DRIVING BUSINESS MODEL TRANSFORMATION

HOW READY IS YOUR DIGITAL THREAD?

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IfM MANAGEMENT TECHNOLOGY POLICY

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01 INTRODUCTION

Not that long ago – in pre-digital times – a company would have a business model and strategy supported by a technology strategy. Today's world is a lot more complicated, with technology architecture informing business strategy and business model innovation as much as the other way round. In this context, we often talk about 'digitally-driven business models'.

Well-designed digital threads – which both support business priorities and anticipate customer demand – can transform enterprise decision-making and create opportunities to either strengthen existing business models in innovative ways or to invent completely new ones. In order to optimise process efficiency, enhance customer experience and improve outcomes, business and technology innovation leaders must factor digital threads into their Internet of Things (IoT) and AI architecture and strategy, and into their plans for digital business platforms.

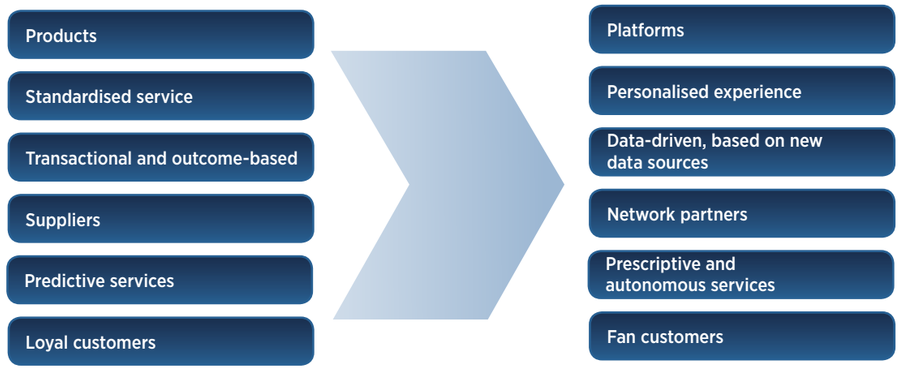
Just one example of how digital threads are likely to have a dramatic impact on us all in the relatively near future is Gartner's recent prediction that by 2022 digital twins will be saving consumers and businesses $1 trillion a year in asset maintenance[1]. But that can only happen if the digital threads that support digital twins are already in place.

Research undertaken by the Cambridge Service Alliance with HCL Technologies last year confirmed that the majority of firms consider the development of digital threads to be a priority task. However, there was significant variation in the maturity of their thinking. While some firms had started formulating their digitalisation strategy 10 years ago, most had begun around 2015, and others were only just taking their first steps. While some have clearly been ahead of the game conceptually, it is still very early days for all of them when it comes to implementation, with most still languishing in the introduction phase, trying to figure out what works and what doesn't.

In this white paper, we consider how the development of a digital thread underpins business model transformation. But we also recognise the challenge of designing and implementing one. To tackle the complexity inherent in the task, we have developed a structured approach that will help firms assess whether they have the right knowledge and capabilities to succeed.

02 BUSINESS MODELS OF THE FUTURE

It is clear that digitalisation has huge potential for disruption. It is already underpinning a transition from the old, linear business models focused on efficiency to new ecosystem-based models focused on outcomes and customer experience. The trend is most clearly exemplified by 'digital first', platform-based, consumer-facing businesses like Amazon, Uber and Airbnb.



Data-driven business model transformation

Tesla, ostensibly a car manufacturer, is in reality, more of a platform company, predicated on software upgrades and service delivery. It has a digital twin of every vehicle identification number (VIN) it manufactures. Data is constantly being transmitted back and forth from the car to the factory. If a driver notices a rattle in a door, for example, it may be fixed by downloading software to adjust the door's hydraulics. Tesla also routinely provides personalised software updates to its customers' cars based on the data it is getting from each VIN[2].

As a platform-based company, Tesla could, if it wanted to, switch from a conventional transactional business model (selling a car to a customer) to a hybrid or solution-based business model (selling mobility solutions to a customer). It could do this by opening up its APIs to third-party developers of new, complementary services and creating a parallel innovation-platform business model[3].

