

CHAPTER 7

A Primer on Supply Chain Digital Transformation

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Digital Transformation

In the preceding chapters of this monograph, a range of approaches to digitalisation on aspects of supply chain activities have been considered. In conclusion, therefore, it is worth reflecting on what digital supply chain transformation for the supply chain means, and what the key developments in the near future are likely to be.

Digital transformation aims to improve an organisation's activities by triggering significant changes through a combination of information, computing, communication, and connectivity technologies (Vial 2019). It has been referred to as 'corporate initiatives to use the new capabilities afforded by digital technologies to transform the strategies and operations of organisations' (Li 2020: 810). Such changes do not necessarily, however, have to be organisation-centric and could be stimulated by changes that take place at either an industrial or a societal level. Thus, an organisation may need to

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respond to changes taking place at one, or both, of those levels in order to remain competitive. However, whether they are leading in developing and implementing such changes or whether they are following the changes, the expected outcome would be that improvements in performance are seen across an organisation, resulting in improved levels of performance and competitive behaviour.

Digital technologies are a key source of disruption within the supply chain and a range of outcomes can be seen. Over the last decade, digitalisation has had a significant impact in altering consumer behaviour and expectations, both raising standards and lowering costs. It is now, for example, not uncommon for goods to be supplied to the consumer within 24 hours of an order being placed, sometimes even on the same day. The competitive landscape has thus been disrupted and traditional approaches to service provision have changed beyond recognition. Organisations that have been able to leverage digital platforms have faced lower barriers to entry into the market, for example not having to invest in traditional high street sales outlets, and have thus been able to combine products and services in different ways in order to generate new forms of digital offering. All of these have reduced the competitive advantage of incumbent players and hindered their sustainability. The increasing availability of data and the use of sophisticated algorithms to analyse and manipulate that data mean that organisations can target their customer base far more effectively.

Digitalisation also allows for the creation of new value propositions. An example of this is Netflix, whose business model was originally based on the rental of movies stored on physical media. Over the years, however, Netflix has moved away from this value proposition to become the first large-scale provider of video streaming services. More recently, it has leveraged data collected from the use of its streaming services to better understand the types of content its viewers enjoy, as well as how it is consumed, in order to help with the production of its own programming (Günther et al. 2017).

Digital transformation is a relatively new concept and is both complex and challenging. A 2018 McKinsey survey of 1,793 participants identified that only 16% of respondents said their organisations' digital transformations have successfully improved performance and also equipped them to sustain changes in the long term. An additional 7% said that performance improved but that those improvements were not sustained (Boutetière, Montagner & Reich 2018). This calls for a holistic approach to strategy and execution, moving away from disconnected digital experiments. The same survey identified that leadership, capability building, empowering workers, upgrading tools, and communication are critical success factors in any digital transformation initiatives.

Supply Chain Digital Transformation

The key question in any digital transformation strategy is: how can data and digital capabilities be used to create new value for existing and new customers? Chapter 1 briefly considered what digital transformation means in the supply chain context and proposed the use of a supply chain digital transformation value framework (Figure 1.2) to guide the design and execution of digital initiatives. In this context, it can be asserted that the value proposition, i.e. the question of what customer needs the business model will address, should be the primary driver of any supply chain digital transformation. Digital technology is a means to achieve supply chain goals but not an end of digital transformation itself. As rightfully stated by Tekic and Koroteev (2019), ‘digital technology is the tastiest ingredient needed for making a digital transformation cake, while the business model is a master recipe for making the cake. If either of these two – the key ingredient or the recipe – is not optimal, the cake will not be worth serving’ (p. 685).

With the framework in Chapter 1 as the starting point, we articulate further in this chapter how companies should leverage digital technologies in a systematic approach to gain competitive advantages, create value and produce desirable sustainable outcomes.

Where Do You Start?

In recent years, there has been a significant amount of hype around digital transformation, promoting the potential benefits of such change. However, many supply chain executives are overwhelmed with the complexity and diversity of instigating such changes, and struggle to identify, understand and evaluate the strategic options for their supply chains. To fully leverage the potential of digital technologies, supply chain executives need to be able to make sense of the digital landscape and equip themselves with sufficient understanding about digital technology capabilities and trajectories, and thus put themselves in a position to be able to envision the possibilities of potential applications for transforming their supply chains. This means that supply chain leaders need to become ‘digital translators’ (Wang et al. 2021) or ‘visionaries’ (Hartley and Sawaya 2019) who understand how technologies work, can intermediate between the physical supply chain and information technology, and possess excellent change management skills.

Being able to see and understand the realm of possibilities afforded by digital technology is one of the two pillars that set the foundation of successful supply chain digital transition (see Figure 7.1). The second pillar relates to aligning the understanding of technology with business and supply chain strategies.

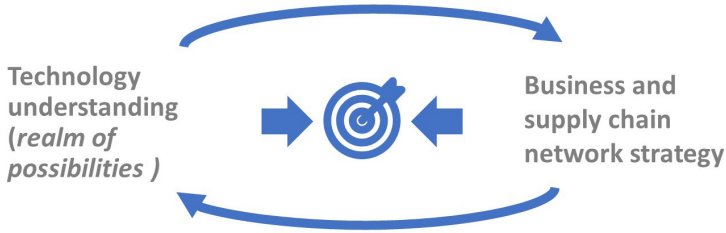


Figure 7.1: Two pillars for digitalising supply chain. Source: Authors.

