shingo Institute	Corporate	Learning & Development Business Partner
3	Type(s)	"On-demand" survey	Annual survey	Direct-report feedback
4	Scope(s)	Site-wide	Organisation-wide	On-site leaders
5	Sample(s)	209 on-site employees, including temporary workforce	Approximately 190 on-site employees, including temporary workforce	Senior management Wider leadership group First-line management High potentials
6	Insight(s)	Performance gap in cultural enablers Leadership gaps present Insufficient demonstration of core values and ideal behaviours by leaders	Leadership gaps present Insufficient demonstration of core values and ideal behaviours by leaders	Leadership gaps present Insufficient demonstration of core values and ideal behaviours by leaders

Source: Author

4.8.2 Key activities follow-up

In January 2019, senior management held a townhall meeting, including all members of the local plant. In this meeting, feedback on limited access to surgeons and issues around cross-functional relationships and recognition had been emerging while WLG members were tasked with thinking of solutions at that time, which were followed up in this masterclass.

4.8.2.1 Voice of the Customer: Accessing surgeons

In practice, it always appeared challenging to interact with customers (i.e., surgeons who ultimately use their medical devices) and other project stakeholders, such as sales, to maximise effectiveness. To improve and strengthen such relationships, a working group had been developing an action plan to exploit opportunities to get a better idea of how surgeons experience their products and their customer needs. In doing so, activities planned for the following year included, for instance, regular meetings with key stakeholders, better links to area sales managers, user-centred workshops, and participation in medical conferences and scientific congresses.

4.8.2.2 Breaking down silos: Improving cross-functional relationships

In the same way, the opportunity was taken to follow up on an internal issue of perceived barriers between departments and a general "them-and-us" attitude, which seemed to be particularly present between OPS and engineering. For instance, this clear divide was simply characterised by the fact that neither everyone was fully aware of another department's responsibilities; nor did anyone even really know (many) employees working outside their departments likewise. Not much interaction had been taking place unless it was the end of the financial year when collaboration was necessary to meet individual targets. Over time, both production and engineering had even been developing an attitude in which they mutually perceived that "the other department thinks they are superior to us".

Paradoxically, however, a desire to collaborate and to improve on cross-functional relationships was noticeable on either side at the same time. That is because each department knew that they could benefit from each other's expertise in somehow.

> "There is also strong interest to work together and learn from each other and on the occasions multi-function groups converge. It generates open forums with good, interesting discussions."

Since the launch of several leadership development programmes (i.e., business excellence masterclasses, the Corporate Leadership Academy, and the INFLUENCE programme),

managers from different departments had, in fact, come more closely together and got to know each other better. Now, it was necessary, however, to take advantage of this and to achieve this cross-functional connection organisation-wide and at the levels below likewise.

In response, a working group elaborated an action plan on how bridges could be built between functional areas. In this action plan, suggestions included, for instance, (1) to run a series of "clipboard talks" (department demos) in which departments introduce each other to raise awareness of what certain areas do day to day, (2) to have more cross-functional (project) teams where appropriate, (3) to have more physical presence in other departments, (4) to run project-event days in which new technologies or achievements of critical milestones are introduced and celebrated together, and (5) to widen the scope of employee inductions.

While all these countermeasures aimed at bringing people from different functional areas closer together, the role of leadership to drive and foster interdepartmental relationships was underlined.

> "What we think, do, and say has a dominant effect on the behaviour of our teams. [We] need to recognise we are key enablers and facilitators to our departments. […] What we fail to do will likewise have a signification negative impact. We all have a responsibility to foster active interdepartmental relationships."

4.8.2.3 Reward and recognition system: Post-launch review

It was evident from the VMBs that the new R&R system was being used by a large number of staff. Following the approval and subsequent launch of the new R&R system, initial feedback upon its effectiveness was sought. As such, some flaws remained. In the following, some critical comments are consolidated (Table 4.28).

Table 4.28 Critical feedback on new reward and recognition system

No.	Theme(s)	Relevant quote(s) as they appear	*f*
1	Non-transparency and invisibility	"Lack of visibility – there is no way of knowing who has been nominated. I may only find out if someone in my team has been put forward when I read the team brief." "Recipients of any recognition only find out at the team brief, [name] found out about hers from someone from another department before her line manager knew about it or could let her know." "If someone is nominated but is filtered out and doesn't make it to the team brief, then nobody knows about it." "The system is quite private. It is not always easy to know who has been nominated if they don't get into the final shortlist in the team brief. A summary of nominations would be really helpful.	5

No.	Theme(s)	Relevant quote(s) as they appear	*f*
		So, where there are team members who get nominated but don't make the shortlist, I can make sure I say thanks."	
		"From our perspective (as an employee), visibility of the scheme could be improved. For example, how may nominations were received in May? Across what departments? What types of nominations have been received?"	
2	Corporate core values and ideal behaviours	"Are we considering and linking to our core values when selecting and recognising people? Can we make a clearer direct link to the values when communicating in the team brief, please?"	2
		"We would like to see more positive behaviours recognised, as well as recognising people for transactional business improvements. For example, [name]'s recent nomination was driven by our values and our well-being culture."	
3	Awareness	"Does everyone know what they need to do to nominate someone? Does everyone understand that ANYONE can nominate an individual or team – we are not certain. However, the number of nominations coming through may tell a different story."	1
4	Incentives	"In addition to the formal scheme, could we consider giving line managers discretion (small nominal budget) at team level to offer small tokens of recognition for a job well done? Sometimes someone can do an exceptional job but not get recognised as it is deemed part of their role."	1

Source: Adapted from OpCo (2019)

Overall, criticism mainly revolved around the non-transparency and invisibility of the revamped R&R system. If somebody was nominated from someone in another department, leaders would get to know about it via the team brief at the earliest. This, however, was seen as too late for recognising timely. Likewise, if someone was filtered out and did not make it to the final shortlist, nobody would know who was nominated.

To be fair, though, the feedback was not critical in a negative way throughout, as expressed in the following.

> "The way the recognition is presented in the team brief is better [and] it seems more inclusive."

> "Personally, we feel removed from the scheme, but have not received any negative perceptions of the new scheme from staff."

In addition, some responses were also given by the Our OpCo team, functioning as the Awards Committee and deciding whether or not nominees were recognised and rewarded. In contrast to the general feedback that contained much criticism and pointed towards weaknesses of the new R&R system, initial experiences made by the Our OpCo team were not fully but much more positive (Table 4.29).

Table 4.29 Our OpCo team feedback on new reward and recognition system

No.	Theme(s)	Relevant quote(s) as they appear	*f*
1	More effective process	"The process of scrutinising and screening nominations has generally seemed effective due to the cross section of departments present. Most nominations are backed up with knowledge by someone present in the discussion." "If the nomination is lacking detail, follow-up mails or discussions have been used to fill the gaps." "The group's feeling is that the system is trending well, and each month has seen an improvement – success will breed success. More examples in the team brief will make people recognise that it is worth nominating people."	3
2	New process not yet fully embedded	"People are still lacking confidence/fearful of the process of nominating others. Some team leaders are still using the old process for their boards. So, there is some confusion about duplication." "There is a perception that information/advertising of the scheme is still lacking." "'I (anyone) can nominate and therefore I feel comfortable' is not the current default position."	3

Source: Adapted from OpCo (2019)

As senior management had been facing challenges when deciding upon nominees in the past, an employee assumed exactly the same issue for the Our OpCo team. This presumption, however, was not confirmed by the experiences the Our OpCo team made at all because they could back up their decisions made due to having a more cross-sectional team composition. In some cases, though, chasing some extra information was necessary to ensure that decisions were made evidence-based. In response to some of the comments criticising the lack of transparency, an Our OpCo team member argued the following.

> "When discussing if all nominations should be published, the comment made was, 'You wouldn't want to see some of the nominations. They fall way short at the first pass.'"

Negative criticism that emerged rather questioned whether individuals really accept the new R&R system and whether they are confident enough to nominate peers, as some remained sticking to the former approach.

4.8.3 Auditing visual management: Update

4.8.3.1 Post-relaunch review

Apart from that, recent changes concerning the VMB audits had been reviewed to see whether they proved effective or not. In practice, however, it turned out that the new approach was working neither. Accordingly, a mutual decision between senior management and the WLG was made to stop the current approach and to make some further changes.

> "There was a checklist that you were audited against […] and they were ending up putting stuff on there because it said so on the checklist, but it wasn't of any value. Then, I did some work with [a lean taskforce member]. We basically said, 'Get rid of it. You don't even have to have a board, but what you have to do is to be able to answer these questions. Do you know who your customer is? Do you know how well you're doing? Does your team know how well you are doing?' If you answer those questions, you end up with a board because it's about visualisation." (Middle Manager 1, OPS)

In doing so, everyone was given the freedom to decide how they would like to use their VMBs and what information they would like to display as long as their customers are known.

> "I think there's a directive that it doesn't have to look the same as everyone else's, but we've gone from very prescriptive, 'This is what your board should look like,' and we were audited, to, 'It's up to you now.'" (Middle Manager 1, SGAE)

In this way, departments were granted more flexibility as opposed to before when a standard structure was dictated. Throughout, the change was welcomed and the feedback very positive.

> "Initially, everybody went for a board, and it was all had to be the same, but it turned out that didn't really work because R&D […] work [in a] totally different way to the way operations work, and finance work in a totally different way to the way IT works. […] Those measures are more customised to your own team and the way you work. So, those are the things from what I've seen […] that have changed and improved." (Middle Manager 3, SGAE)

> "We agreed to change […] how we use them. […] So, the boards are now very much department-focused and -orientated and starting to add some more value. In R&D, we've changed our board and we have much more meaningful conversations." (Middle Manager 1, R&D)

> "We redesigned our board. […] First of all, I removed all the burdening elements and now I have my board how we would like it to be. […] Everything that is not necessary was removed so that the board is really functional for our area. […] Since we no longer have these strict guidelines, the board becomes more interesting." (Middle Manager 2, SGAE)

Although the force-fitting approach had widely been criticised, there was also a positive element to it. That is because some departments reported that they did not have to redesign their VMBs from scratch but could decide which parts they would like to keep and to take over from the structure that was initially imposed on them.

> "So, there are also some things that I want to keep, and it was good that we've put everything on the board at the beginning. Now, we can see, 'Okay, I want to keep this, and this is what I would like to drop.'" (Middle Manager 2, SGAE)

In one functional area, this freedom led to the circumstance that the VMB was completely removed. The reason for this was the intention to redesign the VMB based on a new VoC exercise to be carried out sometime in the near future. Until then, however, not a single person challenged them why they did not have a VMB attached to the wall.

> "I'm sure there are some people in this business that will proactively go and review other people's boards, but, put it this way, no one has asked us in [our department] why we haven't got our board up. And it has been down for eight weeks, and no one has challenged us." (Middle Manager 1, SGAE)

A middle manager explained that since the assessments were dropped, there was simply no need any longer to go through other departments and to have a look at another VMB.

4.8.3.2 Missing cross-functional link

However, some concerns were voiced whether the removal of the audits would enforce silo thinking again due to a missing cross-functional link.

> "Probably, my biggest concern with them is, […] they reinforce silos in the business because all the departmental boards are all designed to funnel information up. […] So, everything goes up and very little goes across business, and I think, for me, the more useful thing would be to have the linkage across the business." (Middle Manager 5, OPS)

> "The one thing I do think that's missing […] is that cross-functional link. So, everyone has their boards […] and they're driven by the Voice of the Customer, but you see very little interaction between departments on that information. I'm coming from [former company]. We had a value-stream board. When we met around the boards, […] we would have everyone across that value stream of that project." (Middle Manager 1, SGAE)

Instead, the use of value-stream VMBs was suggested in which all departments could share a VMB based on projects.

4.9 Failure factors (October 2019 to November 2019)

Over the following months, the perception that lean implementation had stalled at the middle management level had been increasingly gaining ground. In fact, the degree to which lean had been implemented varied significantly from department to department.

> "I've seen improvements in some areas, and then perhaps not so strong in other areas." (Middle Manager 1, R&D)

Overall, the majority of the WLG claimed to be positively inclined towards lean, but their engagement was insufficient.

In OPS, every single middle manager criticised middle managers outside their department for a lack of buy-in whereas a middle manager from R&D clarified that the rate of engagement depends on the department one is in. That is because OPS accelerated ahead while other departments were lagging behind and always catching up. Over time, a level of fear, perceived competition, and uncertainty where the lean programme will take one next had been emerging.

In fact, several middle managers reported that they had been struggling with implementing lean for various reasons. To get a deeper understanding of what was preventing the case organisation's lean implementation from progressing, the WLG decided to meet solely within their management layer. In doing so, senior management were excluded in the morning session of the seventh masterclass but included in the afternoon so that insights could be fed back, and solutions elaborated where appropriate. Isolated from senior management, an open environment was created in which no WLG member had to fear being judged by their senior manager when expressing their view.

Delving deeper into understanding the reasons that were preventing lean implementation from progressing by interviewing middle managers, five key areas could be identified, namely, (1) a lack of meaningfulness, sensemaking, and belief, (2) a lack of vision and strategic direction as well as an inappropriate deployment, (3) insufficient leadership, (4) a lack of knowledge and understanding, and (5) a lack of resources. All middle managers who participated in this research were reflecting upon these failure factors and expressed their views. In doing so, it was certainly not a surprise that their views overlapped to a large extent with the insights they had already gained in their open focus group-style discussion (Appendix 18). Individual reports, however, provided a much more detailed picture of what was going on and a tailored perspective. Insights from such interviews are summarised in Tables 4.30 and 4.31 and discussed more closely in the following with some relevant quotes.

Table 4.30 Failure factors perceived by middle management

No.	Failure factor(s)	Department(s)			
		Operations ("OPS"; n = 5)	*Regulatory Affairs & Quality Assurance ("RAQA"; n = 3)*	*Research & Development ("R&D"; n = 2)*	*Selling, General & Administrative Expenses ("SGAE"; n = 3)*
1	Meaningfulness, sensemaking, and belief	People cannot see the benefits Perception that lean only works in manufacturing Some think lean is an OPS thing (even at senior management level)	Contradictory and impossible targets on policy deployment matrix for several years Does not affect the day-to-day role Just another initiative Lack of application (something for OPS and quality systems department but neither own one nor the project teams in R&D) No benefits (also visible in other functional areas) Struggle to apply it in some departments Too much focus on KPIs and processes than on engagement and behaviours	Some believe it holds no value Takes time in R&D to see the fruits of your labour	Applied "vanilla" – visual management does not work in every department the same way (it is easier to measure output in some departments) Lack of convincing in areas like R&D that there is value Limited benefits Makes no sense and is something for the OPS and the quality department
2	Vision, strategy, and deployment	Lack of benchmark or inspiration what good looks like Lack of collaborative vision and no plan associated with that Misstep of the start with the focus on visual management boards rather than actual behaviours or culture No departmental vision, which involves and engages middle managers Slightly heavy-handed introduction of the visual management boards (e.g., meaningless matric to be monitored)	Faulty vision, which makes the transformation bumpy Force-fitting implementation ("one size does not fit all") Lack of vision guiding direction No clear strategy development No value-stream organisation Uneven rollout	Draconian introduction of visual management boards Lack of vision and strategy No strategy and clear direction	Dictated format of visual management board Jumped a step (visual management and metrics before culture and behaviours) No strategy and no implementation plan No value-stream visual management boards No vision

No.	Failure factor(s)	Department(s)			
		Operations ("OPS"; n = 5)	*Regulatory Affairs & Quality Assurance ("RAQA"; n = 3)*	*Research & Development ("R&D"; n = 2)*	*Selling, General & Administrative Expenses ("SGAE"; n = 3)*
		Visual management boards reinforce silos (designed to funnel up)			
3	Leadership	A bit of the wider leadership group is not taking hold of it (lack of ownership) Lack of gemba (cleanrooms make it more difficult) Senior management support in OPS is good but the buy-in in other functional areas varies and is less good Some middle managers think they are not given enough direction	Different expectations between middle and senior management No senior manager support in comparison to other departments Not same level of buy-in at top level	Lack of top-down support No clear expectations from senior management (but some wider leadership group members do not even want that level of responsibility) Roles and responsibilities not clearly defined	Bad communication (managers in other departments often have more information) Low senior management presence Mixed senior management support No senior manager support
4	Knowledge and understanding	Lack of knowledge and understanding (people limit the concept of lean to visual management boards) Lack of understanding Lack of willingness to understand Masterclasses did not give people what they needed Terminologies overcomplicate it, reinforce a thinking that lean is something OPS-related and scare people off	Buzzwords difficult to understand Buzzwords that make it difficult for some to understand Lack of appropriate understanding by individuals (spectrum of understanding) Lack of understanding (different levels of knowledge in the wider leadership group and impossible to catch up with the learning) Lack of understanding in some departments	Buzzwords make it difficult to understand Lack of understanding (people do not see the reason behind visual management)	Buzzwords make it difficult to understand Lack of self-development Lack of understanding Many people do not quite understand what lean is Newcomers missed the knowledge-building process
5	Resources and priorities	Some say they have no time to do the day job and continuous improvement Visual management boards increase the workload for many		The day job is priority	Time-consuming and extra workload Time and resource

Source: Author

Table 4.31 Success factors perceived by middle management

No.	Success factor(s)	Department(s)			
		Operations ("OPS"; n = 5)	*Regulatory Affairs & Quality Assurance ("RAQA"; n = 3)*	*Research & Development ("R&D"; n = 2)*	*Selling, General & Administrative Expenses ("SGAE"; n = 3)*
1	Meaningfulness, sensemaking, and belief	Has to show benefits (so that it is not perceived as extra work) Meaningful work showing benefits that make people's life easier Some quick-wins that deliver a benefit and drive engagement (building a success story)	Convince people that they made a stuttering start Purpose and meaningful work	Value-adding improvements	Being convinced that it improves the business Better results (e.g., quicker process and smarter systems) Stopping it in departments where it does not make any sense
2	Vision, strategy, and deployment	There is a right time for things (change management)	Clear implementation with a plan across the site (direction of travel) Parity and consistent conditions so that nobody feels left out Rapid monitoring and reaction according to the plan	A vision broken down into clear objectives	Collaborative vision Strategy deployment and implementation plans Working more closely together
3	Leadership	Engagement of the leadership team Frequent discussions on strategy with senior manager Good communication Good recognition Make yourself available so that people feel valued Pushing responsibilities all the way down to involve people Senior management support	Driving engagement in own teams Empowerment Good communication Supportive senior manager Top-down commitment and drive are necessary Universal buy-in at least at the top two levels	Constant reminding and progress review by senior management Employee involvement Flow up needs to senior management	Peer challenging at middle management level
4	Knowledge and understanding	Educating people to increase their understanding Interest to learn from other departments (pull vs push) Willingness to understand	Education Make people understand why it is a benefit Understanding and believing in targets		Raise capability (e.g., leadership programmes) Understanding the principles and being properly educated in it
5	Resources and priorities	Making it the way you do things – not a separate thing	Capacity to do improvements Right people in right positions Support (networks)	Middle management peers working together as a team Should just be a day-to-day running	Has to be part as business as usual Internal support network groups Needs to become part of your daily job

Source: Author

4.9.1 Failure factor #1 – Meaningfulness, sensemaking, and belief

The extent to which lean implementation was experienced as meaningful and sensemaking varied significantly amongst middle managers. Concerns over the meaningfulness of introducing lean were merely expressed outside of OPS, which suggests that this was rather an issue existing in pockets than reflecting a cross-functional stance. This perceived lack of meaningfulness outside of OPS was mostly justified by having limited gains and no belief in it. In the following, the underlying causes for such attitudes are described more closely.

4.9.1.1 "Inapplicability" of lean in office environments

To begin with, there was a clear divide between operational and non-operational departments whether or not lean is perceived as applicable.[48] That was because of a widely shared view outside of OPS that lean is solely conceptualised for manufacturing environments and that it does not fit into non-operational environments.

> "[For] the operations area – the manufacturing-type areas, […] I think, it was very suited […] where things are very easily traceable. And I think we tried too hard to implement the same theories in the departments that didn't really suit it and project teams, some departments like my own. […] It's quite a lot of people here who have come from manufacturing backgrounds who are now in design backgrounds or project management backgrounds, and they know that the system works very well in production and manufacturing environments, because that's what it was designed for." (Middle Manager 2, RAQA)

> "It works well in manufacturing […] but for [my department], I don't believe that it makes sense. […] For example, operations and document control, they see the benefits of it. They really drive it because they can improve their workloads and get a better grip on all their planning activities." (Middle Manager 2, SGAE)

Several discussions on whether or not lean is applicable outside of manufacturing environments could be observed by the researcher in different social settings. Over the last few years, a lobbying opposition had evolved that neither boycotted nor resisted lean implementation per se. Its supporters, however, had strong doubts that lean is applicable outside of manufacturing and had been spreading negativity, which perpetuated across the organisation.

[48] The operational departments include all sub-departments under OPS as well as quality engineering and quality systems whereas non-operational departments constitute the rest (Table 4.32).

Table 4.32 (Non-)operational departments

No.	Operational department(s)		Non-operational department(s)		
	Operations ("OPS")	*Regulatory Affairs & Quality Assurance ("RAQA")*	*Regulatory Affairs & Quality Assurance ("RAQA")*	*Research & Development ("R&D")*	*Selling, General & Administrative Expenses ("SGAE")*
1	Production Management	Quality Engineering	Product Evaluation	Mechanical Engineering	Environment, Health & Safety, and Facilities
2	Purchasing	Quality Systems	Regulatory Affairs[a]	Process Engineering	Finance
3	Manufacturing Engineering			Research Management[a]	Human Resources
4	Sustaining Engineering[a]			Research & Development Management (Project Management)[a]	Information Technology
5				Software & Electronics Development	

Source: Author
Note(s): (a) Sub-department without any middle manager

In OPS, every middle manager was aware of that way of thinking and commented the following.

> "They [some people outside of operations] believe you can't do lean in an office environment, and these sorts of things, whereas – of course, you can!" (Middle Manager 2, OPS)

> "In operations, [lean works] very good [and in] other areas less good. And there's probably a mixture of lack of knowledge at that level and a bit of, 'What it's got to do with me because I work in some way which is not traditionally affected by those things?'" (Middle Manager 1, OPS)

The circumstance that the lean programme evolved from initial improvement activities in OPS reinforced this thinking significantly.

While there was a unified view in OPS on lean being applicable to their manufacturing environment, not all but many middle managers from non-operational departments perceived lean as being inapplicable in an office environment. In RAQA, for instance, two sub-departments believed that lean is applicable to their environment, whereas this view did not find any support in another one. Similar conditions could also be observed in SGAE.

Not surprisingly, this disparity led to an attitude that some middle managers did not really apply what was expected of them (e.g., to participate in the VMB audits). Instead, they went back to "business as usual" after each masterclass.

> "We have a lot of feedback from project managers and such like that they were getting whole groups of people together to go through an exercise that nobody in the studio believed in. […] If my next audit would be a project manager and they'd go, 'Look, I know it's no good. Just give me a mark and I get back to my work.'" (Middle Manager 2, RAQA)

A few months later, at the earliest, once the next masterclass would take place, these middle managers were thinking about lean again, as argued by several middle managers. The fact that benefits were only seen in OPS, quality engineering, and quality systems over the years but not in the own area of responsibility, led to frustration and reinforced such thinking.

4.9.1.2 Meaningless and misaligned key performance indicators

In a couple of cases, such "incompatibility" was justified with a difficulty to develop KPIs to be displayed on the VMBs. In R&D, for instance, they had been struggling with that for a long time due to having lagging KPIs. That was because their data were dependent on market feedback. Such delays, however, made many of their KPIs meaningless and non-expressive.

In another KPI-related case, a middle manager, who was not convinced of lean being ever able to be successfully embedded in his functional area, reported how targets set on the policy deployment matrix often contradict each other.

> "I do understand the matrix […] but that doesn't drive business excellence at that level. […] One of the things that comes out quite loud and clear is [that] a lot of those things on the matrix offset each other – they contradict each other." (Middle Manager 2, RAQA)

Due to these contradicting targets accompanied by various changes in reporting structures to his disadvantage, his annual targets set by the policy deployment matrix as part of the current strategic three-year scope had been out of reach. This circumstance was further accompanied by a difficulty to find managers who were willing to engage in his projects because their priorities had been defined differently by the policy deployment matrix, leaving him isolated.

> "My job was to convince other middle managers to give me their time, their resource, their knowledge, and nobody was interested in it because they all looked at it and said, 'Number one, it's not mine. So, why would I put time into it?' – They've got theirs to do and they've got a whole list of continuous improvements […] – 'We don't think it's achievable.' So, I spent twelve months sitting in a meeting room on my own. Every time I called the meeting, nobody would turn up. Every time I asked somebody to do something, [they] would never get it done." (Middle Manager 2, RAQA)

In essence, annual targets on the policy deployment matrix were not horizontally aligned enough. This is contrary to what is suggested in the literature (Tennant and Roberts 2001b; Cowley and Domb 2012; Thürer *et al.* 2019). In retrospect, this middle manager had been experiencing lean implementation as failing throughout over the last couple of years while losing confidence that anything will change for a better in the future.

In fact, this problem did not seem to be a singular case and was confirmed by another middle manager. Issues were arising because performance measures defined by their MBO system were not consistently aligned towards a joint strategic direction.

> "We have an MBO system, which should be driving key business projects. […] These are the key things on our boards. They are going to move us forward as a business. You want them to be a link to the MBO system. And in some areas, that's done well and that's communicated well. In other areas, that is done disastrously and there's no consistency. So, people's motivators then to be able to drive on strategy […] are […] money and bonuses." (Middle Manager 1, SGAE)

If targets were perceived as being too ambitious or if someone felt that he did not have the resources to complete his project, such projects had often remained untouched.

> "And MBOs are optional. If someone [has] a project in their MBO, it is sitting on our matrix. And someone has an option not to do that. […] It won't be done or if they feel […], 'Actually, I haven't got time to do that.'" (Middle Manager 1, SGAE)

Rather than following organisational interests, such misaligned targets made individuals pursuing incentivised targets that would be achievable most easily for them.

4.9.1.3 "Lean is not part of the job"

Justifying it often with the nature of their work, several non-operational middle managers questioned whether lean should be part of their job. A middle manager described, for instance, how several engineers expressed that they come every day to work as *engineers*.

> "A lot of these people are engineers that come to work to engineer and they're spending a fair amount of their time standing in front of boards. They don't understand why they're there. Their manager doesn't understand why they're there and the manager didn't believe they should be standing there. […] And then people are, 'Well, this isn't what I signed up for.' If those same people are then being criticised, because their design work is not getting done, that's difficult." (Middle Manager 2, RAQA)

In the WLG, there had, in fact, been people already who decided to leave because they could not identify themselves with the "extra work" that they attributed to lean implementation. In an interview, a senior manager described these reactions as a natural yet welcoming process because, in the long-term, the organisation would remain with the people who are really bought in.

While many middle managers and other WLG members from non-operational departments saw lean as something extra on top of their daily job, none of them realised that it was something that should be part of the way *how* they work.

> "We need to get something that will switch people's mindset so that they are not seeing this as an extra thing. You know, for example, they don't see CI as, 'Oh, yeah, that's the thing I'll just do sometimes.' […] It should just be part of the way they think." (Middle Manager 3, RAQA)

> "Some people within certain functions, again, I don't think they see that as part of their job, almost." (Middle Manager 2, OPS)

> "It was almost like you did a normal job and then you did business excellence, rather than, 'No, it is part of *how* you do your job.' And that's one of the links that we've missed. So, I think that really, for it to be sustainable, it can't be separate. It's not a thing – it's what you do now." (Middle Manager 1, OPS)

> "People think that it is just extra work for the sake of extra work." (Middle Manager 5, OPS)

> "It just has to be part as business as usual. It can't be this standalone project forever. It has to just be, 'It is what we do.'" (Middle Manager 1, SGAE)

Instead, middle managers from OPS argue that lean should have been seen as a vehicle incorporated in everyone's daily work to resolve pain points and to accomplish better results.

4.9.2 Failure factor #2 – Vision, strategy, and deployment

Second, several issues centred on vision, strategy, and deployment. In fact, such issues were shared in each single department. Although the general business vision was clear indeed and its purpose statement widely understood, a strategy or roadmap was being missed. Several middle managers made senior management responsible for the circumstance that a clear strategy for the plant was missing.

> "[The strategy development] has been very poor. It has been very weak. And it's what's really been missing across the business. And, to a degree, I think, perhaps it's still maybe missing it at the senior management level. If I went and spoke to [the Managing Director] what the strategy was for the business, I don't know that he could tell me." (Middle Manager 1, R&D)

Apart from the general business vision, the policy deployment matrix conveyed a certain direction of travel likewise; however, both strategic instruments were perceived as being too high level to understand how lean would influence day-to-day activities.

4.9.2.1 Lack of vision and strategic direction

In other words, it was unclear how to translate the business vision into strategic objectives at the operational level. So far, middle managers and the other WLG members had merely been told by senior management to go to their functional areas and to deliver lean without being briefed how the business was supposed to look like in the future. As one middle manager put it metaphorically,

> "We're going to make a cake. Now, what's the recipe?" (Middle Manager 1, SGAE)

In contrast to this, the prevalent opinion within senior management was that the WLG should be knowing what the daily issues of the business are and where improvements are necessary.

> "The wider leadership group should know the problems. They are grown-ups and in leading functions. Most people *are* aware of the direction of travel." (Senior Manager 2)

At the departmental level, however, middle managers felt that there was a lack of vision and no strategic plan associated with that, which guides the way forward what must be achieved and feeds into the general business vision.

> "I did an off-site workshop a couple of weeks ago […] about why business excellence isn't rolling and one of my main conclusions that came out of it was that there is no vision. Also, in areas, which are lagging behind, there's no vision. So, people can't see it." (Middle Manager 1, OPS)

> "We have the business vision, but […] what do R&D need to do to support that business-wide vision? That was missing. So, we previously didn't have something that says, 'In R&D, this is what we're going to do to support the goal of the business.'" (Middle Manager 1, R&D)

> "We've got our purpose statement from the top, 'Become the partner of choice…' […] But there was a lot of discussion, and we had a recent meeting with wider leadership group about, 'Okay, that's the very, very high-level business [vision]. What about my department? What is the vision of my department?'" (Middle Manager 3, RAQA)

Predominantly, however, this sort of disorientation had been present in non-operational departments. The reason for this is that OPS had always been working towards a departmental three-year plan, which was elaborated and issued regularly in a three-year cycle (see Table 4.2). Accordingly, there had always been a departmental vision in OPS.

> "We do have an operations vision, and, from that, we built our three-year plan. […] It has got three circles and one is about people, one is about engagement and competency, and something else – I can't remember. […] So, yes, we do have a vision and that rolls down into plans. But the overall vision, I think, has very much derived from the discussions that we have." (Middle Manager 1, OPS)

In various meetings, strategic matters had also been frequently discussed between the OPS director and his middle management layer responsible for the different functional areas within OPS. Through these reoccurring discussions on strategy between that senior manager and the middle managers in OPS, a collaborative vision at the departmental level further solidified in each manager's mind.

> "I think the […] operations side is working very well and one of the reasons is that, as a senior manager and wider leadership group, we talk about strategy a lot. Every week, we have like a bit of a strategy talking about where we're going, what we're trying to achieve. […] We're aligned in terms of a collaborative vision. We're talking about continuous improvement. […] And I think it's working in operations for that reason, and I think it is not working in other areas because that ain't happening. […] In production or in operations, […] I think we have a common picture in our heads. Because [of] the amount of discussions that we have, I think, we share a common vision […] because we talk about it a lot and we sort of align one another." (Middle Manager 1, OPS)

This corresponds to a statement made by another middle manager from a non-operational department, suggesting that some of these strategic issues could have been overcome and resolved if everyone worked collaboratively with their senior manager together to come up with what that vision is. To no surprise, such activities had, in fact, been undertaken in all departments subsequently after the debate during the seventh masterclass.

> "We're developing a strategy for R&D now and I'm leading that and pulling together. We have the vision for the department, which ties in with the vision of the business. And we've identified five strategic, principal areas [e.g., customers, people development, roadmap, and project management] that we need to focus on to deliver the vision. […] And then, we're now going to break those down into […] improvement objectives against each of those five principles to determine, '[…] *What* are we actually going to do?' And then, '*How* are we going to do it?' So, it all flows from the strategy." (Middle Manager 1, R&D)

At the same time, senior managers were encouraged to involve their departmental leadership community in developing that collaborative vision and a roadmap associated with that so that the WLG's input in strategy development will generate a sense of ownership rather than a feeling of being imposed upon a departmental vision.

> "The senior manager of that area gets together with their middle managers and [they] design their vision with it being *their* vision and not the senior manager's vision. Then, you engage everybody [and] you're more motivated to do it." (Middle Manager 1, OPS)

Especially in R&D, the development of a departmental vision and a respective roadmap was warmly welcomed because this level of detail seemed to be missing for a long time.

> "In all these years, we're now getting to a definition breakdown. Why didn't we have it sooner? […] Certainly, what we're seeing now is […] what this means from a very high level and how it is relevant to our […] R&D team, and then, how it breaks down to the individual discipline teams. […] But my question is, 'Why is it taking this long?'" (Middle Manager 2, R&D)

So, both senior and middle management had their own part to play in developing that collaborative vision, followed by a strategic plan to illustrate what to achieve and by when, helping to monitor progress. From this collaborative vision, they promised themselves to work more closely and cross-functionally together.

4.9.2.2 Change mismanagement

Moreover, the activity on perceived failure factors also sparked a discussion around the way how lean implementation was initially kicked off. There was a general perception that lean was introduced in a very force-fitting manner in which the VMBs were imposed on each functional area. Voices were also being raised concerning several decisions that had been made in the past, which could have been made differently. Acknowledging that change must be initiated at the right time, one of the protagonists leading the case organisation's lean transformation admitted, in fact, that some wrong steps had been undertaken.

> "The skill of organisational change is recognising when the right time is and not trying to push it too hard or, on the other hand, not leaving it too late and missing the opportunities. And I think probably a lot of that was trial and error rather than a glorious plan." (Middle Manager 1, OPS)

In retrospect, the lean taskforce had evolved in early 2015 with the aim to bring the essence of MX also to functional areas outside of OPS. In this non-crossfunctional working group, however, only a small subset of the organisation had been involved, including mainly members from OPS due to their experiences made within the MX projects. In December 2017, when the WLG had formed and managers of all other departments had officially been involved, they were tasked with delivering lean in their functional areas while being equipped with a couple of tools to do so – one of them being the VMBs.

These VMBs, however, had been imposed on the WLG in the sense that the lean taskforce stipulated the format to be used. In other words, rather than being told *what* to do (i.e., what to achieve as part of lean), the WLG was told *how* to do it (i.e., *how* to embed or achieve lean).

> "If you differentiate between 'what' and 'how', some of the stuff was 'how' – 'this is *how* you're going to do it.' And people were going, 'What do you know you're talking about? It doesn't fit my world.' So, what we should have been presenting to people is the 'what'. [...] So, we concentrated on the wrong thing. We concentrated on the 'how' – not on the 'what'." (Middle Manager 1, OPS)

> "I think part of the difficulty that we had with that was that, initially, everybody was told, 'This is the format you have to use. These are the things you have to have on your board.' […] I think it was

a bit too draconian, a bit too strict […] because each department is different. […] Some of the things we just couldn't measure." (Middle Manager 1, R&D)

In this way, too much focus was set on KPIs, processes, and outcomes rather than on the development of behaviours and a CI culture.

"I think we maybe could have gone about it a little bit differently. We focused on the hard KPIs and processes whereas I think it might have been better off focusing on engagement and behaviours. […] Then, the rest would have just happened. I think some of us start to realise that now in the wider leadership group." (Middle Manager 3, RAQA)

"It wouldn't work because people's heads were undercultured and everything else that was going on was in the wrong place." (Middle Manager 1, OPS)

Some middle managers expressed how behaviours should have been built in the beginning, while the tools and processes should have been introduced later. In doing so, tools and processes would have become an evolutionary step forward instead, emerging naturally as part of their lean progress.

"In hindsight, we should have probably focused on […] build[ing] the behaviours in the beginning and then started to introduce the processes later. […] The boards would become a natural evolution of the behaviours rather than what we did." (Middle Manager 3, RAQA)

"We probably faltered initially in our implementation and, in particular, in the focus on business boards. […] We really took some wrong steps. […] Business excellence became about the business excellence boards – not about actual behaviours or cultures. […] It was all about the business excellence boards and having a better score than another department and the amount of work that was required to keep those boards." (Middle Manager 5, OPS)

"I think we kind of jumped a step as well because we really went straight for the boards […] rather than looking at other things that we should have thought about, like behavioural cultures, how people interact and work together. […] I think it needs a recent refocus so that we can perhaps go back a few steps to go forward a few steps." (Middle Manager 3, SGAE)

"So, initially, few thousands of graphs [due to visual management] were everywhere. I don't think it was a good message because that's what people saw. Then, we started trying to get the message, 'It's not about the graphs – it's about the way we behave [and] it's about the culture.' So, that would be driving the business forward. The graphs are a result of what we're doing because you got the measure what you're doing." (Middle Manager 6, OPS)

To put it another way, if the WLG members would have been "cultured" before, hard lean practices would have been pulled rather than pushed or imposed on them.

In R&D, for instance, the use of VMBs had clearly exemplified the issue with a prescriptive lean implementation of this kind.

> "I knew enough project managers who were doing business excellence, because they've been *told* to do business excellence." (Middle Manager 2, RAQA)

Several middle and project managers had always been developing apathy against the prescriptive VMB format introduced, justifying their stance that it is not applicable to their department (see section 4.9.1.1).

> "Even after quite a long time, […] I was not really realising what it meant to me. It didn't seem to fit my department. […] If it doesn't fit, don't force-fit it and I think it was a 'one-size-fits-all'. We've got 18 medium t-shirts, and you're all putting it on whether it fits you or not; and it fits some people comfortably and other people were really uncomfortable in that t-shirt. […] You're trying to take a system that suits 200 people in a manufacturing environment and force-fit it under […] a service department." (Middle Manager 2, RAQA)

At the same time, however, R&D made use of a tiered meeting structure that was even harmonised with their parent organisation's counterpart. In addition, a strict communication and meeting guideline were introduced to accelerate the information flow.[49] More interestingly, however, a self-developed project management board tracking KPIs around cost, quality, time, and risk, which, in fact, was resonating the characteristics of VMBs, was in place and locally well accepted. In R&D, nobody had realised that they had put several lean practices already into practice. A negative attitude towards lean, however, had remained due to the force-fitting manner, whereas its implementation had subconsciously been taking place already while not really being fully aware of it.

