Enterprise-wide Diagnostic in the UK SME: Focus Beyond Tools and Techniques

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Abstract

The paper proposes a theoretical framework that integrates the harder aspects of enterprise-wide diagnostic methodology, i.e. tools and techniques, with softer issues to understand and analyse enterprise-wide issues in the UK manufacturing SME. Enterprise-wide diagnostics application that considers hard and soft practices for managing change in a SME context is less evident in the literature and practice. Case study was conducted in the selected SME and data triangulation was achieved through on-site observations, interviews, and company reports. The use of integrated framework, influenced by Watson (1994), led to identification of several gaps between the three levels- enterprise, business, and operations, that were impacting on demand management and capacity planning. The paper demonstrates the benefits of conducting enterprise-wide diagnostic as a first step to enhance better integration between organisational levels and departments when embarking on continuous improvement journey.

Keywords: SME, Enterprise-wide, Diagnostic, Case Study, Framework

1. Introduction

The enterprise-wide diagnostics, as the name suggest, goes beyond functional boundaries to help organisation to understand the dependencies, flow, and interactions between different parts of the enterprise including people, process, and technologies, and how making a change in one part affects other parts (Salama et al. 2009; Böhme et al. 2013; Gharajedaghi 2012). One of the key reason for failure in organisation to sustain improvement is lack of understanding of interactions at interfaces between employees working in different departments and how they affect each other's performance (Aronsson et al. 2011; Filho et al. 2016).

Literature has limited evidence on how any changes (e.g. to operations) can be combined with enterprise-wide diagnostic tools to identify gaps across the enterprise and processes linked to its supply chain (Gallear et al. 2014; Böhme et al. 2013, 2016; Kumar and Harris 2016; Filho et al. 2016). Enterprise-wide diagnostics tools can aid an organisation implementing specific change initiatives to identify gaps across the functional boundaries and provide better understanding on how constituent parts of the organisation interact and constrain one another (Salama et al. 2009).

Researchers have proposed a range of diagnostic tools to conduct a 'health check-up' of an enterprise's operations that have different characteristics, dimensions and components linked to its supply chain including suppliers and customers (Naim et al. 2002; Atilgan and McCullen 2011; Banomyong and Supatn 2011). This has facilitated in better understanding of current performances and gaps between constituent parts of the organisation and identifying constraints that affects organisation performance (see Table 1).

Compared to large businesses, introducing enterprise-wide change in a SME environment can prove challenging due to limited knowledge on where and how to start; and limited skill-sets and resources at their disposal to implement the change (Kumar et al. 2011;

McAdam et al. 2014; Michalakoudis et al. 2018). SMEs can realise greater benefits from the application of an enterprise-wide diagnostic tool, with minimal investment, to understand the current gaps across the organisation before embarking on any change or continuous improvement (CI) program (Kumar and Harris 2016). There is a need for a modified enterprise-wide diagnostic tool for SMEs that incorporates both hard and soft factors (Bortolotti et al. 2015) to effectively implement CI/change programs and also to incorporate the connections between different organisational levels - Enterprise, Business, and Operations (Watson 1994; Bellisario and Pavlov 2018). The majority of the diagnostic tools reported in the literature take a value steam focus, see Table 1, and fail to address the softer side of managing change in an organisation such as understanding the interactions and constraints between departments, employee engagement, skill development, and leadership issues for managing and sustaining change initiatives (Bellisario and Pavlov 2018; Hadid et al. 2016; Longoni and Cagliano 2015; Bortolotti et al. 2015).

The research adapts Watson's (1994) framework (see Figure 1 and Figure 2) for conducting enterprise-wide diagnostics in a manufacturing SME that produces functional products for healthcare facilities, pharmacies, and households to dispose wastes safely. The reason for adopting Watson's framework for this study is fourfold: 1) the framework goes beyond functional boundaries and attempt to integrate three levels of the organisation – enterprises, business, and operation (see Section 2.2 for more information), which is directly aligned to the focus of this study; 2) the framework can be applied to investigate implementation of any change program in an organisation and its supply chain; 3) it allows to identify gaps in the application of soft and hard practices between different organisational levels, the closing of which can lead to improved performance; and 4) the framework is simplistic and easy to implement in large or small organisation.

The findings reported in the paper reflects on the time period when the selected case company initiated an enterprise-wide improvement project with an objective of better integration of different departments that works towards the same organisational goals. After the failure of the first CI program, i.e. Lean, due to a disjointed approach and only having focus on achieving cost reduction, the company is attempting to erase that organisational memory by taking a joined-up approach using enterprise-wide diagnostic tool for ensuring success during the second round of Lean implementation. A case study-based approach is considered best fit to report changes observed in the company. The authors' role in the project was to provide research expertise to understand, analyse and propose improvement solutions that can help in embedding continuous improvement culture in the selected SME. The paper is not about understanding the Lean literature or its application in the SME context but to explore the application and benefits of conducting enterprise-wide diagnostics and understand the benefits of such tool in taking a joined-up approach to ensure success and sustainability of the CI program.

Rest of the paper is organised as follows: Section 2 provides an overview of literature related to change management and enterprise-wide diagnostic tools in SMEs context. The research method and conceptual framework are discussed in Section 3. Findings and discussion of the study is presented in Section 4. The paper concludes by highlighting contributions, findings and research directions in Section 5.

2. Background Research

SMEs play an important role in the success of supply chain functioning and performance as well as to the economic development and welfare of national economies (McAdam et al. 2014; Dora et al. 2016; Timans et al. 2016; Kumar et al. 2014, 2011). SMEs operating in the dynamic market environment, with depleted resources (human, technical and financial),

require support to develop high capability operations and processes (McAdam et al. 2014; Michalakoudis et al. 2018), to meet the changing expectations of their bigger counterparts. Limited empirical and longitudinal study focuses on managing change in SMEs environment when implementing CI initiatives such as Lean and Six Sigma (Dora et al. 2016). SMEs cannot take the risk of failure when embracing a new initiative as it may question their existence or survival in the market (Kumar et al. 2011; Timans et al. 2016).

The CI literature, focused on change management, highlights several enabling factors for creating a conducive organisational culture (Bortolotti et al. 2015; Hadid et al. 2016) to effectively manage change such as well-trained and prepared teams (Whitehead 2001; Garcia et al. 2014), committed and visible leadership and change agents (Bessant et al. 2001), clear communication (Oakland and Tanner 2007), employee empowerment (Ohno 1982; Liker and Meier 2006; Marin-Garcia and Bonavia 2015; Lam et al., 2015), cross-functional executive involvement (Longoni and Cagliano 2015), recognition and incentives systems (Kim et al. 2011), strategic alignment of company goals with operations key performance indicators (Nicolaides and Harding 2012; Gabcanova 2012; Bititci et al. 2015; Bellisario and Pavlov 2018). Many studies have strongly advised for the correlation between KPIs used at enterprise, business, and operations levels (Deming 1993; Neely et al. 2000; Oakland and Taner 2007; Bellisario and Pavlov 2018). However, there is still little discussion on development and alignment between KPIs used at different levels in an SME environment.

Another important aspect of managing and sustaining CI is engaging employees in an idea generation and implementation (Michalakoudis et al. 2018; De Jong and Den Hartog 2010; Lam et al. 2015). CI initiative encourages employees to participate in suggestion schemes as part of their daily work and take ownership of improvement in their local areas. Such an approach can make employees feel empowered and break down their resistance to embrace change and further trigger innovation at workplace (Janssen 2000; Srivastava et al.

2006; De Jong and Den Hartog 2010; Lam et al. 2015). Creating an environment where employees do not feel threatened and at risk, i.e. improving on psychological safety, when participating in change programs will help in enabling knowledge sharing and sustain benefits of CI (Edmondson 1999; Vallayudan et al. 2013). Employee's intrinsic motivation (Scott and Bruce 1994) to engage, communicate, and participate in change is a key enabler for the success of change management initiatives such as Lean (Cannon and Edmondson 2005; Tang et al. 2010; Kim et al. 2011).

Implementing programs like Lean and Six Sigma also requires a diagnostic test to assess the gaps and capabilities of a SME to ensure change is introduced smoothly and effectively to sustain it in the long–term (Bessant et al. 2001; Bateman 2005; Kumar et al. 2011). Supply chain diagnostic tools are well recognised in the literature as an important instrument to conduct enterprise-wide diagnostics to identify gaps, and understand interactions and constraints between constituents of organisation, where further recommendations are provided as a result of the analysis. The majority of literature on supply chain diagnostics, see Table 1, have primarily focused on a selected case organisation and have collated supply chain data by interviewing departments that interface with suppliers (e.g. purchasing function) and customers (sales function). Hence, it is logical to substitute supply chain diagnostics with another more appropriate keyword 'enterprise-wide' diagnostics. Authors will adhere to 'enterprise-wide' diagnostic terminology from hereon. The practical application of diagnostics includes a range of sectors: automotive, construction; food manufacturing; and public sector hospitals (Table 1).