By aligning the two pillars, companies can develop a clearly defined, coherent digital supply chain strategy that fully integrates with their business and supply chain strategies.

Top Leadership Commitment and Support

Once companies have developed a well-articulated supply chain digital strategy, they will need to fully commit to it. Lack of leadership support is one of the major roadblocks for successful supply chain digital transformation. CEOs need to sponsor the programme heavily, the executive board will need to appoint dedicated senior executives to take ownership of the transformation, and the management team will need to ensure collaboration internally between the different functions, and externally with suppliers, customers and other supply chain stakeholders.

When people in key roles (both the senior leaders of the organisation and those in transformation-specific roles) are more involved in digital transformation, success, although not guaranteed, is more likely. They will be instrumental in setting a high level of aspiration, fostering a sense of urgency for transformation, and establishing a clear change strategy to execute the vision. Having an astute digital leader (e.g. chief digital officer) has also been identified as one of the keys to transformation success (Boutetière, Montagner & Reich 2018).

More importantly, senior leaders should *lead by example*, i.e. they express by their actions a set of values and beliefs to which they want their followers to subscribe (House 1977). Put simply, if leaders want to empower employees to have the shared ownership and pride in digital transformation, they themselves have to model the way, personally embrace the change and provide a live demonstration of how things should be done, and communicate why things should be done. This type of leadership can thus have a cascading effect and instils a behavioural stimulus that motivates employees to invest their own resources and engage more fully with the digital transformation programme (Eldor 2021).

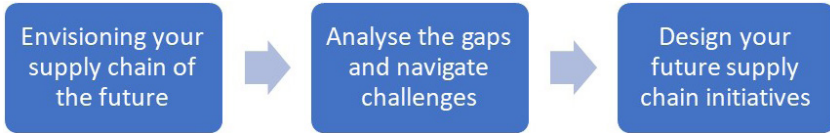


Figure 7.2: Three steps to translate strategy into action. Source: Authors.

Translating the Strategy into Action

There are different approaches to operationalising the strategy into action. Here, a simple three-step approach is proposed (Figure 7.2). Many digital transformation initiatives start by identifying the problematic areas (often known as ‘pain points’) in supply chains and try to utilise digital technologies to address those pain points. Though this is a valid approach, it can be argued that it may bear more fruitful outcomes if supply chain executives start by first envisioning what future supply chains would look like in their own industrial context. This approach is inspired by the foresight–insight–action model developed by the Institute for the Future (Johansen 2020).

Linking back to Chapter 1, which identified the key characteristics of a future supply chain, a vision of what an organisation’s future supply chain would look like can be created. For instance, it can be envisaged that future supply chains will increasingly become not just more automated but more autonomous.

Next, working backwards, there is a need to understand the state of the current supply chain, and ask how transformation from an ‘as-is’ state to the desirable ‘to-be’ state can be achieved. By doing this, there is a need to start examining the gaps that exist between the current and future state of the sector and understand what the potential challenges and barriers in the transformation journey are. This is where the existing pain points are discovered that must be resolved in order to realise the vision for future. For instance, following the future vision of an autonomous supply chain, it might be found that the existing supply chain has issues such as siloed IT systems, lack of end-to-end supply chain visibility and a lack of data scientists in developing AI algorithms for supply chain planning.

In step 2, it is necessary to emphasise the importance of knowing the current digital capability and maturity of an organisation. The work of Bonnet and Westerman (2021) on digital capability offers a useful framework to assess current digital capabilities. Although the framework is not specific to supply chain digital transformation, it nonetheless serves as a guide for benchmarking and self-assessment. They propose how to examine an organisation’s digital capability from the following perspective:

1. business model: digital enhancements; information-based service extensions and multi-sided platform businesses;

2. customer experience: experience design, customer intelligence and emotional engagement;
3. operations: core process automation, connected and dynamic operations and data-driven decision-making;
4. employee experience: augmentation; future-readying and flex-forcing (agile sourcing of talent);
5. digital platform: organisational digital backbone, external facing platform connecting to customers and ecosystem partners, data platform for intense analytics and AI deployment.

The third step is to explore how the identified gaps, while taking consideration of legacy constraints and challenges, can be addressed. The output could be a digital road map that defines different supply chain scenarios, develops goals and objectives, and establishes initiatives and deployment solutions. Digital initiatives that can be put into place could include real-time supply chain tracking, robotic process automation, data lake and master data management, supply chain digital twinning, prescriptive supply chain planning, etc. A road map not only defines a portfolio of digital initiatives but also needs to create initiative measurement criteria and key performance indicators (KPIs).

Supply chain digital transformation tends to consume significant resources, and many initiatives observed in practice takes several years if not longer to complete, ranging from investing in supply chain visibility, setting up control towers, AI-enabled supply chain planning and demand forecasting to onboarding suppliers digitally. The complexities induced by such changes can be overwhelming and affect many parts of a supply chain. A road map helps organisations to navigate complexities, make more informed decisions, and align stakeholders to stay on track to reach their desirable future state. However, a cautionary approach needs to be taken, understanding that with a road map there is a risk that organisations focus too much on the technology rather than how to best achieve supply chain goals. Thus, it is strongly recommended that the value framework developed in Chapter 1 is used in combination with a road map so as not to lose oversight of the transformation process.