For firms like Tesla, such a shift would not pose a technological challenge. In fact, the technology is the easy part. But if the business model is to succeed, it would need to build on complex (digital and non-digital) capabilities within the company as well as foster a dynamic ecosystem of complementary businesses that will stimulate demand by making new products and services that add significant value. However, such businesses often need technical and financial support from the digital platform owner. The challenge lies in working out which ones to support.

We now see this same kind of thinking taking hold across all sectors, in B2B as well as B2C contexts. Only five years ago, we were still talking about making the transition from selling products to delivering solutions. Today, advances in digitalisation make that seem like a relatively modest aspiration for a manufacturer that can relatively easily disrupt its own value chain, create an entirely new platform business model and build direct relationships with its end-users and network partners. During that time, the technological effort required to bring about this kind of change has significantly reduced. The challenge is now largely strategic and managerial: why are we doing it, and do we have the organisational capabilities to make it happen?

Our research shows that those firms thinking about digital twins and digital threads are doing so because they want to reinvent their business model. This could be to:

1 DEVELOPING NEW PRODUCTS FOR NEW MARKETS

An example of a company that is completely rethinking its business model is a global elevator manufacturer transforming the service it provides to its end-users by offering personalised services.

Imagine you get into an elevator and a song starts to play. It's the one you have been listening to a lot on Spotify. A screen comes to life. It asks if you are heading to your usual floor. If that's the ground floor, it suggests that you go fetch your coat as it's going to rain later. Or you arrive in an unfamiliar and complicated building – like an airport – and the elevator tells you which gate you need and the fastest way to get there.

But the end-users are not the people buying the elevators. So why is the manufacturer creating a complex offering to achieve a fantastic customer experience? Answer: it's a price sensitive market with very tight margins where most of the profitability comes from maintenance service contracts in order to add value – and a chargeable service – for its customers.

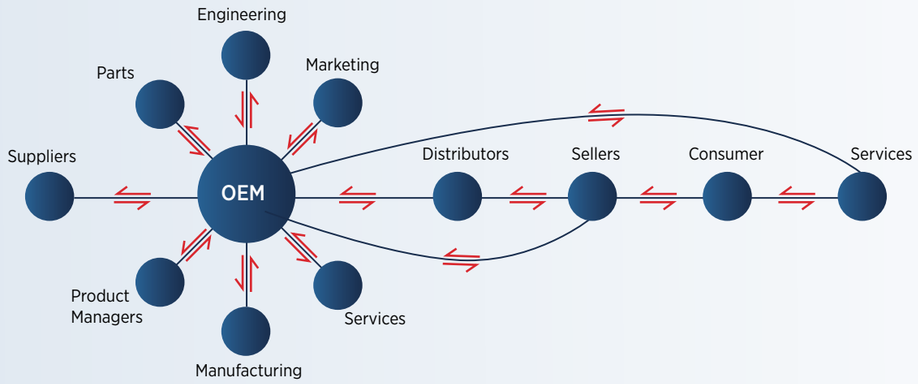
By building a digital thread that will gather data from its own connected (digital twin) sensors and combine it with external data sources such as real-time weather updates, customer data from music streaming services or airline ticketing, it is able to provide a customer experience that building operators will pay for because it gives them competitive advantage.

At the same time, by collecting usage data, the manufacturer will be able to offer additional services to building operators. For example, it could help a hospital see where bottlenecks are occurring – perhaps during visiting time - and advise it on improvements both to the fabric of the building and to its visitor and patient management strategies.