> "In R&D, they have a new project management board, which actually ticks all the boxes of business excellence. […] Really interesting was that one of the people in R&D is really anti-business excellence and does boards and things like that […] – a middle manager; and he has introduced the […] project management sprint boards over there and he said, 'This is what we're doing for this –

[49] In R&D, the WLG members were convinced that lean, which they mainly associated with its hard lean practices known from manufacturing areas, will not suit their office environment. At the same time, however, they were interestingly aware that the value that flows horizontally through their processes is knowledge. For this reason, some lean principles had recently been translated to suit their local context (value, e.g., expertise to manufacture a medical device; value stream, e.g., information flow; and waste, e.g., delayed and excess communication). That is why R&D were concerned with increasing the knowledge or information flow by making use of such practices.

not related to business excellence.' And I said, 'You do know what you've just done? You've introduced something completely in line with business excellence principles, but you don't know you've done it.' He's like, 'Oh, have I?'" (Middle Manager 1, OPS)

Despite various setbacks, it was argued that this experience had at least increased the CI awareness within the WLG because, by now, everyone knew that it was not the best way of implementing lean but still saw the chance to collectively improve on this to get it working in the future.

"I suppose, it's an evolution of the practice. You put in place what you think works. And I think we always said it at the start that they might not be right, but it's a start." (Middle Manager 1, R&D)

Now, this circumstance had become much more apparent. That is because a collaborative vision had never been existing in the past. It was very likely, though, that it would have provided the "what", which the WLG was asking for.

"Nobody had any buy-in. Nobody had any ownership. So, it's like being imposed on you, 'I'm going to tell you *how* to do this." And this started from the wrong place. […] If we had that collaborative vision, we would have been engaged in things." (Middle Manager 1, OPS)

By dictating how an "undercultured" WLG had to implement lean in their functional areas led to the consequence that lean was often only being associated with VMBs. Solely focusing on its tangible elements, however, disregarded lean's intangible nature. Having that said, lean was still not fully understood by many at this point of time.

4.9.2.3 Late involvement of the wider leadership group

Inside the WLG, a late involvement was therefore criticised because they would have been given the opportunity to be included right away from the start and to challenge how lean would be approached. In this case, own departmental needs may have found more consideration.

"I think there should have been an opportunity to start for people to challenge it. And if the middle managers have challenged the initial rollout, I think it would have ended up looking different. And I think it wasn't the case of, 'This is what we're thinking of doing and this is why. What do you think of that and how does that fit for you?' It was, 'This is what's happening.' And I think anytime you do that to people who are capable of their own thought, they're not going to like it. […] And I felt excluded from it." (Middle Manager 2, RAQA)

This means that the WLG expected lean to be more tailored to their individual departmental needs while learning experiences would have taken place jointly.

"I think I'd launch the initiative with the inclusion of at least a subset of the middle managers, if not like the full group in the first place, because I think their engagement is quite pivotal to the success of the initiative. […] There was a subset [i.e., the lean taskforce], which was just a few random people from the organisation and that meant that the appreciation of the benefit and the tools and techniques didn't reach some of the people that it needed to early on. […] Then, that will be more constructive to the success to that it's not like one person's pet project that everybody else is left playing catch up or trying to compete against but it's more of a joint initiative that the team would introduce." (Middle Manager 3, OPS)

"[I would] probably involve more people at the start. So, back when we first started doing business excellence, it was the directors with a select group of other people from within the business [i.e., the lean taskforce] like an additional six or eight of us [but] it just wasn't enough." (Middle Manager 2, OPS)

4.9.2.4 Lack of inspiration and benchmark

Alongside with a missing strategic plan in most non-operational departments, a lack of inspiration was obvious. A reoccurring question within the WLG was, "What does 'good' look like?" In a way, it was assumed that if this question could be answered meaningfully, more WLG members would buy into it.

"Some managers struggle to see, 'What does good look like? Who will we be benchmarking ourselves against? Show me a company that's doing this really, really well.' […] I think if we can kind of paint a picture of that around, […] people may buy into a little bit more. But, at the moment, we're trying to discover what good looks like for us. And, yeah, it feels a bit sometimes like the blind leading the blinds." (Middle Manager 1, SGAE)

In defence of many, however, it must be noted that a considerable number of middle managers and other WLG members had been working at the case organisation for many years. Therefore, they did not see much outside their own organisation yet that could have inspired them to initiate change. In some cases, inspiration was then sought through the external consultancy or site visits, including affiliated plants and third-party plants. Finally, by having a collaborative vision, middle managers had promised themselves to find that inspiration and thus a way forward.

4.9.3 Failure factor #3 – Leadership

Third, another failure factor centred around leadership. While there seemed to be notable differences amongst WLG members, it also turned out that a large part of middle managers were dissatisfied how their senior managers had been engaging in lean in the time periods between each masterclass. Key criticism included middle managers' desire for more senior management involvement in different functional areas and a misalignment between senior and middle management's expectations of how middle managers would be embedding lean in the organisation.

4.9.3.1 Lack of senior management engagement

Interviewing middle managers from different functional areas also indicated that senior managers were certainly not all bought into the initiative to an equal extent. This stance was, in fact, expressed by middle managers across all departments who reported that the level of engagement within senior management was quite mixed and varied (Table 4.33).

Table 4.33 Senior management engagement

No.	Relevant quote(s)	Department(s)			
		OPS	*RAQA*	*R&D*	*SGAE*
1	"I'm not convinced that everybody in the senior team is fully bought into the idea of business excellence." (Middle Manager 1, OPS)	•			
2	"I'm not sure that the same level of buy-in was in place at the top level." (Middle Manager 2, RAQA)		•		
3	"I think the one that springs to mind is just the way that some of the senior management team engage with the different people throughout the business. I've seen a mix of some people do more of it. And some people have stopped doing it all together. […] Some people have disappeared and you don't see them whereas other people you see much more frequently are engaged and happy to talk to anybody in the business." (Middle Manager 1, R&D)			•	
4	"I think there are some very knowledgeable and some are completely bought into the concept. And I think there are others who are less engaged in the process." (Middle Manager 1, SGAE)				•

Source: Author

The impression that senior managers did not invest equal efforts was shared at the operational level likewise. At the same time, a feeling of "empty promises" was present because senior management did not seem to dedicate themselves to lean as expected after their commitment communicated during a few masterclasses.

> "[In the other departments,] I don't see some of the senior managers invested some into continue business excellence either. They might say, 'Yes, we're involved in it,' but do their actions tell me that they're trying to drive business excellence in the organisation? – Probably not." (Associate 3, OPS)

Previously, the VMB audits had pushed many senior managers out of their offices. Ever since the decision was made to stop the audits, middle managers felt that senior managers were less present. In a particular case, for instance, a senior manager did not bother that there was neither a VMB in one of his functional areas nor a CI system installed in his department.

In OPS, a middle manager accentuated the necessity for senior management engagement, otherwise lean would "dilute in the hierarchy". In their own department, however, the senior manager's level of engagement seemed to stand out as compared to his counterparts who were responsible for the other areas of the organisation.

> "I have my own perceptions on how much [other senior managers] drive and how much support they give their teams but [the Director of Operations] has always driven business excellence and been really supportive in terms of trying to develop business excellence within the organisation." (Associate 3, OPS)

This senior manager had, in fact, been championing the lean programme all the while and was therefore particularly responsible for its site-wide rollout. On the intranet, he was also the only senior manager who had been engaging in discussion forums around lean implementation as compared to the other senior managers. In his area of responsibility, this senior manager was inclined to get everybody on board and even took some time to get middle managers from other functional areas engaged. Inducting newcomers, two middle managers who had just been joining the organisation reported how he had supported them in gaining a foothold.

In OPS, every middle manager reported how their senior manager kept attending their differently tiered meetings frequently and how he kept showing interest in their daily work. As postulated by HK, he also involved every management layer until the senior operator level in developing an OPS strategy to co-create a joint way that moves OPS forward.

> "[He] definitely involved the levels of management below him in those discussions with trying to develop the two-year plan that they've now got in place." (Middle Manager 2, OPS)

This level of senior management support, however, did not really seem to be present in non-operational departments. That is because a considerable number of middle managers voiced criticism against their senior managers (Table 4.34).

Table 4.34 Senior management engagement per department

No.	Tendency	Operations ("OPS")	Regulatory Affairs & Quality Assurance ("RAQA")	Research & Development ("R&D")	Selling, General & Administrative Expenses ("SGAE")	
		Director of Operations	*Director of Quality Assurance & Regulatory Affairs*	*Director of Research & Development*[a]	*Director of Finance & Information Technology*	*Director of Human Resources*
1	Positive	"I think the production operations side is working very well. And one of the reasons is that, as a senior manager and wider leadership group, we talk about strategy a lot. […] We're aligned in terms of a collaborative vision." (Middle Manager 1, OPS) "I think one senior manager [Director of Operations] in particular was responsible for the rollout of business excellence on site. So, he was going to make sure that everybody under his wing and remit was completely up to speed with it." (Middle Manager 2, RAQA)	"I've also got a very strong director who understands and is very passionate about business excellence – that helps." (Middle Manager 3, RAQA)	None	None	None
2	Negative	None	"So, […] have I ever sat down and had a business excellence conversation with him? Never. Has he ever come and pass the knowledge on? It just never happened." (Middle Manager 2, RAQA)	"So, he's my line manager. He's supporting it. Especially, he is leading it – maybe not quite as strongly as I would like. I suppose there are things that could have been done better up to this point." (Middle Manager 1, R&D)	"My line manager did not stand a single time in front of my board and asked me, 'Can you tell me what you are doing here?' In the other areas he is responsible for, I haven't seen it neither. […] He did not even attend a single team meeting or our board meetings where he was often invited to." (Middle Manager 2, SGAE)	"My director backed away and could do more." (Middle Manager 1, SGAE)

Source: Author

Note(s): (a) This senior manager had been on an 18-month leave.

Some criticism even went as far as that a middle manager made his senior manager responsible for the limited progress in his own area of responsibility. Although all senior managers should have been equally supportive and driving lean in their departments, he perceived that there was a huge difference to what extent senior managers had been disseminating knowledge.

> "Some directors were actually made responsible for business excellence happening. Everybody that worked for that director is at the top of the tree of knowledge there. If you worked for another director that wasn't responsible for it, you found that by accident, almost. That's a big factor." (Middle Manager 2, RAQA)

In an extreme case, a middle manager reported how his senior manager had never engaged in any activities in his functional area. First, no interest was shown in the VMB at all. Second, despite numerous invitations, his senior manager had been ignoring his team meetings. Third, when that senior manager was asked for support to resolve team matters with high complexity, he agreed to arrange a meeting but never showed up. Although this middle manager expressed that he never really expected every-day support from his senior manager, he concluded that lean was not lived from the top.

> "My line manager did not stand a single time in front of my board and asked me, 'Can you tell me what you are doing here?' In the other areas he is responsible for, I haven't seen it neither. […] He did not even attend a single team meeting or our board meetings where he was often invited to." (Middle Manager 2, SGAE)

In most cases, his senior manager communicated online via e-mail or instant messenger despite the close distance to each other's desks. Even strategic matters concerning the policy deployment matrix had only been discussed via e-mail.

> "A short mail was sent to me, 'This is what I plan to do. Does it work?' – 'Yes, that's alright.' There wasn't even any discussion – not even a small meeting was held. A lot [of communication] goes via [instant messenger] and e-mail and is very impersonal." (Middle Manager 2, SGAE)

For these reasons, this middle manager was confused as to why he was even tasked with driving lean when his senior manager showed no interest in it at all.

4.9.3.2 Lack of gemba walks

While a lack of senior management presence had been an ongoing and untouched issue, interviews in OPS revealed that regular gemba walks to the cleanrooms were difficult to conduct due to strong regulations that the medical manufacturing sector underlies (e.g.,

necessity to wear cleanroom apparel every time), which created a physical barrier between the cleanrooms and the rest of the organisation. While this issue had been existing for several years already, the managing director, the OPS director, and the operations manager had still endeavoured to visit the shopfloor at least once a week. Unlike OPS, gemba walks did not take place outside of manufacturing, though. In fact, many WLG members in non-operational departments associated with "gemba" only the shopfloor.

4.9.3.3 Mismatching expectations

Apart from that, the WLG found senior management's expectations of their new role unclear and insufficiently defined. This had caused confusion about what needs to be delivered.

> "It hasn't been clear what the senior management team have expected from the wider leadership group. […] The senior management team may have thought that the leadership team understood and were clear about what they wanted […] but without being clear on what their expectations are or what our […] remit is, what levels of freedom we've got to challenge things and do things differently, […] it comes back to where we are now." (Middle Manager 1, R&D)

It turned out that senior management and the WLG had mismatching expectations in regard to how to progress with embedding lean across the business. In essence, senior management's basic tenor was that the WLG does not take it on board and does not move ahead. On the contrary, the WLG's general thrust was that senior management do not provide enough guidance and direction.

> "What was happening is that the wider leadership group were saying about the senior management team, 'They give us no guidance. They don't tell us what to do.' And the senior management team, separately, will say, 'The wider leadership group don't take initiative. They don't step forward.'" (Middle Manager 1, OPS)

Implicitly, the WLG challenged the approach to lean implementation to some extent, which had been pursued hitherto. Indeed, senior management had given much input in the last couple of years by holding episodical masterclasses with the presumption that this directive was already provided, but it turned out to be insufficient for the WLG to find their way forward.

Despite of these opposing expectations, the prevailing opinion amongst WLG members was that neither senior management nor the WLG itself were to blame for this circumstance and that nobody was really to be made responsible for this misalignment.

"This isn't anyone's fault. We've got here as far as we have. […] We just need to come together to get it kick-started. […] We're all trying to find a way." (Middle Manager 1, SGAE)

"I think there has been a misalignment between […] what the senior management team […] and what the wider leadership group as a whole on average thought how it was working. It wasn't the same. […] I'm not going to blame either side. It's just, there's a misalignment and a misunderstanding between the two groups and this has to get resolved." (Middle Manager 3, RAQA)

In large parts, the mere need to sit together as a management community and to agree on mutual expectations was expressed.

4.9.3.4 Lack of prioritisation

A counterview on these opinions, however, offered yet another middle manager arguing that both parties were at least partly responsible.

"I think there's a little bit of the wider leadership group not taking hold of it, but also the senior management team aren't making it important." (Middle Manager 1, OPS)

While the WLG were not taking hold of it, it was argued that senior management did not necessarily make the impression to prioritise lean outside the masterclasses.

"Three times a year, we have off-site meetings about it, 'Wow, let's do business excellence,' but the rest of the year it is not mentioned. If I talk to people and say, 'In the 1-to-1s you have with your senior manager, how often you held account for business excellence?' It is never mentioned and never talked about it." (Middle Manager 1, OPS)

"I think for me, particularly, it was very periodic. It was only when we were doing off-sites. So, it was literally once every three months we sit down. We bang the table and tell everybody, 'It's the most important thing in the world,' and then we back to work and don't do anything for three months. That was how it was for me." (Middle Manager 2, RAQA)

Taking both senior management and the WLG into consideration, there seemed to be a consensus that both parties must play their part to realise the potential. More precisely, the WLG were deemed to actively seek their senior managers upon need, while senior managers were urged to demonstrate much more support and involvement in turn.

"Now, we need to do it, but they [other wider leadership group members] do need the support from the senior team. And maybe that was quite sporadic in the past. If you're a manager and you're struggling to do something, then you need to go and ask your senior for help. And people haven't

done that yet because they didn't think it was their role. They thought they were going to be told what to do next." (Middle Manager 3, RAQA)

To put it in another way, middle management were encouraged to approach senior management to indicate more clarity about their needs. In a middle manager's words,

"It seemed to be that we needed to flow up more of what should have been coming down." (Middle Manager 2, R&D)

4.9.4 Failure factor #4 – Knowledge and understanding

Fourth, it had become evident that there was a lack of knowledge and understanding within different functional areas. Interestingly, however, the middle managers from OPS rather seemed to point towards other functional areas, whereas middle managers from these other functional areas had partly been pointing towards themselves and admitting their lack of knowledge and understanding.

4.9.4.1 Lack of knowledge within the wider leadership group

Not only amongst middle managers but in the entire organisation, there was a general perception that non-operational areas had a much narrower view and a limited knowledge about lean as compared to the middle managers from OPS.

"The rate of a pickup […] across the business has varied. It was very clear that operations were the very early leaders [and] engagers with that and accelerated ahead." (Middle Manager 1, R&D)

In OPS, there was a consensual belief upon reluctant attitudes of WLG members from non-operational departments.

"Some people outside of operations are not as motivated enough for whatever reason, […] which creates frustration. […] I think it's a lack of knowledge, which then creates a lack of engagement because they can't see the point of it." (Middle Manager 1, OPS)

In a similar way, a departmental colleague argued that some WLG members are not familiar enough with the underlying lean principles.

"Where people are resistant to it and thinking that maybe only works in operations because of clear metrics, maybe it's not applicable to other parts of the organisation because they haven't looked into it well enough to understand how it's applicable." (Middle Manager 3, OPS)

Yet another colleague referred to an overcomplication as a potential cause why lean was not sufficiently understood.

> "I think people are overcomplicating it. […] I think it's a lack of not knowing what it is and not really understanding [it] because all it is is about trying to run the business better. It's nothing more complicated than that really." (Middle Manager 2, OPS)

To a large extent, these views found support outside of OPS likewise. A middle manager working in RAQA, for instance, made a lack of understanding responsible for disengagement likewise.

> "I think you could subconsciously be resistant if you don't understand 'why', and you don't see the benefit and you don't buy into it. I think I have come across this and I have been involved in those conversations." (Middle Manager 1, RAQA)

This disparity of knowledge within the WLG had led to the circumstance that several lean taskforce members, who had a considerable lean experience, continued to take the reins. In consequence, operational departments continued to drive lean ahead in their functional area, whereas the rest of the WLG felt outpaced and struggled to catch up.

> "Some people were part of the group who determined what we were going to do and part of the group who understood what we were going to do. And I think you had this real, tight-knit group of people with all of the information and then the rest of the people were kind of satellite." (Middle Manager 2, RAQA)

To counteract, a mentoring system was set up, which paired stronger and weaker WLG members with the aim to close existing knowledge gaps. At the same time, plans were made to set up an internal network group for peer support and to install more tailored training programmes.

4.9.4.2 Technical terminology

Apart from a general lack of knowledge, a further issue concerned technical terminology (e.g., "gemba" and "kaizen"). In several cases, such terminology disengaged people and turned them off. That was due to two main reasons. The first reason simply included their understanding. A few middle managers from non-operational areas confessed that they do not know what the meanings behind these "buzzwords" are and kept overthinking what they comprise.

> "Often leader standard work is one of these terms that sounds high, and people try to get behind it but, often the case, people practice leader standard work already […] but people don't realise this.

[…] The way [business excellence] is presented makes it sound more complicated and makes it sound like this sort of deep thing where actually it's not." (Middle Manager 1, OPS)

"I think because it's this mysterious thing over here – business excellence, operational excellence, Shingo… People get scared of it or put off by it and I think if we did a better job first time or second time around, if we could do it again, it would almost be trying to help translate it for everybody […] so [that] it's not as difficult as we make it out to be." (Middle Manager 2, OPS)

"Obviously, learning and education is easy enough – that's training, but some buzzwords […] make it sound like a wonderful science. In fact, a lot of it is basic management applications on how to manage a business." (Middle Manager 3, SGAE)

The second reason concerned the historical origin of these terms. Although their meanings were supposed to be understood in a universal way despite their manufacturing origin, they were a confirmation for that antipole group that lean is solely a manufacturing-focused initiative.

"If you overuse the vocabulary, it's going to turn people off, especially in R&D, because, in R&D, they sit there and go, 'Oh, that's what operations do. Oh, kaizen and things. That's an operations term.'" (Middle Manager 1, OPS)

Over time, the lean programme's name "business excellence" was associated with negative experiences in wide parts of organisation likewise. Outside of OPS, many employees were already annoyed by hearing term.

In response to that, middle managers from OPS argued that there are still too many who have a very narrow view of what it comprises and who are not aware of the concept. To counteract, they suggested demystifying the terminologies by simplifying the language to make it more accessible for individuals and to avoid that these terms were overthought and overcomplicated.

"I think that we need to make the vocabulary simpler, so it isn't that just getting better, not kaizen or whatever. This all sounds very, you know… […] It becomes more natural and a more obvious thing to do with getting rid of some of the vocabulary." (Middle Manager 1, OPS)

"Business excellence is full of words that I almost want to throw away. […] If you boil it down to the behaviours around that, which are in plain English and just say, 'Do this,' the rest comes. […] We're going to stop calling it that […] to get people to see that it's normal to just make improvements all the time." (Middle Manager 3, RAQA)

To some extent, this practice had, in fact, already proved successful on the shopfloor where production managers sought translating those terminologies into an understandable language so that they could engage operators.

> "I think if you mentioned some of those terms […] to the operators, they wouldn't have a clue what you are talking about. […] Even 'CI', they say, 'What's CI?' [Go] to them and try to say, 'Look, come up with good ideas to improve this…' – […] the message is there…" (Middle Manager 6, OPS)

In another functional area, a middle manager completely refrained from using such terms as well because people put already off when hearing them. He stated that it works out way better than before.

> "[Somebody] said he has taken the word 'business' out of the title and he just says, 'I'm driving excellence' because he didn't want people to be put off by the fact that it's business excellence. We don't want business excellence to become this negative term, 'Oh god, it's business excellence.' It is just about doing things in an excellent way." (Middle Manager 1, SGAE)

4.9.4.3 Lack of self-development

However, a learning process had still been taking place over time. Outside of OPS, functional areas had been catching up after a while.

> "A lot of other departments [outside of operations] are starting to catch up." (Middle Manager 1, R&D)

After being involved for two years, a middle manager located in SGAE described how all these different "mosaics" (i.e., different pieces of knowledge about lean) made finally sense for him to understand the bigger picture but, even after a couple of years, notable knowledge gaps had still remained present amongst many middle managers.

> "I'm brand-new to it but there seem to be other people in a very similar position [with a lack of understanding] who have already been here for years." (Middle Manager 2, R&D)

With the intention to challenge every member of the WLG, a middle manager asked during the seventh masterclass,

> "What have you done to increase the knowledge since we met last time?" (Middle Manager 1, SGAE)

While the room remained silent, nobody had apparently made an effort to keep working on oneself by engaging in any type of self-development activity. In fact, this circumstance reflects a statement made by a middle manager from OPS.

> "I think where that sort of situation exists and people don't have that engagement, buy-in, and willingness to sort of look into it and trying to understand. Then, I think, that's the tipping point between success and failure." (Middle Manager 3, OPS)

4.9.4.4 Lack of knowledge within senior management

At the same time, however, there were indicators that such lack of understanding was not only present within the WLG but at the senior management level likewise.

> "[The level of knowledge is] probably about the same in the sense that you've got some in the group that are really knowledgeable and some somewhere in the middle, and then, you've got some that are probably catching up. And I would say probably that's indicative of both groups." (Middle Manager 1, SGAE)

Such lack of understanding, however, rather seemed to be present amongst senior managers outside of OPS. Referring to managers outside of OPS, one middle manager said the following.

> "[Outside of operations,] people aren't able to make that leap for whatever reason, and I think that includes the wider leadership group and also parts of the senior management team because, again, there are some people who understand it and some maybe don't understand it." (Middle Manager 1, OPS)

Together with that, the circumstance that lean implementation was stalled to one extent or the other was partly justified by the perception that most senior managers had already gone as far as they could.

> "The senior team probably has taken us as far as they can from their knowledge point to view. […] The executive team themselves don't feel equipped to be able to sit with their people and induct them into that process." (Middle Manager 1, SGAE)

In other words, senior management were learning as well. To cover this up, a middle manager argued that senior managers pretended to be experts and "are making it up". The will to learn, however, varied too.

> "There are other areas where, I think, the senior manager […] doesn't understand it but he is trying to understand – the will is there. […] You've got some people who are probably able to understand

> or maybe they don't understand it […] but certainly, the will is very low. […] So, there's a combination of those things." (Middle Manager 1, OPS)

On average, the level of knowledge amongst senior management and the WLG seemed to be the same. In both management layers, there were people who stuck out and people who caught up according to some middle managers' statements.

4.9.4.5 Inducting newcomers

In their respective departments, two employees had recently been promoted to a middle management role, which made them part of the WLG. Due to their previous roles in the case organisation, both were familiar with basic structures in the organisation indeed but admitted a lack of experience with lean along with a lack of understanding what it entails. After all, they had missed the entire knowledge-building process that other WLG members underwent in the previous years.

> "I think there's a real mix of experience and knowledge on business excellence in that wider leadership group. Some because they entered fairly recently – relatively new recruitments in. They weren't part of the initial kind of learning process." (Middle Manager 1, SGAE)

In an interview, a newcomer expressed that he was missing a "welcome pack". Instead, he was referred to a network drive and encouraged to self-study the information about the case organisation's lean implementation that was available there.

> "I learnt at the last workshop there's a folder with all of the information in, but I was warned that it's spread out amongst multiple files. So, I said clearly the initial thing is, if you can't disseminate all of those things into a clear statement, if they are spread out across files, then there will be interpretation issues with understanding exactly what it is." (Middle Manager 2, R&D)

In doing so, continuous validation of his interpretation was necessary to gain more clarity and to ensure a correct understanding. As these flaws became apparent, senior management and HR decided to make senior managers responsible for facilitating the knowledge-building process. In practice, however, not every senior manager felt sufficiently equipped to induct their employees into the lean programme.

> "[Newcomers] are managed by their directors [but] no one has sat down as in, 'Alright, let me take you through the process,' or, 'Let me walk you through.' They may know the boards, but the actual theoretical side of [it]? And that maybe says a few things to me that the executive team themselves

don't feel equipped to be able to sit with their people and induct them into that process." (Middle Manager 1, SGAE)

It was then the OPS director who invited both to a 1-to-1 session to introduce the lean programme, although he was only responsible for one of them.

4.9.5 Failure factor #5 – Resources and priorities

A fifth issue, yet seen as a smaller one, concerned resources and priorities. In several cases, middle managers reported how their daily job has priority and how it keeps them too occupied to spare some time for carrying out improvement activities.

"When you come back into the office and you have to do your day job as well as try and do the improvements and change things and make things better, it's very difficult to get the balance or to achieve a balance, because the day job is always priority." (Middle Manager 3, OPS)

"Every time I'm off-site and we all sat there talking, it all makes perfect sense and I'm on board with it. And then, I come back to this door, you're caught in a whirlwind of everything other than trying to do that. And it does always fall off the bottom of my list, which is a bad thing to say." (Middle Manager 2, RAQA)

In smaller areas, middle managers were also more involved in supporting employees at the operational level and had less time to spare. Also, additional tasks from their parent organisation had sometimes led to an increasing workload. In the past, a special role was played by the VMBs because they required a monthly update for the purpose of having them ready to be audited.

"People are always politically correct. They don't like [lean], but then they still say, 'Wow, that's great – we'll do that.' But when you talk to people in private, that's when many say, 'No time and no benefit – all these boards don't do us any good.' It takes too much time to maintain them, and people aren't necessarily on board. […] We just don't have the time for it, you know? And nobody looks at it either – this is the worst." (Middle Manager 2, SGAE)

Several expressions from middle managers outside of OPS made obvious that CI was neither incorporated into their daily work yet nor a priority on a daily basis but rather seen as something extra alongside the daily job.

4.10 Summarisation of results

4.10.1 Diffusing lean from manufacturing operations to the wider organisation

In the following, the results addressing the first research question as to how lean can be diffused from manufacturing operations to the wider organisation are summarised.

RQ1. How can lean be diffused from manufacturing operations to the wider organisation?

In a timespan of more than five years, the findings demonstrate the dynamics and complexity associated with the case organisation's lean evolution until November 2019. Moving towards "excellence agility", a lean taskforce, which was mainly consisting of managers from OPS and functional areas that are closely related, initiated the diffusion of lean from manufacturing operations to the wider organisation in October 2017 according the 3P (i.e., purpose, process, and people) logic with the aid of a consultancy. First, a behavioural deployment system aimed at engaging "people" in the organisational "purpose". Second, a strategy alignment system aimed at aligning the "processes" with the "organisational purpose". Third, a CI system sought "people" to improve their owned "processes". Until November 2019, the case organisation had been undergoing two evolutionary phases to which the organisation referred to as "reactive instability" and "proactive velocity", whereas "excellence agility" had not been achieved in this period according to self-assessment exercises measuring lean maturity but remained an ambition.

The two evolutionary phases "reactive instability" and "proactive velocity" were characterised by nine distinct focus areas, largely relating to the masterclasses to which the WLG had been invited by senior management on a quarterly basis. Alongside these nine distinct focus areas within those two evolutionary phases, 15 different key managerial activities were identified, constituting either one-off events (e.g., identifying failure factors) or longer-term activity streams flowing horizontally over a certain period of time (e.g., visual management). In total, there were four regularly reoccurring activities revolving around (1) behavioural deployment (purpose, core values, and ideal behaviours), (2) maturity self-assessments, (3) audits associated with VMBs, and (4) the R&R system. In every single managerial activity (stream), the case organisation had either been introducing different management systems (e.g., L&D system, CI system, or LSW) or attempting to overcome hurdles and challenges emerging during their lean transformation. In Table 4.35, the case organisation's lean evolution towards "excellence agility" is summarised, while Table 4.36 provides more detailed information about each single activity.

In these years, many positive changes had been undertaken and notable achievements could be denoted. In OPS, most progress was made while lean implementation had locally realised various monetary and non-monetary benefits. At the same time, however, several common and individual issues were experienced in non-operational departments, which made the case organisation's overall lean implementation stall. After all, there was a perceptible lean maturity gap between operational and non-operational departments. The root causes for the circumstance that lean implementation had stalled were explained by middle managers and are summarised as follows.

Table 4.35 Lean evolution chronicle (1)

No.	Evolutionary phase(s) of lean implementation									*f*
	Reactive instability						*Proactive velocity*			
	I. Introducing lean manufacturing	*II. Behavioural deployment*	*III. Strategy deployment*	*IV. Learning & Development and progress*	*V. Continuous improvement and progress*	*VI. Cultural enablers and progress*	*VII. Leader standard work (1) and progress*	*VIII. Leader standard work (2) and progress*	*IX. Failure factors*	
	November 2014 to October 2015	*October 2015 to December 2017*	*December 2017 to February 2018*	*February 2018 to May 2018*	*May 2018 to October 2018*	*October 2018 to February 2019*	*February 2019 to June 2019*	*June 2019 to October 2019*	*October 2019 to November 2019*	
1	Lean manufacturing model									1
2	"Manufacturing excellence": Tackling the low-hanging fruits	Diffusing lean from manufacturing operations to the wider organisation								2
3		Involving a consultancy								1
4		Developing a purpose statement and ideal behaviours		Revisiting ideal behaviours	Aligning corporate core values and ideal behaviours	Aligning corporate core values and ideal behaviours: Update				4
5		Measuring lean maturity: Annual progress review Shingo Insight Assessment #1	Measuring lean maturity: Annual progress review			Shingo Insight Assessment #2 Improving on cultural enablers	Measuring lean maturity: Annual progress review Improving on cultural enablers: Update			4
6		Introducing "business excellence" boards			Auditing visual management: Assessment status	Auditing visual management: Assessment status	Auditing visual management: Assessment criteria update	Auditing visual management: Post-relaunch review		5
7			Involving the "wider leadership group" Delegating lean and future expectations on the wider leadership group				Improving on leadership	Improving on leadership: Update		3
8			Introducing "business excellence" masterclasses							1
9			Breakthrough objectives and policy deployment ("hoshin kanri")				Policy deployment ("hoshin kanri"): Update			2
10				L&D		L&D system: Update				2
11				Recognition and celebrating success	Proposing a new R&R system	Proposing a new R&R system: Update		R&R system: Post-launch review		4
12					Inspiring with continuous improvement in OPS	Implementing continuous improvement systems across departments				2
13								Voice of the Customer: Accessing surgeons		1
14								Breaking down silos: Improving cross-functional relationships		1
15									Identifying failure factors	1

Source: Author

Note(s): See Table 4.36 for more detailed information.

Table 4.36 Lean evolution chronicle (2)

No.	Phase(s)	Focus area(s)	Highlight(s)
Reactive instability			
1	Introducing lean manufacturing (November 2014 to October 2015)	Lean manufacturing model	Appointment of two new hires (operations manager and OPS director) Manufacturing vision and strategic direction determined by lean manufacturing model with predefined manufacturing goals for March 2018
		"Manufacturing excellence": Tackling the low-hanging fruits	Introduction of basic hard lean practices (e.g., 5S and kanban) Improvements towards one-piece flow in a three-month cycle (over two years, eight production lines were relayed, and waste was reduced and/or eliminated) Increase of efficiency by 20 to 30%, reduction of labour by 25% plus a few non-monetary benefits (e.g., space improvements, ease of operation, and product quality)
2	Behavioural deployment (October 2015 to December 2017)	Diffusing lean from manufacturing operations to the wider organisation	Several potentials for optimisation identified by "Your Voice 2013" survey Involvement of non-manufacturing departments in lean implementation Taskforce-led coordination (with two senior managers and a few other managers from manufacturing-associated environments)
		Involving a consultancy	Sourcing of an external consultancy that can support lean implementation during the early stages External consult helped to develop a better understanding of the Shingo model and provided some input into planning, the vision, and around the evolvement of future structures
		Developing a purpose statement and ideal behaviours	Creation of a business vision that engages and guides the direction of travel Development of ideal behaviours because ideal results require ideal behaviours
		Measuring lean maturity: Annual progress review	Shingo Insight Assessment #1 (Shingo Prize as a proxy and quantifiable target) Instability and a narrow focus on hard lean practices was diagnosed whereas more focus on soft lean practices was necessary (e.g., training and recognition) Best-practice review
		Introducing "business excellence" boards	In OPS, visual management proved beneficial Introduction of visual management organisation-wide with a strict format to be followed Introduction of a cross-functional audit aimed at ensuring that visual management is happening
3	Strategy deployment (December 2017 to February 2018)	Involving the "wider leadership group"	Important management community to effect change and to drive excellence organisation-wide (e.g., link between strategic and operational level, mouthpiece of senior management, and development of "stars") Wider leadership group consists of 14 middle managers, five project managers, two research managers and one product manager
		Introducing "business excellence" masterclasses	Quarterly workshops with all wider leadership group members in the organisation Awareness development to enable the wider leadership group to drive lean
		Breakthrough objectives and policy deployment ("hoshin kanri")	Breakthrough objectives (seven hoshins) were set out what needs to be achieved in the next five years (note that strategic goals are largely set by their parent organisation) No wider leadership group involvement in the strategy development process
		Measuring lean maturity: Annual progress review	Annual self-assessment exercise to measure lean maturity ("reactive instability") Best-practice review
		Delegating lean and future expectations on the wider leadership group	Senior management tasked the wider leadership group with leading lean, delivering improvement plans, coaching their teams, and reviewing their visual management boards
4	Learning & Development and progress (February 2018 to May 2018)	Revisiting ideal behaviours	Reorganised, finetuned, and simplified ideal behaviours to reflect the culture that is needed to deliver the performance expected Alignment with the purpose statement

No.	Phase(s)	Focus area(s)	Highlight(s)
		Learning & Development	Awareness development around L&D because it was necessary to drive engagement and to develop a coaching and continuous improvement culture
			Top Employers Institute survey indicated a weakness in L&D
			Several leadership development programmes were launched (i.e., business excellence masterclasses, Corporate Leadership Academy, and INFLUENCE programme)
		Recognition and celebrating success	Ideal behaviours are encouraged by recognition
			Various flaws in existing R&R system (e.g., who to recognise for team efforts, lack of standards, and senior management recognitions despite a limited factual basis)
			Improvement proposal to be elaborated
5	Continuous improvement and progress (May 2018 to October 2018)	Aligning corporate core values and ideal behaviours	Introduction of a set of corporate core values by their parent organisation (should act as a source for role modelling, mentoring, and feedback as well as selecting and recruiting new employees)
			Corporate core values and corporate core behaviours are largely in line with ideal behaviours
		Inspiring with continuous improvement in OPS	Awareness development around continuous improvement
			All non-manufacturing departments are expected to have continuous improvement systems by October 2018
		Auditing visual management: Assessment status	Numerous technical changes on visual management boards (e.g., removal of dysfunctional and duplicate metrics measuring the same, such as service level and backorder)
			Dissatisfying results of visual management board audits (only eight out of 16 scheduled audits were carried out and one visual management board was not even set up yet)
			OPS and quality control department performed best in audits
		Proposing a new reward and recognition system	Peer recognition of contributions and ideal behaviours on individual and team basis
			Daily (“thank you” culture) and monthly (awards) recognition
			Award Committee occupied by a cross-functional team of employees
			More fairness, clarity, and consistency than before
6	Cultural enablers and progress (October 2018 to February 2019)	Implementing continuous improvement systems across departments	Sources for idea and activity generation per department
			Improvement activity plans per department
		Auditing visual management: Assessment status	Issues with visual management boards (e.g., lack of engagement and poor participation)
			Only 13 out of 22 assessments were carried out
			Both senior managers and wider leadership group members did not attend their audits
			Low average audit performance
		Aligning corporate core values and ideal behaviours: Update	Matching corporate core values, corporate core behaviours, and ideal behaviours
			Wider leadership group’s responsibility to cherish corporate core values and ideal behaviours in their functional area
			Involvement of employees in the wider organisation with much more ownership in ideal behaviours
		Proposing a new reward and recognition system: Update	Alignment with corporate core values
			Daily recognition was extended by an e-mail or a message via instant messenger
			Number of monthly rewards increased from three to five
			Senior management reserved the right to make final decisions upon awards
		Shingo Insight Assessment #2	Overall performance was average if compared with other organisations
			Low performance in “cultural enablers” (soft lean practices)
			Manufacturing (46.31%) had the most influence on the survey outcome
			OPS were strongest in “continuous improvement” but weakest in “cultural enablers”
		Improving on cultural enablers	Key actions involved a new salary structure in production, a site-wide bonus, a new R&R system, and L&D opportunities

No.	Phase(s)	Focus area(s)	Highlight(s)
		Learning & Development: Update	L&D roadmap (2017-2021) with a focus on leadership development, talent management, and development and performance
Proactive velocity			
7	Leader standard work (1) and progress (February 2019 to June 2019)	Improving on leadership	All management layers started to recognise positive behaviours and to introduce regular team meetings, 1-to-1s, and PDRs with the aim to institutionalise and strengthen such leadership practices
		Policy deployment ("hoshin kanri"): Update	Update of annual objectives in policy deployment matrix to be launched Involvement of wider leadership group to determine annual improvement priorities in a brief session
		Auditing visual management: Assessment criteria update	Poor participation in audits No more cross-functional audits but responsibility of line manager against a set of assessment criteria Scores were dropped because they drove wrong behaviours
		Management by objectives: Including non-operating staff	Non-operating staff to be included in management-by-objectives scheme Operators to be granted a one-off bonus each year based on organisational performance
		Improving on cultural enablers: Update	Largely with success, several improvements on cultural enablers put in place Very positive feedback from townhall meeting on improvements
		Measuring lean maturity: Annual progress review	Annual self-assessment exercise to measure progress with lean over time Maturity levelled up to advanced "proactive velocity" Best-practice review
8	Leader standard work (2) and progress (June 2019 to October 2019)	Improving on leadership	Insights from several sources suggested a potential for optimising how leadership was practiced Senior management reemphasised the strong influence that the wider leadership group has to conduce change in the organisation
		Voice of the Customer: Accessing surgeons	Limited interaction with end customers (i.e., surgeons) Action plan developed to get a better idea of surgeons' needs (voice of the "external" customer)
		Breaking down silos: Improving cross-functional relationships	Action plan to counteract perceived barriers between different departments (e.g., clipboard talks)
		Reward and recognition system: Post-launch review	Improved R&R system Mixed feedback from the wider leadership group and staff (e.g., non-transparency and invisibility) Very positive feedback from Award Committee (e.g., more effective)
		Auditing visual management: Post-relaunch review	Audits continued to be dissatisfying because of poor participation and were fully stopped Freedom was given to design the visual management boards according to own departmental needs, which proved successful in some functional areas
9	Failure factors (October 2019 to November 2019)	Identifying failure factors and possible solutions	Majority of the wider leadership group expressed that they were engaged in the process Shared perception on issues with lean implementation Identification of failure factors (i.e., [1] meaningfulness, sensemaking, and belief, [2] vision, strategy, and deployment, [3] leadership, [4] knowledge and understanding, and [5] resources and priorities) Development of respective countermeasures

Source: Author

4.10.2 Lessons learnt from the experiences of middle management during the diffusion of lean from manufacturing operations to the wider organisation

In the following, the results addressing the second research question as to how middle managers experience their organisation's diffusion of lean from manufacturing operations to the wider organisation are summarised.