Approaches to Supply Chain Digital Transformation

Typically, there are two primary approaches of digitalisation, often referred to as digital ‘ambidexterity’: (1) exploitation – optimising and enhancing existing supply chain operations – and (2) exploration – launching new business and supply chain models. While the former tends to lead to productivity gains and cost cutting, the latter is associated with business growth and revenue generation, albeit with a higher risk of failure. When an organisation begins to think about undergoing a transformation, it is crucial to balance between the two and allocate resources carefully.

Based on current research, with a group of global digital champions at the forefront of digital transformation, including Amazon, Alibaba, Baidu, Google, JD.com, Uber, VMWare and Slack, Li (2020) found that at least three new approaches are emerging in those leading organisations. They are: (1) innovating by experimenting, (2) radical transformation via successive incremental changes and (3) dynamic sustainable advantages through an evolving portfolio of temporary advantages. Those approaches challenge traditional linear approaches for leading digital transformation and highlight the need for new and iterative approaches for bridging the strategy–execution gap in the volatile digital economy. The author suggested an agile approach to try out many new ideas and select the successful ones to scale up rapidly. By breaking up large-scale, radical digital transformation into smaller, more manageable strategic investments, organisations are able to experiment with many new ideas based on rapid piloting and scaling. Given the rapid changing digital landscape, competitive advantages can no longer be sustained for long periods. Therefore, it is advisable that companies pursue successive temporary advantages via its evolving portfolio of digital initiatives. The cumulative effect can be significant over time.

For supply chain organisations, their businesses are not the digital native ones as discussed in Li’s work. There will be more constraints to experiment with new ideas simultaneously and scale up is more complicated because physical supply chain structures and processes need to be taken into consideration. However, the underlying principles are observed and applicable in traditional incumbent organisations too. For inspiration, incumbents can still learn from those companies born digital. In fact, a white paper published by the World Economic Forum (WEF) (2017) put forward similar arguments for manufacturers that speed and agility in adopting digital technology is the defining factor for digital transformation, and emphasised the importance of experiments (‘fail fast, fail early’ mindset), organisation alignment and level of integration (e.g. via a collaborative network of partners). A further report by the WEF (2018), via a cross-sector analysis, proposed five key enablers and four underlying execution principles for maximising returns on digital investment (Figure 7.3). These offer valuable insights for supply chain leaders when they try to jump-start their digital journey.

A Digital Transformation Framework for Supply Chain Leaders

While there has been a plethora of studies proposing guiding principles and recommendations about digital transformation, there has been a lack of supply chain-specific frameworks to guide actions in practice. It is suggested that using the three pillars as shown in Figure 7.4 – data and technology, people, and process – will provide a viable way forward. Change management is at the centre of the three pillars as it is a key instrument and process for realising digital transformation.

Key Enablers			
2. Forward-looking skills agenda Workforce digital mindset; innovation the focus of training		3. Ecosystem thinking Collaborating within the value chain (e.g., with suppliers, distributors etc.)	
1. Agile and digital-savvy leadership Strategic vision, purpose, skills, intent and alignment across management			
4. Data Access and Management Strong data infrastructure and warehouse capability combined with the right analytics and communication tools		5. Technology infrastructure readiness Building required technology infrastructure to ensure strong cloud capabilities, cybersecurity and interoperability	
Execution Principles			
Establish clear ownership of digital investment	Invest in use-cases, not technologies	Fail fast, fail cheap	Follow an outcome-based approach

Figure 7.3: Key enablers and execution principles for maximising returns on digital investment. Source: Based on WEF (2018).

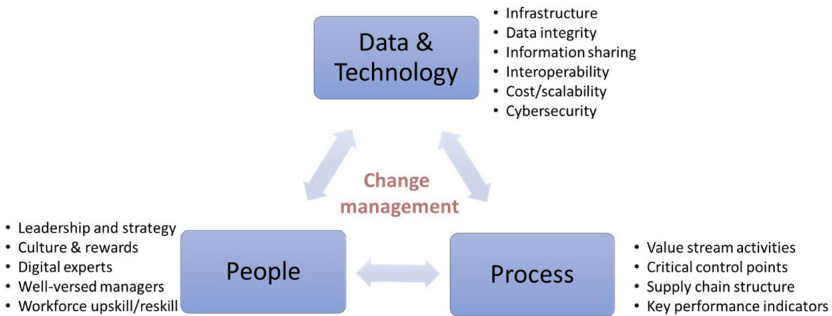


Figure 7.4: A framework for supply chain digital transformation. Source: Authors.

Data and technology

The availability of huge amounts of data (structured and unstructured) gives rise to the concept of the digital economy. Data is now increasingly recognised by firms to be a significant asset to deliver market-driven innovations such as personalised products/services, real-time supply chain tracking and risk alerts, predictive maintenance and advanced demand sensing and forecasting.

With the increasing power of data, the importance of data integrity cannot be overstated. Without ensuring data integrity, the usefulness of data becomes diminished as any information extracted from it is not reliable for accurate decision-making. Many people would confuse *data integrity* with *data quality*, but the former encapsulates multiple perspectives and refers to the reliability,

completeness and authenticity of data. In a scenario where an advanced machine learning (ML) algorithm for supply chain planning has been built, if the data being fed into the ML model is inaccurate, inconsistent, incomplete and dated, the outputs will be inaccurate. In practice, many firms struggle to capture the right data in the right format for them to be available for deployment to big data analytics and AI algorithms. It is not uncommon to see many organisations spend a great deal of time and effort in cleaning and preparing data before putting it into a ‘data lake’⁶ for analytics consumption. The point of a data lake is that its simplicity enables broad, flexible and unbiased data exploration and discovery via advanced forms of analytics (such as data mining, statistics and machine learning) (Russom 2021).