A number of different tools have been developed using different concepts and scope (Table 1). The guidance of the uncertainty circle diagram is the focus of many applications, for example Quick Scan Audit Methodology (QSAM) (Naim et al. 2002; Childerhouse and Towill 2011; Böhme et al. 2013, 2016). QSAM (Naim et al. 2002) is an auditing tool that is

based on systems engineering concepts where primary data sources are collected for understanding four sources of uncertainty (supply side, demand side, process side and control side). The tool uses attitudinal and qualitative questionnaires, quick tour, process mapping, semi-structured interviews, cause-effect analysis and utilizes best practice.

[Table 1 near here]

Other tools focus on the specific function of an organisation or deploy a questionnaire as a main technique to understand challenges faced by particular industry (Foggin et al. 2004; Banomyong and Supatn 2011). It is questionable how enterprise-wide diagnostics can be conducted using only questionnaires across a number of companies. Such an approach may struggle to capture in-depth information on organisational culture, values, and mindsets of employees. The majority of diagnostics tools focuses on improving efficiency using tools and techniques from the operations and supply chain management tool box that may result in sub-optimal improvement. Any improvement is difficult to sustain without addressing softer issues including organisational culture elements, i.e. changing habits, attitudes, and motivation of employees (Bessant et al. 2001; Bortolotti et al. 2015; Lam et al. 2015).

Managing change as an outcome of enterprise-wide diagnostics is another important dimension of the diagnostics that has limited application in literature. For example, Atilgan and McCullen (2011) present a human-centred QSAM where they discuss the limitation of the standard QSAM – the study does not take into account potential resistance to change from an employee perspective. As a result, the adapted tool includes extended feedback stages and wider dissemination to allow consensus building and improve the response to change. The researchers present a case study in a UK food-manufacturing company, where the enterprise-wide audit is conducted to drive change and demonstrate a “listening ear” to employees.

2.1 Research Gap

In Table 1, selected publications on enterprise-wide diagnostics are classified based on overall focus on the following approaches: value stream, people focus and enterprise-wide focus. The scope of value stream papers (Naim et al. 2002; Böhme et al. 2016) include analyses of different organisational functions, where in some papers only primary activities were considered (e.g. operations, logistics, sales) and in others, supporting functions were also taken into account (e.g. procurement, HRM and infrastructure). The 'people focus' papers (Atilgan and McCullen 2011; Watson 1994; Kumar and Harris 2016) emphasise on managing cultural change in organisations including issues linked to communication between interfaces, employee empowerment through approaches such as suggestion schemes, and change in the mind-set of employees. The papers that incorporates enterprise-wide focus considers alignment and coordination between different organisational levels are limited (Salama et al. 2009; Kumar and Harris 2016).

Foggin et al. (2004) comment that the majority of diagnostic tools available for supply chain analysis are complex, quantitative, and time-consuming and can be seen as not suitable for SMEs. Existing enterprise-wide diagnostic tools have received criticism due to issues related to limited customisation to suit the SMEs requirement; data collection limitations; focus only on cost indicators; lack of balance between financial and non-financial performance; a lack of clear distinction between measures at the Enterprise, Business and Operations levels (Shepherd and Gunter 2006; Banomyong and Supatn 2011). Some of tools require extensive time to complete the diagnostic with high involvement of the researchers (SCOR, Innovative Performance Improvement), whereas other tools can be applied from 1-2 days to 20-40 person hours (SCPAT, Quick Scan, Performance Measurement Group)

(Banomyong and Supatn 2011). Due to resource constraint issues, SMEs cannot afford to spend significant time in conducting diagnostics with the research team.

The combination of harder and softer issues in managing change, and integration and coordination at Enterprise, Business and Operations levels are essential for achieving competitive advantage and managing sustainable growth in an organisation (Salama et al. 2009; Deming 1993; Watson 1994). As evident from Table 1, there is limited evidence of research using an integrated approach when conducting diagnostics in an organisation. Consequently, we present a modified auditing methodology, influenced by Watson's (1994) study, for implementing and managing change in a UK SME setting with a focus on value-stream, people, and enterprise. We now discuss the theoretical framework adopted for this study.

2.2 Theoretical Framework

The theoretical framework for this study is based on the Watson (1994) framework for overcoming organisational barriers (OOB) by following four pertinent steps - Understand, Document, Simplify, and Optimise (UDSO). The framework, see Figure 1, and it discusses the degree of integration and coordination between three levels: Enterprise, Business, and Operations, required for overcoming organisational barriers. The framework is aligned with principles of enterprise-wide diagnostics (Childerhouse et al., 2003; Salama 2009), where organisations need to understand the holistic view and interconnections between Enterprise, Business, and Operations activities for maximising the benefits to all stakeholders.

The rationale for adapting Watson's framework was discussed in introduction section and further strengths of this framework is discussed below. Several researchers (e.g.

Childerhouse et al., 2003; Mason-Jones et al., 1998) adopted this framework as it allowed organisations to conduct enterprise-wide analysis; facilitate visualisation of process that links enterprise, business, and operations levels; promote cross - fertilisation of ideas and concepts from different functional areas of the organisations; break down functional silos to ensure that an organisation is viewed as a sequence of integrated tasks. According to Watson (1994, pg.67), each work process is a *"kernel that may be used to grow the entire organisation as it is grafted onto other work processes to form business processes".* Integration between different functional areas and business levels is critical to deliver a common outcome for an enterprise. Therefore, in our research we address the gap in enterprise-wide diagnostic SMEs literature where we establish the interconnectedness between different levels through value stream, human factors and enterprise wide focus.

At the Enterprise level, senior management's focus is on investment that maximises the return on the total business and enhances value for the shareholder. This is accomplished by developing a strategic plan and goals to deliver enterprise-wide objectives. These goals and objectives are cascaded to Business level by taking into account several factors including resource availability, market environment, products and services offering, and managing relationships with stakeholders. The Business level leaders communicate business objectives and goals to individuals and teams at the Operations level and negotiate targets to facilitate achieving Enterprise level objectives. At the Operations level, the agreed targets are then included within both individual and team performance objectives. The review and appraisal activities by senior management help to address the issue of skill shortages and recognise individuals for their performance based on their contributions in achieving the enterprise-wide objectives.

[Figure 1 near here]

The overcoming organisational barrier framework integrates the four-step process improvement model – Understand, Document, Simplify, and Optimize (UDSO), to discuss mismatches and gaps between Enterprise, Business, and Operations levels and suggest recommendations for gap closures. The modified framework adapted for this research is presented in Figure 2. The framework is used to discuss the degree of misalignment between the aforementioned levels and its impact on managing change in an organisation. The UDSO model is similar to the Plan Do Check Act (PDCA) cycle of the Total Quality Management (TQM) initiative proposed by Deming (Deming 1993). The understand and document stage focus on the need for change, strategic vision and goals of enterprises, involving employees in the change process to eliminate fear of change, and documenting the work processes to clearly identify the roles, responsibilities and way of working. The last two stages of the UDSO model, Simplify and Optimize, encapsulate tools and techniques for process improvement that can minimize waste and variations within the work processes. Examples of tools and techniques used in these two phases include a Cause & Effect diagram, Pareto, Control Charts, Regressions Analysis, and Design of Experiments. Researchers have contended the benefits of using UDSO framework as it provides a structured collection of steps for conducting enterprise-wide diagnostics, thereby simultaneously maximising customer value and enterprise-wide performance (Childerhouse and Towill 2003; Atilgan and McCullen 2011).

[Figure 2 near here]

3. Research Methodology

A case study-based approach was adopted for this research to explain 'why' and 'how' (Eisenhardt 1989; Yin 2011) the selected case company, classified as SME, embraced an

enterprise-wide diagnostics methodology for understanding and addressing gaps in their operations and supply chain practices. The case study approach allowed authors to conduct study in a single natural setting that facilitated in considering temporal and contextual aspects affecting performance of the selected SME (Meridth 1998; Barratt et al. 2011). Another benefit of using case study approach is to conduct in depth investigation of the contemporary phenomenon without experimental controls and manipulations and using mixed methods approach to data collection including series of semi-structured interviews, observations, and company reports (Ketokivi and Choi 2014; Meredith 1998).