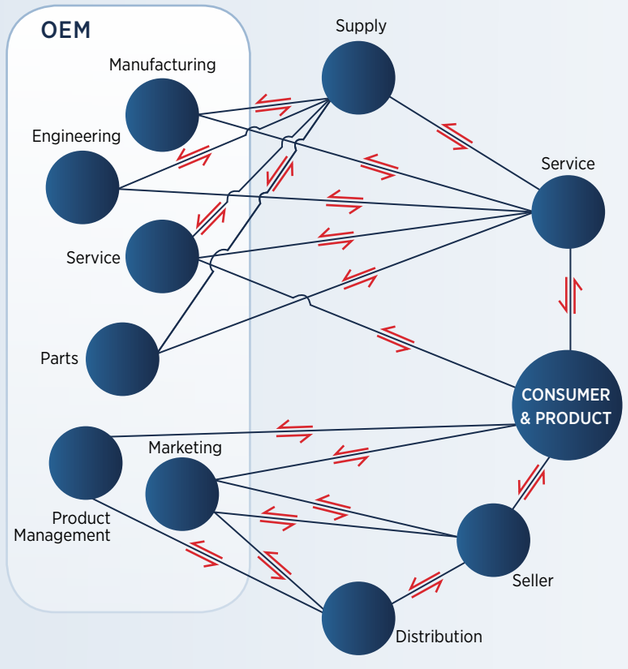
TRADITIONAL VALUE CHAIN

(AUTO EXAMPLE)

- Information flows in a linear fashion with a few direct routes to the entity that needs the information
- Information travelling back to OEM may not reach all appropriate organisations
- Information may not flow to appropriate resources



ECOSYSTEM VALUE CHAIN



- Reduce time for critical information to reach relevant resources
- Information that may be siloed in the traditional model flows freely to appropriate resources
- Information is consistent to all recipients
- Most entities have direct pulse of consumer and/or product
- This looks complex but can reduce operational complexities and missteps

Please confirm/check headings in diagrams – should they be the same?

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2 BUILD AN ECOSYSTEM AND DEFINE ITS ROLES AND RULES

Manufacturers are also grappling with the trade-off between partnering with other firms in the ecosystem versus developing their own services in isolation. To enrich the service it can offer and realise the strategic benefits of digitalisation, a manufacturer often needs to collaborate with other companies, regulators and even with its competitors.

One of the firms we talked to is in the gas sector. This is a heavily regulated and monopolised market in which the regulator controls the prices suppliers can charge and the earnings they can achieve. This has had a significant impact on this firm's digitalisation strategy, largely by *removing* its incentive to develop a digital thread.

However, the firm is working with the regulator to explore new opportunities for data-driven innovations that it could market and sell. It could, for example, use digital twins to predict when pipes are likely to fail. With repex (replacement expenditure) programmes likely to become the principal focus of digitalisation in this sector, this could generate significant savings, as would building prediction models for gas consumption and availability. However, because the regulator might force them to share any advances they make with other gas distributors, the business case for investing in new technologies is not clear.

Finding a way to promote innovation in this sector and engage with the ecosystem will become increasingly important, however particularly if it is to play its part in the development of the UK's National Digital Twin. This is a national programme in which utilities and other infrastructure assets (such as transport) will develop and connect their digital twins so that they can develop more efficient and more joined-up public services.

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3 MONETISING THE SERVICE

If there is no clear and quantifiable benefit to a business, it can be difficult to justify business model innovation. Ensuring that a revenue model is embedded in the new business model is going to be critical, therefore, particularly for digitally-driven models which often require high technological investments.

Again, Tesla is a good example of a firm that spots and seizes opportunities to drive revenues. A customer complained that drivers were leaving their cars charging while they went shopping, resulting in a big queue of waiting Teslas. Elon Musk agreed that this was 'becoming an issue', and only six days later, the company introduced a 'fleet-wide idle fee' service for better supercharger availability. This prompt response delivered better customer experience while creating a new business model.

A manufacturer of construction vehicles has changed its business model in recent years. Previously, it operated through a linear set of transactions between it and its dealerships, and between its dealerships and its end-users. By installing sensors and telematics in its vehicles to enable digital twins, it acquired a huge amount of operational data that it could provide as a service to help its end-users optimise their activities and increase their productivity. To make this happen, it had to move to a more complicated set of relationships whereby it was communicating directly with its end-users while maintaining its old sales channels via its dealerships. It took a lot of communication and trust-building initiatives to switch organisational mindsets to a point at which the OEM and its dealers saw themselves as partners in service delivery.