To acquire the required data, an organisation needs the correct digital infrastructure. This typically includes hardware, software and data platforms. For instance, if a firm wants to build digital capability for end-to-end real-time supply chain visibility, it will have to consider automatic data capturing technologies such as the internet of things (IoT) devices, wireless communication networks such as Wi-Fi 6 or 5G and cloud computing platforms for processing the collected data. A key question supply chain leaders should ask is ‘how digital are my core processes?’ (e.g. procurement, operations, customer engagement and logistics).

Another important issue is cybersecurity. With supply chains becoming increasingly digital and the rise of cybercrime- and cyber-enabled information operations, there is an urgent need to build cyber resilience into supply chains. According to the UK’s National Cyber Security Centre (NCSC 2018), information theft is the fastest-rising consequence of cybercrime. Other cybercrime trends in the supply chain space include cyber criminals targeting the vulnerabilities of IoT devices and of third- or fourth-party supply chain partners’ digital infrastructure to gain entry to target systems. Instead of asking what cyberattacks might be possible on computer systems, supply chain leaders need to ask how a cyberattack could disrupt their supply chain (Parenty & Domet 2019). Companies should identify their critical supply chain activities, assess the risks to those activities, and then identify the systems supporting them. Intervention measures should then be put into place to reduce those systems’ vulnerability.

Other key issues to consider include the cost of deploying digital technologies, interoperability issues between different information systems within and across organisations, and how the focal company should share information (what to share via which means) with supply chain ecosystem partners.

⁶ A data lake is a concept consisting of a collection of storage instances of various data assets. These assets are stored in a near-exact, or even exact, copy of the source format and are in addition to the originating data stores (Russom 2021).

People

The people pillar broadly incorporates the ‘soft’ issues such as leadership and strategy, skills, culture and behavioural change, as well as reward schemes. Having digitally aware supply chain leaders, a workforce with sufficient digital literacy and digital experts such as data scientists in place will give companies a competitive edge to their digitalisation journey. Data science skills and roles, although only forming a relatively small part of the workforce, are in particularly high demand across all sectors (WEF 2019).

Skills

Digital transformation needs to be accompanied by appropriate investment in talent and workforce reskilling and upskilling. Workforce reskilling and upskilling should not be treated as a one-off investment but a continuous process in order to respond to fast-changing technologies and associated skills demand. Wang, Skeete and Owusu (2021), when investigating the application of AI in process automation, identified that, if employees do not possess the appropriate skills and knowledge of how the AI system works, they will create unnecessary workarounds within a system and compromise its intended effectiveness. Fortunately, many firms now realise the urgency of digital talent development and have launched initiatives such as digital academies to prepare their workforce for the digital world.

For instance, Schneider Electric (SE), a leading manufacturer in energy and industry automation, has developed a ‘digital citizenship programme’, aiming to upskill over 90% of its employees (SE 2020). The programme covers essential future skills including data science, digital economy and digital technologies, as well as cybersecurity. SE also set up a supply chain academy creating its own curriculum focusing heavily on data science, analytics and robotic process automation. The energy company Equinor (formerly Statoil) created its ‘Digital Academy’ to increase digital literacy and capabilities across all levels of the organisation (WEF 2018). Through the programme, the company launched various initiatives. For instance, it introduced a ‘digital word of the week’ to raise awareness and interest, established a Yammer (social networking) group to share knowledge and create engagement, and invited people to become digital ninjas, training them in ‘digital ninja gyms’ and making those digital ninjas the ambassadors to drive the digital agenda.

Culture and Behavioural Changes

Leadership is critical but transformation success depends more on the way people on the front lines implement new digital tools (Leonardi 2020). Digital transformation requires a digital culture that supports this change. Digital culture in organisations is a set of shared assumptions and understanding about an

organisation functioning in a digital context (Martínez-Caro, Cegarra-Navarro & Alfonso-Ruiz 2020). Cultural change underpins the sustainability of the impact generated by digital transformation. Adopting a digital organisational culture will provide employees with not only the right tools but also the right structures, incentives and mindsets to integrate new technologies into their work.

However, cultural and behavioural change is perceived by many to be the biggest challenge for a successful digital transformation (Buvat et al. 2018; Catlin et al. 2017). Culture is a complex and intangible ‘thing’ and it is difficult to know where to start and how to create an organisational culture that is fit for digital transformation. Katzenbach, Steffen and Kronley (2012) suggested that focusing on changing just a few critical behaviours to break through organisational inertia, while honouring their organisation’s culture strength, will mean that culture can be an accelerator of change, rather than an impediment. In a similar vein, Mesaglio, Olding and Ommeren (2019) suggested the use of small but powerful culture hacks to find vulnerable points in an organisation’s culture and turn them in to real change that sticks. Struckman et al. (2020) proposed a three-step methodology to change culture: (1) define the North Star of how you want your organisational members to behave using culture attributes. Make sure the North Star of behaviours makes sense given the business strategy. (2) Describe the shifts in both mindset and behaviours that create understanding about the extent of the behaviour changes using a from/to/because model. (3) Create an action plan to change the behaviours described in the from/to/because model by changing the systems, processes and practices that reinforce the old behaviours. Another useful resource is the digital culture guidebook produced by the WEF (2021), which articulates four pillars of digital culture (collaborative, data-driven, customer-centric and innovative) and prescribes detailed guidance on how to accelerate digital culture.