The selected SME manufactures functional/basic product for primary and secondary healthcare facilities, pharmacies and households in the UK and abroad for safely disposing wastes generated in the healthcare facilities. The products manufactured by the case company is not associated with any medical interventions with the patients. The products are only used to safely dispose different forms of wastes generated through healthcare interventions. The company's market share and demand for its products had been increasing on a yearly basis. However, the growth trajectory was difficult to sustain with its existing operations and supply chain practices. The company had a relatively long and successful record that was achieved by ad hoc problem solving and an intuitive production management style. Despite recent investment in an enterprise resource planning (ERP) system for demand management and capacity planning, the company still struggled to manage its high inventory level. The complexities and variation in managing demand of an international supply chain had resulted in an inefficient procurement of raw materials and packaging items.

The research presented in the paper is based on a conducting single case study in the selected SME with an objective to provide recommendations for improving competitiveness through engagement with the academic community. The project was initiated as a result of the company's unsuccessful previous attempt to optimise their processes through Lean

implementation, which failed due to a 'silo attitude', lack of engagement at all levels in the company, and too much focus on improving efficiency, cost reduction and maintaining service level in response to an increase in sales. The initiative led by consultant had a short-term focus of quick gains through Lean intervention. This resulted in a disjointed effort and created confusion between different levels of the company. Those activities also left a 'bad memory' and negative connotations of Lean among employees. Therefore, to erase the 'bad memory' of employees from the previous Lean intervention, this project proposed an integrated framework to facilitate better understanding of gaps between different levels of the company. The project focus was to understand enterprise-wide issues and how the softer factors influence managing change between three levels of the company- Enterprise, Business, and Operations. Thus, entire organisation is the unit of analysis for this study as it facilitates in understanding gaps between three levels.

The project aimed to improve workforce engagement during CI project implementation and enable the release of resources within the existing process areas for reallocation to support future improvement projects, thereby retaining a manufacturing base in the UK. The company also wanted to maintain SME status to have access to government grants and funding.

The case study approach enabled the authors to gather rich qualitative insights through a combination of different methods (Barratt et al. 2011; Yin, 2011), as seen in Tables 2 and 3. Researchers spent considerable time in the case organisation to acquire necessary information by interacting with employees, conducting observations on-site, and implementing improvement solutions with management support. Employees were better prepared psychologically to implement improvements, as they were involved and consulted during the intervention stage and in some cases were involved in identifying the needs for change.

A mixed method data collection approach was used (see Tables 2 and 3), including semi-structured interviews, observations on site and during tier meetings (see Table 3), and company reports, to improve the reliability and validity of data collected (Yin 2011). The data collection included interviews in groups of 3-4 (research team and participants), observing the company's processes and teams' dynamics at different levels including culture, leadership and managements' behaviour, team roles, problem solving approaches, decision making, intra- and inter- organisational relationships.

[Table 2 near here]

[Table 3 near here]

Sixteen semi-structured interviewees were conducted across Enterprise, Business and Operations levels, see Table 2, with interviews lasting from forty-five minutes to ninety minutes. The interview also focused on the degree of integration of each department with other functions, e.g. maintenance, production and quality, etc. Data collection was an iterative process; conduct a few interviews at each level (e.g. 3-4 interviews), transcribe, analyse, and reflect on the data, and then decide on an interviewees list based on missing data to join and complete the jig-saw puzzle. There was always 1-2 weeks gap between each set of interviews to embed the reflection process by the research team. The data analysis was done in collaboration with the management and it allowed identification of the suitable strategies that will be possible to implement through suggested actions.

Interviews were tape-recorded, transcribed, and later coded for conducting qualitative data analysis. Authors developed thematic codes using data reduction techniques proposed by Miles and Huberman (1994) and three phases of conducting qualitative data analysis-description, analysis, and interpretation, proposed by Wolcott (2009). The application of

thematic analysis helped in developing the pattern of the information emerging from the transcription process. Figure 5 was created based on observations on the shop-floor, whereas analysis of interview data helped in creating Figures 4,6,7,8 and Table 5. Tables 4, 6, and 7 were created by combining the data from interviews with field notes during observation on-site.

A constant monitoring and reflection on data collected from interviews was conducted before suggesting any actions and recommendations in the Simplify and Optimize stages to implement improvement plans. The reliability and validity of data was ensured by collecting data in different stages, reflect on the findings, further collecting missing data, recommend improvement solutions and actions plans , get feedback on proposed action plans, and again continue this iterative cycle till all the gaps identified in Understand and Document phases are addressed in the next two phases of the project. The findings presented in this paper reflects on the iterative process followed during six months of project with the selected SME.

[Figure 3 near here]

4. Analysis

The findings are presented using the proposed framework, see Figure 2, and divided into two parts: Understand and Document stage presents the mismatches and gaps between Enterprise, Business, and Operations levels; Simplify and Optimize stage proposes solutions to address the aforementioned gaps across three levels. The findings reported in the first two phases of the framework is based on interviews and observations, see Table 2 and 3, conducted over first three months of the project.

4.1 Understand – Document

4.1.1 Mismatch and gaps between Enterprise and Business levels

The company faced significant capacity challenges due to increase in demand and product portfolios. They were keen to maintain SME status (*current head count- 245*) and stay at the same location, which was only possible if they increased their existing capacity through streamlining their operations. The increasing demand and inefficient operational practices led the company to embark on the second innings of Lean journey to minimize waste, reduce uncertainty in demand, manage process variation, and inventory. The change was led by Lean Champion with the support of the senior management team.

Similar to last failed attempt of implementation, no clear values, mission and vision statements, and corporate strategy were developed and communicated in collaboration with employees at Operations level to explain the rationale for implementation during its second attempt. Less focus was given on employee training, development and involvement during initial intervention. There was no visibility of senior management at shop-floor level to demonstrate leadership and commitment towards Lean implementation and break down the resistance to change witnessed at operations level. Instead of leading by example, Lean implementation ownership was passed on to Lean Champion. The enterprise-wide diagnostics project was kicked-off at the same time to support company during implementation phase of Lean and facilitate culture change in the company to sustain continuous improvement. The use of integrated framework, see Figure 2, allowed the research team to take an enterprise-wide perspective for understanding gaps across the enterprise and propose solutions that optimise the entire organisation.

There was a misalignment between KPIs used at Enterprise, Business, and Operations levels in the organisation, see Table 4. The KPIs at the Operations level only focused on the production hit rate, defect and scrap data. There was no clear link between operations KPIs and Business / Enterprise KPIs and vice versa. For example, the KPIs presented in Table 4

are all efficiency related KPIs. There is no mention of effectiveness related KPIs, such as customer satisfaction, employee satisfaction, customer, and supplier engagement. The following quote from Production Scheduler reflects on the lack of enterprise-wide focus by senior management team: *"there was no change in KPIs used at three levels when implementing Lean for the second time….still the focus was on meeting the targets….KPIs linked to improving employees engagement and communication between different levels would have helped senior management to better manage the change process."*

[Table 4 near here]

Different strategies were used to manage demand for the UK and International customer bases. Compared to UK customers, there were limited interaction and communication exchanges with international customers who often ordered products that can be classed as 'strangers' with significant demand variability. The demand variability was higher for the stranger (Product A) compared to repeaters (Product B) and runners (Product C) product categories, see Figure 4. Demand for Product A was mostly from International customers, whereas Product B and C were request from several UK customers. This is further verified by statistical analysis using coefficient of variation (CV) data to analyse variability for Product A, B, and C across inventory, production, dispatches, and demand data. Table 5 clearly shows that there is very high variability across different stranger type's product categories (i.e. Product A). This causes issues in production scheduling and inventory management, which could be better managed by working closely with key international customers and suppliers of raw materials. Following quote from the Purchasing Manager adheres to issue mentioned above: "*supply issues can arise, such as problems at Christmas can occur when suppliers slow down their operations, we almost ran out of product X in most recent Christmas period due to inability of suppliers to respond to demand."* In another

example, one particular international customer, who is a distributor and contributes to over 30% of export sales, was responsible for causing high demand fluctuation. There is a need to work with that customer to reduce variability in demand and understand why the order pattern is variable.

[Figure 4 near here]

[Table 5 near here]

The company had an option of negotiating the quantity of raw material delivered by suppliers on a weekly basis. Suppliers were making fixed weekly delivery but supplying two weeks raw materials, which was unnecessarily building raw material inventory and occupying the working capital of the company. The predicted future demand for their product families seems to increase exponentially, but the company has failed to reflect on their existing IT capabilities that can drive the business to meet future demands. The minimal use of current IT infrastructure (e.g. ERP, production scheduling, inventory analysis) does not help the operations to react quickly to rising demand. Therefore, the company would struggle to take informed decisions with manual approaches to planning. The current IT infrastructure should be able to support the strategic goals of increasing sales revenue and market share. In terms of other assets, the company needs to replace some of the older, less efficient machinery with new to increase capacity utilisation and meet future demands.