03 ANTICIPATING CHALLENGES

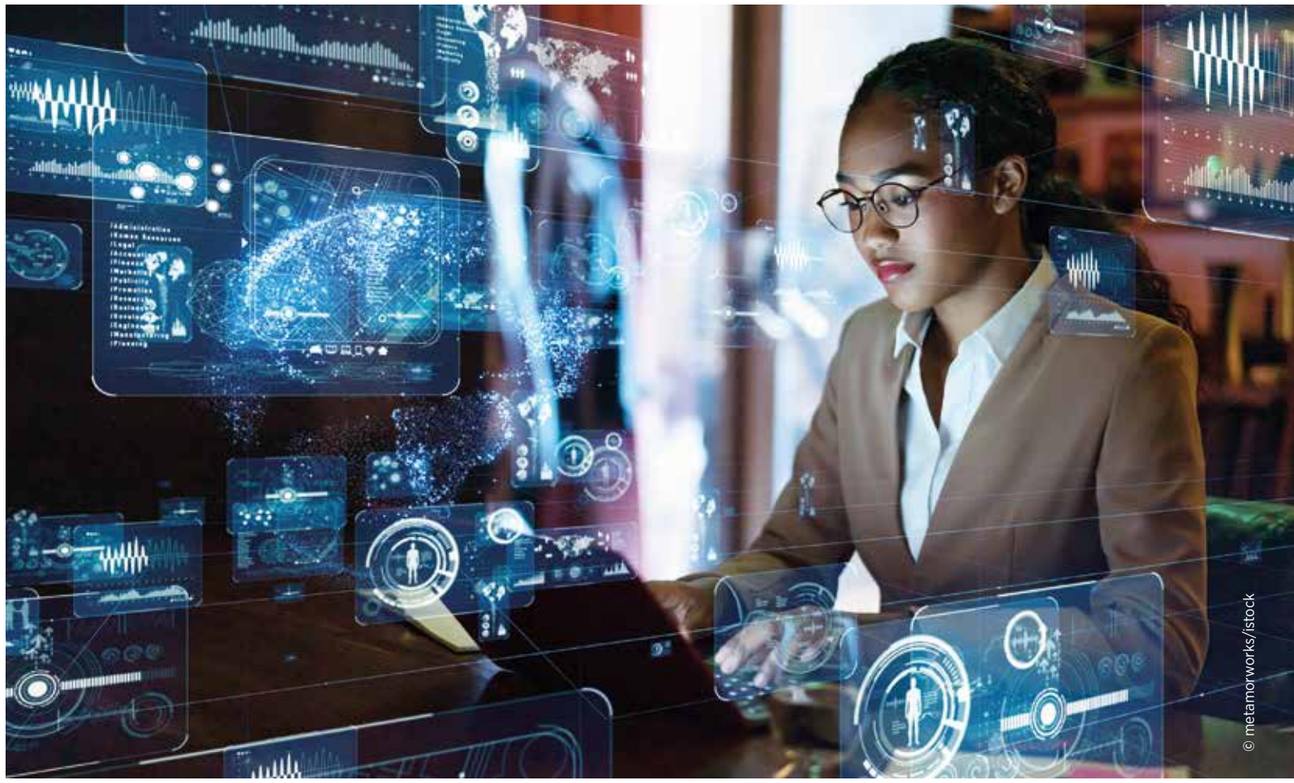
We know that firms are struggling with the implementation of digitally-driven business models, and the reasons are evident: the scale and complexity of the technical and management tasks involved.

Clearly, firms must have the support of senior management if they are to invest heavily in data management, cloud to the edge, IoT, analytics and computational models. There needs to be a clear understanding of the business benefits.

However, in some cases 'more is not always better': the cost of building a sophisticated, high-fidelity and autonomous digital twin model may exceed the anticipated business benefits. This will be an issue for organisations that don't carefully assess the expected outcomes of a project.

BUILDING THE RIGHT FOUNDATIONS

We know that digital twins need complex ***digital building blocks*** such as data structure, metadata (physical and relational) and system models of functional elements, such as product lifecycle management (PLM) or other variables. Other critical inputs may come from simulation models, CAD models, bills, materials and functional models. Capitalising on ***data*** that comes directly from the physical object as well as from external data sources (such as weather, social media, supply chain, and maintenance logs) is also essential for digital threads[4].