> *RQ2*. What are the lessons learnt from the experiences of middle management during the diffusion of lean from manufacturing operations to the wider organisation so that lean can be sustained?

Investigating the diffusion of lean from manufacturing operations to the wider organisation at the case organisation, it became obvious that middle managers had been experiencing its evolution alongside its emerging challenges differently, yet with a negative tendency. Hence, a *uniform* middle management perspective was non-existent due to the heterogeneity of the environments in which middle managers had been interacting, but several consistent themes could still be drawn from the case study, framing a comprehensive picture in regard to the lessons learnt.

While operational departments were progressing with lean implementation and leading the way, as consistently reported, non-operational middle managers widely struggled to implement lean in their functional areas. This led to the circumstance that these middle managers could not sufficiently engage in the transformation process. Their insufficient engagement, however, was neither caused by a general disinterest nor by adverse attitudes per se, but rather by several underlying root causes. To put it differently, non-operational middle managers' insufficient engagement in lean implementation was merely a symptom of more far-reaching problems within the organisation.

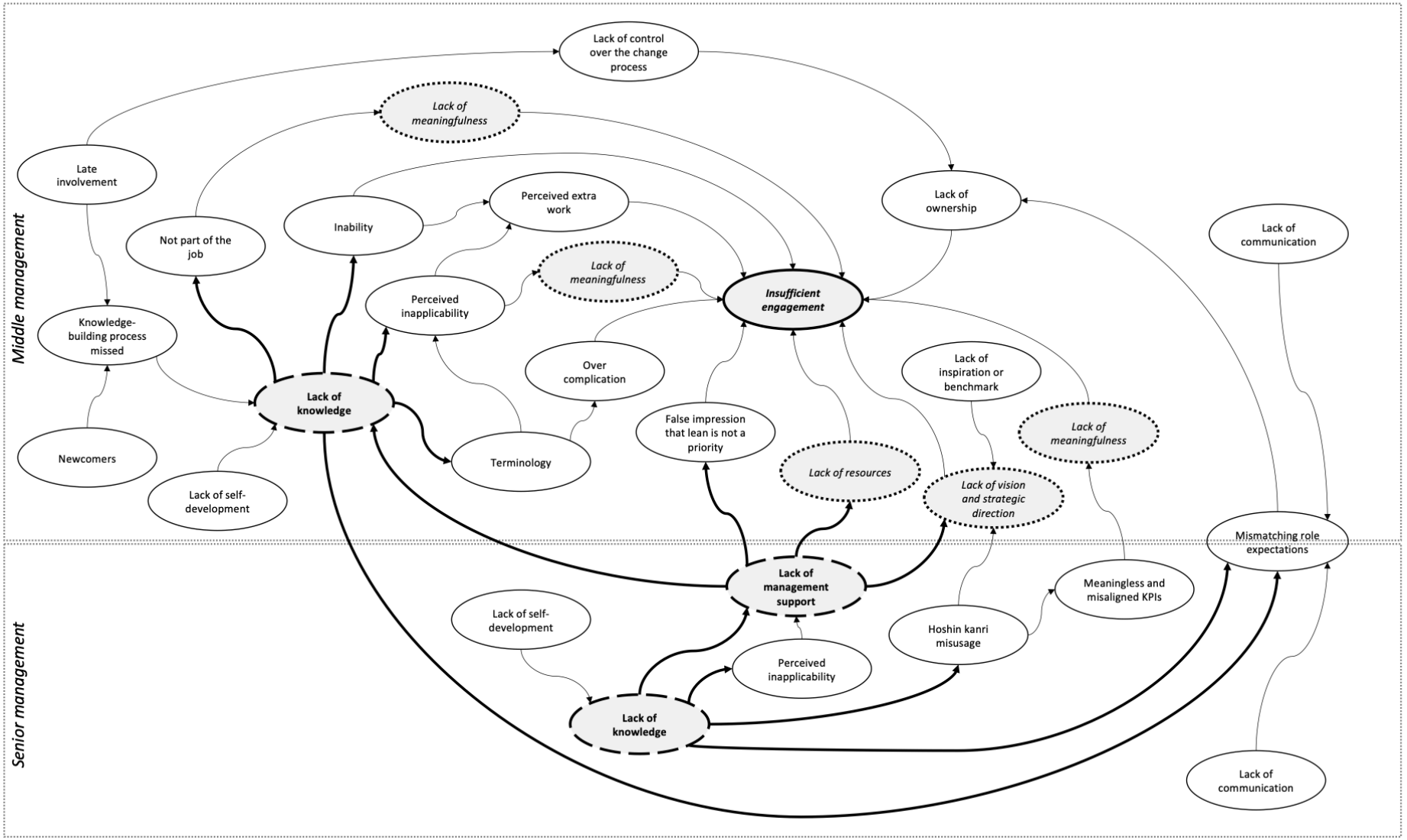
More precisely, insufficient engagement was caused by a (1) lack of meaningfulness, sensemaking, and belief, (2) a poor vision, strategy, and deployment, (3) a lack of leadership, (4) a lack of knowledge and understanding, and (5) a lack of resources. In retrospect, middle managers criticised their late involvement. Due to their late involvement, lean implementation was perceived as being imposed on them while feeling a lack of control over the change process. In several cases outside of OPS, middle managers felt that they were neither sufficiently equipped (e.g., with knowledge or with a strategic direction) nor sufficiently supported by their direct senior managers.

In Figure 4.12, these underlying root causes for their insufficient engagement in lean are summarised. Apart from that, Figure 4.12 shows that the lack of knowledge and the lack of management support they perceived were *critical* failure factors causing several further

downstream issues. A lack of knowledge, for instance, led individuals to see lean as inapplicable in their functional area. Likewise, Figure 4.12 presents the effect that a lack of knowledge at the senior management level had on their support capability.

On the contrary, such difficulties were not experienced by middle managers working in OPS. That was because of several main reasons. First, lean implementation was predominantly led by the lean taskforce, which widely consisted of employees working in OPS. In this way, organisational change could not be perceived as being imposed at any time. Second, a certain lean expertise was present at both the middle and senior management level. Third, middle managers in OPS perceived their senior manager as very supportive. Continuous exchange with their respective senior manager around their OPS strategy, for instance, developed a departmental vision being communicated down to the operator level.

Figure 4.12 Relationships between failure factors from a middle management perspective



Source: Author

5. Discussion

In this longitudinal in-depth case study, the author investigates the diffusion of lean from manufacturing operations to the wider organisation while also focusing on how middle managers experience this transformation process. Taking into account that lean implementation is case-specific and highly dependent on the organisational context (Hasle *et al.* 2012; Marodin and Saurin 2015; Netland 2016; Antony *et al.* 2020; Netland *et al.* 2021), the findings are unique and show that this evolutionary process is quite complex but can still be traced back and reconstructed to a considerably large extent. With regard the research questions, this chapter discusses the results from this longitudinal in-depth case study presented earlier. To recapitulate, Table 5.1 provides an overview of the two research questions to be answered.

Table 5.1 Research questions

No.	Research question(s)
RQ1.	How can lean be diffused from manufacturing operations to the wider organisation?
RQ2.	What are the lessons learnt from the experiences of middle management during the diffusion of lean from manufacturing operations to the wider organisation so that lean can be sustained?

Source: Author

In terms of the structure, this chapter begins with a discussion of the research findings. To begin with, the case organisation's programmatic approach to diffuse lean from manufacturing operations to the wider organisation is discussed. Subsequently, lessons learnt based on middle managers' experiences are elaborated on. In doing so, the latter part will particularly draw on the case organisation's decisions made along their lean evolution from a middle management perspective.

5.1 Integrated socio-technical lean management system: Interlocking "purpose", "process", and "people"

Over more than five years, the case organisation had been studied while undergoing a lean transformation associated with organisational learning. However, sustained cultural change was not achieved until the end of this research project but had remained a vision and desired future state, which the case organisation was working towards. In these years, several changes have been undertaken to diffuse lean from manufacturing operations to the wider organisation. For a concise overview of what the case organisation attempted to achieve during each of its evolutionary phases, see Table 5.2, accordingly.

Table 5.2 Lean evolution chronicle

No.	Timeline(s)		Focus area(s)		Primary intent(s)[a]
	Start	*End*	*Manufacturing*	*Site*	
1	November 2014	October 2015	Lean manufacturing		Implementation of lean principles in the manufacturing environment
2	October 2015	December 2017		Behavioural deployment	Set of ideal behaviours everyone feels encouraged to adhere to Create "employee 'pull' for improvement" (Devine and Bicheno 2019, p. 57)
3	December 2017	February 2018		Strategy deployment	Strategic planning ("hoshin kanri") to set out a mutual direction of travel Visual management to inspire continuous improvement by making unstable process more visible to their local process owners
4	February 2018	May 2018		Learning & Development	Skill-enhancement programmes to build continuous improvement capabilities organisation-wide Enhancement of the organisation's capacity and institutionalisation of lean
5	May 2018	October 2018		Continuous improvement	Continuous improvement infrastructure Improvement opportunities and respective activities to realise and exploit potentials for optimisation
6	October 2018	February 2019		Cultural enablers	Increased focus on soft lean practices to enhance the traction for continuous improvement
7	February 2019	June 2019		Leader standard work (1)	Series of reoccurring leadership practices to drive and institutionalise continuous improvement Continuous improvements culture with leaders recognising, coaching, and seeing if continuous improvement is lived
8	June 2019	October 2019		Leader standard work (2)	Improvement of lean leadership practices
9	October 2019	November 2019		Failure factors	Peer discussion at the middle management layer to identify barriers to lean implementation Joint problem-solving to overcome barriers to lean implementation

Source: Author
Note(s): (a) In Table 4.36, a more detailed overview is available.

Consistent with frameworks by Womack (2006, 2008), Anand *et al.* (2009), and Netland *et al.* (2021), lean was implemented according to the "3P" (i.e., purpose, process, and people) logic. In association with lean, the 3P logic resonates with the contemporary academic focus on "soft-centric" management and cultural-based change, along with a more holistic perspective on the organisation itself (see Table 2.11; Hines *et al.* 2004, 2021; Bhamu and Sangwan 2014; Hines in Åhlström *et al.* 2021). Impacting on lean sustainability, the 3Ps are seen as the essence of a CI infrastructure in the literature (Anand *et al.* 2009; Table 5.3).

Table 5.3 3P framework

No.	Dimension(s)	Intent(s)	Indicative case-study example(s)
1	Purpose	Determine multi-level goals while maintaining unified strategic outlook	Stakeholder management Strategy formulation Organisational design
2	Process	Institute practices and structures gearing implementations towards *purpose*	Order creation Product lifecycle management Order fulfilment Supply chain integration
3	People	Invest in resources towards achieving *purpose*	Health, safety, and environment People lifecycle management Learning and development Reward and recognition

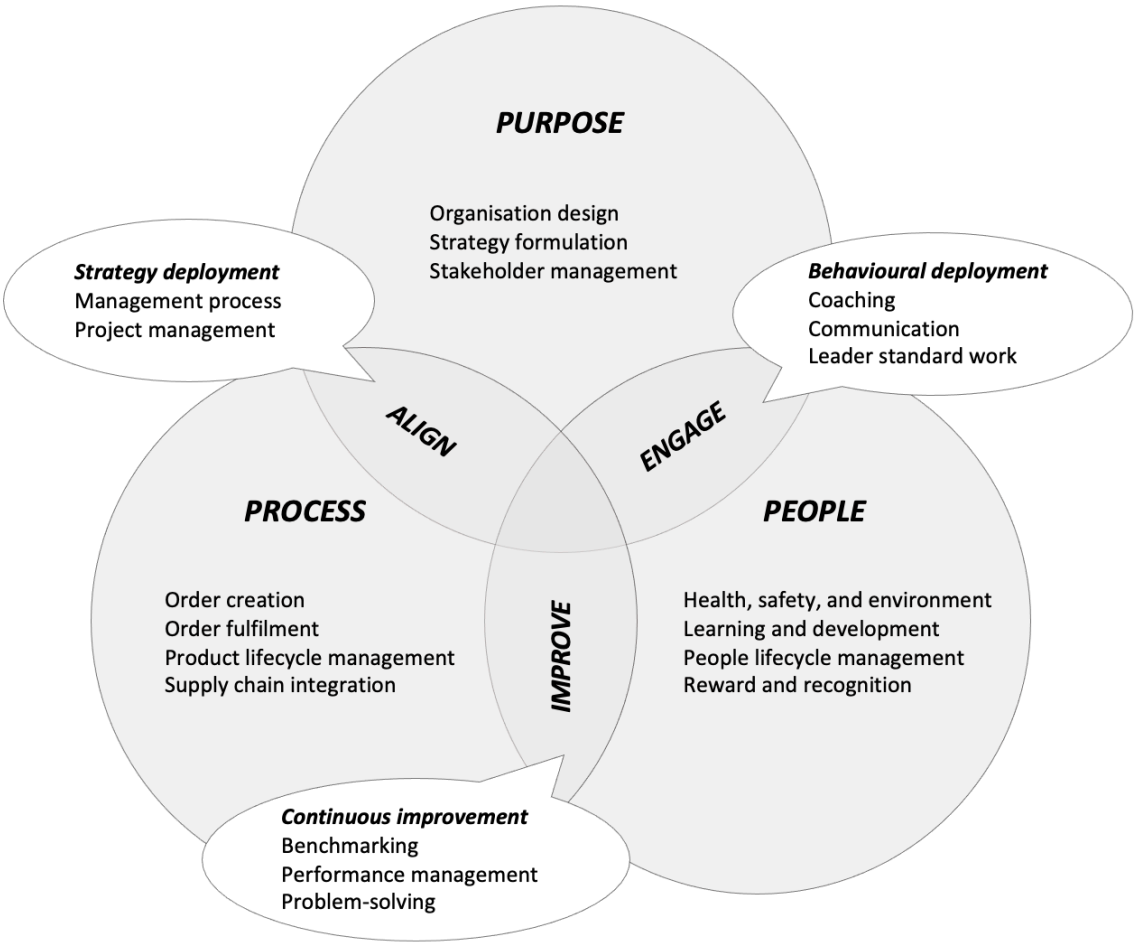
Source: Adapted from Anand *et al.* (2009)

Note that a STS seeks to achieve superior performance by carefully considering its social and technical counterparts (Emery and Trist 1960; Pasmore and King 1978; Trist 1981; Miner 2006; Kull *et al.* 2013; Hadid and Mansouri 2014; Bicheno and Holweg 2016). Therefore, it makes sense to have a closer look at how social ("purpose" and "people") and technical ("process") sub-systems found joint optimisation (or not) within the integrated lean management system and how they were interlocked.

In retrospect, the case organisation attempted to develop a sustainable CI culture by reconciling the 3Ps. In doing so, it gradually introduced elements of an integrated lean management system to achieve an interlinkage and alignment between each of the three dimensions. First, the case organisation focused on behavioural deployment to conduce behavioural change with the aim of encouraging employee engagement towards the organisational purpose. Second, strategy deployment was supposed to align the case organisation's purpose with its processes by breaking down the local site vision into smaller individual targets. Third, a CI system with visual management as its hub aimed at identifying variation from the standard and at making unstable processes more visible so that their local

process owners will be encouraged to engage in process improvements and problem-solving using hard lean practices (Figure 5.1).

Figure 5.1 Integrated lean management system



Source: Adapted from Womack (2006, 2008); Anand *et al.* (2009); S A Partners (2021)

To some extent, these interfacing management systems resonate with Found *et al.*'s (2007) lean iceberg, which emphasises the importance of developing three specific management systems, namely, (1) strategy and alignment, (2) leadership, and (3) behaviour and engagement, in the first place.

It is not unusual that organisations initiate their lean implementation with a strong technical focus on hard lean practices when embarking on lean (Bicheno and Holweg 2016; Kelly and Hines 2019; Hines *et al.* 2020). Characteristics of an initial tool-based change (Hines *et al.* 2020), however, could only be registered within OPS (i.e., prior to diffusing lean from manufacturing operations to the wider organisation) whereas the wider organisation had initiated their lean implementation with a systems-based change (Piercy and Rich 2009a; Hines

et al. 2020) right away.[50] In the past, Hines (2013) described already two roadmaps in which organisations may either embark on their lean journey with an initial focus on hard lean practices *or* with a more structured approach to lean implementation by means of strategy deployment and people engagement. More generally, this equally suggests that the evolutionary stages, which departments undergo, can differ and will not necessarily be following a rigid or gradual sequence of equal events with an initial focus on hard lean practices.

5.1.1 Step #1 – Engaging via behavioural deployment to interface "purpose" and "people"

5.1.1.1 Developing a purpose statement and ideal behaviours

To be sustainable, lean requires a behavioural transformation at the individual level (Atkinson 2010; Bhasin and Found 2021). For more than two years, a purpose statement (see Table 4.5) to set out the "*why*" (Hollister *et al.* 2021) and a set of ideal behaviours (see Table 4.14) had been developed and deployed simultaneously in all departments of the case organisation to initiate the elaboration of a normative framework. A set of guiding principles (e.g., corporate values) associated with ideal behaviours was aimed at closing cultural gaps so that all employees felt encouraged to display habits conducive to a lean transformation.

Instilling ideal behaviours resonates with a few lean implementation approaches, as seen in the literature. They are either conceptual (e.g., Devine 2016; Devine and Bicheno 2019; Hines in Åhlström *et al.* 2021) or empirical (e.g., Kelly and Hines 2019; Hines *et al.* 2020). In the literature, such an approach to creating "employee 'pull' for improvement" (p. 57) is referred to as "rapid, mass engagement" (Devine and Bicheno 2019, p. 57). In Europe, Devine and Bicheno (2019) argue, rapid mass engagement had been adopted in 25% of Shingo Prize-winning organisation between 2010 and 2017.

Consistent with that, the literature suggests that lean transformation is likely to fail unless an organisation embeds such ideal behaviours into its culture (Liker 2004; Bhasin 2012b). In this way, the case organisation promised itself to counteract what they referred to as "cultural hangovers" and encourage the right behaviours so that everyone will be working towards the same direction and purpose.

[50] It is worth remarking that many employees limited lean to its hard lean practices used in manufacturing areas while they could not see how these were supposed to suit their office environment. In this regard, there was a certain cognitive or psychological element to it where lean implementation would have probably started with a focus on hard lean practices for them but not be applicable to their local environment, after all (see section 5.3.4.4 for more).

5.1.1.2 Buying into ideal behaviours

Interesting, in particular, is how the set of ideal behaviours was revised over time as compared to its initial development. The purpose statement and the set of ideal behaviours had previously rather been a preliminary activity that took mainly place between members of the lean taskforce and another working group, whereas the refinement of those ideal behaviours included the wider workforce. Instead of being imposed on employees in a top-down manner, the refined set of ideal behaviours had emerged from consensus as part of a bottom-up approach. Although this set of ideal behaviours had only received a minor update, much more employees were involved and had ownership in them from now on. This participative dialogue avoided that the set of ideal behaviours was perceived as lip service. Consistent with Bicheno and Holweg (2016), it was seen as a daily expectation instead. To find another explanation for why the previous approach was not successful enough, Schein's (1996) concept of organisational culture in social systems may help because he proposes that the manifestation of culture (e.g., via behaviours and artefacts) derives from *shared* values. Shared values, however, are something that comes from *everyone* within an organisation. In line with these insights gained, Devine and Bicheno (2019) urge that the process of developing rapid mass engagement

> "should involve everyone *in the system to be optimised* [italics in original]. It should involve the 'culture' being self developed, and hence owned, from bottom-up rather than being imposed 'top down'" (p. 65).

This, in fact, also aligns with observations made by Hines *et al.* (2020). In a case study, they report how such principle-led behaviours had initially been imposed on employees by senior managers. As a result, local teams struggled to see their relevance. In a subsequent bottom-up exercise, however, senior management decided to change their approach insofar that employees got involved in developing a new set of principle-led behaviours. Interestingly, the new set that the employees came up with was largely the same as the existing one, yet the main difference lay in the level of ownership the employees had in it. After all, ownership and empowerment alike are soft lean practices that conduce lean sustainability by assisting in overcoming socio-cultural barriers (Leite *et al.* 2020a).

5.1.1.3 Sustaining ideal behaviours

In lean systems, overcoming change fatigue and sustaining engagement is one of the major challenges (Taylor *et al.* 2013). In multiple ways, the case organisation attempted therefore to attract sustaining ideal behaviours on an everyday basis after their deployment. To be fair,

however, *sustaining* ideal behaviours has a quite strong connotation considering the low progress made with lean in some functional areas outside of manufacturing. Therefore, it is argued that the following practices helped to gradually embed ideal behaviours within the case organisation in the first instance while finding wider acceptance across the business in the future.

First, senior management strongly believed in the power of recognition to drive ideal behaviours, as also reported by Bicheno and Holweg (2016), Kelly and Hines (2019), and Hines *et al.* (2020). In this respect, peer recognition, day-to-day recognition (a "thank you" culture and immediate recognition), and monthly awards associated with a staff-managed Awards Committee were suggested to counteract the criticism around the previous R&R system. Plus, recognition was made public within the business by communicating it in the monthly team brief so that it could gain a wider reach. Such a practice is, in fact, not uncommon at all (Taylor *et al.* 2013). Indeed, it is true that a "thank you" culture to recognise individuals is also nothing fundamentally new and had already been seen in other case studies (e.g., Kelly and Hines 2019; Hines *et al.* 2020). The essence of it, however, was to make recognition something personal and timely expressed to increase its genuineness. This resonates, in fact, with Porter and Lawler (1968) who extended Vroom's (1964) expectancy theory. Unlike Vroom (1964), they recognised that the value individuals attribute to a reward influences their efforts to perform or act in a certain way likewise. By implication, this suggests that R&R systems must be designed appropriately. Conversely, an inappropriate R&R culture is likely to undermine the success with lean (Antony and Gupta 2019). In addition, a staff-managed Awards Committee enabled to involve employees much more in decision-making. Involving WLG members and the wider workforce in redesigning the R&R system, for instance, made them a part of the solution as they had an opportunity to express how *they* imagined being recognised. In doing so, they had ownership in its redesign, making the recognition of ideal behaviours much more effective.

Second, when recruiting new hires lately, personality was matched against corporate values and ideal behaviours so that the right people would be sourced. Plus, ideal behaviours were formally assessed by becoming a part of everyone's PDR and annual bonus. The rationale behind this was to signalise their relevance. Ideal behaviours were something everyone had under their own control and should own. In this way, they further turned into a daily expectation rather than an incentivised action (Gollan *et al.* 2014). Most widely, however, recognising and encouraging desired behaviours had remained a *non*-financially incentivised matter, although monetary incentives had been existing. This means that less emphasis was generally put on extrinsic motivators, such as financial rewards to participate in improvement activities so that

CI will become a part of everyone's daily job rather than giving the impression that it is something extra alongside. Aligning with that, Netland *et al.* (2015) found non-financial rewards to be favourably associated with more extensive lean implementation, whereas they did not find any supporting evidence for financial rewards boosting lean. In fact, recent research also confirmed that cash incentives are less effective than non-cash ones. That is because they are less promotable and have a narrower utility. Therefore, having a cost-effective R&R portfolio is a positive side effect (van Dyke and Ryan 2012).

Third, as LSW has high leverage to drive cultural change (Bicheno and Holweg 2016), it was encouraged to oversee whether ideal behaviours are lived daily. In practice, for instance, ideal behaviours were encouraged by challenging peers whether they know their customers or whether peers deliver on their agreed commitments. Likewise, a "right-first-time" approach, as seen in the Information Technology's helpdesk, was promoted to reduce lead times. Similar practices to foster cultural change have also been seen in Shingo Prize-winning organisations (Kelly and Hines 2019). Managing cultural change and "indoctrinating" ideal behaviours, however, requires a certain set of soft capabilities and concerns a transfer of tacit knowledge (Liker 2004; Bortolotti *et al.* 2015; Holmemo *et al.* 2018; Kelly and Hines 2019). Such tacit knowledge could have never been embedded by an external consultancy, as seen in the case organisation. That is because consultants are neither leaders nor managers, as elaborated on by Holmemo *et al.* (2018) in the following.

> "[M]anagement consultants have adopted the rhetoric of soft lean, but are unable to integrate this concept into their business model. The outside-in knowledge transfer from young generalists to the 'native' shop-floor employees is not coherent with the idea of lean as a pervading philosophy and management system of continuous learning" (p. 157).

At the same time, it is widely accepted that lean cannot be easily implemented via short-term change projects (Womack and Jones 1996). Instead, it "corresponds to ideas of continuous, cumulative evolving change" (Holmemo *et al.* 2018, p. 226). In many cases, however, external consultants are often only looking for temporary fix solutions, whereas lean must be owned and driven by own staff (Holmemo *et al.* 2018). Integral parts of LSW (e.g., recognising, coaching, encouraging participation, taking corrective action, and providing feedback) enable such knowledge transfer and demonstrate "respect for people" (Bicheno and Holweg 2016; Kelly and Hines 2019) so that ideal behaviours are much more likely to be sustained.

5.1.2 Step #2 – Aligning via strategy deployment to interface "purpose" and "process"

Together with behavioural deployment and LSW, a third "underwater" enabler in Found *et al.*'s (2007) lean iceberg concerns strategy deployment. Its introduction as part of a systems-based change aimed at maintaining focus and at gaining an alignment between the case organisation's strategic objectives (i.e., its "purpose") and its daily activities (i.e., its "process[es]"). It broke down the organisation's purpose into strategic objectives and intended to close the gap between strategy and its operationalisation (Hines 2013). In Bicheno and Holweg's (2016) words,

> "[e]xpectations are set, bottom-up, through behavioural standards and values, and top-down through managerial goals – perhaps through policy deployment" (p. 84).

In this way, the strategy and behavioural norms were supposed to be integrated. Visualising strategy deployment to set out what needs to be achieved and make responsibilities clear, a policy deployment matrix was used with breakthrough goals for the next five-year strategic plan associated with a set of performance metrics and an aligned CI project portfolio measured against milestones. In doing so, employees had an overview of how their individual tasks fit into the overall strategy. In addition, several other communicative instruments (e.g., 1-to-1s, PDRs, and team briefs) were supposed to make the strategy more transparent and to overcome silos. To use Hines' (2013) words, strategy deployment helped to clarify purpose and to define business priorities associated with resource allocation.

Inside the case organisation, lessons learnt had shown that VoC exercises (with internal customers) led to a closer alignment between purpose and process, whereas priority alignments with its parent organisation as well as closer relationships to externals (customers and suppliers) enhanced such an alignment beyond the plant. In essence, this suggests that the more stakeholder involvement is sought, the more likely an organisation is to achieve a closer alignment between their purpose and processes in- and outside the organisation.

5.1.3 Step #3 – Improving via continuous improvement to interface "people" and "process"

5.1.3.1 Visual management

Moving forward, strategy deployment functioned as the basis for visual management (Kelly and Hines 2019), which is, in turn, widely acknowledged as a driver for incremental process improvements (Bicheno and Holweg 2014). First, associated with daily reviews, team huddles, and problem-solving activities associated with applying hard lean practices (e.g., A3 or DMAIC), visual management helped *OPS* to identify performance gaps and to counteract

where necessary. Second, it proved to be a beneficial bottom-up performance reporting structure, as reported in the literature (Netland *et al.* 2015). Third, it eventually engaged people in carrying out process improvements and aimed at developing a CI culture in the long-run as reported in the literature likewise (Hines in Åhlström *et al.* 2021).

In fact, visual management is also recognised as a powerful hard lean practice outside of manufacturing environments (Parry and Turner 2006). It is therefore no surprise that departments outside of manufacturing were tasked with introducing visual management to their functional areas later so that they (1) can have a more aligned approach to strategy operationalisation, (2) can see what must be accomplished daily, and (3) can enable focused (process) improvements and problem-solving. In other words, visual management was supposed to increase transparency about daily activities by exposing abnormalities (Kelly and Hines 2019) so that organisational efforts align with the strategic objectives.

5.1.3.2 Performance reviews and benchmarking

Alongside this, an internal audit system with scores against a set of criteria was introduced to ensure that the VMBs will be used in practice and maintained. This aligns with Kelly and Hines (2019) and Kurpjuweit *et al.* (2019) who suggest carrying out regular VMB audits to make sure that established standards are adhered to. By reviewing VMBs, a first attempt was sought to get the management community engaged in gemba walks and new ways of working according to LSW principles so that VMBs find application in daily practice. This finds, in fact, support in the literature. That is, implementing visual management is a top-down process (Kurpjuweit *et al.* 2019) and requires senior and middle management involvement to be successful (Parry and Turner 2006; Bateman *et al.* 2016; Eaidgah *et al.* 2016; Kurpjuweit *et al.* 2019). In addition, such reviews were supposed to foster a discussion around a problem with the aim to jointly resolve it.

On a larger scale, a general and more holistic performance review was undertaken annually by means of lean maturity assessments (e.g., via a lean maturity scorecard or Shingo Insight Assessments) to measure the extent to which lean had been embedded in the organisation. Such exercises could provide regular feedback on the business development with regard to lean implementation and revealed gaps. Aligning with that, Scherrer-Rathje *et al.* (2009) and Netland and Ferdows (2016), for instance, accentuate that assessment methods are essential for measuring and monitoring lean maturity.

In the case organisation, for instance, such assessments helped to identify an insufficient attention to the soft side of lean, which could experience immediate improvements in due

course to a certain extent (e.g., fair pay, R&R, and personal development opportunities). Soft lean practices are particularly necessary to achieve a joint optimisation within a STS by carefully considering the social sub-system (Shah and Ward 2007; Hadid and Mansouri 2014; Bortolotti *et al.* 2015; Hadid *et al.* 2016; Danese *et al.* 2017, 2018; Wickramasinghe and Wickramasinghe 2020). In OPS, for instance, the new salary structure was a quite pivotal change. The two-factor theory by Herzberg (1959) theorises that huge pay gaps, as they existed before, were an absent hygiene factor causing job dissatisfaction.

Using key behaviour indicators (KBI), the case organisation also measured whether or not the ideal behaviours being sought were in place. Measuring behaviours with KBIs is, in fact, not an uncommon practice and has already been seen both empirically (e.g., Jørgensen *et al.* 2003) and conceptually in a model of future lean organisations more recently (Hines in Åhlström *et al.* 2021). Notably, however, the case organisation was still quite immature with implementing lean whereas such practices are usually typical of mature organisations (Hines and Butterworth 2019; Netland *et al.* 2019).

At the same time, inspiration was also sought via factory visits. In addition, a direct contact to end customers gave an impression of how their products were eventually used and helped to improve them. The essence of these measures was to identify improvement opportunities from both in- and outside the organisation.

5.1.3.3 Learning & Development

Alongside, L&D was seen as an enabler and necessary foundation. The rationale behind this was that employees had to be trained in the first place to be capable of carrying out improvement activities (e.g., cross-functional improvement projects in the CI project portfolio). As Hines (Hines in Åhlström *et al.* 2021) describes more precisely, L&D helped in

> "[a]ssisting individuals and teams to learn, develop, and spread behavioural and improvement activity" and in "[c]oaching individuals in desired behaviours and activities" (p. 9).

In fact, inadequate training is one of the top reasons for failure (Antony and Gupta 2019). Also, Dave and Sohani (2019) found a lack of understanding to be the biggest barrier to lean implementation. Senge (1990) argues the following.

> "The organizations that will truly excel in the future, will be the ones that discover how to tap people's commitment and capacity to learn at all levels in an organization" (p. 4).

Similarly, Yadav *et al.* (2019) argue that a basic knowledge of lean and its benefits must be known to every individual prior to participating in lean transformation. Yadav *et al.* (2017) propose that STSs have to be designed in a way so that its people can self-modify it.

> "If the objective of design is to create a system that is capable of 'self-modification' then organizations that are 'constructively participative' are needed" (p. 8).

Hence, organisational learning via training was seen as a measure to engage staff in problem-solving by enabling them to run their own improvement projects. It was also seen as an enabler to enhance the organisation's capacity and to institutionalise lean, as reported in the literature likewise (Wickramasinghe and Wickramasinghe 2020).

Improvement training, learning, and exploration are, in fact, quite common practices during the initial stages of lean implementation (Netland and Ferdows 2016; Knol *et al.* 2018b). In that respect, the case organisation initiated its implementation at an early stage. In OPS, for instance, tailored training programmes were supposed to promote personal development and foster the evolvement of a CI culture. Here, *tailored* is the keyword, as the findings suggest that training must be relevant. If training programmes do not match the context and are not sufficiently tailored to the environment in which lessons learnt are supposed to be applied, individuals are likely to struggle with transferring the knowledge. Thus, an integral part of LSW had also become identifying particular training needs of subordinates during 1-to-1s and PDRs so that training will become as effective as possible. At the same time, gemba walks were encouraged to coach subordinates and actively participate in problem-solving, as suggested by Knol *et al.* (2018b) likewise.

Though, the necessity for L&D was not really driven by a business need emerging "organically" from the inside out. Instead, a deficient and optimisable L&D system was diagnosed by the external consultancy as employees expressed their desire for personal development during a Shingo Insight Assessment and partly by an industry-wide Top Employers Institute benchmark. Indeed, Holmemo *et al.* (2018) criticise the limited effects of consultant-led lean implementations; however, consistent with Netland (2016), they still acknowledge consultants' usefulness during the early stages and their power to raise awareness about soft lean, as the case was here. At the same time, L&D had become more urgent due to several requests made by the workforce in surveys (e.g., Shingo Insight Assessment or Top Employers Institute).

To be fair, though, the sudden hire of a Learning & Development Business Partner certainly speaks for a change of thinking. Hence, it makes sense that such training programmes had been

either relatively new or under development in many functional areas whereas most positive effects on CI engagement could be denoted in OPS where far-developed training programmes had already been in place for a comparatively long time.

Similarly, such training made sense for individuals within the management community. It may sound banal, but how would the WLG practice elements like LSW as long as they are not aware of what it comprises and how to exert it? Consistent with that, Burawat *et al.* (2019) argue that lean managers must have a thorough understanding to be able to engage their employees. After all, L&D is necessary for middle managers' capability and responsibility development (Anand *et al.* 2009).

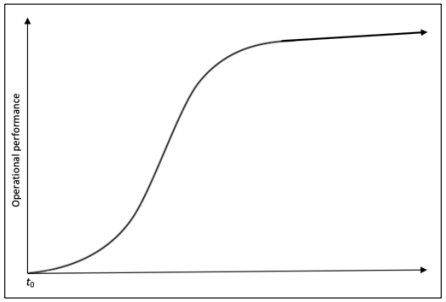
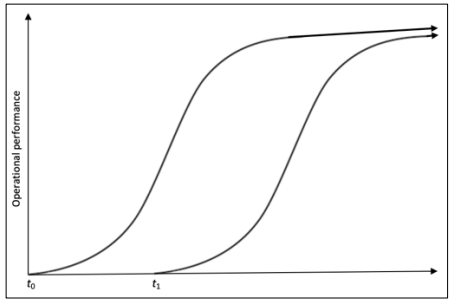
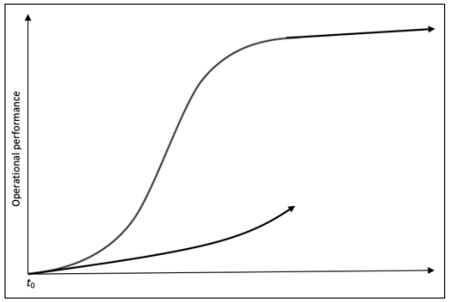
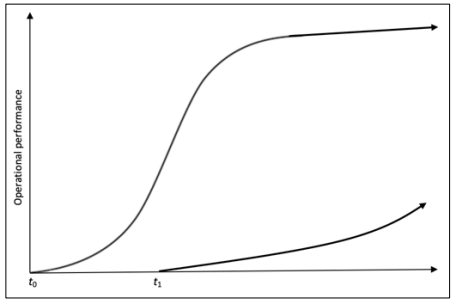
5.2 Visualising lean (im)maturity

In summary, much of what had been experienced during the case organisation's attempt to diffuse lean from manufacturing operations to the wider organisation resonates with principles of Netland and colleagues' (Netland and Ferdows 2014, 2016; Netland *et al.* 2014) S-curve theory (see Table 2.21). Although Netland and colleagues' (ibid) study focused on multiple Volvo manufacturing plants, several S-curve theory characteristics were found to be equally transferable to this single-case context, considering different departments with phase-delayed and non-parallel S-curve trajectories within a UK medical manufacturing organisation.

5.2.1 S-curve scenarios: Illustrating four theoretical lean maturity cases

To be more specific about what is meant by *phase-delayed and non-parallel* S-curve trajectories, the following theoretical example with four different scenarios is helpful (Table 5.4). First, if it is assumed that lean matures evenly in all departments while having embarked on lean at the same point of time, *synchronous* (or *congruent*) S-curve trajectories would be expected. Second, if it is assumed that lean matures evenly, whereas departments have embarked on lean at different points of time, *asynchronous* (or *parallel*) S-curve trajectories would be expected. Third, if it is assumed that lean matures unevenly while having embarked on lean at the same point of time, *non-phase-delayed and non-parallel* S-curve trajectories are expected. Fourth, if it is assumed that lean matures unevenly, whereas departments have embarked on lean at different points of time, *phase-delayed and non-parallel* S-curve trajectories are expected. Taking into account that this study dealt with a *diffusion* of lean from manufacturing operations to the wider organisation, only the second and the fourth scenario are relevant for the following discussion.

Table 5.4 S-curve scenarios

	(1) Synchronous (or congruent) S-curve trajectory	(2) Asynchronous (or parallel) S-curve trajectory	(3) Non-phase-delayed and non-parallel S-curve trajectory	(4) Phase-delayed and non-parallel S-curve trajectory
				
S-curve characteristics				
Parallelism	Yes	Yes	No	No
Phase delay	No	Yes	No	Yes
Lean context				
Diffusion	No	Likely[a]	No	Likely[a]
Pace rate	Even	Even	Uneven[b]	Uneven[b]
Maturity gap	No	Yes	Yes	Yes

Source: Author

Note(s): (a) Theoretically, departments embarking on lean at a later stage could have also decided to do so by themselves; (b) note that the third and fourth example only consider a scenario in which another S-curve's slope is *weaker* than the reference S-curve's one. Hence, both examples do not consider a scenario in which another S-curve's slope is *stronger* than the reference S-curve's one.