4.1.2 Mismatch and gaps between Business and Operations levels

The production scheduling (PS) depends on one person, the production scheduler, who developed a manual heuristic to manage daily production, see Figure 5. The required data for the heuristic is pulled out from the ERP system and scheduling done on a daily basis. The company faces several production challenges when the production scheduler is on leave. The

statement from the Production Manager summarises the way scheduling is managed by the company: *" we rely on production scheduler for scheduling daily production, which happens in his head….all algorithm is in his head…so it becomes a challenge when he is away on holiday… we have to sometimes call him during the holiday period to manage the scheduling of production."* The heuristic used is not documented for others to take scheduling decisions. Once the production schedule is created and displayed using T-Card (manual Kanban system), the scheduler assistant creates work orders and passes on the information to the loader for final finished goods (FG) check. Manual checks and entry by the loader creates a twenty-four hours time lag to update FG data that increases the chance of errors in the production schedule, requires further inspection and data collection, and there is also a question of data duplication and integrity. All this results in less visibility of finished goods inventory and a need to manage customer demand more effectively.

[Figure 5 near here]

Customized in-mould labelling of the product for each export country further created complexity in the scheduling and production process. Fifteen to twenty thousand labels are wasted every year due to year printed on the labels. Improving the labelling process could resolve many production and scheduling issues in the company, enabling better management of demand fluctuation.

The purchasing manager also had no visibility of sales data due to limited knowledge on using the ERP system. The company also invested in advanced production scheduling (APS) system for capacity planning but resorted to manual scheduling due to difficulty in using the APS system. There was also a lack of communication and meetings between the production scheduler, sales team, and finance controller to have better visibility and

management of the raw material inventory. Limited use of trend or run charts resulted in a lack of understanding of what was causing variation in demand. It was also identified through interview that majority of variation in orders was caused by one of the key customers, who was also the distributor for the company products in Europe.

The quality assurance (QA) department in the company has limited responsibility or accountability in managing product quality. Ideally, QA team should take ownership of defects and scrap data and managing customer complaints. Currently, scrap data is recorded in the scrap database that is mostly accessed and analysed by production team instead of QA team. Even the learning from analysis of scrap result is not shared between production and QA team. The QA team were also not involved in leading any Lean projects.

The QA team involvement and participation in Tier 2 meetings (i.e. meeting every morning at middle management level) was also minimal. Despite having 0% defects identified during destructive testing of products by the QA team over the last several months, the team still collects one sample every hour from more than 30 machines operating over three shifts of the day. This led to creation of scrap material, additional cost and ineffective usage of QA time. There is a significant cost associated with non-value added activities conducted by the QA team. Table 6 presents the cost associated with three main activities conducted by the QA team: inspecting and collecting samples from each machine, standard testing, and destructive testing of samples collected from machines. In addition, table 6 also provide information on extra cost incurred by the company to sub-contract recycling of the scrap material to re-use in further production. A significant proportion of this cost could have been avoided if the QA team reduced the sampling frequency, given the defect rate is 0% over several months. The percentage of scrap generated by destructive testing of products to other scrap categories over a fourteen-month period is higher, as presented in Figure 6. Pareto

chart for two product families from the same family in the runner category clearly shows that QA test is the main reason for scrap generation.

[Table 6 near here]

[Figure 6 near here]

There was also misalignment of KPIs used at Business and Operations level, as previously presented in Table 4. There is a need for more meaningful and visual KPIs that could be used and recorded by operators/ cell-leader on an hourly or shift basis, e.g. scrap & their types, types of defects, production hit rate, up-time/down-time, to name a few metrics. The business level KPIs that are discussed every morning in Tier 2 meetings are not mapped to Tier 1 level KPIs. Even the decisions relating to KPIs at the Business level are not clearly communicated to operators. For example, the Mechanical Engineer commented: "*There are no KPIs presently used and the data is verbally communicated in Tier 2/3 meetings….we don't have any idea on how top-level KPIs are aligned with department KPIs."*

A suggestions scheme (SS) was implemented in the company (at the start of this project) to involve and motivate all employees to propose improvement ideas at the work place. Operators and cell leaders contributed majority of suggestions (72%) followed by engineering team (11%). However, managing suggestions at management level was time consuming and required extensive resources (five people reviewing and final decision taken by Production Manager). In the long-run, this is not an effective way of managing suggestions. The engineering department manages the maintenance of machines on a reactive basis. There is no concept of preventive or planned maintenance conducted together by the operators and maintenance team on a daily or weekly basis and as part of the production schedule. The Maintenance Engineer reported that "*the maintenance is not scheduled as such…when tools need maintenance they are identified….tools are serviced when capacity*

constraints allow. This approach means that tools are often serviced when machines are down and the tool room is notified beforehand that's the machine won't be running, then the tool then taken out and serviced."

4.1.3 Mismatch and gaps between Enterprise and Operations levels

There is no formalised mechanism such as appraisal system, skills matrix, and continuous professional development (CPD) course offerings, for identifying the skills-gap at an individual level. Following statement from the Quality Manager reflects on lack of structured approach for developing skill-sets of operators to manage quality at source: *"Training needs are identified by department head and QC does not have any involvement…Type of training required by operator is based on gut feeling of department head… No clear or planned set of training."* The training needs of an individual are left to the discretion of line managers with minimal HR involvement. In addition, there are also limited CPD development opportunities for middle managers.

The enterprise level KPIs are decided at boardroom level and operations are only given targets to achieve those KPIs, see Table 4. None of the enterprise level KPIs focused on the softer issues, such as employee satisfaction, developing skills matrix for individual and team at operations level. Senior management team did not promote public recognition of employees contributing to the suggestion scheme. Activities that can lead to CI team building, such as recognising best CI project, best suggestion, quality day celebration, employee of the month, were non-existent in the company.

The summary of key findings from the 'Understand and Document' stage is presented in Figure 7. The key reasons for misalignment between Enterprise, Business, and Operations were grouped under People, Strategy, Measurement, and Methods categories.

[Figure 7 near here]

4.2 Simplify - Optimize

As a result of the gaps identified from the supply chain audit, future state recommendations were compiled and presented to the senior management team, in addition to the written report. It is important to note that during the data collection phase, authors proposed a number of recommendations and employees implemented some of those before the final report was presented to the senior management team. The implementation of suggested actions helped in improving engagement between employees at different levels and facilitated change in mind-set and receptiveness towards CI (Janssen 2000; De Jong and Den Hartog 2010; Lam et al., 2015). The "Simplify-Optimize" stage of the methodology presented in Tables 7, links the current state issues with future state recommendations and action plan. In this section, we discuss key recommendations at three levels, see Table 7, to minimize the gaps between levels.

[Table 7 near here]

4.2.1 Address gaps between Enterprise and Business levels

At the enterprise level, the company had no published values, vision, and mission statement, and lacked clear strategy linked to their long-term growth and improved market share. An ad hoc approach was used to acquire new customers, new marketplace and acquire more business. The increase in orders and demands were met using make to stock (MTS) strategy, resulting in high level of inventory cost. The MTS strategy questions the sustainability of this approach and whether the company has the required infrastructure and in-house capability to meet increasing demand and still maintain low operations cost (Watson 1994; Bessant et al. 2001; Bateman 2005).

The senior management team was asked to develop vision and mission statements through engagement with other levels and ensure that top-level strategy and goals are aligned with KPIs used at other two levels (Neely et al. 2000; Nicolaides and Harding 2012). This is one way to ensure KPIs at each level are aligned with other level. It was also emphasised that short-term gains should not become a priority to jeopardise long-term improvement plans and sustaining improvements in the company (Bateman 2005; Piercy and Rich 2015; Filho et al. 2016). For example, Lean was introduced with the purpose of reducing operational cost and had limited focus on change management aspect, such as improving employee motivation and engagement. The literature strongly supports the importance of employee engagement and participation to enable CI success in organisation (Tang et al. 2010; Kumar et al. 2014; Bortolotti et al. 2015; Marin-Garcia and Bonavia 2015; Hadid et al. 2016; Longoni and Cagliano 2015).

There is a need to review the KPI system used in the company, see Table 4 in Section 5.1, and ensure alignment between different levels. A balance between efficiency and effectiveness related KPIs is required for organisations to thrive in the market place (Hines et al. 2004; Bititci et al. 2015; Gabcanova 2012). A suggestion was given to include KPIs, such as customer satisfaction score, employee satisfaction, suggestion scheme, supplier evaluation criteria, and number of CI projects including cross-functional team (CFT). Measures at each level should combine both financial and non-financial aspects because non-financial elements, such as customer satisfaction, have more long-term effect on profit and productivity (Gabcanova 2012).