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CREATING THE RIGHT CONNECTIONS

The next level is the communication and integration between the physical, digital and social channels, depending on the particular purpose and context of the digital thread. Firms can create one digital twin that represents only one item and align it with its real-world physical counterpart to create a unique digital twin. On the other hand, to meet the needs of different stakeholders, an object may have more than one digital twin. A digger, for example, may have a different digital twin for its customers, manufacturers, fleet managers, dealers and technicians. For the extended or composite digital twin, the uniqueness will result from the subsystems and components which comprise its complex 'identity'.[5]

Thus, from the perspective of the digital twin, there is a one-to-one communication, but from the perspective of the physical object, there can be a one-to-many communication. ***Feedback and monitor*** features of digital twins dynamically supervise the state of objects which need direct data accessibility (such as microservices, APIs, data streams) combined with ***AI and analytics*** algorithms to generate alerts and predict simple and complex events.[6]

Short-term benefits such as predictive maintenance services can be provided by a digital twin that uses various sources of data collected from equipment and engine telemetry, fluid analysis, inspections, repair history and site conditions to monitor the health and usage of assets.

As result, condition monitoring services can be offered that can increase uptime and improve customer experience and increase the sale of parts for OEMs. The digital twin can also deliver long-term outcomes by making ***recommendations*** and taking ***actions*** to deal with failures and problems without human involvement.

THE CHALLENGE OF DATA OWNERSHIP

Building a digital thread architecture roadmap helps firms to address more complex scenarios and deal with the challenges of data ownership and, in particular, how to integrate different data sources and digital twins across the value chain.

An inability to share data is the result of a longstanding cultural approach to data privacy – as well as a regulatory issue. Data is generally not shared with any service provider outside the OEM group, unless it is under a strict agreement. Difficulties arise when different players in the ecosystem – the OEM, its dealers or customers – contest ownership. For example, an OEM or one of its dealers could legitimately claim ownership because it is their digital twin that has processed the data. However, the end-user could equally claim that it owns the asset and, by extension, the data it generates.

Thus, firms need to develop new practices and a strong culture around data use to ensure that data-based decisions are made frequently and consistently. Trust and collaboration issues between partners need careful handling or they can lead to unhelpfully adversarial relationships. These challenges are often exacerbated by factors in the external environment relating to legal, regulatory and ethical issues. Firms will sometimes have to make trade-offs between competitive advantage and data ownership. Alternatively, they can circumvent the difficulties of data-sharing by extracting insights from the data and sharing those rather than the data itself.

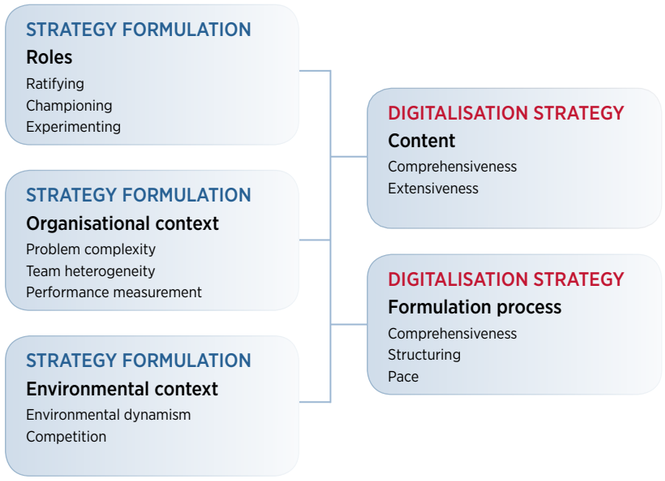
MANAGING CHANGE

We know that, in most cases, it is not the technology that's the problem. Rather, it's how firms can integrate digital twin and digital thread capabilities into their current business operating model. These ***management and operational capabilities*** needed to bring about organisational change are the ones that most firms are struggling with. The development of digitally-driven business models takes place on a spectrum. At one end, these new business models can be used to enhance products and services, improve productivity and reduce costs. But even such a relatively conservative approach requires significant levels of organisational change. At the other spectrum, however, where digital transformation underpins a radical reimagining of the business model, employees, delivery partners and even customers will need to embrace completely new ways of working.

Cambridge Service Alliance has been looking at how we can help firms address these complexities and **develop a successful digitalisation strategy** to realise their digital thread visions. To do this, companies need to assess their digital capabilities, their internal and external environments, their existing leadership and management and as well as take a comprehensive and structured approach to strategy formulation.