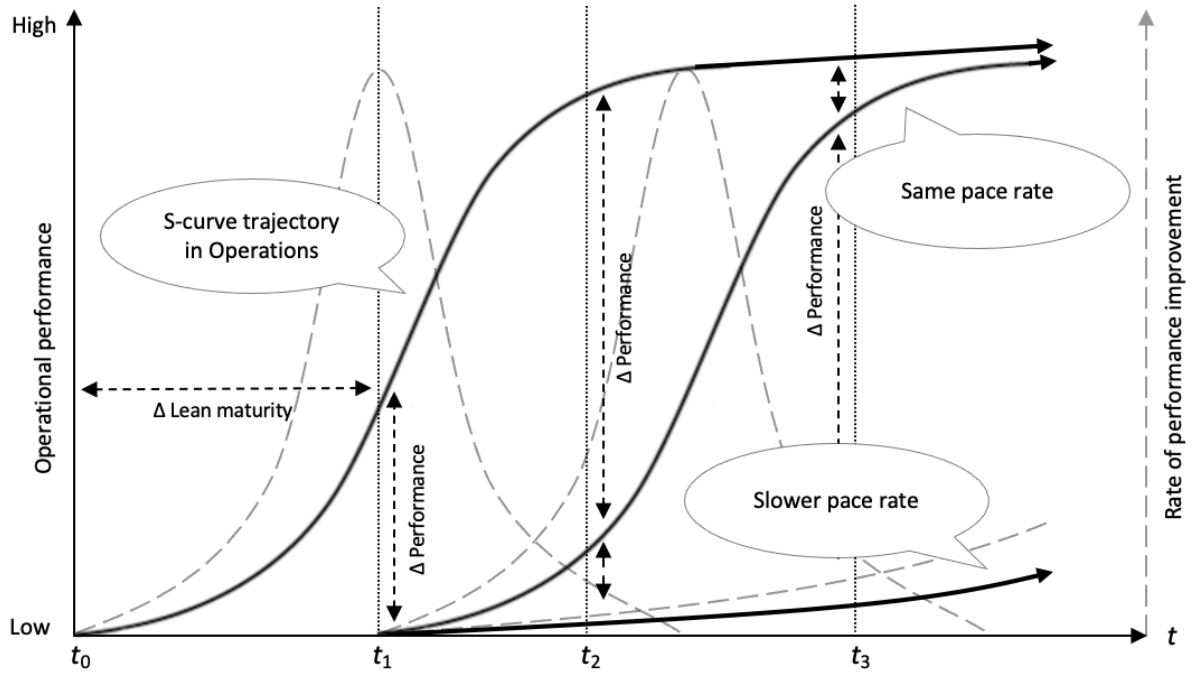
5.2.2 S-curve trajectories: A wide lean maturity gap to manufacturing operations

In the case organisation, lean maturity had solely been measured at the site level, including each department. At an early stage, however, it loomed already ahead that the lean evolution would neither be uniform in all departments nor would lean equally mature at the same pace rate. As compared to OPS, there is enough evidence suggesting that departments outside of OPS had not been at the same but rather a delayed stage of a flatter S-curve with a comparatively slower pace rate. Unlike organisations achieving a total lean implementation, associated with awards, such as the Shingo Prize, the case organisation achieved what the literature refers to as "partial" (Safayeni *et al.* 1991; Bamford *et al.* 2015) or "fragmented" (Pearce *et al.* 2018) implementation.

As OPS made some notable progress by "picking the low-hanging fruits" and by moving into more exploitative phases later, non-operational departments had been somewhat stalled in the exploration phase with little progress only. At any time, there was a perceptible lean maturity gap between operational and non-operational departments. Stuck in the exploration phase, the case organisation had admittedly never reached an "in transition", "advanced", or "cutting-edge" stage as part of the exploitation phase at the organisational level, according to the S-curve theory. The slow progress was associated with limited benefits gained in most non-operational departments, preventing the CI momentum from surging (Netland *et al.* 2021). To be fair, it should be noted at the same time that it is not uncommon to spend many years at this stage (Netland and Ferdows 2016). The fact that lean had not been maturing uniformly in all departments may be explained by Figure 5.2 alongside with some principles of the S-curve theory (Netland and Ferdows 2014, 2016; Netland *et al.* 2014).

To begin with, lean implementation had been initiated much earlier (t_0) in OPS than in all the other departments (t_1). By implication, OPS had a head start and were much longer in the lean maturity process. By the time when lean was eventually diffused from manufacturing OPS to the wider organisation (t_1), OPS had already realised performance improvements. In line with the S-curve theory (Netland and Ferdows 2016), the operational performance in this department had significantly improved over a considerably short period of time. Due to having a head start (time period from t_0 to t_1; see Figure 5.2), it is certainly *natural* that a performance gap was present between operational and non-operational departments at that point of time (t_1).

Figure 5.2 S-curve trajectories



Source: Author

Note(s): First, non-OPS departments are represented in a single S-curve per scenario for the sake of simplicity, although it is beyond question that these departments do not mature uniformly likewise. Second, Figure 5.2 does not display any lean maturity stages as defined by Netland and colleagues (Netland and Ferdows 2014, 2016; Netland *et al.* 2014). Third, Figure 5.2 does not consider the scenario in which non-OPS departments mature at a faster pace rate. Fourth, the rate of performance improvement will never reach zero, although Figure 5.2 gives such impression.

If it is *assumed* that lean matures evenly (at the same pace rate) in each department, a corresponding S-curve would merely have a time delay and parallel to the S-curve trajectory of OPS. In this *theoretical* case, it is likely that such performance gaps will increase over time and therefore become larger (see t_1 vs t_2). That is because OPS' rate of improvement will be comparatively high in the first half between t_1 and t_2, while having its peak at the time of t_1. In the long-run, however, such performance gaps are expected to narrow down. As soon as cultural change (or a "cutting-edge" stage; Netland and Ferdows 2014, 2016; Netland *et al.* 2014) is achieved across the organisation (t_3), performance gaps are likely to reduce to a minimum. That is because, in OPS, sustaining a high rate of improvement will become increasingly difficult over time, giving non-operational departments time to make up ground as their rate of improvement will be in an accelerating state.

In *practice*, however, an S-curve scenario of this type had never been the case for departments outside of OPS. That is primarily because such a scenario conditions that *all* departments mature at the *same* pace rate whereas lean had been evidently adopted at a much slower pace rate in non-operational departments. A slower pace rate corresponds to a lower rate of performance improvements, which is associated with a decelerated increase of

operational performance in turn (see Figure 5.2). As compared to the theoretical example in which the S-curve runs parallel to the S-curve in OPS, a slower (or faster) pace rate causes that a corresponding S-curve trajectory will run non-parallel with a weaker (or stronger) slope.

In the same way, the time periods spent in a certain lean maturity stage (e.g., [1] "beginner", [2] "in-transition", [3] "advanced", and [4] "cutting-edge"; Netland and Ferdows 2014, 2016; Netland *et al.* 2014) will endure longer (or shorter). Due to OPS having a head start (t_0 to t_1), it is true that a considerably large lean maturity gap had been existing right from the beginning; the additional time needed in single lean maturity stages due to a slower pace rate, however, suggests that lean maturity gaps are even likely to enlarge over time. At the same time, a slower pace rate causes wider performance gaps (e.g., t_2 and t_3), which will enlarge over time. By implication, it is likely that a slower pace rate will also require much more patience until all departments reach a virtually even degree of operational performance.

In the case study, lean maturity gaps had, in fact, become more obvious when VMB audits were carried out. They were not only attested by the circumstance that the VMBs had often been seen as a burden outside of OPS (e.g., physical installation and data preparation; Bateman *et al.* 2016) rather than a source for CI but also by the scores in VMB audits in which OPS had been leading the way. Undeniably, many functional areas outside of OPS had been struggling so that their lean implementation had essentially never accelerated but stalled at the middle management level. On the contrary, however, the CI momentum could be kept up and locally sustained in OPS. This was, for instance, accomplished by disseminating improvements to other functional areas within manufacturing (e.g., from one cleanroom to another), as described by Bateman and David (2002) and Bateman (2005) likewise. This circumstance prompts questions about the underlying reasons, which are explained in the following.

5.3 Lessons learnt from the experiences of middle management: Underlying reasons for (un)sustainable lean

Taking their importance to sustain lean (Reynders *et al.* 2022) and their 360° perspective into consideration (Floyd and Wooldridge 1994; Dutton *et al.* 1997; Harrington and Williams 2004), the following discusses the lessons learnt that can be taken away based on experiences of middle management from the case organisation's diffusion of lean from manufacturing operations to the wider organisation by depicting on underlying reasons why lean had stalled outside of OPS.

Inspired and theoretically underpinned by the STS and by four established change models (Table 5.5), Table 5.6 gets down to the essence of things by synthesising the missing but

enabling factors identified in this case study and by integrating these into an evidence-based lean sustainability framework.

Table 5.5 Theoretical underpinnings

No.	Change management framework(s)	Author(s)[a]
1	"Managing complex change"	Ambrose (1987)
2	"The dance of change"	Senge *et al.* (1999)
3	"Lean iceberg"	Found *et al.* (2007)
4	"Model for change"	Found and Griffiths (quoted in Hines *et al.* 2008)[b]

Source: Author
Note(s): (a) In chronological order; (b) based on the lean iceberg (Found *et al.* 2007)

In association with the multitude of experiences, identifying the underlying root causes came along with a certain complexity. That was because each middle manager had his personal interpretation of the organisational dynamics and, therefore, a different story to tell. In the world of STSs, it could be argued that every middle manager experienced a different social or technical sub-system at the individual level, depending on the environment he was acting in. This, by the way, would also explain why engagement co-existed "in pockets". Though, several consistent themes and contrasting views could still be drawn from the case study while Ambrose's (1987) model particularly inspired consolidating and accommodating middle managers' individual views and interpretations into a comprehensive lean sustainability framework (see Table 5.6).

Table 5.6 Lean sustainability framework

No.	Integrated socio-technical lean system								Implication(s)[a]
	Social sub-system						*Technical sub-system*		
	People				*Purpose*		*Process*		
	Behaviour and engagement (Found et al. 2007; Hines et al. 2008)	*People involvement (Senge et al. 1999)* *Networking and diffusion (Senge et al. 1999)*	*Incentives (Ambrose 1987)* *Resources (Ambrose 1987)* *Enhanced confidence, enthusiasm, and willingness to commit (Senge et al. 1999)* *Investment in change initiatives (Senge et al. 1999)* *Networking and diffusion (Senge et al. 1999)* *Leadership (Found et al. 2007)* *Deployed leadership (Hines et al. 2008)*	*Skills (Ambrose 1987)* *Learning capabilities (Senge et al. 1999)*	*Vision (Ambrose 1987)* *Strategy and purpose (Senge et al. 1999)*	*Action plan (Ambrose 1987)* *Strategy and purpose (Senge et al. 1999)* *Strategy and alignment (Found et al. 2007)* *Aligned strategy (Hines et al. 2008)*	*New business practices (Senge et al. 1999)* *Processes (Found et al. 2007)*	*Assessing and measuring (Senge et al. 1999)* *New business practices (Senge et al. 1999)* *Technology, tools, and techniques (Found et al. 2007; Hines et al. 2008)* *Process diagnosis and management (Hines et al. 2008)*	*Behaviour and engagement (Found et al. 2007; Hines et al. 2008)*[b]
	Behavioural deployment	*Involvement*	*Leadership*	*Knowledge and understanding*	*Vision*	*Strategy deployment*[c]	*Standard work*	*Process analysis and improvement*	
1	•	•	•	•	•	•	•	•	Lean sustainability
2		•	•	•	•	•	•	•	Misbehaviour
3	•		•	•	•	•	•	•	Rebellion
4	•	•		•	•	•	•	•	Anarchy
5	•	•	•		•	•	•	•	Incompetency
6	•	•	•	•		•	•	•	Indirection
7	•	•	•	•	•		•	•	Friction
8	•	•	•	•	•	•		•	Backsliding
9	•	•	•	•	•	•	•		Stagnation

Source: Author

Note(s): (a) In Table 5.6, potential implications are expressed in a partially pointed manner (e.g., "misbehaviour", "rebellion", or "anarchy"); notably, however, they still reflect observed events within the case organisation; (b) If all enabling factors are in place and functioning, "behaviour and engagement" (Found *et al.* 2007; Hines *et al.* 2008) is also suggested to be the outcome of an integrated socio-technical lean system in which the social and the technical sub-system operate in harmony so that lean sustainability is conduced. On the contrary, if a single enabling factor is missing, insufficient engagement is likely to be the consequence (see Figure 4.12), which puts lean sustainability at risk; (c) "Strategy deployment" has both social and technical elements (e.g., hoshin kanri as a hard lean practice; see Appendix 1). In Table 5.6, however, its social elements are mainly concerned (i.e., vertical and horizontal alignment, communication, involvement, and catchball).

In essence, the lean sustainability framework is based on the case-study findings, frames lean as a STS, and suggests that several enabling factors (i.e., [1] "behavioural deployment", [2] "involvement", [3] "leadership", [4] "knowledge and understanding", [5] "vision", [6] "strategy deployment", [7] "standard work", and [8] "process analysis and improvement"), addressing (1) people, (2) purpose, and (3) process(es), must be simultaneously in place so that lean can be sustained. In line with the STS, these lean sustainability-enabling factors assist in aligning the social and the technical sub-system to achieve joint optimisation. "Involvement", for instance, aims to avoid resistance when seeking change, while "knowledge and understanding" equips individuals with the relevant information to carry out process analyses and improvements. It stands out that most of the factors relate to *soft* lean practices.

At the same time, however, the lean sustainability framework assumes that lean sustainability is put at risk as soon as one of these enabling factor is *not* in place. There is no doubt that lean sustainability is put at even higher risk once *more* than one of these factors is missing. Equally, the framework proposes that the degree to which enabling factors are embedded within an organisation determines the likelihood of whether or not lean sustainability can be achieved. It may be the case, for instance, that a certain enabler is in place indeed but not sufficiently pronounced (e.g., due to being in the early stages of development or due to poor execution and operationalisation). In addition, it is suggested that all these seven factors are not mutually exclusive. Rather, they are interdependent and may interact. To give an example, the extent to which leadership is present may also determine matters around vision and strategy (see Figure 4.12; Dora *et al.* 2016; Bortolotti *et al.* 2018).

By delving deeper into the underlying causes responsible for an enormous lean maturity gap to OPS and middle managers' insufficient engagement in lean implementation that was widely present outside of OPS, the following discussion aims at conveying a more comprehensive picture and resonates with the failure factors previously identified (see Figure 4.12). Considering that lean was supposed to be functioning outside of OPS likewise, hence, *organisation*-wide, middle managers' views on underlying root causes for the case organisation's difficulties to diffuse lean from manufacturing operations the wider organisation are elaborated on by using Table 5.6 as the backbone for the subsequent discussion and by vitalising this framework with several appropriate case-study examples to illustrate the implications once a lean sustainability-enabling factor is not present.

5.3.1 Involvement

5.3.1.1 Late middle management involvement

Generally speaking, the relevance of middle managers to deploy lean is widely acknowledged in the literature (Spear 2004; Anand *et al.* 2009; Holmemo and Ingvaldsen 2016). In their study, Anand *et al.* (2009) found, for instance, how successful CI organisations keep focusing on upskilling their middle managers to enable them to create excitement for CI at the operational level. This, essentially, aligns with the case organisation's agenda indeed, yet middle managers criticised the point of time *when* they had been involved in lean implementation the very first time. Consistent with that criticism, Holmemo and Ingvaldsen (2016) "suggest that middle managers are involved too late or too little in the lean transformations" (p. 1342). Plus, Hu *et al.* (2014) argue that

> "senior managers […] should involve middle managers at the beginning […] as they can provide useful and up-to-date operational information" (p. 37).

Amongst middle managers, a lack of involvement constitutes, in fact, a commonly perceived barrier to lean implementation (Lodgaard *et al.* 2016). As Lodgaard *et al.* (2016) refer to involvement as a key element of CI integration at all hierarchical levels, they explain that employees would like to get involved to feel appreciated and for the possibility to make contributions, as also expressed by several non-operational middle managers. That is because individuals feel respected once their thoughts, views, and ideas are taken into consideration (Bicheno and Holweg 2016). Note that their views and ideas do "not necessarily [need to be] implemented but seriously considered" (Bicheno and Holweg 2016, p. 77). After all, such respect is strongly related to engagement (Devine and Bicheno 2019). Indeed, it is true that Galeazzo *et al.* (2021) have just recently suggested that

> "a top-down management approach with centralised authority is preferable when CI is low, whereas a bottom-up management approach is helpful when a firm has extensively developed CI" (p. 34).

However, their study's sample does not distinguish between different hierarchical levels. As employees at the operational level naturally outnumber individuals in managerial positions (senior and middle managers) in modern organisations anyway, their results may overlay middle managers' desire to be already involved at earlier stages.

In 2015, the initial planning, which set out what to achieve to rollout lean as an organisation-wide initiative, took merely place within a small, dedicated taskforce in cooperation with an external consultant. In the literature, however, the views on such implementation teams are

quite mixed. Investigating shopfloor operations, Netland *et al.* (2015) found implementation teams that coordinate improvements and lead lean to be favourably associated with higher degrees of lean implementation. On the contrary, Boppel *et al.* (2013) warn that such teams may cause employees to perceive lean as a short-term and top-down project rather than a long-term philosophy and point towards the challenge of ensuring the buy-in of business-unit and line managers.

Taking a look at the composition of this taskforce (i.e., an OPS director, a former HR director, an operations manager, a quality systems manager, and a production manager), it becomes obvious that this masterminding group of people mainly consisted of managers associated with OPS. That was partly because they already had some lean experience due to CI projects and several site visits for inspirational purposes. On top of this, most middle managers from departments associated with OPS had experienced the learnings from lean from scratch. While this constellation entailed limited systems thinking and inhibited cross-functional exchange indeed (Anand *et al.* 2009; Netland *et al.* 2015; Lodgaard *et al.* 2016), a certain lean implementation silo had equally evolved (Holmemo and Ingvaldsen 2016; see Figure 2.12).

In consequence, no opportunity was given to middle managers outside these departments to challenge the approach of how lean would be initially deployed in different departments. If middle managers had been made part of the implementation process earlier, however, participation would have likely conveyed a sense of control and mitigated their uncertainty about change (Lewis *et al.* 2006; Lodgaard *et al.* 2016). In their study, Gollan *et al.* (2014) found, for instance, that ongoing employee involvement and continuous communication can make employees perceive change less radically. On the contrary, insights from the case organisation showed that middle managers might feel overlooked if they are neither involved in decision-making nor given the opportunity to either contribute or challenge the approach right from the start.

By cutting them out, Floyd (2008) argues, organisations "disenfranchise middle management" (p. 193) and risk that even the best people in this management layer may evolve a neutral or negative attitude towards change events that should have their attention. Therefore, change agents are encouraged to consult various stakeholders within the organisation prior to taking solo actions. In this way, it is likely that the case organisation may have found consensus and better ways to implement lean (Lodgaard *et al.* 2016). Involving middle managers at a late point of time had also entailed that a chance for joint learning about lean was missed, which had left a subset of important future change agents behind.

Unless middle managers find involvement in lean implementation, change efforts are likely to fall short (Holmemo and Ingvaldsen 2016). Given that the seventh masterclass around the WLG's perceived failure factors had just taken place almost five years after being in the transformation process, there is also strong evidence that middle management's opinions had been disregarded for a considerably long time and receiving insufficient consideration into the decision-making. Otherwise, corrective action could have been taken way earlier.

Note that a certain value is generated once problems are forwarded to the other party, constructively debated, and solutions sought (Jørgensen *et al.* 2003). By having an intense discussion amongst WLG members, it was finally enabled to delve deeper and explore the underlying root causes. Investigating the effectiveness of self-assessments for a better understanding of CI barriers, Jørgensen *et al.* (2003) gained, in fact, similar insights.

> "The group members [who they examined] were only able to identify the underlying problems that acted as barriers to CI through facilitated dialogue. Further, the advantages to conducting the assessment as a group process were evident in this case: the process led to open communication, a shared understanding of CI, and facilitated group development" (p. 1277).

This circumstance confirms concerns in the literature to what extent self-assessments discover inhibitors (Jørgensen *et al.* 2003) or consider soft lean practices (Pearce *et al.* 2018). Pearce *et al.* (2018), for instance, argue that most self-assessment and lean maturity tools typically disregard soft lean practices. This is probably because they are harder to measure and rely on perceptions. But while it is true that such assessment exercises had partly identified some issues around soft lean practices (cultural enablers), only a facilitated dialogue enabled to reveal the full picture. Moreover, it unveiled the underlying root causes for lean implementation to stall at the middle management layer rather than just detecting symptoms. Hence, the outcomes from self-assessments need to be treated with caution and require careful analysis to maintain their reliability (Netland and Ferdows 2016).

Undoubtedly, it is much easier to tackle obvious issues but much more difficult to identify middle managers' inhibitors that are lying underneath the obvious (Harrington and Williams 2004). Such underlying root causes, as illustrated in Figure 4.12, suggest a distinction between ostensible (visible or tangible) and underlying (less visible or intangible) barriers, whereby underlying barriers are usually fewer than pronounced by Leite *et al.* (2020b) but cause ostensible barriers to emerge.

By implication, this circumstance may raise the question of why such an open peer discussion, bringing challenges as manifested by the WLG to light, has not been taking place

in a much earlier stage in the past. Until the importance of the WLG's views was acknowledged to identify failure factors that had caused the case organisation's lean implementation to stall, the case organisation had rather been "muddling through", as labelled by Jørgensen *et al.* (2003). First, this shows again that issues associated with change can be counteracted by involving their stakeholders. Second, this suggests that ways to transfer and exchange tacit knowledge are needed (e.g., peer networking and staff exchange; Kelly and Hines 2019).

5.3.1.2 "One size does not fit all": Imposing lean "draconically"

As to the case organisation's lean implementation, the results hint that the introduction of lean outside their manufacturing environment had not been carefully "change managed". Instead, lean was pushed down into non-operational departments by a small taskforce and was therefore experienced as policing by many middle managers. Due to its force-fitting manner, the way how lean was introduced was described as "draconian". This was particularly characterised by the introduction of VMBs associated with a standardised format, which did not equally suit each department (e.g., due to meaningless metrics). However, by bringing "standard formulae" (p. 13) to bear, Holweg *et al.* (2018) argue, employees miss taking ownership. Similarly, employees miss taking ownership once improvements are imposed (Bicheno and Holweg 2016). Continuing on this, Holweg *et al.* (2018), conclude that

> "dogmatic implementations […] deprive team members of engaging in a meaningful way" (p. 2).

In this way, it is no surprise that some middle managers saw the VMBs as extra work to be done and not as their own. In doing so, also an opportunity was missed to harness the power of VMBs and the benefits associated with their introduction (Parry and Turner 2006; Holweg *et al.* 2018). In their longitudinal study of 204 improvement projects, Holweg *et al.* (2018) report how meaningful improvements are the strongest motivator but if process improvement is introduced in a dogmatic way, they argue,

> "this cycle is broken, and it all becomes a task, no longer a calling" (p. 13). To this end, they continue that "dogmatic implementations are often short-lived, as team members cannot identify themselves with the improvement initiative" (p. 13).

If change is imposed, the part is missed where those affected have a chance to reflect upon why change is needed and to see the intention behind.

In R&D, the use of a self-developed project management board demonstrates that apathy had not been evolving against change or visual management per se but rather against the

VMBs' "draconian" standard format associated with the introduction of lean in their department. Interestingly, principles of visual management had actually already been followed, yet without being consciously aware of it. Another point that backs this hypothesis is that the VMBs experienced much more acceptance amongst WLG members at the time when more freedom upon their format and design was granted in a more mature stage. This aligns with what Kurpjuweit *et al.* (2019) found in a multiple case study. They observed that employees who have the freedom to design their own VMBs exhibit a higher acceptance and are more willing to keep using and developing them. Consistent with Parry and Turner (2006) and Kurpjuweit *et al.* (2019), this suggests that individuals must be empowered to develop their own VMBs because, in this way, departments are allowed to tailor VMBs according to their specific needs. In their study, Kurpjuweit *et al.* (2019) conclude the following.

> "Some managers demand board designs that the whole company can use. However, individual board design is key" (p. 5583).

If lean is introduced authoritarian by command and control while adoption is enforced, James and Jones (2014) argue, it is likely that resistance emerges. This is also consistent with Canning and Found (2015) who argue that both lack of communication and involvement are two significant factors that contribute to individuals resisting change. If people have some purpose and control over it, they usually do not mind change. Instead, a negotiated imposition with an adaption to local conditions should be preferred. Therefore, it is reasonable to suspect that too much emphasis was put on *standardised* visuals and performance metrics that were widely perceived as meaningless in non-operational departments and not fitting every middle manager's local context.

In any case, it should be noted that such an approach goes against the ethos of lean. That is because being enabled to carry out local improvements is associated with empowerment, a higher responsibility, and the feeling that (senior) management is keen to listen to someone's ideas. A standardised approach, however, fails to acknowledge that each local context requires customisation so that local needs can be met. In their literature review about multi-plant improvement programmes, Netland and Aspelund (2014) conclude that a fair balance between adoption and adaption is essential so that lean practices match with local conditions. This seems to apply in an intraorganisational context likewise. Some evidence even confirms that such a management control practice is not likely to conduce more extensive lean implementation, anyway (Netland *et al.* 2015). Other evidence even suggests that an overemphasis on visuals may be a characteristic of a superficially implemented improvement programme in which

symbolic actions to objectify and represent the improvement programme receive more importance than actual improvements (Baxter and Hirschhauser 2004).

In the case organisation, the VMBs had become a pain point and stood in conflict with the daily job and other business priorities. Many non-operational middle managers referred to the workload associated with them, as their preparation was very time-consuming. Aligning with what had been observed in the case organisation, Harrington and Williams (2004) explain how change initiatives are likely to become a burden if they stress priorities (e.g., daily job or deadlines). In cases where the VMB updates had been delegated to employees at the operational level at which the understanding of lean had been predominantly low anyway, the VMBs had become even less meaningful, while only very limited links to the actual job had been perceived. Although there are several calls in the literature on visual management for empowering employees to update their VMBs flexibly (Poksinska *et al.* 2013; Eaidgah *et al.* 2016), Ulhassan *et al.* (2015) found that the use of VMBs does not equally relate to every worker's daily job. More precisely, Ulhassan *et al.* (2015) observed that VMBs are either well received and enhance CI efforts *or* perceived as not fitting the workflow and making insufficient sense to be sustained. They conclude that VMB must match with the context in which they find adoption.

In retrospect, lean taskforce-belonging middle managers' lessons learnt suggest a sole focus on behavioural and cultural change in the first place to establish a solid foundation from which hard lean practices would naturally emerge as part of a pull effect instead of pushing the VMBs into departments "draconically". If such culture is initially in place, they argued, it would have avoided that employees tend to limit lean to its visible part (i.e., hard lean practices, such as the VMBs and the policy deployment matrix). Even though this assumption sounds plausible, lean had never been implemented like this in practice. However, although no conclusion is directly drawn from this study whether or not this approach is really more effective, it finds some support in the literature. In their book, for instance, Hines *et al.* (2008) expand on Found *et al.*'s (2007) lean iceberg and argue that (1) leadership, (2) behaviour and engagement, and (3) strategy and alignment enable a strong foundation wherefrom the tools and processes naturally emerge.

> "Tools should be driven by the needs of the customer, the business and people within the business; they should be *pulled* [italics in original], not *pushed* [italics in original]" (Hines *et al.* 2008, p. 67).

In the case organisation, middle managers reported how VMBs were imposed on non-manufacturing departments because their effectiveness may have probably been proved in a

manufacturing environment. This is not to say that VMBs are useless in non-manufacturing environments, as their effectiveness has already been evidenced beyond manufacturing (Parry and Turner 2006) but suggests that the introduction of VMBs outside of manufacturing environments may require some more deliberation, care, and freedom to design. By implication, this study exemplifies that lean implementation is not only dependent on the organisational context (Hasle *et al.* 2012; Marodin and Saurin 2015; Netland 2016; Antony *et al.* 2020; Netland *et al.* 2021) but also on the departmental context. In other words, even within single organisations, lean implementation depends on the nature of different departments and different local conditions. It can be summarised that as long as VMBs, which are supposed to function as the basis for CI, remain unaccepted, process improvements are not likely to be carried out at full potential.

5.3.1.3 Insufficient interdepartmental relationships and cross-functional collaboration

Involving cross-functional teams in problem-solving is needed so that unaccepted sub-optimisation can be avoided (Scherrer-Rathje *et al.* 2009). Despite several positive changes, however, interdepartmental relationships and cross-functional collaboration had still remained below the case organisation's expectations, although they are essential to implement lean (Jadhav *et al.* 2014). Isolated CI projects and silo-thinking due to a lack of cross-functional interaction led to interdepartmental conflicts and communication problems, as also observed by other academics (e.g., Upadhye *et al.* 2010; Kumar and Harris 2021). Dysfunctional KPIs had been enforcing such problems (see section 5.3.2.2).

Merely with moderate success, an action plan with several countermeasures (e.g., clipboard talks, more cross-functional project teams, etc) was developed to build bridges between functional areas. If, however, the case organisation did not miss establishing a cross-functional link between VMBs in each functional area within the business over the years, these "bridges" would have probably not been necessary. It is true that some KPIs on the VMBs were directly addressing (internal or external) customers' needs but an *end-to-end* value stream (e.g., from order to cash) that cuts across the organisation and naturally breaks down departmental silos by encouraging cross-functional problem-solving (Kumar and Harris 2021) was non-existent on the VMBs. In this way, cross-functional problem-solving would have stimulated buy-in (ibid) and maintained systems thinking (Anand *et al.* 2009) whereby organisation-wide rather than sub-unit optimisations would have been taking place (Kumar and Harris 2021). Instead, however, the use of VMBs was limited to only identifying issues in local operations, which was especially characterised by their vertical information flow (see Figure 4.4).

5.3.2 Vision and strategy

5.3.2.1 Corporate vs departmental vision

In the literature on lean, several authors accentuate the importance of developing a vision (e.g., Kaye and Anderson 1999; Spear 1999; Rother 2009; Bhasin 2012b; Jadhav *et al.* 2014; Netland 2016; Knol *et al.* 2018b; Sahoo 2020). Kotter (2007) argues that a lack of vision or underestimating its power are prominent causes of change failure. Similarly, Jadhav *et al.* (2014) argue that a lack of direction puts the lean transformation at risk. A vision, as Netland (2016) puts it in simple words, concerns "*having a plan and following it up* [italics in original]" (p. 2442). It functions as a roadmap describing the lean transformation and includes a "master plan that everyone can relate to" (Bhasin 2012b, p. 455) with set goals with the aim to deliver lean sustainably. More generally speaking, Silvers (1994) puts it as follows.

> "A vision focuses on an end results but not necessarily on how to get there. Goals focus on the *how* [italics in original], while visions focus on the *why* [italics in original]" (p. 11).

In the same way, Bhasin (2012b) says that an organisation needs to have a direction *where* to go (i.e., the objectives) and *how* it intends to get there (i.e., the plan).

Although a business vision and a policy deployment matrix associated with a CI project portfolio and defined responsibilities were in place, they did not guide the way forward, as expected by non-operational middle managers. In fact, both the business vision and the policy deployment matrix were perceived as being too high level. At the same time, a desire for more relevance to the own department was expressed. While there was no departmental vision in non-operational departments, a departmental vision was present in OPS (see Table 4.2), indicating a way forward. Interestingly, however, although a vision had been in place in OPS, the same uncertainty like in non-operational departments had partly been emerging towards the end of the data collection amongst local middle managers because the strategic objectives set out three years ago had nearly been reached. In this regard, clarity was sought by middle managers in OPS about what has to be done *after* achieving the three-year objectives likewise.

Moving forward, these insights suggest that the relevance and the level of detail, which a vision and a strategic direction entail, matter. In this study, the results propose that a *business* vision may not be sufficient enough at the department level if it is decoupled and too far away from the day-to-day work. Instead, a *departmental* vision may genuinely support the workforce to understand what their daily work contributes towards (Paatsalo 2018). On this account, middle managers decided to develop their own vision congruent with the business vision in

cooperation with their respective senior manager to counteract. In the literature, this, in fact, finds support.

> "Your department's vision must not be contrary to the corporate vision but congruent with it; make it relevant to your department. Show how your department adds value to the corporate vision" (Silvers 1994, p. 11).

Generally speaking, discussions about departmental visions are not fundamentally new. In 1996, Cunneen (1996) explored the concept of departmental visions likewise. In a higher education context, she gained three key insights. First, departmental visions share characteristics of organisational visions. Second, they are useful to centre the activities of departments. Third, departmental visions can be discussed whenever a department feels like doing so.

To date, however, the notion of *departmental* visions beyond HK has been quite overlooked in the literature on lean. Though, the necessity for having a shared improvement vision is frequently expressed (e.g., Cowley and Domb 2012; Dora *et al.* 2016; Knol *et al.* 2018b). First, especially if an organisation-wide lean implementation is attempted, a shared improvement vision ensures an aligned direction of travel, otherwise improvements may result in sub-optimisations. Therefore, a shared improvement vision ensures that improvement activities in different functional areas align with each other (Knol *et al.* 2018b). Second, a shared improvement vision is necessary to sustain improvements' long-term effectiveness (Dora *et al.* 2016). Since departmental visions are supposed to feed into a corporate vision (Silvers 1994), they do not undermine the idea of a shared improvement vision at all.

Notably, Knol *et al.* (2018b) found a shared improvement vision to be a key characteristic of organisations with an *advanced* lean implementation. If it is assumed that this finding is projectable onto the department level within a single organisation, there is further evidence indicating that operational and non-operational departments were not at the same lean maturity level. Instead, non-operational departments were at an early stage of a delayed S-curve while their low lean maturity may explain why a vision was not yet in place. Considering that departmental visions had not been developed until the end of the data collection, this study can only *cautiously* suggest that a departmental vision *may* help middle managers to develop a shared improvement vision, which they can transport and communicate to the operational level in turn in order to get the wider workforce engaged in lean.

5.3.2.2 Lack of strategic alignment and dysfunctional performance management

In comparison to departmental visions, the importance of strategic planning is widely acknowledged in the literature on lean (e.g., Samson and Terziovski 1999; Womack and Jones 2005b; Bhasin 2012b; Hadid and Mansouri 2016; Netland 2016). In the case organisation, however, strategic planning also seemed to be missing in many non-operational departments, as expressed by respective middle managers. First, although the overall direction of the business was clear ("why"), the strategic objectives to be achieved ("what"; or in Silver's [1994] words, "how to get there" [p. 11]) in order to contribute to that were not. Even if there was a clear strategy in place, middle managers were not aware of it. Second, middle managers had only been briefly involved in the elaboration of the annual improvement priorities set out by the policy deployment matrix (e.g., as part of a 25-minute session during a masterclass or via email). In this way, annual improvement targets were rather deployed in a top-down manner again according to management-by-objectives (see Table 2.32), resulting in limited ownership at the middle management level.[51] Third, Found *et al.*'s (2007) lean iceberg identifies strategic alignment as a critical success factor for lean implementation. In some cases, however, the annual objectives on the policy deployment matrix even contradicted and offset each other, inhibiting to move towards a mutual strategic direction (i.e., rather than working towards a value-stream organisation, offsetting targets enforced silos) and causing frustration and dissatisfaction. Improvement projects, however, must not cause any sub-optimisation (Knol *et al.* 2018b). Note that HK is a cross-functional instrument that requires horizontal alignment so that such conflicts will not occur (Nomi 1991). Deploying a strategy with improvement projects in such a way is therefore inadequate because it entails a lack of alignment. Improvement projects mapped to a policy deployment matrix cannot replace a strategic plan that is needed to execute a strategy. If the departmental strategy is misaligned with the overall strategy, the way how the policy deployment matrix was used is simply incorrect and a wasted effort.

Taking a systems perspective, the primary work system and the organisational objectives were not aligned (Yadav *et al.* 2017). The case organisation evoked such circumstances itself by stressing conflicting signals about priorities (Harrington and Williams 2004). For instance, the "MBOs" (management-by-objective targets) that the case organisation refers to, led to

[51] To be fair, this had also to do with the circumstance that many strategic objectives had been dictated by the case organisation's parent organisation, allowing no room for consensus in the sense of HK's catchball principle. In this way, the essence of HK's bottom-up nature was inhibited. Almost two decades ago, Rich and Bateman (2003) reported how measurement systems imposed by outside organisations tend to conflict with the behaviours required to support process improvements programmes. It can therefore be argued that parent organisations may have a negative impact on a subsidiary's lean implementation depending on the level of influence they have.

unintended consequences and drove wrong behaviours rather than the ideal ones that were primarily sought. Given that middle managers across the organisation were measured by individual performance metrics (e.g., via "MBOs"), they naturally strived to achieve their *own* targets. In some cases, following own interests, however, resulted in CI disengagement. First, individual performance metrics that entailed monetary incentives stimulated employees' behaviours. As a result, cross-functional CI projects that had not been assigned individual incentives but required cross-functional expertise were not considered a priority and were therefore ignored. Second, a closer look at owned processes and their efficiencies was neglected and, in contrast to complying with KPIs, not seen as a priority. In this way, there seemed to be a dilemma between effectiveness and efficiency.

This phenomenon has, in fact, some parallels with the scores in VMB audits, which had also been driving unintended behaviours (e.g., "tick-box exercise" to chase scores while neglecting business priorities). It is important to understand that *individual* performance measures drive *individual* behaviour (Bicheno and Holweg 2016) whereas inappropriate performance measures stimulate dysfunctional behaviour (Bond 1999; Bhasin 2008). In Emiliani's (2000) words,

> "conflicting measures create conditions that support defective individual and organizational behaviors, which can result in a debilitating inward focus and loss of productivity" (p. 614).

Initially, scores in audits were intended to stimulate and encourage desired behaviours. Scores, however, had been identified as misguiding, leading to adverse effects and unintended consequences. Over time, transparency gained by the scores had even caused a certain level of fear and a perceived competition between departments. It is true that Akmal *et al.* (2020) found fostering competition by using performance metrics and audits to be maximising the gains with lean in a healthcare setting, but their results entirely contradict what the dynamics in the case organisation unveiled. Unlike Akmal *et al.* (2020), the circumstances suggest such competition as a downside and, therefore, audit scores as counterproductive. An explanation for this is provided by Netland and Ferdows (2016) who argue that once being new to lean, the new principles and practices to be implemented may be overwhelming while low audit scores may lead to dissatisfaction, which may harm the morale within the workforce in turn and puts the entire lean programme at risk. Under consideration of the negative impact that a slower pace rate outside of OPS had on their rate of performance improvements, such reactions are understandable and may be seen as a natural response to a widening performance gap (see Figure 5.2).