Behavioural research is receiving increased attention in various academic disciplines. A method that has recently come to prominence in the last decade to influence behaviour change is nudge theory, developed by Richard Thaler⁷ and Cass Sunstein in 2008. Nudge theory is based upon the idea that, by shaping the environment, also known as the choice architecture, one can influence the likelihood that one option is chosen over another by individuals. A key factor of nudge theory is the ability for an individual to maintain freedom of choice and to feel in control of the decisions they make. An example of such a nudge is switching the placement of junk food in a store, so that fruit and other healthy options are located next to the cash register, while junk food is relocated to another part of the store. Currently, the use of nudge theory to drive desirable supply chain behaviours for digital transformation is an under-explored area but it may produce fruitful results if done well.

⁷ Richard Thaler won the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2017 for his contributions to behavioural economics.

Process

Supply chain transformation requires a baseline understanding of the current operational model. A current state value stream mapping exercise is essential to identifying the key frictions across the end-to-end flow of work. It may also reveal the critical activities that may be vulnerable to disruptions. For instance, if firms want to achieve end-to-end (E2E) supply chain visibility, it needs to understand the whole order-to-fulfilment process. Starting from the point when customers place an order, ‘walk’ through all the necessary activities until the order is fulfilled and delivered at customer’s site. The supply chain diagnostic methodology known as *quick scan* discussed by Naim et al. (2002) can be used as a systematic approach to identify the change management opportunities in supply chains.

If we use the analogy of water flowing through a pipeline as information flows in the supply chain, we would expect the smoother the water (i.e. information/data) flows through the pipeline, the easier it is for the E2E visibility to be acquired. If there are many blockages in the ‘water’ pipeline, it typically means there is a heavily siloed information flow in place. Figure 7.5 provides a current state map of a telecoms manufacturing supply chain with orders (components) being shipped from the manufacturing sites (or imports) to a regional warehouse, then via a local 3PL depot, arriving at the client’s partner site before they are delivered to the designated site for use. As can be observed, while the material flows are fairly straightforward, the information flow is much more complicated, causing significant delays and inefficiencies. As information flow dictates the movement of materials, streamlining the information flow can ultimately lead to improvements in the physical order fulfilment practice. Naturally, a digital transformation initiative should then target the problems with the information flow and explore potential digital solutions that could improve the current situation.

However, it can be dangerous to jump straight into digital solutions. In some cases, the processes themselves need to be scrutinised first before overlaying digital systems onto them. Questions need to be asked, for instance, using lean concepts: whether there are non-value-adding activities in current practice, and, if so, whether processes need to be streamlined before we restructure the associated information flows. Several generic methodologies exist to ensure a repeatable process to simplify existing complex operations, which was summarised by Watson (1994) as UDSO:

1. Understand: define the problem, system boundaries and performance metrics.
2. Document: model existing operations, whether in written, verbal, diagrammatical, mathematical, software or combined format.
3. Simplify: utilise the current state model to eliminate waste in all its forms (i.e. time, material, information and capacity).