In relation to misalignment between customer demand and production, suggestions included monthly analysis of the demand, production, inventory and dispatch data per product line to understand variations in demand and its root-causes. Some product lines exhibiting higher degree of variability, see table 5, were linked to specific types of customers

(national/international). The case company was suggested to work closely with the distributor in Europe to manage the variation in demand. The company initiated contact with a major international customer that exhibited high degree of demand variability. This customer agreed to share their forecasting data with the company in order to minimize variation in their ordering pattern. The close interaction with customer and probing of customer's forecast data, as discussed in Section 4, on a regular basis helped to reduce variation in orders and demand patterns from this International customer.

At the start of the project, tier meetings were introduced to improve communication between senior and middle management teams. The authors observed the proceedings of current tier meetings (refer to Table 3 in Section 3) to suggest improvements and effectiveness of those meetings and bridge the communication gaps between three levels. The current practice was to host monthly meetings at management level in the boardroom to discuss company performance and weekly meetings at production level to discuss their performance with respect to demand, productivity, and scrap data. There were no meetings conducted to improve communication at shop-floor level. Tier 1 meetings between cell leader and operators were introduced to update the team about work orders and expected production in the shift, last shift productivity figures, any maintenance issues related to the machines in the cell, and sharing mistakes and best practices. Such meetings at employee levels can help to get situation-specific feedbacks related to mistakes and best practices when interacting with their cell-leader and co-workers (Cannon and Edmondson 2005; De Jong and Den Hartog 2007; Lam et al., 2015). Tier 2 meetings involved cross-functional team (CFT) of middle managers and line supervisors to discuss previous day issues and action plan to address those issues. Introduction of CFT helped to improve communication between departments, also supported by literature (Longoni and Cagliano 2015). The literature indicates that organisations that had limited success in institutionalizing CI knowledge across

all levels have struggled to sustain CI benefits in the long run (Bateman 2005; Piercy and Rich 2015; Filho et al. 2016). The evidence suggests a mechanistic approach to process improvement and low emphasis on knowledge sharing between departments, and between teams within a department.

The identified issues and action plan were communicated to the shop floor through Tier 1 meetings, actions were taken and learning was shared between cell members and any feedback from the shop floor was discussed in Tier 2 meetings. Similarly, Tier 2 attendees made sure that any improvement actions and rationale were explained to the shop floor team. Members of Tier 2 shared information with the senior management team in Tier 3 weekly meetings on some of the improvement actions and updated on weekly performance data, customer orders, inventory, sales figures, to name a few items discussed during Tier 3 meetings. It is important to highlight that the location for Tier 3 meetings was moved from boardroom to manufacturing facility to improve the visibility and commitment of the senior management team towards CI (Bessant et al. 2001; Kumar et al., 2014).

4.2.2 Address gaps between Business and Operations levels

The authors worked with the production scheduler (PS) to document the manual algorithm used for production scheduling in the form of a flow chart to be used by others in the absence of PS. However, this does not address the key issue of not using the existing APS system that was originally installed for capacity planning. The authors interviewed CFT to understand the reasons for the failure of the APS system in the past. The recommendation was given to revisit the APS system and treat it as a separate IT project. A hybrid approach to production scheduling, including visual boards and APS system combined with education and training on using those system, would improve understanding of what is expected from the employees (Garcia et al. 2014; Marin-Garcia and Bonavia 2015).

One of the key reasons for complexity related to product customization is in-mould labels that are different for each country. These labels were moulded into the product as part of the production process. Labels were also identified as one of the key reasons for scrap, see Figure 5. The authors proposed to consider the idea of a postponement strategy either at the end of production or at the customer end (Naylor et al. 1999). Suggestions were also given to explore the latest labelling technologies and conduct a cost-benefit analysis, e.g. if there is a possibility for common labels for neighbouring countries (one label incorporates 3 languages), dividing the labels into two parts: one is generic and other country specific. The generic part could stick to the product during moulding process and specific part of the label can stick at the end of the production process.

QA department was identified as a bottleneck operation in terms of both scrap generation and lack of ownership towards CI, see Table 6 and Figure 5. Currently, majority of the QA team time was spent on destructive testing. Authors' suggestions related to a proactive QA role, rather than following traditional role of doing inspection and testing, are as follows: review sampling strategy to reduce the scrap generation without compromising on quality and safety; taking ownership of scrap data; and more active engagement in Lean implementation. The QA team worked with the production team to review the sampling strategy and agreed to reduce the samples collected for destructive testing to 50%. The data collected after implementing the new sampling strategy showed no compromise on quality and safety fronts.

The recording of suggestion schemes was onerous, time consuming, and resource intensive. There is a need for modification related to recording suggestions to include information about the target date for suggestion implementation and when actual implementation was done. In addition, a new method for managing suggestion scheme was proposed, see Figure 8.

[Figure 8 near here]

Instead of all suggestions being managed by production manager and five team members, the new method requires employees to seek feedback from their line manager/cell leader first before submitting the suggestion for further consideration (Ohno 1982). This will help in improving communication between operators and line manager, which further leads to improvement in the quality of suggestion (Cannon and Edmondson 2005; De Jong and Den Hartog 2007). Engaging employees in idea generation and implementation through suggestion scheme is critical for creating innovative work behaviour (Janssen 2000; Srivastava et al. 2006; Marin-Garcia and Bonavia 2015). It would be beneficial if employees and management can track and review the status of the proposed suggestion in real time. It is also important to have a clear understanding of the suggestion selection process. Community recognition and socially celebrating employee's awards can also bring further benefits that go beyond financial reward. The literature also identifies the importance of recognition by senior management to drive intrinsic motivation in employees and promote innovation at the work place (Scott and Bruce 1994; De Jong and Den Hartog 2010).

4.2.3 Address gaps between Enterprise and Operations levels

One of the key elements in the success of any change management initiative is the integration of top down strategy with bottom-up approach (Bellisario and Pavlov 2018; Oakland and Taner 2007; Filho et al. 2016). Initially, when the company implemented Lean, senior management provided resources for the middle level management but had limited interaction with the shop-floor in understanding their needs and requirements to meet production target and company goals. As discussed previously, there is no formalised training program to identify skill gaps and provide required training to employees. The recommendation was to

develop a skill-matrix for each employee (Ohno 1982; Liker and Meier 2006; Michalakoudis et al. 2018), through co-ordination between operations and HR, will help to identify the skill-shortage to be addressed in order to achieve Business or Enterprise level KPIs.

As discussed in the previous sub-section, it is important for the management to publicly recognise the contribution of employees, either financially or through other methods, to sustain CI culture and drive innovation in organisations (Bessant et al. 2001; Kim et al. 2011; Marin-Garcia and Bonavia, 2015). The recommendations were given to introduce recognition methods (such as employee of the month, best suggestion, and best 5S) and communication methods (such as visual boards, intra company newsletter, and quality month celebration) that are critical for sustaining the culture of CI (Bateman 2005; Kim et al. 2011).

5. Conclusion

This paper makes threefold contribution to the operations management body of knowledge: i) the integrated framework contributes to the enterprise-wide diagnostics literature by combining value stream, people focus, and enterprise-wide focus in a unified framework; this helps to establish the interconnectedness between different levels when conducting enterprise-wide diagnostic - an element that is ignored in the enterprise-wide diagnostic literature in SMEs; ii) the paper contribute in relation to the importance of soft factors (e.g. communication, training, employee engagement) in managing enterprise-wide change iii) majority of the operations management (OM) publications are dominated by cross-sectional case studies and survey approaches; methodologically, this applied research adopts a case study approach over longer durations that facilitated in getting in depth insights on gaps between three levels and develop an action plan to minimise those gaps. Our paper attempts to contribute to the practical concerns of an organisation and to the goals of the science

(Gummesson 2000). The study contributes to the body of knowledge in the field enterprise-wide diagnostic for SMEs that is still a developing area of research.

The findings would benefit SMEs in avoiding the pitfalls, discussed in this study, when embarking on a CI initiative. Compromising on softer issues, such as employee engagement, and education and training, over financial metrics can have a negative impact on employee morale and sustainability of the proposed change. Irrespective of the size of organisation, an enterprise-wide diagnostic could prove beneficial for many organisations that are thinking to implement, or are in the early stages of CI implementation, as it will facilitate cross-functional team of executives collaborating together for problem solving and devising solutions that focuses on enterprise-wide optimisation rather than sub-unit optimisation. Forming a cross-functional team when conducting diagnostic can help in breaking functional silos, improving communication and problem solving capability, stimulating buy-in from the employees and thereby resulting in more effective change implementation. The following statement from Jackson highlight the issue when taking a 'functional-project based' approach during CI intervention: *"Optimising the performance of just one sub system risk the danger of sub optimisation of system as a whole"* (Jackson 2009, 195).