04 DEVELOPING A PROGRAMME FOR DIGITAL TRANSFORMATION

There is not a huge amount of academic research supporting digital strategy formulation. To bridge this gap, we have developed a systematic approach to formulating and implementing a digital transformation programme. In this framework there are three key areas of strategy formulation – management roles, organisational and environmental contexts – which determine the success both of the process of developing a strategy (formulation) and the success of the strategy itself (content).



1 DEFINE THE ROLES NEEDED FOR STRATEGY FORMULATION

Leadership is clearly a critical success factor in strategy formulation but firms are finding that the usual governance structures and mechanisms no longer apply in this age of rapid technological and cross-functional change.

For example, there is some debate as to whether the CEO or CDO (Chief Digital Officer) should drive initiatives such as digital threads. Because of the typically high problem complexity and the cross-functional nature of both the problem and the teams needed to execute solutions, it can be helpful to create a dedicated CDO role with a mandate to coordinate digitalisation activities across departmental boundaries and educate the rest of the business about digital opportunities and threats[7]. Whether it's the CEO or CDO who ultimately takes on the responsibility, there must be strong communication between business leadership and information systems leadership. Clarity about who is doing what is vital, with unclear accountability often a problem for organisations undergoing change.

Top-down versus bottom-up

In spite of the attention given to leadership attributes and capabilities, research suggests that firms need bottom-up as well as top-down strategising[8]. By bottom-up strategising, we mean idea generation through experimentation, prototyping and idea pitching. It is a vital part of a firm's digital transformation journey and can be more productive than its top-down counterpart as it is much less likely to encounter resistance. In some cases, firms have gone one step further and established an external incubator to manage their digital operations, with a view to disrupting their business models. With both bottom-up and externally-driven change, there does, however, need to be overt support from senior management coupled with mechanisms for multi-level, cross-functional implementation.

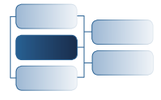
When we look at roles needed for digital strategy formulation, therefore, we have identified three that support strategy formulation: **ratifying**, **championing** and **experimenting**, which tend to be associated with top, middle and operational management respectively.[9]

Ratifying is seen as a senior management activity and refers to a cluster of behaviours which include articulating strategic intent, monitoring change and endorsing and supporting other levels of management. **Championing** usually sits with middle management and refers to more nurturing and advocating behaviours, championing and presenting alternatives to top management.

Operations managers are the ones who tend to engage in **experimenting**, which includes learning and improving, linking technical ability and need, initiating autonomous activities and taking risks.

Getting the balance between top-down leadership and bottom-up drive is both difficult and critical to ensure effective change. Business and IT leaders need to develop new ways of collaborative working which involve all the operational levels affected by digitalisation. It is no longer useful to divide work into independent silos and maximise the efficiency of each. Firms need to increase collaboration on the functional level as well as the organisation hierarchy level, if they are to succeed.

2 ASSESS YOUR GOVERNANCE STRUCTURES AND ORGANISATIONAL (INTERNAL) CONTEXT



We recommend assessing three aspects of the internal context: problem complexity, team heterogeneity and performance measurement.

Problem complexity should be analysed in terms of the number of different variables that have to be considered in strategy formulation and how interconnected and dynamic they are. For example, if the intention is to optimise an existing business model the problem complexity will be lower than if you are looking to re-invent a business model with all the organisation-wide disruption that entails.

Team heterogeneity is measured by looking at how many different functions and hierarchical levels are represented by the team members and by the information that is input into the process.

Once the digitalisation strategy has been formulated, a business still requires two distinct sets of capabilities for execution – an *operational backbone* and a *digital service platform* where the *operational backbone* represents the capabilities that guarantee quality, repeatability and scalability, and *digital services* refer to the ability to develop and implement digital innovations rapidly.[10]

Performance measurement also has different and important roles to play here: to *scan* key improvement areas, to *decide* in which areas to pursue improvement and finally to *rationalise* and *sell* the proposed improvements in social relations.