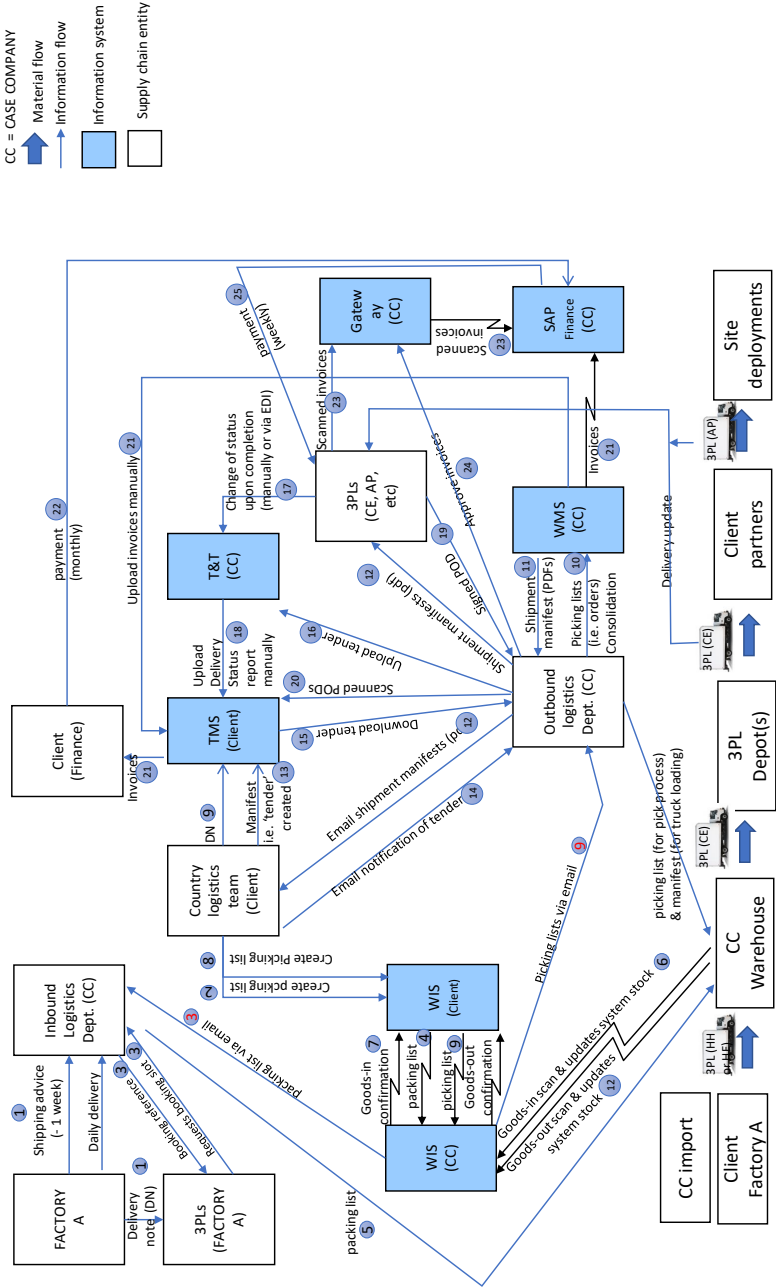


Figure 7.5: An example of current value stream map (information and material flows). Source: Authors.

4. Optimise: only once the processes have been identified and streamlined should advanced methods of control using digital tools can be applied to ensure consistency, reliability and transparency.

The simplicity paradigm is powerful, as quoted in Naim et al. (2002): ‘Good managers can manage complexity, but better managers simplify.’ It should be noted that implementing digital solutions usually demands changes in existing processes; for instance, implementing an ERP system in a multinational company will force the processes in local regions to be standardised. Therefore, process reengineering and digital solutions should go hand in hand.

In many cases, when it comes to supply chain digital transformation, firms need to ensure that their supply chain ecosystem partners are on board. Sometimes improvement may need to look beyond current process and capability improvement and involves supply chain structural adjustment (e.g. from off-shore to near-shore). Consequently, when it comes to information integration, where is the appropriate place to begin? A common approach suggested by the academic literature is that a company should focus on internal integration first, move on to integration with suppliers, and then with customers (Horn, Scheffler & Schiele 2014; Stevens & Johnson 2016). However, supply chain models no longer focus on linear integration between customers and suppliers; we need to increasingly consider the ecosystem concept and use digital platforms (often powered by cloud computing) to achieve agile and flexible connectivity and collaboration.

Finally, under the process pillar, it is also important to consider the issues of having the right KPIs in place so that it can be determined whether a digital initiative delivers what is expected. Performance measures drive people’s behaviours and therefore need to be designed carefully to be in line with the companies’ strategy and goals.

Change Management

Change management is a well-established discipline in its own right. There are many change management models in academic and practice literature. Galli (2018) provided a detailed discussion about some of those models. One notable framework is the eight-step change model proposed by Kotter (1996; 2012) (Figure 7.6), which articulates how to manage change.

The original eight-step model is described as follows:

1. Establish a sense of urgency: people will not change if they cannot see the need to do so. Without motivation, people will not help, and the effort goes nowhere.
2. Create a guiding coalition: this step requires an organisation to assemble a group with power energy as change agent to chief the change effort and encourage the group to work together as a team.

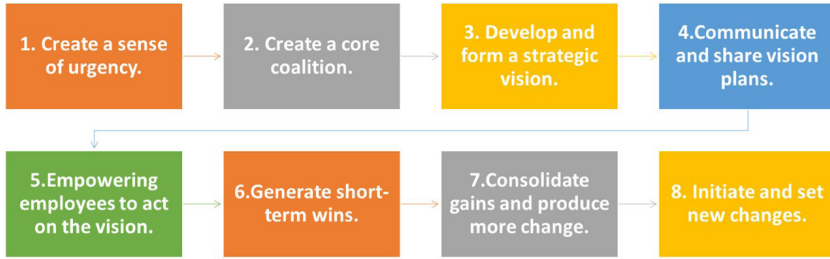


Figure 7.6: Eight-step change model. Source: Kotter (1996).

3. Develop a vision and strategy: create a vision of what the future will look like and how it will be achieved.
4. Communicate the change vision: tell people, in every possible way and at every opportunity, about the why, what and how of the changes.
5. Empower others to act on the vision: the first action in this step requires the removal of any obstacles to the change, and also allocating money, time and support needed to make change effective.
6. Generate short-term wins: complete transformation may take a long time so a loss of momentum is a major barrier to effective change management. Creating a lighthouse case, make the improvement from change visible, recognising and rewarding those involved is critical.
7. Consolidate gains and produce more change: this is a snowball approach. Kotter warns ‘do not declare victory too soon.’ Create momentum for change by building on successes in the change, invigorate people through the changes and develop people as change agents.
8. Anchor new approaches in the corporate culture: this is critical to long-term success and institutionalising the changes, so the new approaches become ‘the way we do things around here.’ Otherwise changes achieved through hard work and effort may slip away, with people reverting to the old and comfortable ways of doing things.