Even if often intended to be a motivator, such incentive systems are said to undermine long-term success due to their incompatibility with lean (Jadhav *et al.* 2014; Antony and Gupta 2019). Vice versa, Piercy and Rich (2009a) found how removal of dysfunctional performance measures may have a positive impact on the workplace morale.

5.3.3 Leadership

5.3.3.1 Need for visionary senior leadership outside of Operations

These circumstances, however, did not apply in OPS where strategic objectives had been set out in their departmental three-year plan, complemented by means of continuous discussions between the local senior manager and his middle managers. In fact, improvement methodologies, such as lean, depend on how senior managers interact with their workforce because they play a significant role in how the workforce understands strategy (Jadhav *et al.* 2014).

If department leaders, such as the OPS director, achieve inspiring a shared departmental vision to convey a sense of purpose and a direction of travel, Kouzes and Posner (2012) and Timcheck and Martin (2019) argue, they lay the groundwork for enabling successful future planning. In addition, such open communication generates a shared sense of urgency for change (Jørgensen *et al.* 2003). In their study, Creswell *et al.* (1990) found that excellent department managers, as seen in OPS, develop a collective departmental vision. As "visionary leadership […] is the ability to influence people […] to adopt new behaviours needed for strategy implementation" (Sahoo 2020, p. 747), Roth (2006) rightfully concludes that leaders are ultimately the ones who help to close the gap between the vision and its operational implementation.

In the literature on lean, there is no doubt that senior managers are responsible for exhibiting this long-term view (Kaye and Anderson 1999; Spear 1999; Rother 2009; Alefari *et al.* 2017; Holweg *et al.* 2018; Netland *et al.* 2019) but several middle managers from non-operational departments seemed to be missing such visionary leadership by their senior managers. After all, middle managers need a strategic direction so that they can develop appropriate measures for the hierarchical levels below them (Nonaka 1988; Westley 1990; Floyd and Wooldridge 1996, 1997; Holmemo and Ingvaldsen 2016; Engle *et al.* 2017). More precisely, the role of senior managers is to define the "*what*" and the "*why*" of the vision and the associated strategy, whereupon middle managers must define the "*how*" and "*when*".

5.3.3.2 Mismatching expectations of roles and responsibilities

In retrospect, there was no agreement upon middle management's role and responsibilities. The circumstance that lean implementation had stalled looked like as if middle management resisted from a senior management perspective. That was because senior management had the impression that the WLG does not sufficiently engage in lean to move the initiative forward, whereas non-operational WLG members expected more guidance and direction.

Undergoing the lean implementation process for a couple of years already, both senior and middle management found finally out about their mismatching expectations of middle management's role and responsibilities. Previous research has already shown that many middle managers perceive a lack of defining roles and responsibilities as a barrier to CI (Lodgaard *et al.* 2016). Similarly, Emiliani (2015) finds that a lack of specificity in terms of the new roles and responsibilities stands out in organisations with a slow lean transformation. At the same time, most quality programmes seem to omit to define the role of middle management in quality-orientated organisations (Martin 1992; Roth 1998). But if the middle management role is insufficiently defined, middle managers will struggle with finding their path (Harrington and Williams 2004). This suggests that mismatching expectations or a lack of defining their role and responsibilities undermine middle managers' engagement in lean, as seen.

Moving forward, this example does not only show the importance of defining middle management's role and responsibilities, but also the relevance of understanding their needs by making inhibiting barriers more transparent and by bringing them to the surface. Certainly, middle management reluctance is much easier to counteract once it is openly expressed, but as soon as indifferent attitudes are kept beneath the surface and middle managers remain passive, respective issues become much more difficult to address (Davis and Fisher 2002). More generally speaking, one may technically also refer to a communication problem between senior and middle management. Considering the point of time when both management layers came together to identify problems that caused "pain", it may be implied from this case study that such discussions should take place way earlier and on a regular basis.

5.3.3.3 "Hands-off" approach: Delegating lean implementation to middle managers

In their systematic literature review on lean production, Marodin and Saurin (2013) refer to the importance of managerial support and management commitment. This aligns with Crute *et al.* (2003), Antony and Gupta (2019), and Ali and Johl (2021). In fact, this factor appears to be the most crucial one when embarking on lean implementation, as leadership is consistently seen as the biggest success factor in the literature (Netland *et al.* 2019; Ali and Johl 2021; Holmemo

et al. 2022). In the same vein, Jadhav *et al.* (2014) derive from their systematic literature review on lean in the manufacturing sector that senior management involvement and leadership are crucial factors that determine the success with lean. In any case, as organisations mature, senior management commitment to lean becomes even more important (Alefari *et al.* 2017).

In their study, however, Lodgaard *et al.* (2016) have already discussed middle managers' concerns about a lack of senior management commitment. That being said, senior management engagement varied in each department.[52] In fact, evidence shows that senior managers outside of OPS had been perceived as being less engaged and insufficiently supportive by at least one middle manager within each non-operational department. They seemed to limit their engagement in lean to talks but had never really been "walking the talk" and participating in the lean transformation. In doing so, they did not take ownership and responsibility for lean implementation (Emiliani 2015; Netland *et al.* 2021). Not only several interviews back this circumstance but also internal documents (e.g., engagement in VMB audits). Denial of support when needed, as seen in the case study, indicates disengagement and may be seen as disrespectful (Amabile and Kramer 2011) whereas "respect for people" is a key pillar of lean (Liker 2004; Gupta *et al.* 2006; Emiliani 2015). In their study, Scherrer-Rathje *et al.* (2009) demonstrate how such a "hands-off approach" (p. 81) associated with limited senior management presence might lead to failure. In contrast to that, senior management support in OPS was perceived as being positive by middle managers in- and outside of OPS. If, however, senior managers do not sufficiently support lean in their departments and commit to it, they are likely to "promote a flavor-of-the-month attitude across the business" (Antony *et al.* 2018, p. 942).

Along these lines, there was a perception that non-operational senior managers did not make lean implementation important enough on a daily basis. Their continued involvement, however, is necessary for lean to sustain (Holmemo and Ingvaldsen 2016; Netland and Ferdows 2016; Holweg *et al.* 2018; Robert *et al.* 2019). In well-performing organisations, senior managers personally participate in lean on a daily basis (Emiliani and Emiliani 2013). This includes, for instance, active encouragement, follow-up, the recognition of displaying appropriate behaviours (Lodgaard *et al.* 2016), CI promotion, and coaching at the gemba (Netland *et al.* 2019; see Table 2.34 for a comprehensive overview). Instead, though, lean was mistakenly delegated to lower levels in the organisation (Roth 2006; Emiliani and Emiliani 2013) and

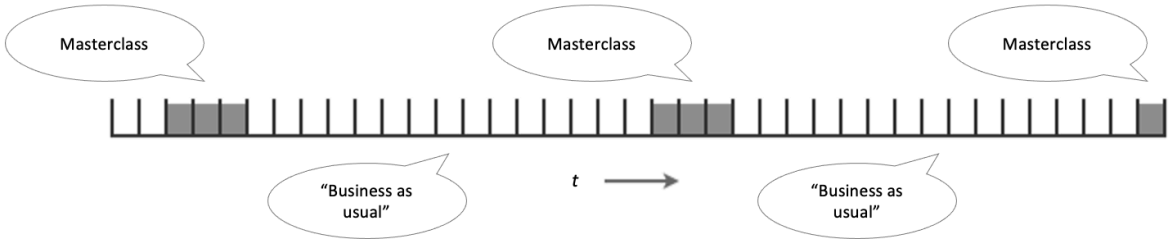
[52] To be fair, the local senior manager in R&D had been on an 18-month leave. It should therefore come as no surprise that a limited engagement by the local senior manager was perceived (e.g., due to a missed knowledge-building process).

found mostly discussion quarterly only once a masterclass took place. What happens in this case, though, is that "business as usual" is taught, as explained by Rother (2015).

> "If we only periodically conduct training events or only episodically work on improvement – and the rest of the time it's business as usual – then according to neuroscience what we're actually teaching is *business as usual* [italics in original]" (p. 48).

In Figure 5.3, Rother (2015) attempts to illustrate how periodical training events (or episodical work on improving), such as the case organisation's masterclasses, actually teach business as usual rather than a new way of working. In this way, lean was rather seen as a standalone project and had never the chance to become an embedded daily practice.

Figure 5.3 Daily practice



Source: Adapted from Rother (2015)

Notably, Pearce *et al.* (2018) found that such events are neither vision-inspiring, nor do they guide practical steps on how to proceed. Instead, they argue that regularity and a focus on personal development and CI associated with constant follow-ups is necessary.

5.3.3.4 "Miscommitting" to traditional ways of management

In their study, Scherrer-Rathje *et al.* (2009) demonstrate how a lack of senior management commitment and interest in lean makes it difficult for subordinates to understand how changes resulting from lean implementation are relevant to their daily job. Similarly, Frohman (1990) found that many managers do not understand how newly introduced change programmes will affect or benefit them but often remain blamed for being inhibitors of change.

To that end, Rother (2015) continues that "coaches should be line managers, because they are *there* [italics in original] every day" (p. 48). In the same vein, Holweg *et al.* (2018) argue that senior managers are supposed to define the frame in which their subordinate can act and grow. Rather than experting, they suggest coaching to nurture ongoing engagement by harnessing the power of quick-wins. Admittedly, Rother (2015) refers to the middle management role indeed, urging them to coach their subordinates but it is questionable how

the case organisation's middle managers could be expected to act in a certain way, if their own superiors are not good role models (see section 4.9.3.1). Continuing on this, it is often claimed that leaders have to inspire (Spear 2004; Rother 2010; Liker and Convis 2011; Netland *et al.* 2019). To enable middle managers to be inspirational, it is necessary to inspire them in the first place, but the circumstance that senior managers do not equally do the things they expect from their middle managers is common in most lean-transforming organisations (Emiliani 2015). It should therefore come as no surprise that such a circumstance was widely present in the case organisation likewise.

However, the literature shows that the success of an organisation depends on the extent to which senior managers are committed to lean and to which make themselves available (Dora *et al.* 2016). Harrington and Williams (2004) stress that senior managers must lead by example; and although the message "lead by example" was preached in the case organisation, it is questionable to what extent senior managers from non-operational departments had really adhered to this. In a public sector study, Holmemo and Ingvaldsen (2016) found that, in four out of five cases analysed, lean experts were concerned that senior managers are not sufficiently devoted to lean despite occasional symbolic praises of lean and financial sponsoring, while, according to Emiliani (2015), middle managers share the same concerns. Unless middle managers do not see senior management's continuity of actions, they will likely adopt a certain indifference towards change initiatives (Harrington and Williams 2004); and once the talk is not transformed into action, it is likely that organisations continue operating the old way (Jørgensen *et al.* 2003; Holmemo and Ingvaldsen 2016). The circumstance that middle managers from non-operational departments did not demonstrate the engagement expected by senior management suggests that senior managers' role model function and behaviours may predict how their middle managers will behave and engage in lean. After all, middle managers will transfer their enthusiasm for lean to levels below *them* in the same manner (Alefari *et al.* 2017).

To be fair, however, an extensive presence of senior management support is usually seen in organisations with an *advanced* lean implementation (Knol *et al.* 2018b). Under this consideration, the findings do not necessarily suggest that several senior managers were uncommitted to lean per se but rather remained (mis)committed to the traditional way of management. To be more specific, leadership roles change during lean implementation (Found and Harvey 2007; Netland *et al.* 2019), but many senior managers were not aware of how they had to adjust their habits and management style to make them compatible with lean.

Having that said, a lack of role modelling had provoked pursuing false priorities. Equally, insufficient coaching at the gemba had been taking place over the years in non-operational departments. The gemba, however, also concerns places in non-operational environments where value is created. In his book, Liker (2021) argues that, in most organisations that pretend to be lean, senior managers are neither involved in day-to-day operations nor in CI activities. This, however, is at the heart of lean. At Toyota, he continues, learning takes place at the gemba rather than as part of collective classroom activities, as seen in the case organisation. In this way, a pull-based learning can be enabled insofar that competency needs are directly drawn from the gemba at an individual level whereas adopting a "scattergun" approach (i.e., collective learning activities, such as the masterclass or the leadership workshops) seemed ineffective and less relevant for the individual in some cases.

5.3.4 Knowledge and understanding

5.3.4.1 Lack of knowledge at the senior management level

To be fair, this circumstance may raise the question of the underlying reasons why the case organisation's senior managers from non-operational departments had been insufficiently engaged in cultivating lean and why they had been "miscommitting" to traditional ways of management.

Providing a root cause, several middle managers expressed concerns about whether knowledge about lean was actually present at the senior management level. In other words, they found that some senior managers were simply not sufficiently equipped to engage and enthuse their subordinates, whereas a good understanding associated with a personal drive for process improvement is a critical enabler to conduce change (Rich and Bateman 2003). Aligning with what several middle managers reported, Emiliani (2015) and Holmemo and Ingvaldsen (2016) argue that the reasons often lie in the depth of senior management's understanding. Consistent with that, Alefari *et al.* (2017) conclude from their literature review on the role of leadership in implementing lean manufacturing that a lack of understanding and poor knowledge is often a cause for poor commitment at the senior management level. In a study in the Greek manufacturing sector, Salonitis and Tsinopoulos (2016) gave four reasons why senior managers are poorly committed, namely, (1) no sufficiently lasting commitment, (2) change inertia, (3) a poor belief in the advantages of the approach, and (4) a poor knowledge and insufficient understanding of lean. In their systemic literature review on critical failure factors of LSS, Albliwi *et al.* (2014) also report that many organisations fail to attain the success with lean due to managers' limited understanding of lean performance.

This circumstance links back to Pearce *et al.*'s (2018) concerns about self-assessments who argue that more emphasis must be put on the extent to which organisational learning is embedded. In two longitudinal case studies in New Zealand, they examined the root causes for poor management commitment to lean likewise and concluded that

> "the real problem with achieving lean success was not management commitment but their ignorance of what they should commit to, hence a knowledge problem" (Pearce *et al.* 2018, p. 94).

Underscoring the importance of developing managers' lean knowledge, the organisations they studied did not make learning a priority. A broad lean knowledge is necessary, though, to overcome technical limitations and to be able to act as an effective problem-solver (Leite *et al.* 2020a). In five successful organisations, Anand *et al.* (2009) found, for instance, that much focus is put on the development of middle managers because this enables enthusiasm for CI initiatives being multiplied at hierarchical levels below them. The findings suggest that such L&D activities should also address senior managers. In small to medium-sized enterprises with constrained resources, Pearce *et al.* (2018) argue, management knowledge is crucial in particular. Continuing on this, they also refer to learning the capability of forming a vision for leading change. Unless leaders possess such knowledge, they argue, it is most likely that they do not know how to initiate change in the organisation.

These studies' inferences are, in fact, congruent with the dynamics in the case organisation and may thus explain why senior management's engagement in lean fell short within many of their non-operational departments. More generally, this study suggests that a lack of senior management engagement (support or commitment) is not necessarily an indicator of disinterest in lean per se. Instead, it is important to have a look at the underlying reasons *causing* insufficient management engagement in the first place. On this note, a lack of knowledge may be a plausible cause, for instance, as the case was here.

5.3.4.2 Lack of knowledge at the middle management level

Considerably, however, the case study indicates that a limited understanding of lean was not only present at the senior management level but also, as occasionally confessed, at the middle management level, yet primarily within the non-operational management community. Despite these knowledge gaps, senior and middle management's average level of expertise seemed to be still the same, as pronounced by middle managers. In both management layers, some individuals were sticking out, and some individuals were catching up (e.g., new middle managers). Considering this circumstance, it is not a surprise why certain functional areas

within the business had been progressing better than others. Generally speaking, the literature supports that the workforce's understanding and commitment play a crucial role as organisations initiate their lean implementation (Salonitis and Tsinopoulos 2016; Alefari *et al.* 2017). Similarly, Rich and Bateman (2003) found that a lack of understanding may lead to a poor level of internal support.

Importantly, however, this case example shows that a lack of knowledge constitutes a fundamental barrier to deploying lean organisation-wide for another reason. Besides the incapability of driving change (Pearce *et al.* 2018), a basic misunderstanding of lean may rub off on other middle managers and spread negativity to the wider workforce, paving the way for the formation of opposition that perpetuates pessimism about lean. In line with Netland *et al.*'s (2021) results, it appeared that

> "the presence of a culture that dismisses the importance of the lean program" (p. 147) characterised by a "negative perception of local managers about the need for the lean program [and] its relevance to their operating context […] is a primary obstacle that slows the pace of lean implementation" (p. 148).

Similarly, Crute *et al.* (2003) and Bhasin (2015) make effects of company culture responsible for the rate of lean implementation. If, however, key protagonists remain unconvinced about the potential gains associated with lean, they are likely to refuse promoting CI and exacerbate a successful implementation of lean (Netland *et al.* 2021). In the case organisation, the forming of an antipole group made a cultural transformation even more difficult because it caused the spread of negativity about lean in certain functional areas. Taking the number of R&D managers being represented in the WLG who had remained unconvinced about lean and its advantages into consideration, their stance had a strong lobby and rubbed eventually off on middle managers from other non-operational departments. Ironically, a few of them confessed a limited understanding of lean at the same time.

In fact, Pearce *et al.* (2018) already observed similar group dynamics escalating negativity during lean implementation and confirm how this breeds negativity, sustains resistance, and inhibits a mindset growth. In this way, a lack of knowledge may even backfire and therefore be considered counterproductive because indifferent attitudes towards lean at the individual level, caused by fundamental misunderstandings, are taken to a collective level. If such indifferent attitudes last in an organisation and are not counteracted, apathy will grow further and eventually lead to long-term harm (Holweg *et al.* 2018). Taking its important role into consideration, knowledge could therefore be seen as another enabler "below the waterline" in

regard to the lean iceberg by Found *et al.* (2007). At the same time, this proposes that middle managers can be not only a significant lever but also a major showstopper to lean implementation.

5.3.4.3 Lack of self-development

While senior management could be blamed, on the one hand, for putting insufficient emphasis on lean education to gain traction from all their middle managers, evidence also shows, on the other hand, that many middle managers simply lacked self-initiative to learn about lean themselves. Instead, a certain indifferent attitude towards learning about lean was present at the middle management level.

Ideally, such self-education should concern every single manager across all hierarchical levels. Proactive learning, however, had never been a big thing, although its necessity is accentuated (Harrington and Williams 2004; Liker and Convis 2011; Poksinska *et al.* 2013; Netland *et al.* 2019; Valente *et al.* 2019; Reynders *et al.* 2022). In their literature review, Reynders *et al.* (2022) underline the importance of middle managers being strongly committed to self-development because it is an essential element to implement and sustain lean. In line with that, Manville *et al.* (2012) refer to the necessity of building learning capabilities. Interestingly, they also found in their study that middle managers' expressed criticism often relates to insufficient senior management commitment, support, and enthusiasm as well as insufficient (or inappropriate) training and education. This, in fact, was referred to by some of the case organisation's non-operational middle managers likewise as previously discussed. Likewise, Powell and Coughlan (2020) refer to "developing a learning-to-learn capability [as] a core and critical success factor for lean transformation" (p. 921).

In the case organisation, learning had, however, mostly been taking place within a small core group (the "lean taskforce") that led the transformation. While most taskforce members had already some experience with CI and access to other types of learning (e.g., inspirational site visits in the early beginning), individual learning outside this group had only been taking place to a small extent. This means that the taskforce's learning had often been imposed on individuals outside this group, undermining that many individuals outside the operational departments had a chance to explore lean for themselves, as theorised by the S-curve (Netland and Ferdows 2016). Imposing learning without letting individuals learn for themselves may be another way of depriving employees of meaningfully engaging them.

5.3.4.4 Inapplicability of lean due to erroneous knowledge

In non-operational departments, lean was perceived as being inapplicable by several middle managers and had only led to limited success. Although perceptions like these are not uncommon (Hines *et al.* 2004; Baines *et al.* 2006; Strategic Direction 2006; Thirkell and Ashman 2014; Gupta *et al.* 2016; Pearce *et al.* 2018), they are predominantly refuted by the academic literature. In fact, sufficient evidence proves that lean is equally applicable in any environment where value flows in a sequence of activities (Womack and Jones 1996; Rother and Shook 1999; Baines 2006; Liker and Morgan 2006; Piercy and Rich 2009a, 2009b; Antony *et al.* 2017); and so does waste exist in activities taking place in non-manufacturing environments likewise.

As previously seen in non-manufacturing environments (Radnor and Osborne 2013; Asnan *et al.* 2015), the underlying reason for this attitude amongst the case organisation's middle managers laid in a limited understanding of lean's strategic level associated with its core principles focusing on driving value for the customer in the best way possible (Womack and Jones 1996; Hines *et al.* 2004; Radnor and Osborne 2013). In 1999, Spear and Bowen (1999) already pointed out that the essence of the TPS is to be understood as abstract, high-level principles rather than visible shopfloor practices. Omitting lean's strategic level associated with its core principles, non-operational departments' interpretation merely focused on the operational level at which hard lean practices are concerned (Hines *et al.* 2004; Bhasin 2012a; Radnor and Osborne 2013; Asnan *et al.* 2015). In this way, it makes arguably perfect sense that lean is difficult to transfer to non-manufacturing environments because hard lean practices used in manufacturing had originally been developed to suit manufacturing needs. Once hard lean practices are taken out of their original context, they will not necessarily apply in another environment (Bicheno and Holweg 2016). To put it another way, hard lean practices developed in manufacturing are tailored to manufacturing environments and not necessarily operatable in non-manufacturing environments (James-Moore and Gibbons 1997; Liker 2004; Radnor *et al.* 2006; Alsmadi *et al.* 2012; Gupta *et al.* 2016). Instead, non-manufacturing environments are supposed to derive their own tailored lean practices from lean's core principles by developing management instruments that suit *their* needs (Bicheno and Holweg 2016). To put simply, adaption rather and adoption is necessary, as also seen in multi-plant improvement programmes (Netland and Aspelund 2014; Boscari *et al.* 2016).

Mentioned in the following, several misconceptions could be observed in the case organisation, though. First, a certain translation of the lean *principles* (value, value stream, flow, pull, and perfection) away from manufacturing by redefining what value (e.g., expertise

to manufacture a medical device), value stream (e.g., information flow), and waste (e.g., delayed and excess communication) comprise in an R&D environment had been taking place; however, despite acknowledging that information flow is concerned, the resulting translation did not lead to sufficient conviction but an attitude that lean is inapplicable due an everlasting association with manufacturing areas and an incompatibility with their work ethos. Annoyed by that, a few WLG members from R&D had even decided to leave the organisation, as they felt that such responsibilities had alienated their job as engineers. In fact, the literature on visual management reports about how employees from R&D are usually not used to optimising their workflow and to providing transparency about their work and progress (Kurpjuweit *et al.* 2019). Second, traceability ("value is easier to trace in manufacturing") was raised as a major concern regarding lean's applicability in some functional areas within RAQA and SGAE whereas it would have probably been helpful to focus on a translation of the lean principles, as seen in R&D, to understand value and its flow within the own environment rather than to keep failing with implementing lean by trying to force-fit principles and hard lean practices originating from manufacturing. On the contrary, two functional areas within RAQA (i.e., quality engineering and quality systems) were capable of embedding lean in their local environment. Their success was justified with being closely linked to OPS' activities and a much easier traceability of variation in their processes.

Imitating hard lean practices from a manufacturing environment will not lead to the same success. By all means, lean has to be understood as both a philosophy *and* practices (Pullin 2002; Hines *et al.* 2004; Bhasin and Burcher 2006; Shah and Ward 2007) whereby the philosophy applies to any environment, whereas hard lean practices do not (Bicheno and Holweg 2016). In their study, Piercy and Rich (2009a) describe, for instance, how a lean transformation in a pure service environment may look like. In doing so, they refer to the identification of true value, VSM, workplace redesign, and the application of problem-solving techniques in a coordinated and integrative manner. Similarly, Baines *et al.* (2006) argue that an understanding and a (re)definition of value as well as a set-based approach are necessary to succeed with "white collar lean" (p. 1539).

In various ways, the introduction of VMBs exemplifies this dilemma likewise. In interviews, for instance, most middle managers from non-operational departments referred to the VMBs when talking about lean implementation, whereas a reference to lean principles remained neglected. At hierarchical levels below middle management, the views had even been narrower. In some cases, the derogatory term "wallpaper" was even used, confirming that VMBs had only remained a visible artefact without understanding the strategic level of lean (Hines *et al.*

2004; Arlbjørn and Freytag 2013; Holmemo and Ingvaldsen 2016). Plus, the VMBs had been imposed on non-manufacturing departments while remaining largely meaningless for the targeted audience. In other words, their introduction had *not* been pulled out of necessity for having a vehicle to increase the business visibility of the respective non-operational department. As suggested in the literature (Parry and Turner 2006; Bateman *et al.* 2016; Eaidgah *et al.* 2016; Verbano *et al.* 2017; Kurpjuweit *et al.* 2019), it seemed that much more training and management support was necessary so that VMB owners could develop the understanding needed.

The circumstance that the VMBs did not receive sufficient attention in non-operational departments did not really surprise considering their low level of lean maturity at this stage. The STS theory may explain such dissonance. That is because technical equipment (i.e., the VMBs) and their social counterparts (i.e., VMB owners' expected behaviours or their mindset) did not operate in harmony; rather, they seemed to be misaligned. Apart from the policy deployment matrix, the VMBs had remained the only tangible element of lean at that time, but did all VMB owners really understand why they had been in place? Also, was there a sufficient understanding of whether these VMBs were supposed to support the operationalisation of the case organisation's strategy and guide improvements? Without having developed a culture, mindset, or passion for excellence yet that would make them engage in visual management, it rather seemed that a considerably large proportion of the organisation had limited CI to its visible elements. In fact, evidence shows that lean-immature organisations are less likely to use such boards. In their study, Kurpjuweit *et al.* (2019) report how introducing VMBs goes easily from the hand, whereas gaining that cultural change behind it is much more challenging. Instead, organisations are usually more likely to dedicate time and interest in visual management as they progress in their lean evolution (Netland *et al.* 2015). Time is necessary so that visual management can find adoption (Verbano *et al.* 2017). In the present case, this insight may be projected onto the department level likewise. With the Shingo Insight Assessment #2 noting the much stronger CI entrenchment in OPS, there is further evidence to support this.

5.3.4.5 Lean's origin in manufacturing associated with its technical terminology

Paired with lack of understanding and self-development, a special role was played by lean's technical terminology. Including senior managers, lean was often perceived as "something for manufacturing" in non-operational departments, not only in regard to its hard lean practices, but also its technical terminology. According to reports by middle managers, this view was

even shared amongst some non-operational senior managers. In particular, lean jargon (by many referred to as "buzzwords") contributed to many middle managers' confusion and disengagement outside of OPS. It may be even argued that the adoption of the Shingo model further contributed to this.

Admittedly, this is nothing particularly new (Lodgaard *et al.* 2016; Saurin *et al.* 2021). In the past, this phenomenon has, in fact, already been observed in a couple of non-manufacturing settings, including service (Hadid and Mansouri 2014), healthcare (de Souza and Pidd 2011; Akmal *et al.* 2020), and higher education (Antony *et al.* 2012, 2018). First, in their literature review, Hadid and Mansouri (2014) found lean having its origin in manufacturing to be one of the key barriers to lean in the service sector. Second, in eight out of fifteen healthcare organisations, Akmal *et al.* (2020) found lean terminology to be a barrier to lean implementation. They report how clinical staff did not perceive lean to be applicable in a healthcare context. In addition to this, the clinical staff viewed their professional values as being devalued when terms, such as waste, value, and efficiency, were used. The conflicts between lean and medical logics, they conclude, do not emerge from the end goal, but rather from how lean is approached. Third, in another healthcare context, de Souza and Pidd (2011) examined barriers to lean likewise and found the "perception, caused by lean's origin in manufacturing; and, terminology, originating in lean's Japanese background" (p. 65) to be a common one, yet being exclusive to lean in comparison to other change initiatives. In any setting, they argue, the introduction of lean terminology is challenging but not absolutely necessary as long as a consistent language is used at least. Maintaining consistent language is a must, they accentuate, otherwise misunderstanding may occur. Fourth, in a higher education context, Antony and colleagues (Antony *et al.* 2012, 2018) found that

> "there is a problem with terminologies taken from manufacturing industry […] (we do not make cars at the [higher education institute])" (Antony *et al.* 2018, p. 516). They conclude that "[t]erminologies taken from manufacturing and engineering industries are not readily accepted" (p. 522).

Considering that these three studies took place outside of manufacturing environments, it may not surprise that the same issue had been occurring in many of the case organisation's non-operational departments. However, most of these studies do not refer to root causes that may explain the antecedents for disengagement. Indeed, Akmal *et al.* (2020) made a reference to the conflict between lean and medical logics, yet the question remains from where this mismatch emerges. That being said, this study rather suggests a lack of knowledge as the underlying reason for disengagement. Inferring from this, the findings neither suggest lean's

origin nor its technical terminology as a barrier as such, but rather as a symptom of a limited understanding and lack of transferability capabilities instead.

The way how such barriers were tackled in several non-operational departments of the case organisation was by simplifying the language and cutting buzzwords. In R&D, for instance, one middle manager had started to avoid the term "*operational* excellence" so that the initiative was not seen as a "manufacturing thing", as suggested by Bicheno and Holweg (2016). In several functional areas below the middle management layer, attempts to do so turned out to be a success. Surprisingly, though, this example contrasts with current discussions about whether the term "lean" should be replaced by "operational excellence" (Browning and de Treville 2021) and shows that changing the terminology in favour of "operational excellence" would bring its own problems and challenges when implementing lean beyond manufacturing environments. Although a different sector is concerned in Akmal *et al.*'s (2020) study, the case organisation's approach finds support in the literature. In their study, Akmal *et al.* (2020) found how healthcare organisations decided to change their communication strategy to develop what they refer to as "new vocabularies of practice" (p. 7) so that terminology is much more compatible with clinical staff's everyday work. More abstractly, their findings suggest that lean terminology requires a contextual translation that matches the environment to be addressed, as Leite *et al.* (2020a) suggest. Consistent with that, Dannapfel *et al.* (2014) argue that initial resistance within the workforce can be counteracted as soon as manufacturing connotations are avoided. By implication, it is quite possible that new communication strategies with the aim to attain more acceptance for lean apply to other non-manufacturing environments (besides service, healthcare, and education) likewise. That being said, this study suggests that new communication strategies may increase the likelihood of lean being accepted in non-operational departments of manufacturing organisations when diffusing lean from manufacturing operations to the wider organisation.

5.4 Summarisation of discussion

5.4.1 Diffusing lean from manufacturing operations to the wider organisation

The first research question was concerned with how lean can be diffused from manufacturing operations to the wider organisation. In retrospect, it can be concluded that the case organisation was not aware how to diffuse lean from manufacturing operations to the wider organisation but had gradually been learning from its mistakes how to move ahead. Taking this into account, *one* way of diffusing lean from manufacturing operations to the wider organisation associated with organisational learning was presented in this study. The

theoretical lenses, namely, STS and the S-curve theory, helped to understand the phenomena studied.

In the case organisation, lean implementation had begun with a strong focus on hard lean practices in OPS as usually typical (Bicheno and Holweg 2016; Kelly and Hines 2019; Hines *et al.* 2020). The way how lean implementation was then diffused from manufacturing operations to the wider organisation resonates with the 3P logic (Womack 2006, 2008; Anand *et al.* 2009). Focusing on the intersects, the case organisation sought management systems that align the 3P dimensions, namely, "purpose", "process", and "people". In doing so, a broader approach to lean implementation was selected that went beyond a focus on hard lean practices. Hence, functional areas outside of OPS had initiated *their* lean journey with a systems-based change (Piercy and Rich 2009a; Hines *et al.* 2020) straightaway rather than a strong focus on hard lean practices, as theorised by Hines *et al.* (2020; see Figure 2.5), for instance.

To a large extent, this study confirmed the necessity of developing and solidifying cultural-enabling factors (e.g., [1] strategy and alignment, [2] leadership, and [3] behaviours and engagement; Found *et al.* 2007) for a successful lean implementation prior to embarking on hard lean practices. First, to link "people" with the case organisation's "purpose", a behavioural deployment system functioning as a normative framework associated with a purpose statement and ideal behaviours was found to encourage habits conducive to lean implementation, yet under certain conditions. To increase the likelihood that employees feel encouraged to adopt ideal behaviours, the case organisation had learnt that it is important to involve employees in developing such behaviours as they will have ownership in them then. In a supplement to this, R&R and LSW were found to further encourage ideal behaviours. A major change, in fact, involved a revamp of the existing R&R system. The case study suggests, for instance, that employee involvement and a personal "thank you" by a senior manager are powerful so that recognition is perceived as being genuine. In fact, there is limited literature that states that a personal "thank you" (e.g., Kelly and Hines 2019; Hines *et al.* 2020) or other non-monetary rewards (e.g., Netland *et al.* 2015) can also increase motivation for CI, whereas monetary rewards do not seem to. Most importantly, such a behavioural transformation will take time and does not happen overnight.

Second, a strategy deployment system was found to align the case organisation's "purpose" and its "process(es)". In essence, it breaks down the business vision into multiple operational measures associated with targets. Importantly, however, it came out that strategic targets must be vertically and horizontally aligned, otherwise inappropriate performance metrics may stimulate dysfunctional behaviours or cause a level of fear (e.g., due to a perceived

competition). At the same time, inappropriate performance metrics will make embedding ideal behaviours much more difficult. In addition, employees should be involved in strategic discussions so that they are given an opportunity to negotiate and own the strategy. If catchball is impossible (e.g., due to strict targets set by a parent organisation), strategy should at least be thoroughly communicated down to the operational level so that a sense of involvement is conveyed. In doing so, a departmental vision can be elaborated, making individuals see how their work contributes to the business.

Third, in some parts of the case organisation, a CI system was found to encourage "people's" engagement in "process" improvements. At its core should be visual management. In all functional areas, local VMBs are intended to present the business vision in the form of operational measures linked to local targets that derived from strategy deployment, while KPIs increase the business transparency so that improvement opportunities can be identified. Visual management, however, only appears to be effective under certain conditions. It must not be pushed into departments because such a change may be perceived as imposed and policing. In other words, rather than "shoehorning" lean, change should be negotiated. Taking different local conditions into account, adaption rather than adoption is sometimes necessary. For instance, the study exemplified that it is important that employees are given the freedom to design VMBs according to their needs. In this way, ownership is given to drive change. Ideally, a CI mindset associated with appropriate behaviours should evolve beforehand so that hard lean practices, such as visual management, will become a natural call. In addition, L&D aimed at equipping the WLG members and their subordinates with the capabilities needed to improve the processes they owned. Training programmes, however, must be relevant and suit the context in which they are supposed to find adoption in the future. More transparency upon remaining cultural gaps can be gained through regular performance reviews. In this case study, for instance, performance reviews assisted in revealing several missing or insufficiently embedded soft lean practices, which are needed, though, to accelerate lean implementation. In comparison to surveys, in-person discussion may reveal deeper rooted issues.

It was clearly presented that lean will not necessarily evolve evenly during an intraorganisational implementation, whereas different patterns of change may rather be expected in all transforming departments instead. More precisely, a major challenge that may become obvious at a quite early stage already concerns departments' varying degrees of lean maturity. It cannot be ruled out that a certain department, which is already in the transformation process for a while (i.e., OPS, for instance, as the case scenario was here), will be dominating the implementation and leading the way when lean is diffused to the wider organisation. That

is because it is usually much more advanced in lean implementation and has made some previous experiences simply by being in the process for a longer. If organisations decide to pursue diffusing lean from manufacturing operations to the wider organisation, they need to take into consideration that all transforming departments may be evolving and maturing at different (slower or even faster) pace rates. With reference to the S-curve theory, departments in the wider organisation will undoubtedly embark on lean at a phase-delayed S-curve, as seen in the case organisation. A certain lean maturity gap will therefore always exist. Whether or not a department can mature at an even (or higher) pace rate to reduce lean maturity gaps solely depends on its capabilities and the support it is given. In the case scenario, almost all departments in the wider organisation were not able to catch up with OPS' pace while lean maturity gaps had been widening over time. Unlike isolated lean transformations in manufacturing ("lean production" or "lean manufacturing"), organisations are therefore likely to experience an extra complexity when undergoing an organisation-wide lean implementation because different lean maturity levels imply different managerial implications (Netland and Ferdows 2016).

A remarkable development that had been taken place over the years is the transition from a "one-size-fits-all" (i.e., adoptive and top-down) towards a more participative and tailored (i.e., adaptive and bottom-up; e.g., ideal behaviours and visual management) approach, as also suggested for implementing multi-plant improvement programmes (Netland and Aspelund 2014; Boscari *et al.* 2016). In summary, diffusing lean from manufacturing operations to the wider organisation is not straightforward but requires deliberation and care so that departments outside of manufacturing environments are engaged in the lean transformation process likewise.

5.4.2 Lessons learnt from the experiences of middle management during the diffusion of lean from manufacturing operations to the wider organisation

The second research question was concerned with the lessons learnt that can be taken away from the experiences of middle management during the diffusion of lean from manufacturing operations to the wider organisation. In retrospect, it can be stated that the excitement and enthusiasm for lean were nowhere near as great as in OPS. In the functional areas outside, lean implementation had stalled at the middle management level. By no means, do the results suggest, though, that these middle managers had an interest in resisting or boycotting change. That is because their attitude to change was less a reluctance to pursue organisational interests but rather a symptom of deeper underlying issues. In essence, lean was pushed down a layer

by senior managers without having appropriate conditions in place (e.g., equipping middle managers with the necessary capabilities to do so) beforehand. Instead of having an indifferent attitude towards lean, the findings indicated that most middle managers *wanted* to engage but had been experiencing severe issues in their local work environment (i.e., disharmony with the STS or, more practically, misalignments related to the 3P logic), which disabled them to engage and turned them eventually away. As the case was here, root causes for disengagement are often overlooked insofar that the focus, mistakenly, remains on how to overcome middle managers' foot-dragging (Frohmann 1990; Harrington and Williams 2004; Emiliani 2015).

Notably, the circumstance that senior managers do not identify underlying root causes for lean to stall, as seen in the case study, is not unusual, as suggested by Emiliani (2015). However, he continues that such an attitude will often lead to guessing solutions, though.

> "[Senior managers] have not identified the real problem and are guessing at the causes, which will surely lead to guessing solutions such as, 'We don't have the right people in these key positions' or 'We need new managers.' These will not correct the problem" (p. 175).[53]

It is true that any system will always remain imperfect (Takeuchi *et al.* 2008). Nevertheless, the study suggests that lean programmes must aim at minimising the risk of having disengaged employees and maximising the opportunities that empower individuals to continuously improve the system itself. Using STS terminology, solutions are needed to align and optimise social and technical sub-systems. Rather than firefighting against symptoms, it is very important to seek the bigger picture of such barriers so that there is a chance to resolve symptoms' underlying root causes. In the past, Emiliani (2015) argued that

> "[l]ean transformations that go too slowly suffer from structural problems, not from a middle manager problem" (p. 176).