3 EVALUATE YOUR ENVIRONMENTAL (EXTERNAL) CONTEXT

Our approach to evaluating the environmental context has two principal elements – **environmental dynamism** (or turbulence) and **industry competition**. By turbulence we mean changes to the market affecting both inputs to the business (being able to recruit the right staff, for example, or source the necessary raw materials or components) and outputs, which could be determined by customer demands.

These two external factors are important for strategy formulation. According to some researchers,[7] high levels of environmental turbulence lead to highly decentralised organisational structures.

High levels of competition, on the other hand, tend to increase what is called 'strategic posturing'.[11] This is when firms are actively seeking to differentiate themselves from the competition by, for example, adopting completely new business models.

The intensity of competition is a particularly significant factor driving digitalisation. In one study of more than 180 firms, competition was the only condition that was almost always necessary for high digital innovation performance.

There is universal consensus that environmental dynamism and competition affect firms' strategies and value networks. Even incremental innovation can shift value networks from static and vertically integrated to dynamic cycles.

THE OUTCOMES

1 THE CONTENT OF THE STRATEGY: WHAT SHOULD IT INCLUDE?

Opinions differ on where the digital transformation strategy should sit and how it relates to, for example, the business strategy or the IT strategy. Some suggest that it is part of the latter while others prefer to see it as a combination of the business and IT strategy which create an overarching digital business strategy.

In terms of what needs to be in the strategy, four key themes have been identified[12]:

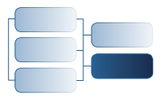
1. The use of technologies needed for building a digital thread: a firm's attitude towards technology and its capabilities to exploit it
2. Value creation: what problem is digitalisation solving and how does it affect the entire value chain – how far upstream and downstream, and how dramatic will changes be compared to the current state?
3. Structural changes: where digital activities sit in the firm's organisational structure
4. Financial aspects: underlying all of the above, the firm's ability to finance a digital transformation.

In order to create the fully connected ecosystem needed to develop and sustain a digital thread, firms need to embrace new ways of working. Those who are able to collaborate with their upstream and downstream supply network partners are going to be the big winners. Challenges arising from contested areas such as data ownership makes this difficult, which is why the companies that get it right will be at a significant advantage. To achieve this they will need understanding and capability in *all* of the following areas:

- business model innovation
- customer and community collaboration
- cross-channel integration
- insights from AI and analytics
- digitally-enabled supply chain
- a networked workforce.

If there is one key marker we are looking for in a digital transformation strategy, it is the shift to a more customer-centric and collaborative model, in which businesses move from responding to customer needs to anticipating them[13].

2 HOW FIRMS FORMULATE THEIR DIGITAL STRATEGIES



There seem to be two main pathways to strategy development which tend to be determined by sector. For example, those focused principally on developing products with relatively low customer requirements tend to concentrate on enhancing their digital operations[14].

On the other hand, B2C firms – or B2Bs more focused on service delivery – are likely to put the development of new customer value propositions first. Sometimes market factors may force firms to do both in tandem, a high-risk, high-reward approach that – if it works – can put the them in an industry-leading position.

Useful tools for strategy formulation

Balanced scorecards and performance prisms are well established tools which can be usefully applied to digitalisation strategy. A model derived from the plan-do-check-act cycle is also helpful in this context[15]. This has four process steps: positioning a company in its digitalisation journey, reviewing its current state, creating roadmap for digitalisation and implementing with technical support.

When formulating their digital strategy, firms should always ask themselves if there is a way they can involve their customers and their network partners in the process.

KEY TAKEAWAYS

HOW GOOD ARE FIRMS AT FORMULATING A DIGITAL STRATEGY?

We used this framework to investigate how 20 manufacturing firms are setting about developing a digital strategy.