Another notable model is the data-driven business transformation road map by Gartner (Duncan 2020), which argues that becoming a data-driven enterprise requires explicit and persistent organisational change management to achieve measurable business outcomes. Senior executives need to promote cultural change and orchestrate ‘leadership moments’ in which they act as role models, exemplifying new cultural traits at critical points. Central to their success will be the ability to guide the workforce by addressing both data literacy (‘skills’) and data-driven culture (‘will’).

Bearing some similarity to Kotter’s model, Duncan (2020) suggested a five-step road map. The starting point will be to sell the value and drive organisational awareness and ideation. Although supply chain leaders recognise the inherent need for data-driven decision-making, linking this need to specific

benefits and outcomes can be challenging. The measurable value of digital transformation needs to be clearly articulated to both internal and external stakeholders. Step 2 moves to envisioning – develop vision and value propositions and communicating what stakeholders will get in return. Step 3 is about current state assessment in collaboration with HR and line of business leaders, particularly about data literacy and cultural readiness. Step 4 focuses on education, to devise curriculum and training plans. The last step focuses on embedding – launch and execute the transformational change programme. In a similar way to Kotter, Duncan argued that quick wins and basic changes to address immediate pain points build momentum and help recruit a ‘coalition of the willing’. But he also cautioned that lasting, meaningful change takes time, because it requires the changing of mindsets and behaviours, the learning and practising of new skills, coordination and discipline, as well as the incentivising of people to participate.

Conclusion

In conclusion, we reflect here on the impact of emerging technologies on supply chains. It is clear from the range of examples presented throughout this monograph that the impact in the coming decades is going to be both far-reaching and extensive. Only organisations that are able to adapt their business models and adopt information technology systems in an effective way will survive. Leveraging and exploiting systems more widely will lead to greater competitive advantage, the reshaping of supply chain management, improvement in service speeds and reliability, the lowering of operating costs and improvements in efficiency. Positive adaptation to change will be fundamental to the success of many businesses and it will be important for supply chain organisations to understand the strategic value of ICT and assess what the impact on performance could be.

To address the issue of how data and digital capabilities can be used to create new value for existing and new customers, the concept of customer-centricity and the quest for sustainable supply chain outcomes and competitiveness have been shown to be the primary drivers of supply chain digital transformation. Aligning customer journeys with technology solutions, bringing the wider supply chain stakeholders on board and asking where your supply chain will be in the future will allow supply chain executives to innovate and focus. While digital technology is part of the solution to achieving supply chain goals, it is not an end in itself. Any organisation that is serious about a ‘digital transformation project’ will need to set this in the context of a robust business model. The three key pillars of data and technology, people and process discussed earlier in this chapter could be utilised to make sure a systematic approach is in place and help to identify gaps in current capabilities. All supply chain digital transformation will experience barriers and challenges and have setbacks. That is why we suggest that change management be at the heart of

a transformation journey. Capturing and sharing the learnings as well as best practices throughout the journey is key to scale up and sustain the positive changes from the transformation.

The rate of advance in ICT will also create a range of challenges in the future. Data protection and governance will be important issues. With data becoming a strategic asset, organisations that control the flow of data will be increasingly under scrutiny. While governments will seek to limit the extent of such control through legislation, organisations are often more agile in how they respond, seeking to stay several steps ahead of any potential curtailing of their business models. Issues relating to the restriction of liberty and freedom at both personal and corporate levels will almost certainly become more prominent. Countries with centralised command-and-control economies already use ICT in ways that countries with democratic accountability are not. The interface between opposing approaches is likely to lead to a reshaping of how business is conducted. Companies involved in global supply chains will have to engage with and confront such issues. There is a continuing need to stress-test systems to understand where issues are likely to occur and how problems can be avoided, and, if not avoided, how negative outcomes can at least be suppressed. Risk management and supply chain resilience is of critical importance, and should be strategically embedded in any digital transformation programme, in response to a range of ever-increasing disruptions from pandemics (e.g. the Covid-19 crisis), cybercrime (e.g. the 2017 NotPetya attack), incidents (e.g. the 2021 Suez Canal blockage by the cargo ship *Ever Given*), natural disasters (e.g. the 2011 Japan tsunami) and geopolitical uncertainties (e.g. Brexit, 2020).

References

- Bonnet, D. & Westerman, G. (2021). The new elements of digital transformation. *MIT Sloan Management Review*, 62(2), 82–89.
- Boutetière, H., Montagner, A. & Reich, A. (2018). Unlocking success in digital transformations. Retrieved from: <https://www.mckinsey.com/business-functions/organization/our-insights/unlocking-success-in-digital-transformations> [accessed June 2021].
- Buvat, J., Solis, B., Crummenerl, C., Aboud, C., Kar, K., El Aoufi, H. & Sengupta, A. (2017). *The digital culture challenge: Closing the employee-leadership gap*. Capgemini Digital Transformation Institute Survey. Paris: Capgemini Digital Transformation Institute.
- Catlin, T., Lorenz, J-T., Sternfels, B. & Willmott, P. (2017). A roadmap for a digital transformation. Retrieved from: <https://www.mckinsey.com/industries/financial-services/our-insights/a-roadmap-for-a-digital-transformation> [accessed December 2020].
- Duncan, A. D. (2020). Roadmap for data literacy and data-driven business transformation: A Gartner trend insight report. Retrieved from: <https://>

www.gartner.com/document/3991368?ref=solrAll&refval=295022867 [accessed December 2020].