This study confirms this view. That being said, exchanging tacit knowledge via facilitated dialogue and peer networking at the middle management level helped to identify structural problems, to gain more clarity about underlying root causes, and to find a better fit. That was because middle managers who were affected were made part of the solution by being given the opportunity to redesign and optimise the social and technical sub-systems according to their desires. This, ultimately, resonates with Deming (1986) who argues that the systems within which individuals interact must be blamed and not the people per se. To use Yadav *et al.*'s (2017) words,

[53] In fact, a similar statement was made by a senior manager during a face-to-face interview (see section 4.9.1.3).

> "organizational lean transformation can be achieved through consideration of challenges at all levels of socio-technical systems involving all subsystems of the socio-technical system" (p. 13).

Importantly, the study unveiled that senior managers may not equally experience the presence of barriers like the rest of the organisation. Interestingly, for instance, the case organisation's senior managers perceived soft lean practices as being much more positively embedded across the organisation than the rest of the business. An explanation for this could be that senior managers tend to perceive conditions better as they actually are (Gollan *et al.* 2014). Another explanation is offered by Lodgaard *et al.* (2016) who argue that perceptions of barriers during lean implementation depend on the hierarchical level, while middle managers tend to agree more upon these with employees at the operational level than with senior managers. Like Lodgaard *et al.* (2006), this study suggests that it is important to consider and listen to different groups across hierarchical levels, such as middle managers, prior to taking action. Interviewing senior managers gave the impression that they tended to look for failure factors outside themselves rather than trying to understand what *they* might have done wrong themselves.

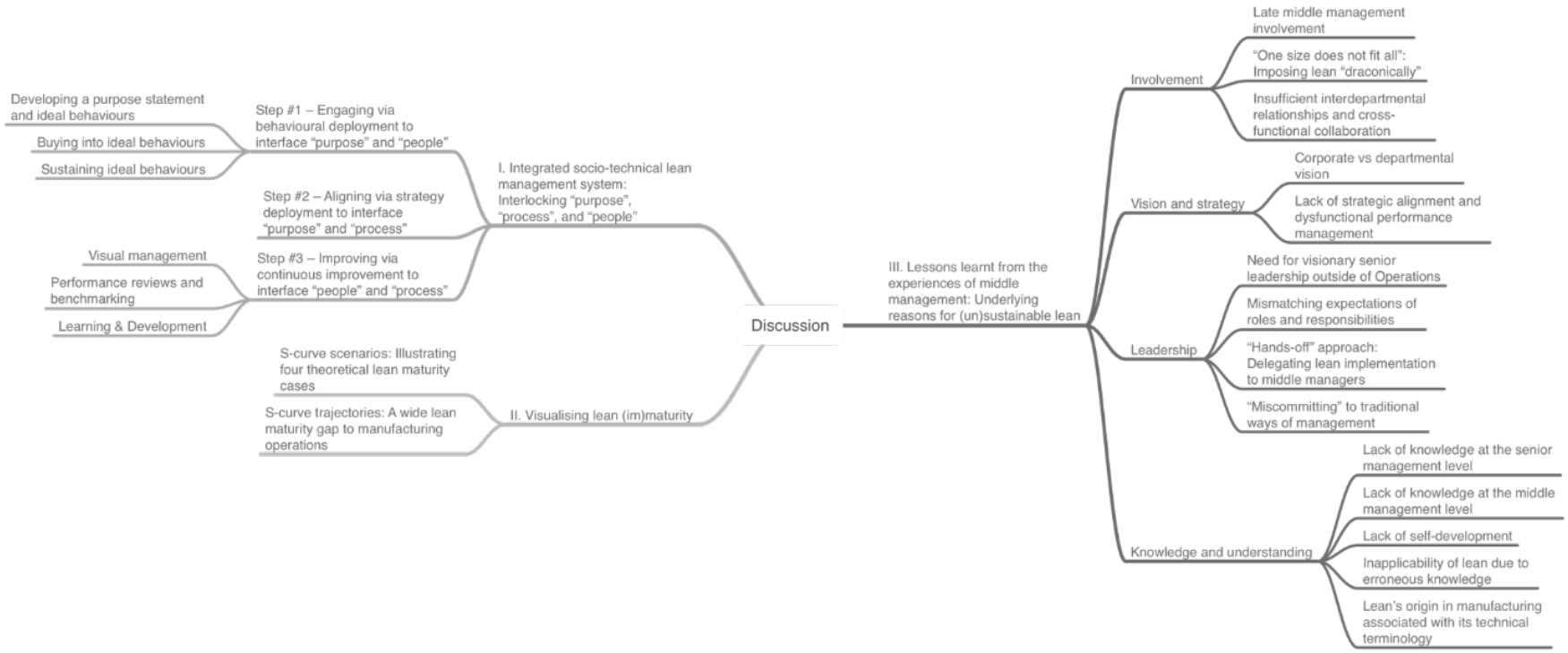
It is true that self-assessments can be helpful and that they are associated with a couple of benefits; it is also true, however, that they may bear risks and pitfalls. That is because self-assessments' capabilities to identify underlying issues or root causes may be limited and therefore only assisting to a certain extent. Consistent with Jørgensen *et al.* (2003), this study proposes that self-assessments should be rather seen as "just a tool" (p. 1276) of the lean toolbox. Again, more important is to pronounce the necessity of managing and overcoming barriers by involving middle management, as the case was here, or, more generally, employees who are affected by change. Due to their late involvement, an opportunity was taken away from middle managers to challenge the approach to lean implementation right from the outset. Note that most of the barriers seen relate to soft lean practices, which ultimately have a critical impact on a lean programme's success and its sustainability (Liker 2004; Liker and Rother 2011; Bortolotti *et al.* 2015; Zeng *et al.* 2015; Magnani *et al.* 2019). If, however, senior managers overlook soft lean practices of which some concern "underwater" factors (e.g., [1] behavioural deployment, [2] lean leadership, and [3] strategy deployment; Found *et al.* 2007), it is likely that the conditions to embed and sustain lean will not be met.

Although several failure factors explain why the case organisation's lean implementation had stalled, the findings clearly show that the two main root causes responsible for an insufficient engagement at the middle management layer equally lied in an insufficient knowledge at the senior and middle management level and an insufficient senior management

support. More specifically, a lack of knowledge at the middle management level and a lack of senior management support led to further downstream issues (e.g., perceived inapplicability or not knowing about lean terminology), eventually causing an insufficient engagement in lean at the middle management level (see Figure 4.12). This means that middle managers' perceived failure factors were not necessarily the root causes for lean to stall but partly concerned downstream issues, either induced by a lack of knowledge or a lack of senior management support. This clearly shows how intertwined and interconnected the different failure factors can really be.

Notably, a lack of meaningfulness, sensemaking, and belief did not occur for no reason, though. Instead, various indicative examples (e.g., misalignments in the policy deployment matrix) highlighted that such impressions were generated by specific circumstances within the organisation. Similarly, a lack of knowledge at the senior management level had caused that not every senior manager was equally capable of driving lean in his department. As a result of this, false impressions and wrong signals were given (without accusing intent but diagnosing a miscommitment to traditional ways of management) that induced middle managers not to treat lean as a priority. In the same way, senior managers usually provide resources and a strategic direction (Dora *et al.* 2016; Bortolotti *et al.* 2018). By implication, a lack of vision and strategic direction as well as a lack of resources cannot both be seen as "standalone" issues but rather as a senior leadership problem likewise.

Figure 5.4 Structure of discussion



Source: Author

6. Conclusion

The purpose of this final chapter is to summarise the insights of this study. Addressing a research gap in the literature, this longitudinal in-depth case study investigated how lean can be diffused from manufacturing operations to the wider organisation while having a special focus on middle managers' experiences during this transformation process. Adopting STS theory, the study attempted to answer the following two research questions (Table 6.1).

Table 6.1 Research questions

No.	Research question(s)
RQ1.	How can lean be diffused from manufacturing operations to the wider organisation?
RQ2.	What are the lessons learnt from the experiences of middle management during the diffusion of lean from manufacturing operations to the wider organisation so that lean can be sustained?

Source: Author

In summary, this case study presents how lean can be diffused from manufacturing operations to the wider organisation, while the results suggest that this is no easy undertaking. In essence, varying local conditions and needs complicate managing its implementation. At the same time, large lean maturity gaps between manufacturing operations and the wider organisation add to the complexity and make mismanagement more likely. Lessons learnt from middle management experiences teach how diffusing lean from manufacturing operations to the wider organisation should have been managed, so that its stalling could have been avoided.

In the following, this chapter's structure is described. First, the study's value and its contribution to the academic literature are touched upon. Second, managerial implications are articulated. Third, research limitations and avenues for future research are pointed towards.

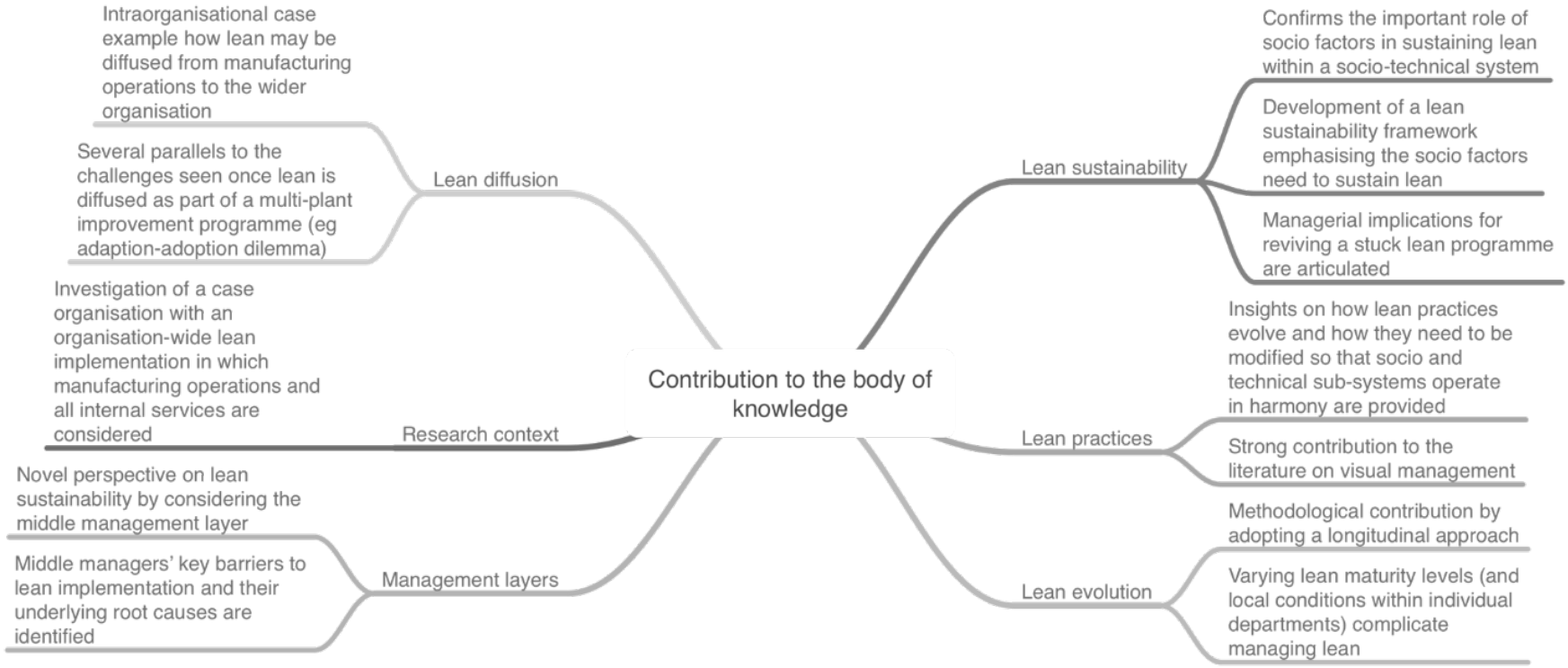
6.1 Value, relevance, and contribution to the body of knowledge

Several significant main contributions are articulated as follows (Figure 6.1). First, covering both manufacturing and service environments within a single-case organisation, the study contributes with an analysis of a holistic approach to lean implementation, elaborating on the challenges faced when diffusing lean from manufacturing operations to the wider organisation. In any case, the true value of this in-depth single-case study lies in its unique context and its explorative nature associated with deep insights of the middle management perspective during the diffusion of lean from manufacturing operations to the wider organisation. Second, focusing on middle managers in this context, this study enriches today's limited literature on middle managers during this transformation process and offers a novel perspective by moving away from the commonly used corporate- or senior-management perspective. By making such

a hierarchical distinction, this study identified the underlying conditions why middle managers tend to disengage in lean and suggests solutions to counteract. Third, insights on how lean practices evolve and how they need to be modified so that socio and technical sub-systems operate in harmony are provided. In particular, a strong contribution was made to the literature on visual management. Fourth, with an extended S-curve model (see Table 5.4; Figure 5.2) and a lean sustainability framework (see Table 5.6) rounding off such insights, this study enhances existing theory and contributes to the growing literature on lean implementation and its sustainability. Several findings are consistent with those reported in the literature while there are also some novel ones that contribute to a better understanding of why lean sustainability remains an unsolved issue (e.g., standardised VMBs, inappropriate rewards and incentives, and a lack of local vision). Plus, managerial implications for reviving stuck lean programmes are articulated. Fifth, rather than carrying out a post-hoc analysis, this study contributes with a longitudinal approach to the lean literature by acknowledging lean's evolutionary nature, which is why change and organisational learning could be captured over time.

In Table 6.2, several (other) notable academic contributions (i.e., main- and sub-contributions) of this study are listed, accompanied by relevant evidence, research gaps, or calls from the academic literature to underline them. It should be noted that some contributions are more significant, while others may be somewhat limited because it was never intended from the outset to address specific research gaps beyond the main scope of this study. Nevertheless, they still remain relevant and constitute a contribution to academia. In essence, these contributions concern (1) theorical aspects (e.g., use of STS and S-curve theory), (2) the research context (e.g., in-depth analysis of a holistic lean programme and coverage of [internal] services), (3) lean sustainability (e.g., longitudinal study to identify the soft lean practices needed to revive and sustain lean), (4) management layers (e.g., distinction between different layers of management and examples of supportive and non-supportive management), and (5) visual management (e.g., underlying reasons why implementing visual management can fail [in non-manufacturing environments]).

Figure 6.1 Main contributions to academia



Source: Author

Table 6.2 (Sub-)contributions to academia

No.	Contribution(s) to academia		Relevant evidence, research gap(s), or academic call(s)	Level(s) of contribution
	Contribution(s)	*Type(s)*		
I. Theoretical lens				
1	Use of socio-technical systems theory Use of S-curve theory[a]	Theoretical	"Only 10% of papers (n = 24) are grounded on existing consolidated theories" (Danese *et al.* 2018, p. 592).	○
2	Analysis of an integrated socio-technical lean system	Theoretical	"[T]here is a need to develop a new and deeper theoretical understanding of complex systems that exist in real-world operations management" (Rich and Piercy 2013, p. 971).	○
	Deeper theoretical understanding of systemic relationships between failure factors for lean from a middle management perspective	Empirical		
3	Consideration of middle managers' individual sub-systems	Theoretical	"Research work focusing on organizational commitment encompassing all the socio-technical subsystems is practically non-existent in the existing literature" (Yadav *et al.* 2017, pp. 11-12).	
	Reasons for a lack of middle management engagement due to an interaction of socio-technical elements is articulated	Empirical	"[F]uture research should investigate the practical challenges of implementing the lean concept by studying the interactions among various socio-technical elements in an organization, and finding the reasons for the lack of organizational commitment and participation of leadership in lean transformations" (Yadav *et al.* 2017, pp. 13).	•
II. Research context				
4	In-depth examination of a holistic lean programme within a medical manufacturing organisation	Empirical	"[N]eed to explore in-depth the peculiarities of lean in environments different than manufacturing" (Marodin and Saurin 2013, p. 6673)	
	Investigation of non-manufacturing departments providing internal services to manufacturing operations		"Lack of studies on lean service" (Danese *et al.* 2018, p. 592)	•
5	In-depth examination of a holistic lean programme within a medical manufacturing organisation	Empirical	"Most of the frameworks/models are only concentrating in the area of manufacturing operations instead of across enterprise" (Jasti and Kodali 2015, p. 880).	•
III. Lean sustainability				
6	Several CI enablers (especially soft lean practices) to avoid stagnation during lean implementation are presented, although their long-term effects cannot be predicted	Empirical	"[F]uture research should also investigate whether certain enablers implemented during various stages of CI implementation may hinder stalls or reenergize stagnant CI" (Jørgensen *et al.* 2003, p. 1277).	
	Similar to Jørgensen *et al.* (2003), this study explored that an open exchange helps to identify barriers to lean implementation		"[F]uture research in this field should seek to understand whether there are other methods and tools in addition to self-assessment that can help to identify barriers to CI implementation" (Jørgensen *et al.* 2003, p. 1277).	○
7	Methods for rejuvenating a stagnant lean programme are suggested	Empirical	"[M]ethods for rejuvenating stagnant CI programs are still lacking" (Jørgensen *et al.* 2007, p. 1260).	
	Counteractions are proposed to overcome situations in which lean implementation has stalled		"Yet another question is what managers should do if the plant has stagnated in a stage" (Netland and Ferdows 2016, p. 1118).	•
8	Confirmation that characteristics during the first stages of the S-curve theory apply in a medical manufacturing organisation likewise	Theoretical Empirical	"[R]esearchers can test whether the S-curve theory can be validated in settings different from ours. If so, how does it behave across different industries, under different local conditions, and in different external environments?" (Netland and Ferdows 2016, p. 1118).	○
	Inside organisations, however, S-curves may be shifted or lagged when comparing lean maturity between different departments			
9	Some advice is articulated how organisations may manage lean transformation along the early stages of the S-curve	Empirical	"A […] promising route for future research is how to manage lean transformation along the S-curve" (Netland and Ferdows 2016, p. 1118).	○
10	Instead of technical aspects, this research focuses on soft lean practices to achieve lean sustainability	Empirical	"Lack of studies that analyse the social outcomes of lean and their sustainability" (Danese *et al.* 2018, p. 592)	
	Inhibiting factors that prevented middle managers from engaging in lean (social outcome) and that caused lean to stall were explored		"Many articles analyse the outcomes of lean from a technical point of view […], while few studies analyse social outcomes (employees' personal and work outcomes) and the sustainability of lean improvements over the years, which are instead crucial factors of lean success" (Danese *et al.* 2018, p. 598).	•
11	Inhibiting factors that prevented middle managers from engaging in lean (social outcome) and that caused lean to stall were explored	Empirical	"Only 4 articles consider the sustainability of lean improvements over the years" (Danese *et al.* 2018, p. 592).	•
12	In a longitudinal case study, several important soft practices are presented that are needed to sustain lean	Methodological Empirical	"[O]ur review reveals a clear interest towards the investigation of the effects of lean on social aspects, thus we encourage longitudinal studies for a better understanding of the hard and soft practices needed to sustain lean outcomes over years" (Danese *et al.* 2018, pp. 596-597).	○

No.	Contribution(s) to academia		Relevant evidence, research gap(s), or academic call(s)	Level(s) of contribution
	Contribution(s)	*Type(s)*		
13	In a longitudinal case study, a counterview is proposed that a principles- and behaviour-based approach does not necessarily guarantee immediate success with lean	Methodological Empirical	"It will be useful to test whether a principles-based approach and behaviour-based approach, coupled with tools and systems, can be applied successfully from the start of a Lean transformation. Will this be quicker? Will this be more effective? Will this be more sustainable? Such research questions are likely to require longitudinal case studies" (Hines *et al.* 2020, p. 403).	•
14	Interplay between barriers to lean implementation is analysed from a middle management perspective Distinction between root causes (underlying barriers) and symptoms (ostensible barriers)	Empirical	"[B]arriers interact and influence each other in different degrees" (p. 14). "[W]e encourage future research on this subject, based on Leite, Bateman, and Radnor (2020[b]) model, which analyse the interplay between ostensible and underlying lean barriers" (Leite *et al.* 2020a, p. 16).	•
15	Exploration in qualitative field research	Empirical	"Our theoretical proposition can be modeled and tested using survey studies or further explored in qualitative field research" (Netland *et al.* 2021, p. 149).	○
IV. Management layers				
16	Distinction is made between different layers of management with a specific focus on the middle management layer Inhibiting barriers and conditions preventing middle managers to initiate change are presented Success factors and conditions enabling middle managers to initiate change are articulated	Empirical	"Failure or unsatisfactory results from organisational transformations aiming at excellence are often attributed to lack of management support and commitment. Why these issues become problematic has only been superficially explored in the literature, and typically no distinctions are made between different layers of management" (Holmemo and Ingvaldsen 2016, p. 1332). "Although much research has been conducted on barriers to CI, little focus has been directed towards identifying opinions of different groups at different hierarchical levels in an organization" (Lodgaard *et al.* 2016, p. 1123). "We encourage empirical research […] as empirical research to date on the role of middle managers in implementing lean still remains relatively sparse" (Reynders *et al.* 2022, p. 339). "[F]urther research is required to know more about the individual needs of middle managers to enable them to initiate change" (Reynders *et al.* 2022, p. 339).	•
17	Qualitative research on the middle management perspective within the context of a holistic lean implementation	Methodological Empirical	"The purpose of this paper is to evaluate lean six sigma from a middle managers' perspective" (p. 7). "Further research could involve more qualitative research with this management group" (Manville *et al.* 2012, p. 17).	•
18	In major parts, the unit of analysis comprised mainly lean-immature middle managers who were examined for over a longer period of time	Empirical	"[F]urther research is required to know more about […] how [middle managers] develop through a lean programme" (Reynders *et al.* 2022, p. 339).	○
19	Several empirical examples are provided, illustrating supportive and non-supportive senior manager actions Managerial implications are articulated how senior managers may support their middle managers in implementing lean	Empirical	"55% of the studies mention the importance of management support and/or commitment. However, none of them clearly describes criteria to distinguish a supportive from a non-supportive management team" (Marodin and Saurin 2013, p. 6666).	○
V. Visual management				
20	Deep empirical insights of why the case organisation failed with visual management implementation are presented Several examples how to overcome failure when implementing visual management are presented	Empirical	"[T]he empirical evidence on VM [visual management] implementation remains scarce. Only few studies report – outside of their main findings – on why VM implementation might succeed or fail" (Kurpjuweit *et al.* 2019, p. 5576).	•
21	In-depth examination of a holistic lean programme within a UK case organisation Investigation of non-manufacturing departments providing internal services to manufacturing (e.g., HR and R&D)	Methodological Empirical	"Future studies could focus on the implementation of VM in other corporate functions (e.g. R&D, HR, or sales), geographical contexts" (Kurpjuweit *et al.* 2019, p. 5586).	•

Source: Author

Note(s): (a) Netland (in Åhlström *et al.* 2021) himself describes the S-curve theory as a part of "specific lean theories" (p. 10); however, although it is acknowledged in the research field, it remains unclear whether it may be considered as a standalone theory; (•) significant contribution; (○) limited but relevant contribution

6.2 Managerial implications

In terms of the lean sustainability framework (see Table 5.6), several valuable conclusions and some interesting lessons for practitioners can be drawn from this study based on the experiences of middle managers in diffusing lean from manufacturing operations to the wider organisation. The managerial implications are particularly interesting for organisations, which are new to lean and would like to learn from the mistakes that the case organisation had been initially doing. To a large extent, though, the managerial implications deriving from this study address senior managers because they are ultimately the ones who sponsor initiatives, such as lean, from the top and have probably most interest that such improvement initiatives flourish organisation-wide. Note that Bhasin and Burcher (2006) have already concluded that "there is no 'cookbook' to explain each step of the lean process" (p. 63) and, undoubtedly, there is no such recipe even 16 years later. Hence, the following should be seen as a guidance or an "extended checklist", which organisations are encouraged to work towards, rather than a "one-size-fits-all" solution.

First of all, senior managers must be "change ready". This means they should have acquired a certain set of capabilities to conduce change and lean expertise so that they can understand their new role and responsibilities. On the one hand, this part avoids being miscommitted to traditional ways of management and is needed to show full commitment to change (Fast 2021); on the other hand, such capabilities were found to be necessary to disseminate lean to lower levels of the organisation. While a certain expertise also helps to support levels below, full commitment conveys a genuine interest in the initiative and signalises that lean is not just an episodic fad but a new part of everyone's daily practice. Importantly, senior managers need to be present, visible, and available (e.g., coaching at the gemba) whereas quarterly events are insufficient, as seen in the case organisation. In doing so, middle managers may feel encouraged to adopt the same behaviours and to drive lean at their levels below.

Second, right from the outset, senior managers are encouraged to develop a vision in cooperation with their subordinates associated with an aligned strategic plan. For instance, this could be a departmental vision, as seen in the case organisation. More importantly, however, is that this vision is not decoupled from middle managers' daily work. Instead, this vision should be relevant so that, in turn, middle managers are also able to enthuse employees at the levels below them. Involving employees in developing a departmental vision and a corresponding strategic plan gives them more ownership in an organisation's future.

Third, senior managers are advised to develop a behavioural deployment system. That is because a set of ideal behaviours linked to the business vision guides individuals towards a

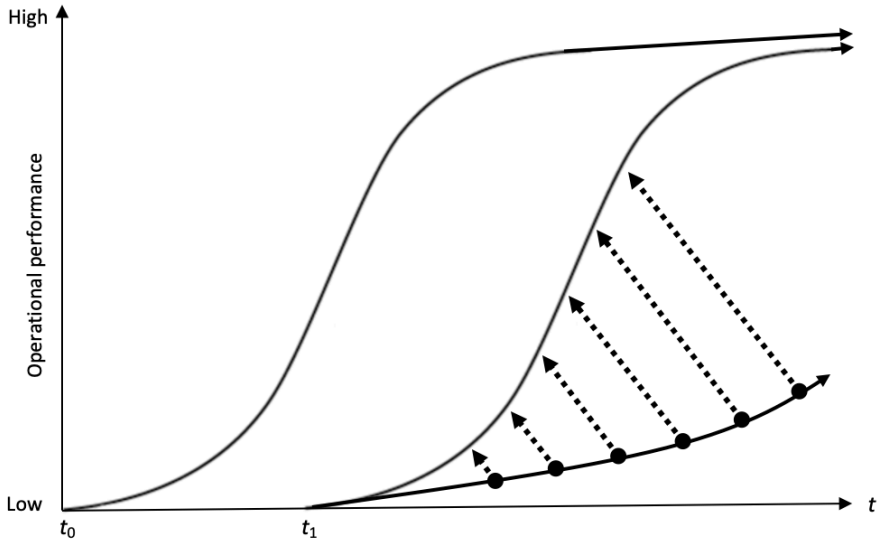
mutual direction of travel. It is important, however, that employees are involved in developing this set of ideal behaviours so that they have ownership in them. Ideal behaviours are more likely to be sustained if they are coached and routinely rewarded in a timely and genuine manner. However, an organisation's performance management (e.g., associated with KPIs and individual targets) must be vertically and horizontally aligned and compatible with lean. If misalignment exists, unconducive behaviours may be encouraged that put lean sustainability at risk.

Fourth, senior managers and HR managers ought to develop training programmes, such as personal development, coaching, and mentoring schemes, that support middle managers in fully understanding the concept of lean. In particular, a distinction between the strategic and the operational level of lean is necessary so that lean is not solely understood as a toolbox or "something for manufacturing". Associated with this, a technique to mitigate the risk that individuals see lean as "something for manufacturing" is to learn and use a common language that suits environments outside of manufacturing likewise. To some extent, the case study exemplifies that, if appropriate and non-operational terminology is used, the likelihood that such confusions appear is much less. A next step may be to translate lean principles and to coach middle managers to identify waste in *their* functional area so that lean may become more relevant to the day job. Here, direct senior managers play an important role in supporting their middle managers on a continuous basis because it is likely that they can give more tailored advice than senior managers from other departments. If such senior managers select projects addressing chronic problems or yielding quick-wins, as also suggested in the literature (Netland and Ferdows 2016; Fast 2021), individuals are more likely to be convinced of the meaningfulness of lean. Importantly, however, senior managers should be aware that it will take time to train up people and must therefore be patient (Fast 2021). After all, these measures may eventually counteract the formation of antipole groups, which inhibit organisational change. If, however, senior managers do not have the right attitude to support their subordinates, the initiative is likely to fall short.

Fifth, initiating lean in OPS led unsurprisingly to a head start over other departments, although, in theory, lean was supposed to work equally across the organisation. This circumstance, however, bore a risk insofar that non-operational departments did not only fail to support lean in some cases but were also likely to inhibit the overall success with it as described in the literature (Maskell and Baggaley 2004; Bhasin and Burcher 2006). Hence, senior and middle managers should be aware of departments' varying pace rates in regard to lean maturity associated with the performance gaps that are very likely to occur when diffusing

lean from manufacturing operations to the wider organisation (see Figure 5.2). Such gaps may naturally arouse feelings about a competition between departments. Once leaders are aware of this natural phenomenon, however, they may counteract by coaching the wider organisation. In addition to this, leaders may seek measures to reduce such gaps (Figure 6.2; e.g., by involvement, open communication, mentoring, peer support, and internal networks).

Figure 6.2 Minimising lean maturity gaps via corrective actions



Source: Author

Sixth, change cannot be imposed (Lucey *et al.* 2005) and must neither be pushed nor shoehorned. Instead, senior managers are advised to involve middle managers across the organisation as early as possible. Involving middle managers means inviting them to evolve the social system needed to embed and sustain lean, after all. In doing so, an opportunity is given to middle managers and their teams to challenge the lean implementation approach from the early beginning. In this way, it is less likely to be perceived as being imposed or dictated from the top, but rather as negotiated upon consensus. Apart from that, middle managers have the opportunity to learn about lean collectively from scratch. Especially when being new to lean, senior managers are advised to be patient and to focus on the enabling factors, including (1) strategy and alignment, (2) behaviour and engagement, and (3) leadership (Found *et al.* 2007), first. This will help that CI may evolve to a natural call rather than a dictate from the top.

Seventh, another prime example constitutes visual management. That is because involvement also means granting employees the freedom to design their VMBs according to their needs, otherwise senior managers may encounter apathy. It makes perfect sense to pursue

becoming a lean enterprise because value streams do simply neither begin nor end in manufacturing environments. Hence, visual management should mirror such end-to-end values streams that cut across the entire business and break down silos. Similarly, by the way, senior managers must also adapt their organisation's physical structure (e.g., matrix organisation) and management systems to encourage cross-functional collaboration and to avoid silo-thinking and sub-optimisation. It is not unlikely that such an undertaking counteracts the difficulties with managing numerous departments with different lean maturity levels, because departments in a matrix organisation would rather conflate instead.

Eighth, senior managers should be aware lean cannot simply be delegated in a "hands-off" manner. This is especially the case if basic knowledge to execute is missing. Hence, both senior and middle managers are advised to be aware of their new roles and to agree upon each other's expectations. This may counteract confusion on responsibilities, as happened in the case organisation. Such roles and responsibilities should particularly also include an element of continuous self-development on both sides. At the middle management level, self-development may be a behaviour to be encouraged with appropriate incentives because learning constitutes a factor that everyone has under their own control. More effectively, however, is continuous senior engagement that gives everyone in the organisation the impression that lean associated with its new way of working is important.

Ninth, as part of their LSW, senior managers are encouraged to seek and identify middle managers' barriers to lean implementation so that they can counteract if necessary (e.g., during weekly 1-to-1s). In their literature review, Leite *et al.* (2020a) already proposed that barriers interact and influence each other, as confirmed by this case study (e.g., a lack of knowledge can lead to a person thinking that engaging in lean is not part of his or her daily work). While it is easier indeed to tackle obvious passivity (Harrington and Williams 2004), the case study demonstrates that lean implementation is likely to stall if important information on inhibiting factors remains concealed. It is likely that middle managers may feel more comfortable and encouraged to open themselves once they also have an opportunity to exchange their challenges with middle management peers. That is because they may feel more comfortable to seek advice from peers than from superiors (Fast 2021). In group discussions, middle managers have an opportunity to identify underlying issues in a dialogue-type setting and may further grow as a management community (Jørgensen *et al.* 2003).

6.3 Research limitations and avenues for future research

Despite its potential to serve as a basis for future research, this study is subject to several limitations. Although a high external validity was never sought, the first constraint concerns its generalisability. That is because this empirical study builds on qualitative data from an in-depth single-case study (Yin 2014) within a medical manufacturing organisation with unique dynamics presented. Due to such unique contextual conditions, the lean sustainability framework's non-applicability in other settings cannot be ruled out. In other words, it is not unlikely that the lean sustainability framework is not universally applicable. While there are significant advantages of working with a single case organisation (e.g., access to richer data, access to key personnel, and stable confounding factors) as compared to multiple-case studies (Netland *et al.* 2015), future research may yet identify to what extent this study's findings are applicable to other settings and sectors (e.g., public sector; Glesne and Peshkin 1992). In this way, the findings of this study may also be challenged.

Second, the selected case organisation was far away from being considered as a best-practice organisation, such as Toyota, for instance. In retrospect, too much focus was put on adoption rather than adaption for a long time. After all, no more than 10% of the organisations pursuing lean implementation have managed to introduce it effectively (Bhasin and Burcher 2006; Bhasin 2012a). For this reason, it may be interesting to see how other organisations "multi"-manage their departments that move along at different stages of the S-curve. Therefore, longitudinal multiple-case studies are encouraged to identify the best practices needed to narrow down lean maturity gaps between different departments. Associated with that, another particular weakness of this study concerns its lack of quantifying lean maturity at the department level. Hence, studies that consider quantitative methods to measure lean maturity with appropriate instruments at the department level are advised likewise.

Third, given a qualitative research design, it is also difficult to determine causal relationships between variables (Pearce *et al.* 2018) that concerned inhibitors to middle management engagement. Such causal relationships require more empirical validation. To verify the findings of this study, future research may therefore use quantitative methods associated with surveys (Eisenhardt 1989). A quantitative research design would also counteract researcher bias and subjectivity as typical for qualitative studies (Saunders and Lewis 2012), although a number of tactics were adopted to minimise that (e.g., triangulation). After all, Pearce and Pons (2019) argue that more quantitative analyses (e.g., via structural equation modelling) are necessary to strengthen the existing body of literature on lean by confirming the critical factors required to implement lean successfully.

A fourth weakness of this study concerns its timeframe. It is not a secret that lean is a lifelong journey (Hines *et al.* 2020). This circumstance, however, made it impossible for the researcher to observe any further developments in the case organisation that dated beyond 26 November 2019. For this reason, it could not be determined whether or not some of the middle managers' desired changes (e.g., a departmental vision) will have a significant impact on the case organisation's success with lean. In other words, the long-term effects of the changes after acknowledging the power of middle managers' views were not considered in this study.

Fifth, building on this piece of work, more broad research avenues are articulated in the following. To begin with, hiring temporary workers, as seen in the this case study, has become a trend after the COVID-19 outbreak and may remain a norm in the post-pandemic era. The question that arises therefrom is how this circumstance will impact on building a CI culture associated with ideal behaviours, as emphasised in the literature on lean. Apart from this, research may also address the impact of technology on lean implementation as organisations are becoming increasingly more digital and vertically integrated. Future research may address, for instance, whether a change from analogous VMBs to a digital solution helps in (1) having a better integration between strategic and operational levels or (2) achieving a wider acceptance in the workforce.

In summary, there is still much to learn about lean, even though a lot of knowledge has been created over the last decades. Most importantly, both academics and practitioners must be aware of the need to move with the times. That is because lean has evolved, lean is evolving, and lean will most likely continue to evolve.

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F. Appendix

Appendix 1. Definitions of hard lean practices

Hard lean practice(s)	Definition(s)
5S	Sort – sort out what is wanted in an area and what items can be disposed of, reduced, or moved Set in order – place items to be retrieved closest to the area for frequency of use and determine volume of use. Make visible so abnormalities are apparent Shine – make sure all items are in the best working condition and remain so Standardise – standardise work routines as well as equipment and material usage Sustain – ensure standards set are followed and improved
A3 report	It is a one side of A3 paper size that addresses a specific problem in a systematic manner
Automation	It is the replacement of manual labour by advanced equipment
Change management	A structured approach to transitioning individuals, teams, and organisations from a current state to a desired future state
Continuous improvement	A philosophy, which promotes organisational change based on an ongoing pattern of planning, execution and evaluation of results related to all operations of an organisation for the purpose of forever improvement
Eliminating loopbacks	Methods used to eliminate the possibility of returning work to a previous step for further processing
Group technology	Work processes are designed to form work cells, which are located close to each other with the object of cutting down on unneeded transport and waiting times
Changing the facility layout	A layout designed according to optimum operational sequence or flow
Just-in-time	It is the delivery of what is needed to where they are needed, in the quantity needed, at the time they are requested
Kaizen blitz	Short-term process improvement projects that concern a specific area to improve
Kanban	It is an information system that indicates when a subsequent activity within a connected series of activities can start
Mistakes proofing (“poka yoke”)	It is a process that helps eliminate the chance for mistakes
Model cell, roll out	The establishment of a microcosm of business processes in which new improvement practices are implemented to examine their effectiveness and solving mistakes in the implementation process before rolling them out to the entire business
Outsourcing	Hiring a third-party business to manage some non-core activities
Point of use storage	To keep the items used most often in the space where they are used Therefore, waste of searching for items or walking to get needed items is minimised
Policy deployment (“hoshin kanri”)	A process used to connect corporate strategy to key objectives and resources, including daily activities across functions
Process redesign	To redesign content, scope, flow and structure of tasks and subtasks within an organisation to enhance operational and customer-related performance outcomes such as cost, productivity, quality, service, satisfaction, and speed

Hard lean practice(s)	Definition(s)
Production levelling ("heijunka")	It is to balance production and delivery of services over a period of time to meet customer demand
Pull system	To produce and deliver services at the request or pull of the customer or user
Quality circles	A group of employees that meets regularly to consider ways of resolving problems and improving production in their organisation
Quality function deployment	Using a cross-functional team approach to reach consensus about final product/service specifications, in accordance with customer requirements
Quick set-up time	It is the ability to re setup an area for providing a different product/service quickly
Root-cause analysis	Methods used to determine the root cause of a problem and identify countermeasures to avoid repeat occurrences Key tools are "5 whys" (asking why five or more times until the root cause of the problem is discovered) and fishbone or cause-and effect diagram
Segregating complexity	It is to cluster tasks of similar levels of difficulty into separate groups with their own performance goals
Self-inspection	It is having people inspect their own work
Simplification	To simplify operations by eliminating steps delaying the production and delivery of a product/service
Single-piece flow	To pass the work to the next station right after finishing it without making any batches
Small lots	To process transactions/information in the smaller batch possible and passed it along to the next step
Standardisation	It is an agreed-upon set of work procedures that establish the best and most reliable methods and sequences for each process and each worker
Takt time	The rate of customer demand Used to establish a direct link between marketplace demand and workplace activities
Total preventive maintenance	A programme used to ensure that equipment is in good operating condition and available for use when needed
Total quality	To assign the responsibility of improving and maintaining quality to every employee in the company
Use of new technologies	It is the use of new methods and practices that have become available and can develop and improve operational processes
Value stream mapping	A visual picture of material and information flows from supplier to customer: current-state map determines current conditions of flow; future-state map shows opportunities for improvement at some future point
Vertical information system	It is a simple information system relying on direct information flows to the relevant decision makers, which allows for rapid feedback and corrective action
Visualisation	Signs and other forms of visual information used to simplify the workplace and make it easy to recognise abnormalities
Workload balancing	It is the allocation of tasks in a balanced amount between employees so that none will be over or under loaded with tasks

Source: Hadid and Mansouri (2014)

Appendix 2. Ethics forms 1

SURNAME: REYNDERS
Student Number: C1422690
(if applicable)

ETHICS 2
Full ethical approval

Cardiff Business School
Ysgol Busnes Caerdydd

For guidance on how to complete this form, please see Learning Central – CARBS RESEARCH ETHICS

Once complete, please send this form and all other relevant documents to the CARBSReserachEthics@cardiff.ac.uk mailbox.

