



THOUGHT LEADERSHIP

A REPORT BY:
CASS BUSINESS SCHOOL ON BEHALF OF AIRMIC

Roads to Revolution

**DIGITAL TRANSFORMATION:
RESHAPING RISK AND
RESILIENCE FOR THE FUTURE**

IN PARTNERSHIP WITH:



ROADS TO REVOLUTION

Building dynamic approaches to risk and resilience throughout a digital revolution that is transforming the way in which organisations create, deliver and capture value

A report by Cass Business School on behalf of Airmic in partnership with F M Global, KPMG, Marsh & McLennan, Russell Group and Zurich Insurance

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1. EXECUTIVE SUMMARY

This report is based on research and focusses on building dynamic approaches to risk and resilience throughout a digital revolution that is transforming the way in which organisations create, deliver and capture value. The research focussed on answering the question: “How are organisations transforming their business models to ensure resilience, value and growth in the Digital Age?” To answer this question, Cass Business School, City University London, studied a number of leading organisations who are active stakeholders in the space of digital transformation.

The ‘Roads to Ruin’ report published by Airmic in 2011 looked at high-profile crises of companies which left their reputation in tatters. The ‘Roads to Resilience’ report published by Airmic in 2014 looked at how companies could be helped to avoid corporate catastrophe by learning from those who were leading the way in creating resilient organisations. The report introduced the Airmic Resilience Model.

The main objective of the ‘Roads to Revolution’ report is to provide pragmatic advice for risk professionals and board members, executives and other top management. It is aimed at those who want to ensure that risk management, resilience and digital transformation permeate their organisations to constantly protect brand and reputation. Achieving resilience and transformation is challenging and it requires significant board-level support.

WALKING THE “ROADS TO REVOLUTION” IS NOT AN OPTION

Walking the “Roads to Revolution” is an existential must. The report highlights the research findings on some of the business and organisational trade-offs that leaders and managers will have to grapple with while walking these revolutionary roads and shows the implications of these trade-offs for risk, risk management and governance.

The report makes the point that while some definitions and practices for risk management and governance might seem unaffected by the digital revolution, the underlying business and organisational dynamics are so different from the past ones, they trigger the need for a major rewiring of both risk management and governance. For instance, this report shows

that boards will have to deal with the digital revolution not just as a cybersecurity issue. Cybersecurity is, and will remain key for any organisation, but boards will have to reskill and introduce new mechanisms to ensure effective and efficient oversight, strategic leadership and, ultimately, legitimacy for their organisation.

The lack of a common language is one of the most material issues standing in the way of good governance.

We need a structure for the digital conversation to take place.

Technology, information and security expertise needs to be deployed to help the decision makers ask the right questions to build strategy and allow effective board oversight.

“RESILIENT ORGANISATIONS IN THE DIGITAL AGE MUST CONSTANTLY REINVENT THEIR PURPOSE. THIS INVOLVES BEING AWARE OF OPPORTUNITIES, BEING WILLING TO COMMIT AND RECOGNISING THAT CONFIDENT FORWARD-LOOKING BEHAVIOUR SHOULD BE REWARDED”

THE AIRMIC RESILIENCE AND TRANSFORMATION MODEL

The research discovered that additional components are required for the Airmic Resilience Model to take account of digital transformation. The additional components are identified as 'redesign processes'; 'retain stakeholders'; and 'reinvent purpose'

Enhancement of the existing components of the Model is also required, so that they become more aligned with advances in technology.

The research has resulted in the development of the 'Airmic Resilience and Transformation Model'. This provides a comprehensive and coherent structure to enable organisations to embrace advances in technology.

Taken individually, some of the transformational capabilities are not particularly new. For instance, the first industrial revolution was spurred by automation, and organisations and businesses have sought connections and used 'data' since the early days of human trading. But while these 'capabilities' in isolation are not particularly new, the research shows that, together, they shape some peculiar "born-digital" strategic and organisational challenges and risks for the case study organisations.

The eight principles for achieving resilience and digital transformation are summarised as:

1. risk radar focused on emerging risks and developments in technology
2. resources and assets able to take full advantage of developments in technology
3. relationships and networks that are constantly developed and extended
4. rapid response supported by excellent communication within the organisation
5. review and adapt to events to protect and enhance reputation
6. redesign processes to embrace new technologies and encourage innovation
7. retain stakeholders during the transformation by analysing big data
8. reinvent purpose by opportunity awareness, commitment and capabilities

Board members require assurance that the eight principles of resilience and transformation are implemented. However, the board conversation

about resilience and digital transformation is most likely to focus on the associated business enablers within the organisation, rather than the principles.

The four business enablers identified in this report are

1. Leadership and governance
2. Business structure
3. Strategy, tactics and operations
4. People and culture

IMPLICATIONS FOR GOVERNANCE

Organisational structures, the economy and society are evolving very fast. Alongside this, the world of the risk professional has to evolve too. Technology is driving greater connectivity and interdependence at an escalating speed, which in turn means that risk can be more connected and concentrated. Risks that previously might have been considered distinct may develop blurred boundaries.

All this is happening in a global context. Organisations may have to synchronise risk management activity across several jurisdictions, yet keep it locally relevant and across different operational, tactical and strategic business levels, yet keep it business division relevant.

Building on the four business enablers, resilience and transformation can be summarised by considering four types of organisational resilience. Table E.1 presents the features of the four types of organisational resilience and these can be used to guide the board conversation on resilience and transformation.