- Eldor, L. (2021). Leading by doing: Does leading by example impact productivity and service quality? *Academy of Management Journal*, 64(2), 458–481.
- Galli, B. J. (2018). Change management models: A comparative analysis and concerns. *IEEE Engineering Management Review*, 46(3), 124–132.
- Günther, W. A., Mehrizi, M. H. R., Huysman, M. & Feldberg, F. (2017). Debating big data: A literature review on realizing value from big data. *The Journal of Strategic Information Systems*, 26(3), 191–209.
- Hartley, J. L. & Sawaya, W. J. (2019). Tortoise, not the hare: Digital transformation of supply chain business processes. *Business Horizons*, 62(6), 707–715.
- Horn, P., Scheffler, P. & Schiele, H. (2014). Internal integration as a pre-condition for external integration in global sourcing: A social capital perspective. *International Journal of Production Economics*, 153, 54–65.
- House, R. J. (1977). A theory of charismatic leadership. In J. G. Hunt & L. L. Larson (eds.), *Leadership: The cutting edge*, (pp. 189–207). Southern Illinois University Press, Carbondale, IL.
- Johansen, B. (2020). *Full-spectrum thinking: How to escape boxes in a post-categorical future*. Berrett-Koehler Publishers, Oakland, CA.
- Katzenbach, J. R., Steffen, I. & Kronley, C. (2012). Cultural change that sticks. *Harvard Business Review*, 90(7), 110–117.
- Kotter, J. P. (1996). *Leading change*. Harvard Business School Press, Boston, MA.
- Kotter, J. P. (2012). Accelerate! *Harvard Business Review*, 90(11), 44–52.
- Leonardi, P. (2020). You're going digital – now what. *MIT Sloan Management Review*, 61(2), 28–35.
- Li, F. (2020). Leading digital transformation: Three emerging approaches for managing the transition. *International Journal of Operations & Production Management*, 40(6), 809–817. DOI: <https://doi.org/10.1108/IJOPM-04-2020-0202>.
- Martínez-Caro, E., Cegarra-Navarro, J. G. & Alfonso-Ruiz, F. J. (2020). Digital technologies and firm performance: The role of digital organisational culture. *Technological Forecasting and Social Change*, 154, 119962.
- Mesaglio, M., Olding, E. & Ommeren, E. V. (2019). Toolkit: 2019 collection of 85 culture hacks from the real world. Gartner. Retrieved from: <https://www.gartner.com/document/3971030?ref=gfeed>.
- Naim, M. M., Childerhouse, P., Disney, S. M. & Towill, D. R. (2002). A supply chain diagnostic methodology: determining the vector of change. *Computers & Industrial Engineering*, 43(1–2), 135–157.
- NCSC. (2018). Supply chain security guidance. Retrieved from: <https://www.ncsc.gov.uk/collection/supply-chain-security> [accessed December 2020].
- Parenty, T. J. & Domet, J. J. (2019). Sizing up your cyber risks. *Harvard Business Review*, 97(6), 102.
- Russom, P. (2021). Best practices for designing your data lake. Gartner. Retrieved from: <https://www.gartner.com/document/4001766?ref=solrAll&refval=294701003> [accessed May 2021].

- SE. (2020). Company annual report 2020. Retrieved from: <https://www.se.com/ww/en/about-us/investor-relations/regulatory-information/annual-reports.jsp> [accessed June 2021].
- Stevens, G. C. & Johnson, M. (2016). Integrating the Supply Chain ... 25 years on. *International Journal of Physical Distribution & Logistics Management*, 46(1), 19–42.
- Struckman, C., Reina, D., Gabrys, E. & Ramirez, J. (2020). Using Gartner's Culture PRISM to change culture. Gartner. Retrieved from: <https://www.gartner.com/document/3982141?ref=gfeed> [accessed July 2021].
- Tekic, Z. & Koroteev, D. (2019). From disruptively digital to proudly analog: A holistic typology of digital transformation strategies. *Business Horizons*, 62(6), 683–693.
- Thaler, R. & Sunstein, C. (2008). *Nudge: Improving decisions about health, wealth, and happiness*. Yale University Press, New Haven, CT.
- Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems*, 28(2), 118–144.
- Wang, Y., Skeete, J. P. & Owusu, G. (2021). Understanding the implications of artificial intelligence on field service operations: A case study of BT. *Production Planning & Control*, 1–17.
- Watson, G. H. (1994). *Business systems engineering: Managing breakthrough changes for productivity and profit*. John Wiley & Sons, New York, USA.
- World Economic Forum. (2017). Technology and innovation for the future of production: Accelerating value creation. Retrieved from: <https://www.weforum.org/whitepapers/technology-and-innovation-for-the-future-of-production-accelerating-value-creation> [accessed December 2020].
- World Economic Forum. (2018). Digital transformation initiative executive summary report. Retrieved from: <https://reports.weforum.org/digital-transformation> [accessed July 2021].
- World Economic Forum. (2019). Data science in the new economy: A new race for talent in the fourth industrial revolution. Retrieved from: <https://www.weforum.org/reports/data-science-in-the-new-economy-a-new-race-for-talent-in-the-fourth-industrial-revolution> [accessed December 2020].
- World Economic Forum. (2021). Digital culture: The driving force of digital transformation. Retrieved from: <https://www.weforum.org/reports/digital-culture-the-driving-force-of-digital-transformation> [accessed July 2021].