The authors have identified that the majority of issues related to an inefficient way of demand management and capacity planning could be attributed to minimal communication between functional teams, including scheduler, purchasing, finance controllers, and quality. Limited knowledge on using existing IT infrastructure (i.e. APS) created further issues in effectively managing capacity. More active participation from QA and maintenance would improve productivity and, more importantly, communication with shop-floor teams for managing defects, scraps and lost hours due to machine breakdown. The new method for managing the suggestions scheme frees up valuable time for the production manager and five

team members to focus on other important activities in the business. It also helps in breaking down communication barriers between operators and middle management. All these steps help senior management in the company to embrace bottom-up approach along with top-down approach for sustaining CI culture.

Managers in the SME environment can benefit greatly from taking an enterprise-wide perspective to identify gaps in their current operations by conducting enterprise-wide diagnostics using the proposed framework. This allows them to have a birds' eye view of interactions (or lack of it) and constraints between constituents which encourages them to integrate tools and techniques with softer dimensions when implementing a CI initiative. Diagnostics provide an excellent platform to prepare for smoother implementation of CI initiatives, such as Lean, as it addresses the softer aspects of change management.

However, to test the robustness of the framework and extend the generalisability of the findings to wider population, future research would involve testing the framework in different types and size of organisations. Especially, in the cases of small firms with less than 50 employees, the feasibility of conducting enterprise-wide diagnostics in a shorter duration of less than a week would be key to encouraging them to embrace such an approach. Future research would focus on customising the framework by embedding the resource constraints issues faced by smaller firms.

The company was still implementing some of the suggestions proposed by the authors as part of the diagnostics. It will be interesting to re-visit the case company in twelve months, after the initial diagnostic, to monitor their progress against the recommendation. An in-depth study was undertaken in a manufacturing SME environment. Testing its applicability in other manufacturing sectors and service SMEs would further benefit in the improvement of the framework.

Acknowledgement

The authors would like to express their gratitude to Sam S. for his support in relation to this research.

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Table 1. Supply chain diagnostic tools and their scope.

Reference	Diagnostics tool	Sector & Company Size	Scope of the diagnostics		
			Value Stream	People Focus	Enterprise-wide Focus
Watson (1994)	UDSO method	-	-	✓	✓
Barker et al. (2000)	Terrain scanning methodology	House building supply chain	✓	-	-
Naim et al. (2002)	Quick Scan	20 European Automotive supply chains	✓	-	-
Foggin et al. (2004)	Supply chain diagnostic tool	3PL	✓	-	-
Chan and Qi (2003)	Performance Measurement Method	Proposed new algorithm with illustrative example	✓	-	-
Fahmy Salama et al. (2009)	Audit methodology	Three EU initiatives (Household-appliances; Textiles; Food)	✓	-	✓
Atilgan and McCullen (2011)	QSAM (human-centred QS)	UK food-manufacturing; Medium-sized	✓	✓	-
Banomyong and Supatn (2011)	Supply chain performance assessment tool	43 SMEs (Thailand)	✓	-	-
Böhme et al. (2014)	QSAM	8 public sector hospitals (Australia)	✓	-	-
Current paper	Enterprise-wide Diagnostic Tool	SME manufacturer	✓	✓	✓

Table 2. Interviewees details and scope of interview.

Levels	Interviewee's Role	Scope of interview
Enterprise	Managing Director	Strategy; Mission; Vision; Values; Structure; Objectives
	Production Manager	Strategy; Vision; KPIs; Tier meetings; Suggestion schemes; Automation; Communication b/w levels; Line balancing; Visual Boards
	Research & Development Manager	Lean deployment; Strategy; Vision; Training; New product development (NPD); KPIs; Demand and supply uncertainties
	Purchasing Manager	Raw material procurement; Managing suppliers performance; Communication; ERP system
	Finance Controller	Safety stocks; ERP/APS Production System
	HR & Health and Safety Manager	Training; Risk Assessment; Environment; ISO 9000 standards
	IT Manager	IT systems; ERP/APS system
	Quality Manager	Training; Customer complaints; Standard Operating Procedures (SOPs); ISO; Lean implementation; Defects
	Production Scheduler	Scheduling Algorithm; ERP system; Communication; Tier meetings; KPIs
	Maintenance Engineer	Method of conducting maintenance; Communication
	Warehouse Manager	Goods-in and out; communication
	Shift Foreman	Communication about schedule and production planned; Defects;
	Goods-in & Goods- out Operators	Picking, loading, and dispatch data; Method of doing job; Data duplication and errors; Inventory
	Assistant to Production Scheduler	Communication b/w production scheduler and shop-floor; ERP system
Operations	Sales Support team	Customer orders; communication with production scheduler and warehouse manager
	Shop-floor team	SOPs; Defects

Table 3. Observation methods as part of data collection.

Types of Observations	Focus Area
Tier 1, 2, & 3 meetings (*see details in Section 5.2*) Tier 1- At shop-floor level, at the beginning of each shift; daily Tier 2- Cross functional team at middle management level; daily Tier 3- Senior management meeting; weekly	Understand misalignments between three levels including KPIs, reported issues, intra-communication
Shop-floor	Understand and collect process related data including cycle time, productivity, scrap, maintenance, KPIs; Use of data for communication and decision making
Warehouse	Storage of raw materials inventory; Layout efficiency; Picking, loading, and dispatch of FG items for local and international customers; Communication with other functions

Table 4. KPIs used at Enterprise, Business, and Operations levels.

Level	KPIs
Enterprise	Operating Profit
	Capital Investment
	Net Working Capital
Business	On-Time-In-Full
	Shift Data Entry Accuracy (Stock Adjustments)
	Made in, finished goods volume
	WIP Kanban Results
	Absenteeism
	Weekly Energy Efficiency
Operations	Production Hit Rate
	Defect Types
	Scrap Data

Table 5. Coefficient of variation for different product lines (sample).

	Product A	Product B	Product C
Inventory	1.88	0.42	0.57
Production	1.82	0.54	0.66
Dispatches	1.75	0.41	0.55
Demand	2.03	1.26	0.49

Table 6. Cost associated with QA activities.

Breakdown by shift	Three main activities of QA team			Total annual cost
	Inspecting & Collecting Goods	Standard testing	Destructive testing	
	10%	15%	75%	100%
Shift 1	£1,933.92	£2,900.88	£14,504.41	£19,339.22
Shift 2	£1,933.92	£2,900.88	£14,504.41	£19,339.22
Shift 3	£1,933.92	£2,900.88	£14,504.41	£19,339.22
QA cost for different activities	**£5,801.76**	**£8,702.65**	**£43,513.24**	**£58,017.65**

Comparison of cost related to reuse of material versus new raw material

Activities related to reuse of scrap materials	Cost	Other information
Use of Granulator machine	£2,000.00	£10k machine depreciated over 5 years
Time of operators regrinding	£3,818.16	
Transport between sites	£70.20	1 transport per week
Reprocessing costs at sub-contracted recycling facility	£24,030.40	
Reprocessing Costs for last 12 months	£29,918.76	

Table 7. Recommendations to address gaps between Enterprise and Business levels.

Mismatches and Gaps between three levels	**Understand-Document** *Understanding Current State*	**Simplify-Optimize** *Future State Recommendations*
Enterprise-Business	▪ Lack of values, mission and vision statement to align to Business Goals ▪ Short-term gain vs. Long-term focus ▪ Misalignments b/w strategic and business level KPIs ▪ High variation in demand from major customers ▪ Communication gap between three levels ▪ Limitation of existing infrastructure to meet increasing demands	▪ Development of values, mission, and vision statement by involving employees at all levels ▪ Developing a set of KPIs that is aligned with vision statement and mapped across all levels ▪ Working with major customers to identify reasons for variation ▪ Tier meetings structure and objectives revised to improves communication at all levels ▪ CFT for problem solving and joint learning ▪ Creating a hybrid IT based visual management system for optimizing capacity planning and demand management
Business-Operations	▪ Misalignment b/w customer demand and production ▪ Manual approach to production scheduling (PS) ▪ QA department taking back-seat ▪ Customization and product variety create challenges ▪ Misalignments b/w business and operations level KPIs ▪ Reactive approach to maintenance ▪ Managing suggestion scheme (SS) is challenging	▪ **PS**: Re-training on APS and ERP system to effectively do capacity planning and scheduling-move away from manual method ▪ Review labelling process to reduce complexity in scheduling ▪ **Warehouse** layout, picking and dispatching rules need to be reviewed. ▪ **QA**: Review (with potential reduction) sampling strategy for destructive testing; taking more ownership in driving quality initiatives like Lean at the shop-floor level; active engagement in Tier 2 meetings. ▪ **KPIs**: KPIs at business and operations levels to be aligned with enterprise strategy; include non-financial aspects; develop more visual KPIs at shop-floor level that is owned by operators. ▪ **SS**: Suggestions given by operators in consultation with their cell-leaders to have better quality of suggestions; Also this reduces bureaucracy involved in managing suggestions. ▪ **Maintenance**: More ownership to shop floor operators for daily maintenance; integration into production scheduling; focus on planned and preventive maintenance.
Enterprise – Operations	▪ Ad hoc training & appraisal ▪ Skill-shortage to meet enterprise level KPIs ▪ Limited explanations of enterprise level KPIs and given operations targets	▪ Skills-matrix needs to be developed for identifying current and future training needs of employees ▪ Enterprise level KPIs and Operations target should take both top-down and bottom-up approach

Figure 1. Managing to overcome barriers between different levels (Adapted from: Watson 1994).