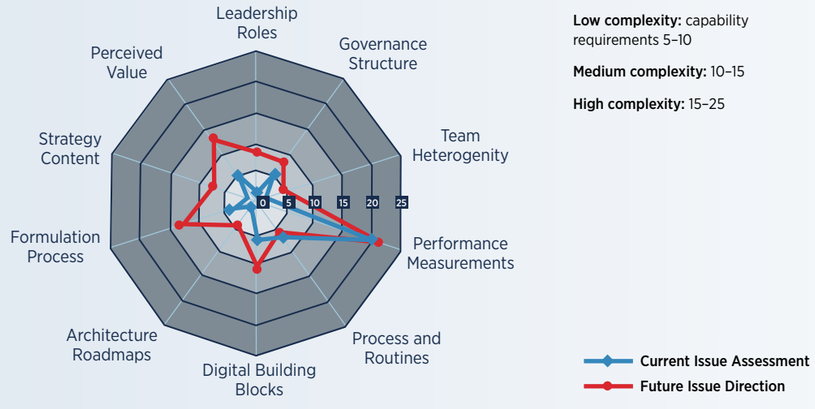
1. Digital transformation is undoubtedly a hot topic across all the companies we looked at. Virtually all had embarked on strategy formulation, some had done so ten years ago but they were the exception. Most had started around three years ago. In terms of implementing the strategy, however, the majority are still at the introduction phase.
2. Perhaps the most significant finding is that the factor that most determines the outcome of strategy formulation is problem complexity. This can be addressed using a structured approach but if a strongly experimental approach is combined with a lack of team heterogeneity and the absence of performance measurement it could lead to an uncontrolled or chaotic strategy development process. The higher the level of problem complexity, the greater the organisational and managerial readiness needed to develop successful digitally-driven business models and strategies.
3. At the other end of the spectrum, the pace of the process was considered to be the least important factor. In some cases, this was due to a conscious decision by the firm to focus on comprehensiveness and structure at the expense of speed. In others, it was because there was perceived to be less need for urgency due to the nature of the industry, perhaps owing to high levels of regulation or a relative lack of competitive pressure.
4. Taking a structured approach was found to be the key factor in ensuring a successful strategy outcome and was more important than comprehensiveness. Establishing a clear set of process stages and decision rules for the strategy formulation process is critical, therefore, and should become the strategy formulation process designers' top priority.

05 READINESS ASSESSMENT TOOL:
APPLYING THE FRAMEWORK

To help firms with the task of formulating a digital strategy, we have developed a workshop-based approach using the framework described above to assess their readiness for digital transformation. It is based on three components:

1. Understanding the **problem complexity** relating to the level of turbulence in the external environment, the dynamics of their ecosystem and whether their ambition is to optimise or revolutionise their business model.
   - **The breadth of complexity:** ie the proposed digitalisation affects processes, offerings, customers and SBUs?
   - **The depth of complexity:** ie the proposed digitalisation radically affects processes and enables a large number of new processes
   - **The duration of complexity:** ie the speed of digitalisation changes.
2. Assess the **firm's capabilities** in the key areas of strategy formulation:
   - Does it have the digital building blocks and architecture roadmaps to build complex systems like digital twins and threads?
   - Does it have the right leadership and management skills (organisational roles)?
   - Does it have the right structures, teams, processes and routines in place (internal context)?
   - Does it have the right performance measurements in place?
3. What should the **outcomes** look like? How comprehensive and extensive are they (strategy content and formulation process)?

READINESS ASSESSMENT TOOL



By taking a structured approach to assessing a firm's capabilities, we can see which are the areas of strength and identify any weaknesses that need to be addressed.

Developing digital thread capabilities is a complex, multifaceted technological and organisational challenge across different functions and network partners. If firms are to succeed in this endeavour, they need to be systematic in their approach. Our framework and the assessment tool derived from it, have been designed to highlight the factors that will be critical to the success of digital strategy formulation.

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Ashish Gupta, CVP and Head of EMEA, HCL Technologies

"CEMEX has started its journey to design new services focusing on improving our customers' experience. The Design Lab Services was launched to research, diffuse and implement new approaches and best practices for service design. We are also committed to collaborating with the best universities and experts around the world on applied research and innovation projects to get prepared for the digital revolution."

Martin Adolfo Herrera Salado, Digital Enablement, Business Consulting Services, CEMEX

"One of the key things about the Alliance is the non-competitive nature of the partners within it. That allows us to move away from some of the more traditional IP and confidentiality rules, to openly share our challenges, dig beneath the surface of some of the hype about digital and get into the nuts and bolts about how we really deliver it and the challenges we all face.'

Caroline Burstall, Supply Chain Manager for Industrial Power Systems, Caterpillar

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