If your research will involve patients or patient data in the NHS then you should secure approval from the NHS Health Research Authority. Online applications are available on http://www.hra.nhs.uk/resources/applying-for-reviews/

NB: Safety Guidelines for researchers working alone on projects – please go to this University's web link to learn about safety policies - http://www.cf.ac.uk/osheu/index.html

Name of Lead Researcher: **Philipp Reynders**

School: Cardiff University (CARBS)

Email: ReyndersP@cardiff.ac.uk

Names of other Researchers: Maneesh Kumar (1st supervisor) and Annie Pye (2nd supervisor)

Email addresses of other Researchers: KumarM8@cardiff.ac.uk and PyeAJ@cardiff.ac.uk

Title of Project:

Preliminary working title 'Accelerating innovative work behaviour: Building sustainable CI organisations'

Start and Estimated End Date of Project: Start Date: 01/10/2017
Estimated End Date: 30/09/2020

Aims and Objectives of the Research Project: The aim of this research is to identify how organisations can foster innovative work behaviour within their employees for the purpose of sustaining continuous improvement on the shop floor.

Please indicate any sources of funding for this project: 1) Economic and Social Research Council
2) Olympus Surgical Technologies Europe

SURNAME: REYNDERS
Student Number: C1422690
(if applicable)

1. *Describe the methodology to be applied in the project*

Please attach copies of questionnaires or interview topic guides to your application

The overall aim of this research project is to identify how organisations can foster innovative work behaviour within their shop-floor employees for the purpose of sustaining continuous improvement (CI). Given that the researcher is embedded within a case organisation (i.e. being funding body and access is already granted), the data collection takes already place at early stages of the project as part of an ethnographic in-depth case study. As such, this research adopts a qualitative approach from today's point of view (might evolve to a mixed methods approach though, e.g. an exploratory sequential design), in which data will be collected through daily observations in situ, scanning company-internal data (e.g. reports, archives and protocols) as well as formal (e.g. meetings and appointments) and informal interactions (e.g. conversations). The researcher initially intends to identify the status quo of the organisation, mostly relating to the degree of the current Lean and CI implementation(s) as well as aspects of climate and culture. In terms of climate and culture, the researcher intends to look at what individuals are doing and how they do it in order to develop an understanding of their work environment and to learn about their culture with an eye how innovation and creativity come to light and may or may not flourish there. Data will be recorded via field notes.
It needs to be considered that this research is at exploratory stage in order to develop future interviews. As soon as the formal interviews stage is reached, a revised ethics form will be submitted. Accordingly, no interview questions are attached.

2. *Describe the participant sample who will be contacted for this Research Project. You need to consider the number of participants, their age, gender, recruitment methods and exclusion/inclusion criteria.*

The study is conducted on the case company's site. Beyond secondary data, this study generally considers any member of the case organisation as a potential source of data. However, for a more grounded understanding the main focus will lie on interactions with executives, middle managers, operations managers, shop-floor employees and individuals who are related to the shop-floor operations in a way.
Age and gender will not play a critical role within the sampling process of this study because insight is what generally matters. The researcher is aware of unconscious bias in terms of gender discrimination when sampling. He intends to conduct as many explorative conversations as possible, targeting every single eligible participant and although a gender balance is preferred, the researcher is finally reliant upon the natural gender distribution of the organisation. In terms of age, the organisation has no underaged employees at this time. Age and gender aspects may still play a greater role when evaluating the data at a later stage of the project.

3. *Describe the method by which you intend to gain consent from participants.*

Please attach a copy of all information which will be given to prospective participants (including invitation letter, briefing documents and the consent for you will be using

Consent was initially gained verbally through the HR director of the case organisation. Moreover, the researcher has been introduced to various departments as part of two induction days (i.e. operations team, HR team, IT team, finance team and R&D team), which set the scene that he is on site for research purposes. A consent form and an informed consent declaration will be further issued to participants when collecting data in order to inform them about the purpose of the research, its voluntary participation, the nature of explorative conversations as well as its confidentiality and anonymity.
As such, an informed consent declaration will inform about the background, the purpose and the data collection method(s) of this research (i.e. being observed and engaged with as part of an ethnographic study). Where applicable (e.g. formal interactions, such as meetings) and if permitted by the participant(s), the researcher will inform about taking records and that participants have the right to pull out at any time or to refuse answering without giving any reason. The researcher will brief participants that records will be transcribed, stored securely on Cardiff University's network drive, only kept for the duration of the project and possibly sent back to participants for confirmation and amendment purposes. Participants will be instructed that data will be anonymised and kept confidential and that it might be only shared with other researchers who are involved in the project. In case participants are interested in this project, the researcher will offer copies of publications arising from the research and/or a soft copy of the final thesis draft. Finally, participants will be asked to sign a consent form to obtain their consent in written form. Any member of the organisation who does not want to participate in the research project will not be approached any further. This also applies to participants who are obliged through their team leaders.

SURNAME: REYNDERS Student Number: C1422690 (if applicable)

4. *Please make a clear and concise statement of the ethical considerations raised by the project and how you intend to deal with them throughout the duration of the project. (Please use additional sheets where necessary.)*

This research project involves human participants and has therefore to meet the ethics code of Cardiff University and the ESRC. Beyond this, the researcher aims to comply with Bryman and Bell's (2007, p. 128) ethical considerations within the social sciences as far as possible (see challenges with the third bullet point in the following):

(1) Research participants should not be subjected to harm in any ways whatsoever;
(2) Respect for the dignity of research participants should be prioritised;
(3) Full consent should be obtained from the participants prior to the study;
(4) The protection of the privacy of research participants has to be ensured;
(5) Adequate level of confidentiality of the research data should be ensured;
(6) Anonymity of individuals and organisations participating in the research has to be ensured;
(7) Any deception or exaggeration about the aims and objectives of the research must be avoided;
(8) Affiliations in any forms, sources of funding, as well as any possible conflicts of interests have to be declared;
(9) Any type of communication in relation to the research should be done with honesty and transparency;
(10) Any type of misleading information, as well as representation of primary data findings in a biased way must be avoided.

Since major parts of this study will be elaborated on the case company's site (i.e. two visits per week on average), the researcher will be involved in various social interactions, involving formal (e.g. meetings and appointments) as well as informal interactions (e.g. conversations during lunch breaks). In this, conversations bear the risk that data could be generated in situations where participants take part in the study without their full knowledge and explicit consent despite an initial introduction of the researcher during the two-day induction. Alternatively, the researcher might interact with employees who are not aware of his role yet. Though, this is a common issue when adopting an ethnographic in-depth case study. Some researchers rightfully argue that it is not always adequate and/or even possible to seek full consent within ethnographic research (Homan and Bulmer 1982). As such, it is nearly impossible to obtain consent from the whole organisation (270 employees locally plus approximately 2,750 employees on further plants). However, there are ways to mitigate the risk of facing ethical issues.

Generally, each employee will be informed about the researcher's role during the first interaction as part of an introduction in case the researcher has not been introduced to this particular employee during the induction days before. Although institutional consent (Thorne 1980) has been granted through the HR director, informed consent declarations and consent forms will be distributed to request their research participation, and potential participants will be briefed according to 3). Since consent is seen as an ongoing process within ethnography (Murphy and Dingwall 2007), informed consent will be obtained incrementally, i.e. firstly from employees that are within the researcher's immediate physical environment. This involves employees from the OM department (8 people), from the HR department (5 people) and employees who the researcher usually sees during lunch breaks in the staff room (approx. 5-8 people; these people partly overlap with the employees from the OM department). From the researcher's experience, this should cover most of the individuals he interacts with on a daily basis, considering that the shop floor as well as the other departments are structurally separated from the one where he works in. On the researcher's floor there are four department, namely OM (8 people), HR (5 people), IT (3 people) and Finance (approx. 5-7 people) plus the MD. Accordingly, in the midterm he intends to cover the whole floor to be ethically on the safe side. When it comes to meetings, the researcher will ask for consent on an individual basis (e.g. a cross-departmental meeting). Moreover, if data have been generated through participants whose consent has not yet been obtained or who do not know about the researcher's role (Librett and Perrone 2010), for instance through a spontaneous conversation with a new employee, the researcher will pursue to gain a signed consent form afterwards since this practice is not uncommon in ethnography (Sveningsson 2004). As recommended by the Doctoral Academy of Cardiff University (referring to the workshop "Staying Safe when Doing Field Research"), a copy of the informed consent declaration is carried along by the researcher when being on site so that potential participants who have not signed a consent form yet can have a look at the document at any time.

It might occur that contexts repeat when having several conversations. In case the researcher intends to hint at something that a previous participant brought up, no name(s) will be mentioned when referring to this context for protective reasons. If a personalisation of data is necessary for contextual reasons when doing field notes, the researcher will make use of anonymised abbreviations that are only known to him (e.g. SE_1 for first shop-floor employee or OM_2 for second operations manager). While field notes will be stored securely on Cardiff University's network drive as well as the case company's server, records and transcriptions will exclusively be stored securely on

SURNAME: REYNDERS Student Number: C1422690 (if applicable)

Cardiff University's network drive and only kept for the duration of the project Finally, also an NDA that has been initiated by the case organisation has been signed by the researcher for the purpose of confidentiality (see attached).

5. Please complete the following in relation to your research project:

		Yes	No	n/a
(a)	Will you describe the main details of the research process to participants in advance, so that they are informed about what to expect?	X	☐	☐
(b)	Will you tell participants that their participation is voluntary?	X	☐	☐
(c)	Will you obtain written consent for participation?	X	☐	☐
(d)	Will you tell participants that they may withdraw from the research at any time and for any reason?	X	☐	☐
(e)	If you are using a questionnaire, will you give participants the option of omitting questions they do not want to answer?	☐	☐	X
(f)	Will you tell participants that their data will be treated with full confidentiality and that, if published, it will not be identifiable as theirs?	X	☐	☐
(g)	Will you offer to send participants findings from the research (e.g. copies of publications arising from the research)?	X	☐	☐
(h)	If working with children and young people please confirm that you have visited this website : Working with children and young people and vulnerable adults please go to web link - http://www.cardiff.ac.uk/racdv/ethics/guidelines/index.html	☐	☐	X
(i)	**DATA PROTECTION:** (A) Will any non-anonymised and/or personalised data be generated? (B) If "YES" will it be stored beyond the end of the project/archived? http://www.cardiff.ac.uk/socsi/research/researchethics/destructionofdata/index.html	☐	X	☐

PLEASE NOTE:
If you have ticked **No** to any of 5(a) to 5(g), please give an explanation on a separate sheet.
(Note: N/A = not applicable)

If there are any other potential ethical issues that you think SREC should consider please explain them on a separate sheet. It is your obligation to bring to the attention of the Committee any ethical issues not covered on this form and checklist.

Signed:
(Principal Researcher/Student)

Print Name:
Philipp Reynders

Date:

SUPERVISOR'S DECLARATION (Student researchers only): As the supervisor for this student project I confirm that I believe that all research ethical issues have been dealt with in accordance with University policy and the research ethics guidelines of the relevant professional organisation.

Signed:

Print Name:
Maneesh Kumar

Date:

Informed Consent Declaration – For Research Participants

This study is being conducted by Philipp Reynders, PhD student at Cardiff Business School and Cardiff University, under the supervision of Maneesh Kumar and Annie Pye who can be contacted via following email addresses: KumarM8@cardiff.ac.uk and PyeAJ@cardiff.ac.uk.

Participation in the research project will involve observations and formal as well as informal interactions attempting to identify the status quo of the organisation, mostly relating to the degree of the current Lean and continuous improvement implementation(s) as well as aspects of climate and culture. The researcher intends to look at what employees are doing and how they do it in order to develop an understanding of their work environment with an eye on how innovation and creativity come to light and may or may not flourish.

Participation in the study is entirely voluntary and participants can withdraw from the study at any time without giving a reason. Participants may also ask questions at any time and discuss any concerns with either the researcher (ReyndersP@cardiff.ac.uk) or the supervisors as listed above.

The findings of the study will form part of the PhD research project.

All information provided during the interview will be held anonymously so that it will not be possible to trace information or to comment back to individual contributors. Information will be stored in accordance with the current Data Protection Act.

Participants can request information and feedback about the purpose and results of the study by applying directly to the researcher ReyndersP@cardiff.ac.uk.

15th of December 2017

Philipp Reynders
Cardiff Business School
Cardiff University

CARDIFF BUSINESS SCHOOL
RESEARCH ETHICS

– Consent Form –

The researcher initially intends to identify the status quo of the organisation, mostly relating to the degree of the current Lean and continuous improvement implementation(s) as well as aspects of climate and culture. The researcher intends to look at what employees are doing and how they do it in order to develop an understanding of their work environment with an eye on how innovation and creativity come to light and may or may not flourish.

I understand that my participation in this project will involve being observed at work and talking with Philipp Reynders who will be gathering data about my work environment.

I understand that participation in this study is entirely voluntary and that I can withdraw from the study at any time without giving a reason.

I understand that I am free to ask any questions at any time. If for any reason I have second thoughts about my participation in this project, I am free to withdraw or discuss my concerns with Maneesh Kumar (KumarM8@cardiff.ac.uk) or Annie Pye (PyeAJ@cardiff.ac.uk).

I understand that the information provided by me will be held confidentially and securely, such that only the researcher can trace this information back to me individually. The information will be anonymised. I understand that if I withdraw my consent I can ask for the information I have provided to be deleted or destroyed in accordance with the Data Protection Act 1998.

I, _____(*NAME*) consent to participate in the study conducted by Philipp Reynders (ReyndersP@cardiff.ac.uk), PhD student of Cardiff Business School, Cardiff University, under the supervision of Maneesh Kumar and Annie Pye.

Signed:

Date:

This Agreement is made on 30th October 2017 between

 **(hereinafter called "the Company")**

and

Philipp Reynders- PhD Student

The parties hereto agree the terms and conditions upon which the Student is spending a week with the company on work experience.

1. STUDENTS UNDERTAKING

1.1 The Student shall, at all times during the period this Agreement is in force carry out any Work assigned to it under this Agreement faithfully and diligently, in a timely and professional manner, and to the highest contemporaneous academic standards, and shall obey all lawful and reasonable directions of the Company.

1.2 Except where specifically authorised in writing, the Student will not represent that it is an officer, agent or employee of the Company, nor will it create or incur any liability or obligation on behalf of the Company (and acknowledges that it has no right to do so).

2. INFORMATION

2.1 For the purposes of this Agreement Confidential Information shall mean any information of a confidential nature relating to the Company's business, including without limitation any matter relating to the Company's research, design, development, manufacturing, marketing or sales activities disclosed to the Student after the date of this Agreement (whether in writing, orally, or in any other way), or any such information arising in any way from the performance of the Work.

2.2 In respect of any Confidential Information, the Student undertakes;

i. not to disclose the Confidential Information to any third party without the prior written permission of the Company;

ii. not to use the Confidential Information for any purpose other than for the purpose of meeting its obligations under this Agreement, not to copy any medium upon which Confidential Information is stored other than to the extent necessary to meet its obligations under this Agreement;

iii. to exercise in respect of the Confidential Information at least the same degree of care in preventing disclosure to third parties as it exercises in respect of its own proprietary information.

For the avoidance of doubt, it may be necessary to keep certain information confidential, not only from third parties, but also between certain teams or departments within the company. An example is the confidentiality of information between teams working on developments for [redacted] customers and those working on developments for [redacted] companies. This confidentiality will apply to prevent the passage of information in either direction.

2.3 The foregoing obligations of confidentiality shall not apply to any information in respect of which the Student is able to show:

i. was, at the date of this Agreement, or subsequently comes into the public domain other than by virtue of a breach of any of the terms of this Agreement;

ii. was in its possession prior to the date of this Agreement;

iii. is independently developed by the Student;

iv. is subsequently received by the Student from a third party not under any obligation of confidentiality in respect of the Confidential Information;

v. is required by law to be disclosed.

3. JURISDICTION

The terms of this Agreement shall be governed by and construed in accordance with the law of England and Wales, and the parties submit to the exclusive jurisdiction of the English and Welsh Courts.

SIGNED For and on behalf of Company,

Name [redacted])
Title HR ADVISOR)
Date 30 OCT 2017)

[redacted]

SIGNED For and on behalf of Student,

Name Philipp Reynders)
Title PhD student)
Date 30/10/2017)

[redacted]

Appendix 3. Ethics forms 2

CARDIFF UNIVERSITY BUSINESS SCHOOL RESEARCH ETHICS COMMITTEE

APPLICATION FOR ETHICAL REVIEW

For Office Use Only	
SREC Reference: [ ]	Meeting/Review Date: [ ]

SECTION 1. GENERAL INFORMATION	
Application Type:	☐ Staff X PGR student ☐ PGT/Masters Student ☐ Undergraduate
Research Project Title:	Building sustainable CI organisations: the role of middle management (working title)
Short Title (where applicable):	Not applicable
For Staff Projects	
Name of Chief/Principal Investigator:	Not applicable
Contact details:	Not applicable
Other members of research team:	Not applicable
For Student Projects	
Name of Student:	Philipp Reynders
Contact details:	reyndersp@cardiff.ac.uk
Name of Supervisor(s):	Prof. Maneesh Kumar
Contact details:	kumarm8@cardiff.ac.uk
Other members of research team:	Not applicable

SECTION 2. SCREENING QUESTIONS			
		Yes	No
2.1	Is the research project categorised as 'Research' (as defined in the Cardiff University Policy on the Ethical Conduct of Research involving Human Participants, Human Material or Human Data)? *If no (i.e. the research project is a Service Evaluation or Audit), the Committee is not required to conduct a review of the proposal but may choose to do so.* ***Please contact the School Ethics Officer to seek advice before proceeding with this application.***	Yes	
2.2	Does the research project involve human participants, human material or human data (as defined in the Cardiff University Policy on the Ethical Conduct of Research involving Human Participants, Human Material or Human Data)?	Yes	

	*If **no**, you are not required to submit the research proposal to this Committee – however, you must **please provide a brief description of the research under 3.1 below and sign and submit to the Research Office.***		
2.3	Does the research project require review by an external ethics committee (refer to Appendix 1 of the Cardiff University Policy on the Ethical Conduct of Research involving Human Participants, Human Material or Human Data)? Please note that this includes all research projects involving participants who lack the capacity to consent. *If **yes**, the research project should be submitted to the relevant external ethics committee for review and does not fall within the remit of this Committee. Please contact the Research Governance Team for further advice. **Please do not continue with this application.***		No
2.4	Has the research project been ethically reviewed by another university or research institution (for example, where the Chief/Principal Investigator for the research project is based at another institution)? *If **yes,** please provide evidence of the review conducted (such as an outcome letter or communication) and the ethical review policy of the relevant institution or committee. **Please do not continue with this application.***		No
2.5	Does the research project only involve the use of information that is publicly and lawfully available e.g. census data, population statistics published by government departments and personal letters/diaries in public libraries. Note: research projects involving the use of Human Data obtained from social media (or similar internet forums) do not fall within this category. *If **yes**, you are not required to submit the research proposal to this Committee – however, you must **please provide a brief description of the research under 3.1 below and sign and submit to the Research Office.***		No
2.6	Does the research project fall within the scope of the UK Policy Framework for Health and Social Care Research? This Framework broadly applies to research taking place within, or involving, the health and social care systems. *If **yes**, you will need to apply to the Research Governance Team for Sponsorship using the Advanced Project Information Proforma (APIP) (available on the Cardiff University intranet). The Research Governance Team will advise you on the approvals that are required for the research project after it has conducted a review of the APIP and supporting documentation. **Please do not continue with this application until you have sought advice from the Research Governance Team.***		No
2.7	Does the research project involve the collection or use of Human Tissue (including, but not limited to, blood, saliva and bodily waste fluids)? *If **yes**, the research project should be submitted to the Human Tissue Act Compliance Team (HTACT) prior to submission to an ethics committee. **Please do not continue with this application until you have sought advice from HTACT.***		No

2.8	Does the research project fall within the scope of the University's Security-sensitive Research Policy? This Policy broadly applies to research involving terrorism, extremism or radicalisation (or access to materials of such a nature). *If **yes**, you must register the research in accordance with the Policy and comply with the IT and security arrangements contained in the Policy.*		No
2.9	Has the research project received scientific review? (For student research projects, review by the research project supervisor is an acceptable form of scientific review) *If **no**, please obtain appropriate scientific review before submitting the application to this Committee.*	Yes	

If the research project involves the use of animals, please contact the Cardiff University Biological Standards Office bso@cardiff.ac.uk to seek further advice.

SECTION 3. PROJECT SUMMARY

3.1	Summarise the research project (including the purpose and its methodology) using language that would be understood by a lay person.

The overall aim of this research is to examine the role of middle management during lean implementation.
The researcher is embedded within a case organisation (i.e. funding body and access is already granted) and some data collection took place already at early stages of the project (see previous ethics form). This research adopts a qualitative approach from, in which data will be collected through daily observations in situ, scanning company-internal data (e.g. reports, archives and protocols) as well as formal (e.g. semi-structured interviews, meetings and appointments) and informal interactions (e.g. conversations). In the first stage of data collection, the researcher intended to identify the status quo of the organisation, mostly relating to the degree of the current lean and CI implementation(s) as well as aspects of climate and culture. In terms of climate and culture, so far, the researcher looked at what individuals are doing and how they do it in order to develop an understanding of their work environment and to learn about their culture with an eye how innovation and creativity come to light and may or may not flourish there. Data were recorded via field notes.
Insights from this exploratory stage told an interesting story about middle management. That is, the organisation develops their middle managers in order to drive lean via internal lean masterclasses, internal/external leadership training, etc. In lean, in particular, middle management are important not only to drive the initiative but also to reconcile the senior managements' vision with daily challenges at the operational level. Given the scarcity of academic literature on the role of middle management during lean implementation, the researcher decided to have a closer look at how their role evolves during lean implementation.

3.2	Describe the research question(s).

The research questions are as follows:

Main research question
How do middle managers experience the evolution of their role and responsibilities during lean implementation?

Sub research questions

a) How does lean implementation evolve over time? b) What is a middle manager's role and what are his or her responsibilities during lean implementation? c) How do middle managers' roles and their responsibilities change over time? d) How do middle managers reconcile their role between senior management and their subordinates during lean implementation?	
3.3	Estimated start date.
01.10.2017 (data collection already started)	
3.4	Estimated end date (usually the end of data collection).
30.09.2020 (however, it is more likely that data collection will end earlier)	
3.5	Is the research project funded? *If **yes**, please name the funding body.*
There are two funding bodies 1) Economic and Social Research Council 2) [redacted]	
3.6	Are there any potential conflicts of interest? *If **yes**, please confirm the action you propose to take to address such conflicts.*
No	
3.7	Does the research project involve the use of **only** common methodology(ies) previously approved by the SREC? *If **yes**, please provide details in 'Section 10: Supporting Documents' below and attach the relevant documentation (e.g. protocol or stand operating procedure for the common methodology(ies)) to this application.* *In Cardiff University Business School, common methodologies include the use of interviews, questionnaires, focus groups and surveys accompanied by informed consent. Informed participant observation i.e. observation that gains the explicit consent of research participants is also a common methodology, but any covert data collection or observations (including the use of social media), may not fall within this category and further advice must be sought from SREC BEFORE submitting an application.*

SECTION 4. FULL REVIEW CRITERIA				
Note: CM means common methodology(ies) previously approved by the SREC – as detailed above. For each response given as 'Yes-CM', please provide details of the CM in the text box below.		Yes	Yes-CM	No
4.1	Will the research project be performed without the participants' prior consent?			X
4.2	Does the research design include an element of deception, including covert research?			X
4.3	Will the research project involve children under the age of 18 or 'at risk' (vulnerable) adults or groups? *The Cardiff University Safeguarding Children and Adults at Risk: Policy and Guidance sets out examples of 'at risk' or 'vulnerable' adults.*			X

4.4	Does the research project include topics which may be considered highly sensitive for participants? *This includes sexual behaviour, illegal activities, political, religious or spiritual beliefs, race or ethnicity, experience of violence, abuse or exploitation, and mental health.*			X
4.5	Does the research project require access to records of a sensitive or confidential nature, including Special Category Data, for the purposes of the General Data Protection Regulation and Data Protection Act 2018?			X
4.6	Is permission of a gatekeeper required for initial or continued access to participants? *This includes participants in custody and care settings, or research in communities where access to research participants is not possible without the permission of another adult, such as another family member or a community leader.*			X
4.7	Does the research project involve intrusive or invasive procedures? *This includes the administration of substances, vigorous physical exercise, procedures involving pain or more than mild discomfort to participants (including the risk of psychological distress, discomfort or anxiety to participants).*			X
4.8	Does the research project involve visual or audio recordings where participants may be identified?		X	
4.9	Does the research project involve the collection or use of human tissue?			X
4.10	Is there a risk to the safety and wellbeing of the Researchers?			X

For each response given as 'Yes-CM', please provide details of the CM that has been approved by the SREC.

4.8 Participants will be recorded during the interviews for transcription. Records will be kept secure on the university's network drive and transcriptions will be anonymised so that data is not traceable. Data will be retained until the end of the project and securely destroyed after completion.

PROCEDURE TO FOLLOW, BASED ON RESPONSES IN SECTION 4:

- If any 'Yes' box applies, the research project should follow a full ethics review.
- If all 'No' boxes apply, the research project may be considered for proportionate review.
- If a combination of only 'No' and 'Yes-CM' boxes applies, the research project may be considered for proportionate review.

SECTION 5. RECRUITMENT	
5.1	How will you recruit participants to the research project? *If appropriate, please include sampling criteria.*

The researcher is embedded within a case organisation and access is granted (please also see NDA attached). Organisational members know about the research project. Ideally, semi-structured interview will be conducted will all their middle managers. Middle managers will be approached via email or a "desk visit". The researcher has access to the facilities and is allowed to book meeting rooms.

5.2	How many participants are you aiming to recruit? *If applicable, please include a breakdown of participants by type and number.*

Approximately 15 middle managers will be interviewed. This depends on (1) how many middle managers are employed at the time of data collection and (2) their availabilities. As to the latter, various attempts will be made to make sure that every middle manager is interviewed.

Below please find the middle managers to be interviewed based on their organisation chart.

1. Platform Development Manager
2. Research Manager
3. Mechanical Engineering Manager
4. Process Engineering Manager
5. Quality Engineering Manager
6. Quality Systems Manager
7. Product Evaluation Manager
8. IT Manager
9. Finance Manager
10. Manufacturing Engineering Manager
11. Operations Manager
12. Purchasing Manager
13. Production Manager 1
14. Production Manager 2
15. HR Business Partner

5.3	What is the inclusion and exclusion criteria for participants?

The researcher considers employees as middle managers as soon as they are one level below senior management and have subordinates to lead. Age and gender will not play a critical role within the sampling process of this study because insight is what generally matters. The researcher is aware of unconscious bias in terms of gender discrimination when sampling. He intends to conduct as many interviews as possible, targeting every single eligible participant and although a gender balance is preferred, the researcher is finally reliant upon the natural gender distribution of the organisation. In terms of age, the organisation has no underaged employees at this time. Age and gender aspects may still play a greater role when evaluating the data at a later stage of the project.

5.4	How will the research project address recruitment of participants who are not fluent in the English/Welsh language?

All middle managers are fluent in English. Welsh language is not needed.

5.5	Will the research project involve participants that are Cardiff University staff or students or people who are likely to become students or clients of the University or the place in which you may otherwise work? *If applicable, please provide details.*

The case company has already worked together will Cardiff University together in various projects. So, there is an ongoing knowledge exchange. To the researcher's best knowledge, also the School of Engineering conduct research with [redacted] together.	
SECTION 6. CONSENT PROCEDURES	
6.1	How will informed consent be obtained? *Please include who will be taking consent, how consent will be recorded, when participants will be provided with information about the research project, and how long potential participants will be given to decide whether to take part.*
Consent was initially gained verbally through the HR director of the case organisation. Moreover, the researcher has been introduced to various departments as part of two induction days (i.e. operations team, HR team, IT team, finance team and R&D team), which set the scene that he is on site for research purposes. A consent form and an informed consent declaration will be further issued to participants when collecting data in order to inform them about the purpose of the research, its voluntary participation, the nature of semi-structured interviews as well as its confidentiality and anonymity. As such, an informed consent declaration will inform about the background, the purpose and the data collection method(s) of this research (i.e. being interviewed). If permitted by the participant(s), the researcher will inform and ask about taking voice records and that participants have the right to pull out at any time or to refuse answering without giving any reason. The researcher will brief participants that records will be transcribed, stored securely on Cardiff University's network drive, only kept for the duration of the project and possibly sent back to participants for confirmation and amendment purposes. Participants will be instructed that data will be anonymised and kept confidential and that it might be only shared with other researchers who are involved in the project. In case participants are interested in this project, the researcher will offer copies of publications arising from the research and/or a soft copy of the final thesis draft. Finally, participants will be asked to sign a consent form to obtain their consent in written form. Any member of the organisation who does not want to participate in the research project will not be approached any further. This also applies to participants who are obliged through their team leaders.	
6.2	Will participants be offered any incentives to take part in the research project?
No	
6.3	If a questionnaire is to be used, will you give participants the option of omitting questions they do not wish to answer?
There is no questionnaire. During the interview, however, participants have the option to pull out at any time or to refuse answering a question (cf. 6.1; 6.3).	
6.4	Will participants be informed that their participation is voluntary and that they may withdraw at any time and for any reason?
A consent form and an informed consent declaration will be further issued to participants when collecting data in order to inform them about the purpose of the research, its voluntary participation, the nature of semi-structured interviews as well as its confidentiality and anonymity. During the interview, participants have the option to pull out at any time or to refuse answering a question (cf. 6.1; 6.3).	
SECTION 7. POSSIBLE HARM TO PARTICIPANTS/RESEARCHERS	

7.1	Is there is a risk of the participants experiencing physical, emotional or psychological harm or distress? *If yes, please provide details of how ethical issues will be handled and how any risks will be minimised. Please consider whether the research project includes topics which could be considered as highly sensitive for participants.*
No	
7.2	Is there a risk of the Researcher(s) experiencing physical, emotional or psychological harm or distress? *If yes, please provide details of how ethical issues will be handled and how any risks will be minimised.*
No	
SECTION 8. DATA MANAGEMENT, CONFIDENTIALITY AND DATA PROTECTION	
8.1	How, and by whom, will data be collected?
Data will be collected by the researcher via semi-structured interviews.	
8.2	Will you be accessing or collecting Personal Data (identifiable personal information) as part of the research project? *If yes, please confirm what data will be accessed and/or collected (including details of the information participants are asked to provide on a written consent form).*
Yes. The following will be collected: • Official job title • Tenure	
8.3	How long will you retain the Personal Data collected in connection with the research project?
Data will only be kept for the duration of the project.	
8.4	What efforts will be made to anonymise the data collected (where possible)?
Middle managers will be numbered to avoid that data is traceable by job titles. In addition, the researcher will make use of anonymised abbreviations that are only known to him (e.g. MEM for Mechanical Engineering Manager or PM1 for Prodcution Manager 1).	
8.5	Are you proposing to utilise 'public task' as the lawful basis for processing Personal Data for the purposes of the research project (as recommended in the University's GDPR Guidance for Researchers)? *If no, please explain why and what alternative lawful basis you propose to use.*
Yes	
8.6	Have you utilised/incorporated into the Participant Information Sheet the template GDPR privacy information for research participants? *If no, please explain why this has not been used.*
Yes	
8.7	For how long will the collected anonymised data be retained?

Data will only be kept for the duration of the project.	
8.8	Who will have access to the data?
Only the research team. This includes the researcher and his supervisors.	
8.9	Will the data be shared in any way, for example through deposit in a data repository, with third parties, or a transcription service?
No	

SECTION 9. OTHER ETHICAL CONSIDERATIONS

Please outline any other ethical considerations raised by the research project and how you intend to address these. You are obliged to bring to the attention of the SREC any ethical issues not covered in this Ethics Review Application Proforma.

No further ethical considerations have been identified.

SECTION 10. SUPPORTING DOCUMENTS

I have attached the documents, as indicated in the table below, in support of this application.

Please note that the documents listed below **MUST BE** provided where relevant to the research project, alongside any other documents relevant to recruitment, consent and participation.

		Yes	No	Version no. (where applicable)
1	Research Project Protocol/Proposal		X	
2	Recruitment Adverts/Invitation Letters		X	
3	Participant Information Sheet	X		
4	Consent Form	X		
5	Data Collection Tools (e.g. questionnaires)	X		
6	Other participant communications (e.g. debrief sheets)		X	
7	Protocol(s) or Standard Operating Procedure(s) of documented and ethically approved common methodology(ies) being used for the research project		X	
8	Evidence of Research Integrity training completion	X		

SECTION 11. SIGNATURES AND DECLARATIONS

General declaration

I confirm that:

a. The information in this form is accurate to the best of my knowledge and belief and I take full responsibility for it.
b. I have the necessary skills, training and or/expertise to conduct the research project as proposed.
c. I am familiar with the University's health and safety requirements and policies and that all relevant health and safety measures have been taken into account for the research project.

d. I am familiar with, and will comply with, the University's Policy on the Ethical Conduct of Research involving Human Participants, Human Material or Human Data and the University's Research Integrity and Governance Code of Practice. e. The relevant equality and diversity considerations have been taken into account when designing the research project. f. If the research project is approved, I undertake to adhere to the research project protocol, the terms of the full application as approved and any conditions set out by the Committee and any other body required to review and/or approve the research project. g. I will notify the Committee and all other review bodies of substantial amendments to the protocol or the terms of the approved application, and to seek a favourable opinion from the Committee before implementing the amendment.
FOR STAFF PROJECTS
Signed: Chief/Principal Investigator
Print name:
Date:

FOR STUDENT PROJECTS	
Signed: [redacted] Student	Signed: MANEESH KUMAR Supervisor
Print name: Philipp Reynders	Print name: Maneesh Kumar
Date: 18.10.2019	Date: 18.10.2019

Please submit the completed application and supporting documents to CARBS-ResearchEthics@cardiff.ac.uk

Your electronic submission should contain wet-ink or electronic signatures of all relevant parties. Please note that if any information is missing, the application may be returned to you.

Informed Consent Declaration – For Research Participants

This study is being conducted by Philipp Reynders, PhD student at Cardiff Business School and Cardiff University, under the supervision of Maneesh Kumar who can be contacted via following email address: KumarM8@cardiff.ac.uk.

Participation in the research project will involve being interviewed with tape recording, if permitted, (1) to identify the role and responsibilities of middle management during lean implementation, (2) to identify how middle managers' roles and responsibilities change over time and (3) how middle managers reconcile their role between senior management and their subordinates during lean implementation.

Participation in the study is entirely voluntary and participants can withdraw from the study at any time without giving a reason. Participants may also ask questions at any time and discuss any concerns with either the researcher (ReyndersP@cardiff.ac.uk) or the supervisors as listed above.

The findings of the study will form part of the PhD research project and could be published in academic journals.

All information provided during the interview will be held anonymously so that it will not be possible to trace information or to comment back to individual contributors. Information will be stored in accordance with the EU Data Protection Regulation (GDPR) 2018.

Participants can request information and feedback about the purpose and results of the study by applying directly to the researcher ReyndersP@cardiff.ac.uk.

18th of October 2019

Philipp Reynders
Cardiff Business School
Cardiff University

PARTICIPANT INFORMATION SHEET

THE ROLE OF MIDDLE MANAGEMENT DURING LEAN IMPLEMENTATION

You are being invited to take part in a research project. Before you decide whether or not to take part, it is important for you to understand why the research is being undertaken and what it will involve. Please take time to read the following information carefully and discuss it with others, if you wish.

Thank you for reading this.

1. What is the purpose of this research project?
The purpose of this PhD research is (1) to identify the role and responsibilities of middle management during lean implementation, (2) to identify how middle managers' roles and responsibilities change over time and (3) how middle managers reconcile their role between senior management and their subordinates during lean implementation.

2. Why have I been invited to take part?
You have been invited because you are either a middle manager or because you have expertise knowledge about lean.

3. Do I have to take part?
No, your participation in this research project is entirely voluntary and it is up to you to decide whether or not to take part. If you decide to take part, we will discuss the research project with you and ask you to sign a consent form. If you decide not to take part, you do not have to explain your reasons and it will not affect your legal rights.

You are free to withdraw your consent to participate in the research project at any time, without giving a reason, even after signing the consent form.

4. What will taking part involve?
Participation in the study will involve being interviewed by the researcher (approximately 60 to 90 minutes). If permitted, participants will be tape recorded. If not permitted, interview data will be recorded via field notes. Tape records will be stored on the university's network drive and transcribed for detailed analysis.

5. Will I be paid for taking part?
No. You should understand that any data you give will be as a gift.

6. What are the possible benefits of taking part?
Potential benefits include but are not limited to better insights of lean implementation in your organization and of middle managers' roles and challenges during lean implementation. These insights may ultimately build a foundation for managerial decision-making.

7. What are the possible risks of taking part?

No risks identified.

8. Will my taking part in this research project be kept confidential?
All information collected from (or about) you during the research project will be kept confidential and any personal information you provide will be managed in accordance with data protection legislation. Please see 'What will happen to my Personal Data?' (below) for further information.

9. What will happen to my Personal Data?
Cardiff University is the Data Controller and is committed to respecting and protecting your personal data in accordance with your expectations and Data Protection legislation. Further information about Data Protection, including:

- your rights
- the legal basis under which Cardiff University processes your personal data for research
- Cardiff University's Data Protection Policy
- how to contact the Cardiff University Data Protection Officer
- how to contact the Information Commissioner's Office

may be found at https://www.cardiff.ac.uk/public-information/policies-and-procedures/data-protection

Personal data will include your official job title and your tenure. After the interview, the research team will anonymise all the personal data it has collected from with the exception of your consent form. Interviewees will be numbered to avoid that data is traceable. The researcher will make use of anonymised abbreviations that are only known to him. Your consent form will be retained for as long as research data are retained according to the ESRC Framework for Research Ethics and may be accessed by members of the research team and, where necessary, by members of the University's governance and audit teams or by regulatory authorities. Anonymised information will be kept until the end of the project but may be published in support of the research project and/or retained indefinitely, where it is likely to have continuing value for research purposes.

If you decide to withdraw from the study, you have the right to get data you provided removed. It will not be possible to withdraw any anonymised data that has already been published or in some cases, where identifiers are irreversibly removed during the course of a research project, from the point at which it has been anonymised.

10. What happens to the data at the end of the research project?
Data collected will be kept confidential but could be shared anonymised within the University amongst researchers for further research projects aimed to be published in academic journals. At no point of time, raw data will be shared with third parties or made publicly available.