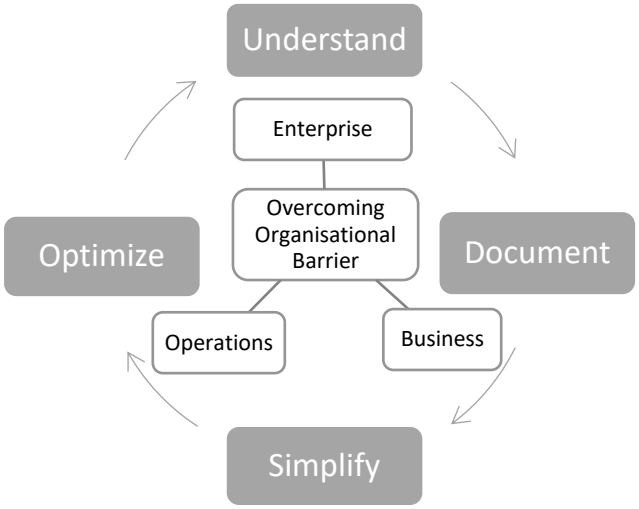

Figure 2. Integrated framework used for the research study.

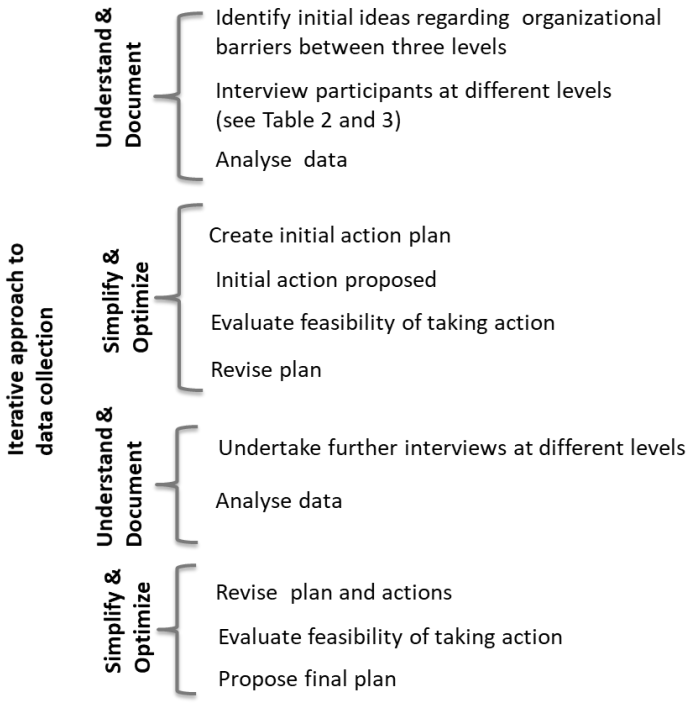

Figure 3. Iterative approach to data collection.

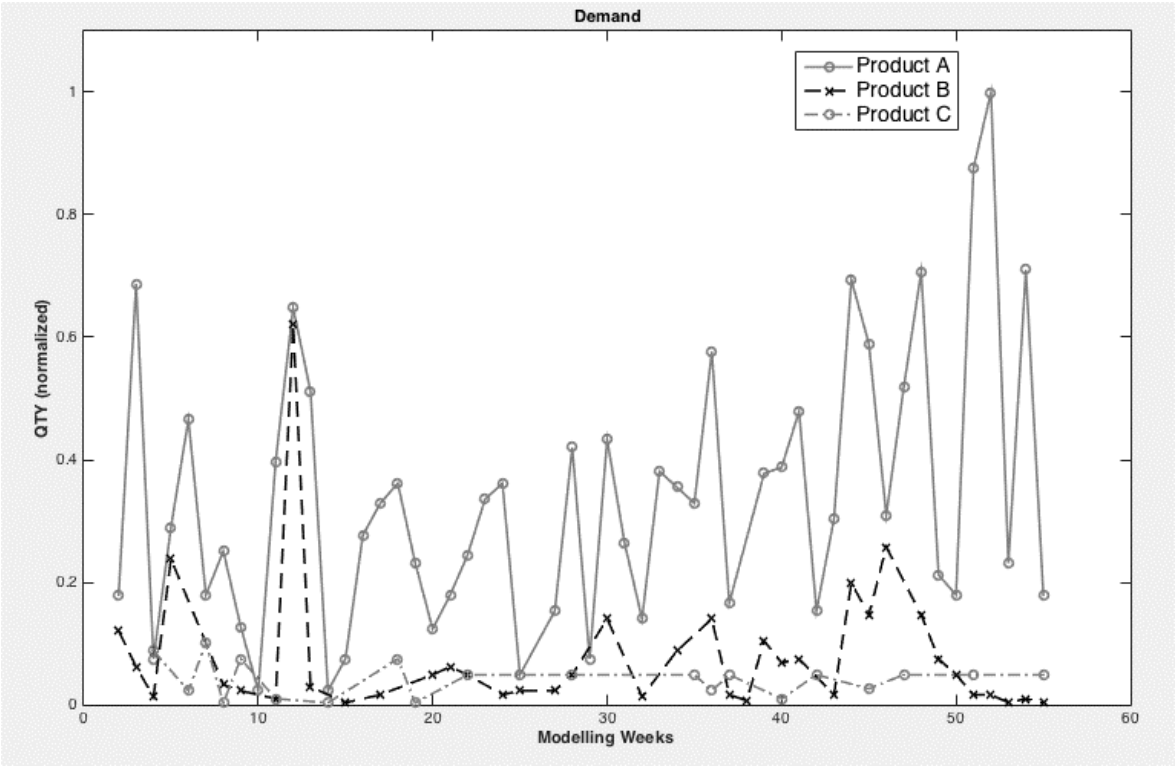

Figure 4. Demand variation for different product categories.

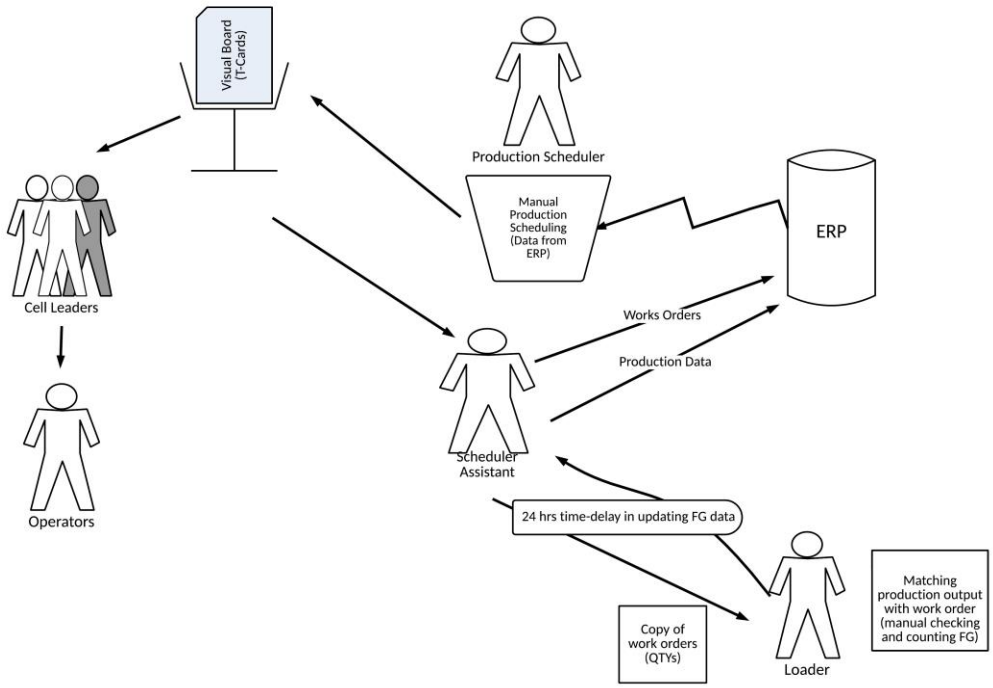

Figure 5. Information flow related to production and finished good inventory.

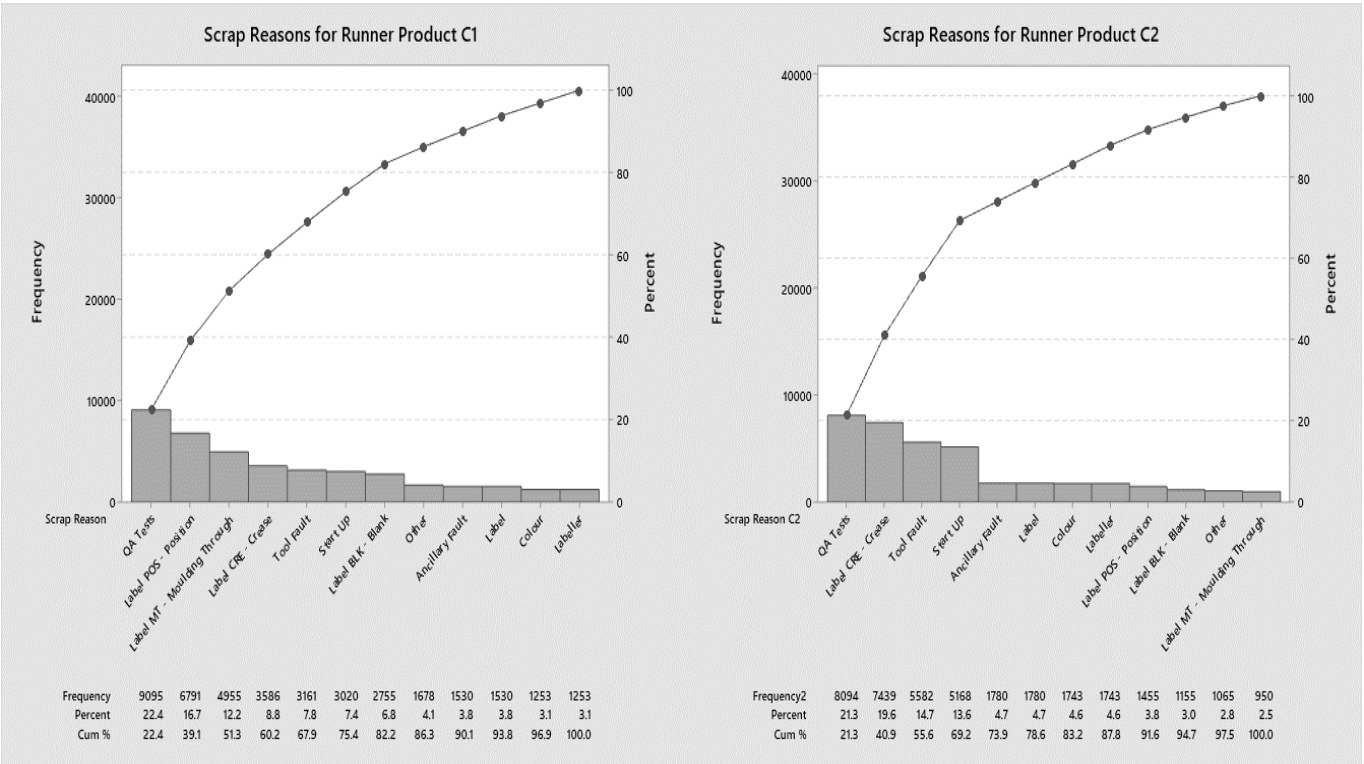

Figure 6. Pareto Chart for Scrap Generation for Two Runner Product categories.

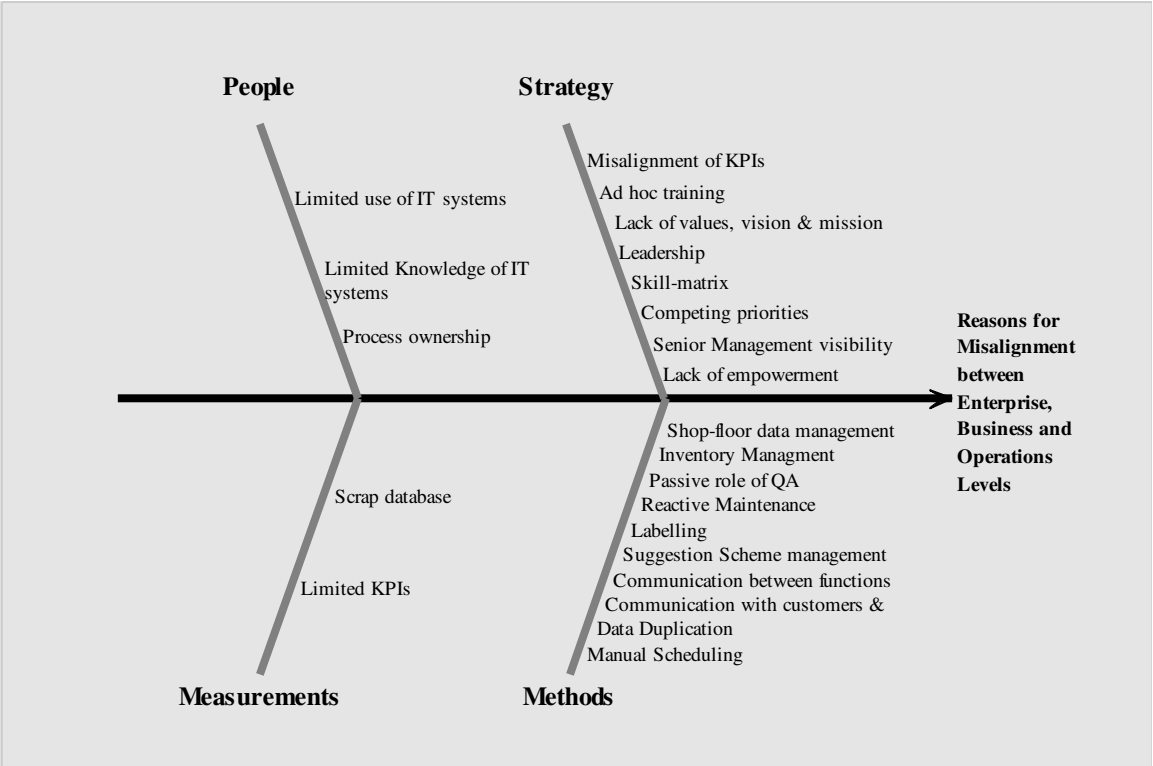

Figure 7. Cause and Effect Diagram related to misalignment between different levels.

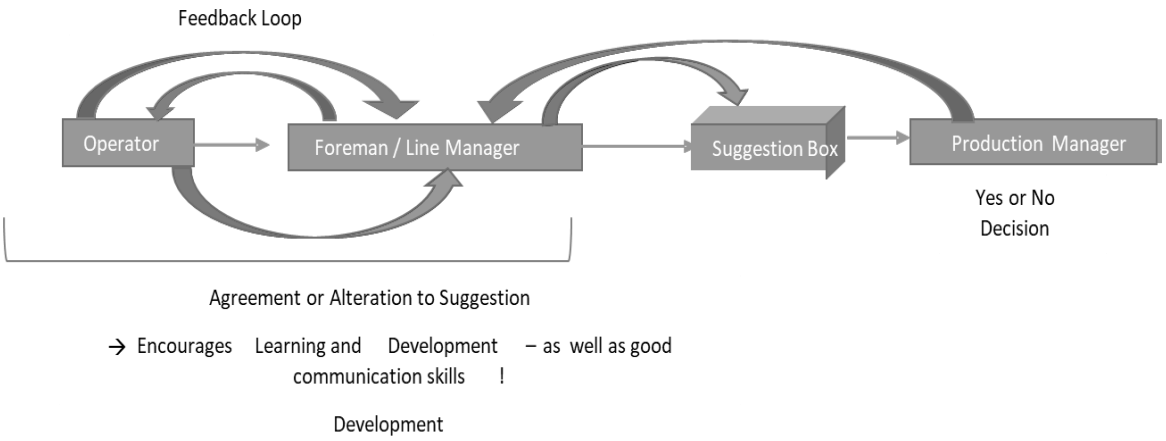

Figure 8. Proposed method for effectively managing suggestion scheme.