11. What will happen to the results of the research project?
The results will be submitted as part of the PhD thesis and are likely to be published in academic journals in the future. You can obtain a copy of the published results. It is our intention to publish the results of this research project in academic journals and present findings at

conferences. Participants will not be identified in any report, publication or presentation. It is likely that verbatim quotes from participants are used.

12. What if there is a problem?

If you wish to complain, or have grounds for concerns about any aspect of the manner in which you have been approached or treated during the course of this research, please contact Philipp Reynders (reyndersp@cardiff.ac.uk) or Professor Maneesh Kumar (kumarm8@cardiff.ac.uk). If your complaint is not managed to your satisfaction, please contact the Business School's Research Ethics Committee (CARBS-ResearchEthics@cardiff.ac.uk).

If you are harmed by taking part in this research project, there are no special compensation arrangements. If you are harmed due to someone's negligence, you may have grounds for legal action, but you may have to pay for it.

13. Who is organising and funding this research project?

The research is organised by Philipp Reynders in Cardiff University supervised by Professor Maneesh Kumar. The research is currently funded by ESRC and your organization.

14. Who has reviewed this research project?

This research project has been reviewed and given a favourable opinion by the Business School's Research Ethics Committee, Cardiff University.

15. Further information and contact details

Should you have any questions relating to this research project, you may contact us during normal working hours:

Address:
Philipp Reynders
Room B52, Aberconway Building
Colum Drive
CF10 3EU, Cardiff
Wales, United Kingdom

Contact details:
Email: reyndersp@cardiff.ac.uk
Tel.: [redacted]

Thank you for considering to take part in this research project. If you decide to participate, you will be given a copy of the Participant Information Sheet and a signed consent form to keep for your records.

CARDIFF BUSINESS SCHOOL
RESEARCH ETHICS

– Consent Form –

In his PhD project, the researcher intends to identify how middle managers experience their role and responsibilities during lean implementation. In particular, the researcher intends to look at how the role and responsibilities change over time and how middle managers reconcile their role between senior management and their subordinates.

I understand that my participation in this project will involve being interviewed with tape recording, if permitted, by Philipp Reynders who will be gathering data about my role as a middle manager.

I understand that participation in this study is entirely voluntary and that I can withdraw from the study at any time without giving a reason.

I understand that I am free to ask any questions at any time. If for any reason I have second thoughts about my participation in this project, I am free to withdraw or discuss my concerns with Maneesh Kumar (KumarM8@cardiff.ac.uk).

I understand that the information provided by me will be held confidentially and securely, such that only the researcher can trace this information back to me individually. The information will be anonymised and could also be used for publications in academic journals. I understand that if I withdraw my consent, I can ask for the information I have provided to be deleted or destroyed in accordance with the EU Data Protection Regulation (GDPR) 2018.

I, _____(*NAME*) consent to participate in the study conducted by Philipp Reynders (ReyndersP@cardiff.ac.uk), PhD student of Cardiff Business School, Cardiff University, under the supervision of Maneesh Kumar.

Signed:

Date:

Background information

1. What is your official job title?
2. For how long have you been working in this organization?

Understanding of lean

3. How do you define lean?

Lean initiative and its evolvement

4. What is your view of lean in your organization? Please describe the initiative and its purpose.
5. In what ways did the lean initiative change the way of working at your organization?
6. Have you experienced positive or negative outcomes from this initiative?
7. What do you perceive are the specific conditions needed to embed a lean philosophy?
    a. According to you, what are the critical success factors for leading a lean initiative?
    b. What are the most prohibitive barriers when implementing lean?
8. Who has the most important role in the implementation of lean?
9. Has there been any resistance among managers? If so, in what way?

Strategy development ("hoshin kanri")

10. How would you describe the organization's approach to strategy development?
    a. Who is involved in strategy development?
11. How do you participate in the strategy process? Please describe your role in strategy development.
12. Please describe the senior management support for lean.
    a. How does your direct manager support lean?
13. How do you communicate strategy to lower levels of the hierarchy?
14. How do you reconcile your role between senior management and your subordinates during lean implementation?

Lean leadership role

15. How would you describe a good leader? What do you think are characteristics of good lean leaders?
16. How do you see your role as a middle manager in a lean-adopting organization?
17. In what way does lean affect your daily work?
18. How do you spend your day?
    a. How much of your time do you spend in lean-related activities?
    b. How often do you meet with your team?
    c. How do you lead your team meetings?
    d. How often do you visit the shop floor, watching and interacting with operators?
19. What are the factors that had an impact on your transformation towards lean leadership?
20. What are the lessons learnt from your transformation to a lean leader?
21. Is the lean involvement part of your performance objectives and reviewed in your annual personal performance review?

Change of lean leadership role

22. Please share your experiences as a middle manager going through a lean transformation.
    a. When and how did you realize implementing lean meant a change in leadership?
    b. What did you learn about leadership and about yourself as a result of lean transformation? What did you personally have to change about your leadership?
    c. How did you approach making these changes? How did you feel about making these changes?
23. What do you do different since your organization underwent a lean transformation as opposed to before?

24. Given your experience and expertise at this time, how would you approach your lean leadership transformation if you had the opportunity for a “do over”?

Staff

25. Do all employees know what they should do to support strategic goals?
26. What systems do you have in place to help your employees to meet the challenges of lean?
27. Is everybody committed to lean? What have they done to indicate that they do or do not?
28. Who is responsible for approving or rejecting the implementation of ideas?
    a. How long does this acceptance/rejection process take?
    b. How is the decision to approve/reject a suggestion communicated to you?

Results

29. In the improvement projects you have been involved, have the changes been sustainable?
    a. Please describe examples.
    b. Have some changes showed initial success and then faded?
30. According to you, how can lean be sustained?

Final question

31. Is there anything else that has not been covered that you wish to add? If so, please feel free to share it with me.

Philipp Reynders,
Cardiff Business School
Cardiff University

11 December 2019

Dear Philipp,

Ethics Approval Reference: 1920005

Project Title: Building sustainable CI organisations: the role of middle management

I would like to confirm that your project has been granted ethics approval as it has met the review conditions.

Should there be a material change in the methods or circumstances of your project, you would in the first instance need to get in touch with us for re-consideration and further advice on the validity of the approval.

I wish you the best of luck on the completion of your research project.

Yours sincerely,

Electronic signature via email

Dr. Debbie Foster
Chair of the School Research Ethics Committee
Email: CARBSResearchEthics@cardiff.ac.uk

Appendix 4. Reactive instability, proactive velocity, and excellence agility

No.	Criteria	I. Reactive instability	II. Proactive velocity	III. Excellence agility
1	Characteristics	Life is uncomfortable Performance is variable Inconsistent process stability Serious improvement needed	Business purpose understood Delivering more results Winning customers Developing new products Improving the people assets Driving engagement at all levels	Shingo Prize winners Improvement journey mastered by aligning the purpose, engaging their people, and improving the process to deliver greater customer results
2	Duration	The system has been running for a period in excess of one year and can show a measured improvement in performance	The system has been running for a period in excess of one and a half years and can show a measured improvement in its performance	The system has been running for a period in excess of three years and can show a measured improvement in its performance
3	Improvement	Reactive data are used from within the enterprise and its supply chain to improve the performance of the system	Both reactive and proactive data are used from within the enterprise and its supply chain to improve the performance of the system	Both reactive and proactive data are used from within the enterprise, its supply chain and via collaboration with its customers to improve the performance of the system
4	Involvement	Improvement is managed by individuals within departments to improve the performance of the system	Improvement is managed by cross-functional teams from both within the enterprise and its supply chain to improve the performance of the system	Improvement is managed by cross functional teams from both within the enterprise, its supply chain and via collaboration with its customers, to improve the performance of the system
5	Performance	The results of the system are aligned to the organisation's strategy	The results of the system are aligned to the organisation's strategy Consider what is required both today and tomorrow from the organisation and its suppliers	The results of the system are aligned to the organisation's strategy Consider what is required both today and tomorrow from the organisation, its suppliers, and interactions with its customers

Source: Adapted from S A Partners (no date)

Appendix 5. Visual management assessment criteria

No.	Area(s)	Criteria
1	Purpose	A purpose statement is in place that guides the activities of the team Behaviours are displayed and the team understands their purpose Customers have been defined and a process is in place to understand their needs A team charter has been developed that shows commitment to customers, purpose statement and behaviours
2	Process	Measures exist that confirm the performance of the areas: innovation, value, delivery, cost, quality, people, culture and zero harm Measures are both leading and lagging, including key behavioural indicators Targets are in place that drive improvement aligned to the goals of the business and team
3	People	A meeting agenda is in place Attendance at meetings is monitored and actions taken for non-attendance The team have considered their development and introduced appropriate activities to upskill themselves and their teams The behaviour focus group outputs are displayed and the team are aware of actions being taken The team recognition system is operational and recognises, good saves, great ideas, and exceptional effort
4	Improvement	Actions are documented and deadlines adhered to Escalated issues are documented and acted on within timeframes agreed Priorities (1) Business and departmental improvement priorities are clear and linked to OpCo's 5Cs (management policy) (2) Individual top 3 priorities are widely used (3) A3s are used for highest priority items Benefits are captured and communicated amongst the team The business excellence audit scores are demonstrated, and action plans are in place

Source: Adapted from OpCo (2017)

Appendix 6. Best practices and improvement opportunities

No.	3P framework	"Reactive instability" (December 2017)		"Proactive velocity" (February 2017)	
		Best practice(s)	*Improvement opportunities*	*Best practice(s)*	*Improvement opportunities*
1	*Purpose*				
	Stakeholder management	Voice of the Customer	Networking opportunities Supplier relationships	Corporate alignment Our OpCo team and charity Supplier relationship management University visits Voice of the Customer	Across group priority alignment Anticipate future needs of stakeholders Supplier relationship management and early supplier engagement
	Strategy formulation			Clear purpose statement Improved information flow Policy deployment matrix	
	Organisation design			Facilities development Technicians team structure and training	
2	*Engage*				
	Behaviour deployment	Behaviours on visual management boards Definition of behaviours Embedding of behaviours in PDRs	Behaviours not owned, not bought into Coaching skills	1-to-1s Behaviour sessions/values INFLUENCE coaching	Cross-departmental interaction
	Leader standard work	Daily meeting in OPS Visual management meetings (in pockets)	Accountabilities and responsibilities not understood Better understanding what leader standard work is	Morning meetings Team brief	Visual management audits
	Communications	Multiple communication channels (e.g., off-site meetings, visual management meetings, team brief, and intranet)	Consistency, timeliness, and priority Cross-functional involvement Horizontal communication	Business excellence masterclasses Team brief Townhall meetings	Overcome silos (departmental barriers)
3	*People*				
	Health, safety, and environment	Health and safety champions Well-being initiatives		Environment (no plastic cups, containers, cans) Food vending machines Hazard incident reports Health and safety groups Health and well-being initiatives	Food waste Materials and energy usage Pedestrian walkways Recycling
	People lifecycle management	Mentoring Induction Training Internal promotion	Career paths Mentoring deployment Retain talent	PDR opportunities in succession Raise profile (e.g., university and social media) Relationship with agencies	Career development plans Improve induction
	Learning & Development	L&D Business Partner hired Training programmes	Proactive L&D Utilise L&D	ELITE (electronic learning information training environment) Health and safety INFLUENCE programme Technician programme Using PDRs to drive training needs	
	Reward and recognition	Incentives (e.g., team brief, financial incentives, pictures, and blog post for nominated teams, and group awards)	Behaviour recognition Proactive rewarding and recognition	Alignment of pay in production and others Flexible work hours	Bonus/management-by-objectives process

No.	3P framework	"Reactive instability" (December 2017)		"Proactive velocity" (February 2017)	
		Best practice(s)	*Improvement opportunities*	*Best practice(s)*	*Improvement opportunities*
		R&R on visual management boards	Transparency in choice	Rewards Wider recognition in team brief	Expanding clarity of pay bands and structure to other areas Implement new improved R&R scheme
4	*Improve*				
	Benchmarking	Lean maturity benchmarking (e.g., other sites) Salary benchmarking Top Employers Institute assessment	L&D benchmarking	Top Employer Institute User story Voice of the Customer	Behavioural benchmarking Management group benchmark
	Continuous improvement	Continuous improvement process in OPS Management by objectives to drive improvements R&R Use of visual management boards	Little involvement at shopfloor level Site-wide continuous improvement process rollout	Continuous improvement process in OPS, RAQA, and R&D Voice of the Customer	Depth of engagement in continuous improvement
	Performance management	Visual management boards	Visual management board rollout in more departments	Improved results (service level up)	
	Problem-solving	DMAIC and continuous improvement process in OPS			A3 thinking is not embedded Lessons learnt
5	*Process*				
	Order creation	Closer interaction with stakeholders	More interaction with other business units		
	Product lifecycle management		Obsolescence planning Retiring product		
	Order fulfilment	Effectiveness (delivery on time and minimal backorder) Leading and lagging KPIs	Efficiency	Service level higher	Working capital/inventory
	Asset lifecycle management			Facility improvements	
	Supply chain integration	Supper relationship management	System focus rather than individuals Management by objectives for supply quality	MRP/forecasting Stock agreements	Expert supply base Slow moving stock
6	*Align*				
	Strategy deployment	1-to-1s, PDRs, and team briefs Corporate strategy plan Intranet Management by objectives Off-site meetings Senior management meetings Visual management boards	Further embedding through involvement	Overall communication of strategy development Policy deployment matrix Strategy aligned with PDRs	Visual management boards rethink
	Project management		Better governance for some projects Increased use of A3 plans Standard approach to projects	A3s on various boards Policy deployment matrix	Definition/clarity of project management process
	Management process	R&R Visual management boards	Culture (improved decision-making and empowered dissent)	Business excellence process	Improve visual management board PDSA process

Source: Author

Appendix 7. Aligning corporate core values and ideal behaviours

No.	Corporate		OpCo
	Core value(s)	*Core behaviour(s)*	*Ideal behaviour(s)*
1	Integrity	We are trustworthy and act in good faith	Be honest and sincere in every interaction Take personal responsibility for action Have the courage to admit mistakes
2	Empathy	We are about all our stakeholders	Solve customer and patient challenges with passion and persistence Treat all colleagues with respect regardless of position Actively participate in local and professional communities
3	Long-term view	We look beyond the present to deliver future value	Take bold action with the future in mind Take smart risks to achieve long-term success Set the bar high to achieve what may feel beyond our reach
4	Agility	We challenge the status quo with open minds, focus and speed	Empower others to achieve shared goals Act decisively Listen to new ideas and always pursue opportunities to improve
5	Unity	We are strongest when we work together as a team	Share knowledge and help each other make progress Value people with diverse perspectives and backgrounds Put what is best for OpCo ahead of individual or team interests

Source: OpCo (2018)

Appendix 8. Monthly awards proposal changes

No.	Criteria	Previous proposal for monthly award(s)	New proposal for monthly award(s)
1	Description(s)	Nomination in any category if meeting the criteria Up to three awards will be made each month Individual and team basis	Nomination in any category for exceptional results or behaviours in line with the corporate core values Up to five awards will be made each month Individual and team basis
2	Categories	Take initiative to solve problems and improve work situations without being prompted Positively influence others to build consensus in group, departmental or organisational settings Consistently go above and beyond without fanfare Deliver a consistently high quality of service to their internal and/or external customers Take the initiative to improve the value and efficiency of the services they provide Create new, cost-effective and/or innovative methods for performing day-to-day operations Help others by sharing knowledge of practices and resources or job-related skills Create a positive attitude and atmosphere, positively influencing others by their example Demonstrate reliability, perseverance and focus on results Take a proactive and innovative approach towards findings sustainable solutions to business challenges	Good saves Good ideas Exceptional effort
3	Process(es)	Nomination via nomination form (paper or electronically) to be submitted to Award Committee Nominees shortlisted via team brief Employees cast vote for their choice of nominee All votes to be counted by Awards Committee to determine three awardee(s)	Nomination via nomination form (paper or electronically) to be submitted to Our OpCo team[a] Decision upon five suitable candidates to receive recognition by Our OpCo team Pre-selected nominees to be forwarded to senior management Final decision upon awardee(s) to be made by senior management
4	Prize(s)	Recognition on display boards Trophy for the month Buffet together with other awardees	£200 voucher Medial recognition on screens around the site, the intranet, or a designated display board

Source: Adapted from OpCo (2018)

Note(s): (a) The Our OpCo team is a voluntary working group organising company events, such as Christmas parties.

Appendix 9. Shingo model structure

No.	Dimension(s)	Guiding principle(s)	Behavioural benchmark(s)
1	Results	Create value for the customer	Measures
			Relationships
			Value
2	Enterprise alignment	Create constancy of purpose	Alignment
			Clarity
			Communication
		Think systematically	Linkage
			Optimisation
3	Continuous improvement	Flow & pull value	Demand
			Elimination
			Uninterrupted
		Assure quality at the source	Connectedness
			Mistake-proofing
			Ownership
		Focus process	Attribution
			Design
			Understand
		Embrace scientific thinking	Analyse
			Collaborate
			Reflection
		Seek perfection	Mindset
			Structure
4	Cultural enablers	Lead with humility	Empowerment
			Learning
			Servant leadership
		Respect every individual	Fairness
			Recognition
			Safety
			Support

Source: Adapted from Shingo Institute (2018)

Appendix 10. Cultural enablers principles

No.	Principle(s)	Description(s)	Example(s) of ideal behaviour
1	Lead with humility	A common trait among leading practitioners of enterprise excellence is a sense of humility Enabling principle that precedes learning and improvement A leader's willingness to seek input, listen carefully and continuously learn creates an environment where associates feel respected and energised and give freely of their creative abilities Improvement is only possible when people are willing to acknowledge their vulnerability and abandon bias and prejudice in their pursuit of a better way	There is consistent, predictable leadership engagement where the work happens Employees can report issues with confidence in a positive response
2	Respect every individual	Respect must become something that is deeply felt for and by every person in an organisation Respect for every individual naturally includes respect for customers, suppliers, the community, and society in general Individuals are energised when this type of respect is demonstrated Most associates will say that to be respected is the most important thing they want from their employment When people feel respected, they give far more than their hands – they give their minds and hearts as well	Create a development plan for employees including appropriate goals Involve employees in improving the work done in their areas Continually provide coaching for problem solving

Source: OpCo (2018)

Appendix 11. Shingo Institute feedback report

No.	Shingo Institute feedback report
1	There is an unusually large number of respondents that preferred not to divulge their age or gender. This may be an indicator of trust issues.
2	Compared to other Shingo Insight Assessments, there is a large amount of people that answered "do not know" and "not relevant". This is especially peculiar in "cultural enablers". Also, the number of these responses in "flow & pull value" would seem to indicate that employees are not aware of how this critical principle impacts their work.
3	Look at the difference between temporary and permanent employees. Generally, temporary employees answer more positively about the behaviours they observe. Why is that?
4	"Cultural enablers" is the weakest dimension in the report. Of particular note is the following: (1) Training and people development (2) Fairness and recognition
5	Throughout the report, it appears that OPS is stronger in the continuous improvement area
6	Common themes from the feedback: (1) Personal development concerns and increased training (2) Gemba issues (3) Associates want more input into improvements involving their own work (4) Fairness and treatment in benefits (5) Temporary employees want a path into employment with OpCo

Source: Shingo Institute (2018)

Appendix 12. Frequently occurring themes in Shingo Insight Assessment #2

No.	Theme(s)	Management level(s)	Relevant quote(s) as they appear	*f*
1	Training and personal development	Senior managers	"Improved career planning for some high potential employees" "Companywide training on change management soft skills [and] global mindset training"	2
		Managers	"Develop talent from within – graduate training, apprenticeships, career progression" "Increased focus on individual skillsets within project process engineering" "Ensure process engineering is […] focused on people's strengths and skills as opposed to assuming each person is multi-skilled" "More opportunities for promotion" "Better investment in people to utilise skills" "More training to individuals for subjects that they are working with" "Personal development of employees to take the next step in career" "Provide the means, training and facility to implement improvements"	8
		Associates	"A small training course should be made available to all employees […] Full cross-training and movement between lines can ensure the development of each employee" "Transparent and precise personal development scheme for employees" "Give more opportunity to employees to further their careers" "Support for employees who wish to train or educate themselves (also outside from work hours)" "Better training of team leaders" "Skill development for employees to advance in the workplace" "Development[,] cross-training[, and] training facilities" "More training" "Identify training needs for individuals on all levels" "Internal career progression […] being fully committed to delivering planned training objectives" "More job-related training available to all employees" "More opportunities to additional courses" "More opportunities to improve personal development and additional training" "Training courses should be mandatory (with relevance)" "Promote and recruit within [OpCo]"	15
2	Continuous improvement	Senior managers	"Consistency in driving pockets of excellence across the company"	1
		Managers	"Provision of feedback for department improvement" "Consider consulting external experts to lead the implementation of business improvements rather than driving these initiatives through the MBO programme […] Reduce change or plan implementation better – there have been a large number of initiatives […] that have brought about a step change in expectations without a clear roadmap for implementation […] – we are making changes quicker than we can measure success in some cases and it creates a lot of confusion and lack of clarity" "Learn from mistakes. There is a big gap in the system with lessons learnt and knowledge transfer." "Provide feedback from lessons learnt" "Refine CI philosophy to be more MTM-driven, i.e. bottom-up, not top-down"* "Use production employees as well as team leaders in CI meetings […] Improvements can be made better with production support"	7

No.	Theme(s)	Management level(s)	Relevant quote(s) as they appear	*f*
		Associates	"Focus on eliminating outdated, redundant or simply unnecessary procedures – to improve work efficiency and comfort of employees" "An employee should have the opportunity to […] see […] the real effects of poor quality mean for the patient"* "Streamline the current business processes to eliminate waste and build an open and transparent system with clear process ownership that is harmonised with the empirical structure […] Make the process owners responsible for open and transparent reporting of the KPI's for those business processes together with improvement identification proposals that will feed into the management review for business process improvement […] Actively promote the idea that ALL failures are like 'business gold'. They represent an opportunity to learn." "Less focus on business excellence boards and board audits and more focus on the processes behind business […] Build a world-class culture of trust to retain and attract the people necessary for us to achieve world-class performance" "Obtain customer feedback quicker to help making improvements faster"* "Introduce a dedicated team for holistic continuous improvement of our products, processes and systems" "Eliminating waste" "Emphasis on quality over quantity/speed" "Improve production process" "Reduce product development project time and cost […] Develop a lean and effective quality system to achieve the above" "Think systematically, create value for the customer"	10
3	Resource issues	Senior managers	"External review of our project management approach – to help us deliver on time" "Future-led resource planning"*	2
		Managers	"Front-load the development process with resource / effort, as part of a real shift towards long-term thinking instead of short-term thinking"* "Minimise non-core function R&D distractions to allow time to be better spent on quality of product rather than a focus on quality of documentation" "Consider realistic timescales on projects and not shrink timelines to suit ensuring project is manned correctly" "Recognise that a supply chain expert is needed. There is no knowledge-binding level within the organisational structure." "Using departments correctly rather than another resource"* "Work more closely with [OpCo] Tokyo. They have significantly more R&D resource than we do."*	6
		Associates	"Resource planning to allow staff to focus on one thing at a time" "Usage of internal workforce and resources to reduce tremendous costs of outsourcing" "Timely manner of projects, preventing slipping of deadlines" "New product development teams do not have the resource or remit to improve legacy systems before adopting into new projects" "There is also an appearance of little appreciation of the process development time/resource on projects" "Project on time"	6
4	Break down barriers	Senior managers	"Improved working relationships between [UK plants] and product management"	1
		Managers	"Closer, easier, more frequent contact with end user" "Continue to work towards breaking down functional barriers" "Using departments correctly rather than another resource"*	3
		Associates	"Work more closely with [OpCo] Tokyo. They have significantly more R&D resource than we do."* "More cross-functional interaction on business excellence boards" "Focus on Voice of the Customer […] Interaction with customers via focus groups for new projects" "Obtain customer feedback quicker to help making improvements faster"* "Create links and working medical schools, nationally, to develop links with current and future users of devices"	8

No.	Theme(s)	Management level(s)	Relevant quote(s) as they appear	*f*
			"We are too quick to accept 'good enough' without understanding the full picture of the process and its long-term viability. A project-based production line architect is not defined and therefore the development is immediately siloed to engineers working on individual process IDs. Where is the coherence?"	
			"Improve communication/information flow within and between department (also customers)"*	
			"Departments communicating with the end user [and] more activities to break down cross-functional barriers"	
5	Pay and benefits	Managers Associates	"Employee benefit vs responsibility visibility"	1
			"Bonus scheme available to all employees, current system highly inequitable. Less/no weight on individual performance, this is already rewarded through PDR/annual pay rise."	
			"Flexitime"	
			"Flexible working hours for all non-production staff to improve equality [and] comparative wages with other engineering sites"	
			"There is no flexibility from company's side especially for people working on double-shift pattern"	
			"Increase wages for both permanent staff and agency staff"	10
			"Less agency workers, more payment"	
			"Flexible hours"	
			"More trips to [continental headquarter] for long-serving employees [and] a summer party for all employees – not just the chosen few"	
			"It would be nice to buy and sell holidays at salary sacrifice"	
			"Treat everyone the same, i.e. same rules for everyone, entitlements, sick pay same across the board"	
6	Temporary employees	Associates	"[…] members of staff who have been working for [OpCo] but are still with [recruitment agency name] after a two-year period should automatically be given a position or at least preferred candidate status"	
			"More opportunities for temporary staff to become permanent members of staff"	
			"Treat [OpCo] and [recruitment agency name] the same way"	
			"Stop the test for [recruitment agency name] and go more on merit"	
			"Contracts for all temp staff after an initial qualifying period"	11
			"Employ long-term agency staff before newcomers"	
			"Fairness in the way agency workers are considered for full-time employment"	
			"It will be more better to employ an experienced long-term worker […] than engaging new and inexperienced workers"	
			"Making temps permanent"	
			"Better chance of becoming employed by [OpCo]"	
			"Take more permanents on"	
7	Incentives and goal setting	Managers	"Shape the organisation to be in line with common goals"	
			"Have more wide-spread MBOs that are team-related […] If you have an objective and no one else has an interest / gain, it is hard to gain support, as other people are working on their 'own' objectives […] Do not score objectives against other peoples. If you are given objectives, they are standalone, and you should not be penalised just because someone else had a different objective / a 'harder' objective. Goals need to be SMART and fair."	3
			"Open and honest conversation and communication around MBO bonus and pay increases"*	
		Associates	"MBO projects to be rolled into day job and rewarded through PDR"	
			"An MBO system, which is fair for all colleagues. Every person in this company is important […] They should all be entitled to earn a bonus if they have achieved their annual goals."	5
			"Clarity regarding bonuses and how appraisal system affects the level of pay rise we receive"	
			"Improve the reward and recognition scheme"	
			"Review of 'reward and recognition' as it seems to cause more unhappiness than happiness in its current form"	

No.	Theme(s)	Management level(s)	Relevant quote(s) as they appear	*f*
8	Gemba and employee involvement	Managers	"Someone changing procedures 'making improvement' without the actual person effect on – is not get[ting] involved at all until the end"*	2
			"Refine CI philosophy to be more MTM-driven, i.e. bottom-up, not top-down"*	
		Associates	"Ask the staff more questions. Don't just listen to team leaders."	
			"Become better at listening"	
			"More input from shop-floor workers on new or improvements regarding their place of work"	
			"Listen more to team members when they have ideas, problems, etc. as sometimes it feels as if we don't matter and are an inconvenience"	6
			"More people in the organisation spending time in the manufacturing areas"	
			"Take into account team members' opinions"	
9	Communication	Managers	"Open and honest conversation and communication around MBO bonus and pay increases"*	
			"More open approach to why decisions are made to allow people to understand rather than be told"	
			"Continually improvement site communication"	4
			"Someone changing procedures 'making improvement' without the actual person effect on – is not get[ting] involved at all until the end"*	
		Associates	"Relevant communication to be improved between staff, management, technicians and engineers about products, changes to processes and also updates on orders"	
			"Communication needs to improve. This is still lacking in some areas."	3
			"Improve communication/information flow within and between department (also customers)"*	
10	Strategy and future of the business	Senior managers	"Future-led resource planning"*	
			"Future technologies to support business processes"	2
		Managers	"Front-load the development process with resource / effort, as part of a real shift towards long-term thinking instead of short-term thinking"*	
			"Investment in future manufacturing processes and techniques"	3
			"We need a 'voice' and firm direction when it comes to our strategy as a site in terms of new product development"	
		Associates	"Provide better visibility of the [local] strategy and future product/site roadmap. It never appears that we are planning for the next five to ten years. The [local] strategy always seems short-term. I'm sure this isn't true, but we don't often see future plans."	2
			"Discussion or understanding of [company name's] future plans around impact of changes in the medical and commercial landscape. What do [OpCo] consider the major future events to impact both us and our industry?"	
11	Environment	Associates	"Recycle more"	
			"Environmental impact of our single-use devices"	
			"Recycling more as we're way behind in that field"	5
			"Waste – plastic (recycle)"	
			"Reusable plastic packaging"	
12	Risk	Managers	"Phase gating – I've never seen a phase review get rejected despite also not seeing one that meets the criteria. The culture of accepting at risk needs to be evaluated"	1
		Associates	"An employee should have the opportunity to […] see […] the real effects of poor quality mean for the patient"*	2
			"Gates are there for a reason – not to go through when not ready. Doing so, only creates more issues and bottlenecks."	

Source: Author
Note(s): (*) A few quotes were allocated to more than one theme.

Appendix 13. Lowest scoring statements in Shingo Insight Assessment #2

No.	Dimension(s)	Principle(s)	Behavioural benchmark(s)	Statement(s)	Score(s)
1	Results	Create value for the customer	Relationships	My group actively creates opportunities for close employee-customer interaction	6.3
2	Cultural enablers	Lead with humility	Learning	My group learns from sources not directly related to us	6.6
3		Respect every individual	Fairness	My organisation distributes rewards based on effort and contributions made	6.3
4				My organisation distributes rewards following consistent and unbiased procedures	6.0
5			Support	My group invests time and energy developing other's potential	6.7
6				My group makes personal development a priority	6.2

Source: Adapted from OpCo (2019)

Appendix 14. Improving on cultural enablers

No.	Improvement activities	Status		Description(s)
		Live	*Momentum*	
1	ABC programme	Yes	Yes	In-depth skills and competency programme for process and quality engineers First phase on process design and validation training Second phase on skills/competency development via a mentoring programme
2	Continue with business excellence	Yes	Yes	In February 2019, next masterclass #5 Lots done but way more to do
3	Embedding corporate core values and ideal behaviours	Yes	Yes	Discussing the new corporate core values and behaviours with all employees has been deployed across all areas of the business
4	INFLUENCE programme for managers	Yes	Yes	Management development programme that has recently launched for 23 managers of the management community Helping managers to become more efficient and consistent with their management and leadership skills Doors will be open for other managers next year
5	New style communication (e.g., townhall)	Yes	Yes	Continue with newer, more open two-way style of communication
6	Feedback and coaching	Yes	In pockets	Develop coaching skills so that all levels of leaders and managers are more effective at coaching so that individuals/teams are empowered, and decisions are made at the "right" level of the business Some aspects of mentoring introduced as part of the INFLUENCE programme
7	Improving "our" recognition culture	Yes	In pockets	In the last masterclass, agreement to take the lead in encouraging a culture where everyone takes time to appreciate and say thanks for a job well done by colleagues
8	Ownership of training plans within departments	Yes	In pockets	Training requests via the annual performance development review process have not been robustly followed up in the past This year, new process in place where each manager works with human resources and their teams to develop and deliver appropriate in-year training
9	Create more varied work environments for office staff (e.g., quite zones, standing desks, breakout areas)	Yes	Moderate	Sometimes a project team needs a meeting room for days at a time and open-plan offices can be noisy environment to think and work in A mindful area, which can be booked for short periods is being set up next to the quality systems meeting room in the new building
10	New recognition system to replace existing one	Yes	No	A new recognition system being launched Originally, scheduled for November/December 2018

No.	Improvement activities	Status		Description(s)
		Live	*Momentum*	
				Instead of senior management deciding from a long list, the Our OpCo team will review all entries and then recommend the best ones to senior management for a final decision
11	Continuous improvement to be checked with regards to inclusion	In progress	Moderate	Ensure that all areas of the business create the space for everyone to be involved in continuous improvement Not yet clear how effective this is
12	Right people in the right roles (fit to person)	In progress	Moderate	Conduct a review and evaluate whether people are in the right roles Change their roles if needed
13	Subject matter experts, learning platforms (opportunities to learn and competency development)	In progress	Moderate	Develop processes, which enable staff to develop deep technical skills and expertise Increase effectiveness so that there is no need to rely as much on external experts Have clear competency pathways for employees
14	Wellbeing (salad bar, fitness programme)	In progress	Moderate	Improve the wellbeing programme to include healthy food and fitness opportunities Healthier options now in vending machines
15	Strong personal/career development plans at all levels and job grade	In progress	No	Ensure that there is visibility of career paths based on clear job grades and requirements Being launched in production (not yet clear elsewhere)
16	Better UK surgeon access	No	No	Helping R&D and product evaluation teams to better understand customer needs
17	Fairness and transparency of bonus scheme, flexible time, notice period and pay	No	No	Flexible time changes about to be announced
18	Industry ambassadors	No	No	Encourage more staff to be involved as “industry ambassadors” in local schools, colleges, etc.
19	Lunchbox talks	No	No	Create more opportunities for employees to present topics of interest
20	Secondment opportunities	No	No	Create “secondment” opportunities so that employees can “try out” a job before
21	Visibility of senior management	TBC	TBC	Senior management being more visible spending time with people across the business

Source: Adapted from OpCo (2019)

Appendix 15. Learning & Development milestones

No.	Focus area(s)	2017-18	2018-19	2019-20	2020-21
1	Leadership and development	100% leadership commitment to a company leadership academy programme	100% of operational managers to participate in a management development programme Deliver a sustainable management development programme for new managers and continuous development post programme	100% of team leaders to participate in a team leader development programme	Leading via coaching Internal network of coaching
2	Talent management	ABC competency framework Identification of business-critical roles and potential successors	Develop and agree a standardised competency framework template across all department Personal development plan in place and active/alive for all identified as high potential	All departments to have adopted a competency framework Succession pipeline identified and talent pool programme launch for all identified as high potential	Use information to inform workforce planning 100% retention of talent pool
3	Development and performance	100% employees to have annual performance development reviews All leaders to be provided with a training plan for their department Learning feedback	Identify strong subject matter experts in all key internal development areas A catalogue of central training opportunities is developed and communicated 100% of managers are trained in and understand the training process and the expectations of their role (pre- and post-training)	L&D is driven by business needs identified in competency framework gaps and via strategy deployment process Commitment to five days of learning per employee	Review PDSA of process Maintain and stabilise

Source: Adapted from OpCo (2018)

Appendix 16. New visual management audit procedure

No.	Assessment approach	Description(s) where necessary
1	Current approach of scoring boards will stop	
2	Revised approach will be an assessment by the line manager, at least quarterly	Ensure board has the core structure Ensure board has core content Key performance indicator review
3	Review will ask questions of the process owner and team members	Who are your customers? How do you know what they want? What are your targets to ensure your customers are being served? How well are you performing against these targets? What are you doing about any missed targets? Are any of these actions linked to people development? Are you doing any improvements activities? What have these improvement activities achieved? How do your targets and improvement activities link to the company purpose?
4	This will result in a discussion and an agreed conclusion of what is working well and what should be improved	
5	The next assessment can follow up of the progress of these improvements	

Source: Adapted from OpCo (2019)

Appendix 17. Townhall feedback

No.	Dimension(s)	Principle(s)	Behavioural benchmark(s)	Survey statement(s)	Proposed action(s) derived to counteract	Score(s)	
						SIA[a]	*Townhall*
1	Results	Create value for the customer	Relationships	My group actively creates opportunities for close employee-customer interaction	Improve/strengthen interaction with product management, surgeons, and sales teams	6.3	8.5
2	Cultural enablers	Lead with humility	Learning	My group learns from sources not directly related to us	Develop interdepartmental relationships for (a) learning and (b) building bridges	6.6	8.5
3		Respect every individual	Fairness	My organisation distributes rewards based on efforts and contribution mad	Develop a fairer company-wide R&R system	6.3	8.1
4				My organisation distributes rewards following consistent and unbiased procedures		6.0	–
5			Support	My group invests time and energy developing other's potential	Review of production targets and "people" resources to balance training vs efficiency	6.7	–
6				My group makes personal development a priority		6.2	–

Source: Adapted from OpCo (2019)
Note(s): (a) Shingo Insight Assessment #2

Appendix 18. Wider leadership group's key barriers and counteractions

No.	Key barrier(s)	Department(s)				Counteraction(s)	*f*[a]
		OPS	*RAQA*	*R&D*	*SGAE*[b]		
1	Understanding "why"	None	Buy-in More work with little obvious gain No personal benefit Our ambition Outside of comfort zone Past history Seen it all before	Apathy No belief Resistance to change	None	Common message to answer "why" Preach message Simplify language (cut buzzwords)	7
2	Strategy and plan	Clarity of what OPS will look like when we have achieved it Don't know what "best practice" looks like No roadmap for implementation Too conceptual to engage wider team	Non-value stream organisation makes it harder to implement	Approach strategy Detail Focus on what areas to achieve business excellence Strategy aligned with business, department, and team	Benchmarking (lack of something to compare to) What does excellence look like?	Develop a strategy and departmental vision in each functional area (including benefits and targets) Share long-term vision and strategy between departments Support each other within wider leadership group Understanding the long-term goal/vision for your area	3
3	Leadership and culture	Contradiction between hierarchy and empowerment Contradiction between senior management expectations and wider leadership group expectations Cultural foundations not in place Define culture of the business	Lack of acknowledgement from senior management when there is success	Leadership vs management Perceived lack of accountability Risk averse	Delegation (insufficient) Guidance/buy-in from senior manager	Business secondments to transfer business excellence Connect community to share business excellence material/good practice Willingness to commit	2

No.	Key barrier(s)	Department(s)				Counteraction(s)	*f*[a]
		OPS	*RAQA*	*R&D*	*SGAE*[b]		
4	Knowledge and sharing knowledge	Limited knowledge in some areas	Communication between and across groups Lack of knowledge	Knowing what we need to know Lack of knowledge/ understanding Sharing of learning	Inducting new team members Lack of change management capability Lack of knowledge and training	Benchmarking against best-in-class Buddy system (pair strong with weak) Plant "guidebook" Focused training programme Internal groups given exposure to systems (e.g., what does good look like in action?) Standard induction for new starters in business excellence Training in change management	1
5	Time and priorities	Balance between today's work and tomorrow's	None	Driving activity – not the day job External influences Priorities Time management Time to show results/benefits	Guidance (how can I do more?) Lack of resource (firefighting) Lack of time Not a priority, not urgent (day job takes over)	No solutions	1

Source: Adapted from OpCo (2019)

Note(s): (a) Votes according to wider leadership group member's priorities; (b) Environment, Health & Safety, and Facilities, Finance, Human Resources, and Information Technology