All four types of resilience are required for an organisation to achieve successful resilience and digital transformation. None of the styles of resilience is more important than the others, although they do represent an aspiration hierarchy. Arguably, integrative resilience is the starting point for successful resilience. Ultimately, the most successful organisations have strong people and culture business enablers and this represents a position where resilience and transformation results from the confidence, commitment and capability of individuals.

Although all four types of resilience are required in order to achieve successful resilience and digital transformation, it is often integrative resilience that is the strongest within an organisation. It is from this point that the three other types of resilience are developed

towards structural, transformational and ultimately contextual resilience. This progression represents developing maturity in the resilience agenda of the organisation. Transformational resilience will be enhanced by redesigning processes and retaining stakeholders. In many ways, the ultimate and most difficult to achieve form of resilience is contextual resilience. By developing people and culture and ensuring robust implementation of risk radar and reinvent purpose principles, risk and opportunity awareness will be improved and contextual resilience will be achieved.

The business enablers define and support the business model for the organisation. They are 'leadership and governance'; 'business structure'; 'strategy, tactics and operations'; and 'people and culture'. As indicated by Figure 3, the enablers can, in combination, be used to support resilience and transformation. The ways in which the business enablers lead to increased resilience and transformation are context specific, as they are dependent on the size, nature and complexity of the organisation, as well as the business environment and organisational capabilities

All organisations have these business enablers in place, but the different nature of the enablers in each organisation indicates why there are different roads to resilience and transformation. Every organisation has the capability to achieve increased resilience and digital transformation, but it requires risk professionals and boards to decide how each of the enablers can be managed, to change the way an organisation views risk management and the achievement of increased resilience and successful transformation.

IMPLICATIONS FOR RISK PROFESSIONALS

Taking advantage of the new opportunities requires a shift of emphasis in three areas:

1. Better alignment with business priorities: Risk professionals need to demonstrate strong business and commercial acumen and engage more intensely with the company's strategic ambitions and major investments. This will sharpen their ability to develop valuable insights into emerging concerns and help scope innovative risk mitigation solutions.
2. More flexible deployment of resources: Enhanced analytical skills and methodologies, including the introduction of new data science and automation techniques, should free up capacity in risk teams for more project-based (as opposed to routine) risk work and the provision of advice to business and functional leaders.
3. Greater dynamism in stakeholder engagement: A more creative lens with regard to emerging risks will enable risk teams to engage with institutional and individual biases and blind spots and help build an appreciation of threats for which evidence may be limited or conflicting.

Strategic, tactical and operational technology risks must be synchronised to avoid the creation of lags. Risk management must synchronize the different speeds at which the strategic (or external) risk, tactical risk and internal (or operational) risk run. The job of the risk professional is to challenge the organisation to make sure that lags do not emerge and that the typically faster speed of external developments is synchronised with those of the organisation, that they move smoothly and in the same direction.

To take this forward, some risk leaders may need to expand their comfort zone. But those who can mesh strategic vision, influencing skills, and technological fluency on top of their core risk-management expertise will be best positioned to help their organisations negotiate dynamic risk environments laden with potential shocks and disruption. A cultural change is required because risk professionals have historically been technical people. There is a need for risk professionals to become business partners. They need to go and talk to people and champion the new type of risk. The job of the risk professional will involve challenging the leadership team. Tools such as the risk register might be misleading and give a false sense of confidence. In these legacy governance models based on risk registers, risk used to be concerned with events. Therefore, organisations are moving away from static risk registers and towards horizon scanning and scenario analysis. In the words of Airmic CEO John Ludlow: "The risk professional is someone who understands context and business and becomes a business partner."

2. PREFACE EMBRACING CHANGE

The digital revolution has been gathering pace for many years, changing how we live our lives, run our businesses; turning aspects of our relationship with technology from enhancement to dependency.

The pace of change is exponential, isolated systems have joined up forming systems of systems. Big data, data analytics, the Internet of Things, cloud computing, Blockchain, machine learning, robotics, artificial intelligence and virtual reality are all accelerating change. Everything connects and is interconnected.

We are embedding digital technology into our world, our businesses and ourselves. We know more, do more, make more and impact faster and with greater effect. We are both disruptor and disrupted.

Such power can be deployed more widely than ever before, concentrating power in the hands of the few. The distribution of benefits heightens the age-old battle between the few and the many.

Furthermore, we seem willing to allow digital artificial intelligence to take decisions for us, to thinking faster than we can imagine and certainly faster than we can reflect. Unintended consequences seem to be the only certainty.

How can we take advantage of this power, how can we not fall victim to it, how can we resist doing harm faced with such rewards, either intentionally or unintentionally? Few of us would dispute that humankind's relationship with digital

technology is not always pure-hearted or wise.

Faced with such fundamental and profound change and uncertainty we must assess the risks, identify strategies, implement, change and monitor and review. That is what we do.

Our Airmic Roads to Resilience report (2014), which followed on from Roads to Ruin (2011), was developed in a world where physical and commercial assets were well understood and intangible assets and risks, for example trust and reputation, were being developed. This evolution of our economy and our wealth was largely enabled by technology and driven by the need to differentiate products and services through experiences. The report gave us a robust understanding of how businesses could build resilience.

Given the fourth industrial revolution, what rules do we need to reset, what governance and risk management capabilities do we need as a society, in business and in our own lives?

Our Airmic Roads to Revolution report was commissioned to help us understand how the exponential influence of digital technology

might ultimately change our business resilience model and how the digital revolution must transform the management of risk.

"WE KNOW MORE, DO MORE, MAKE MORE AND IMPACT FASTER AND WITH GREATER EFFECT. WE ARE BOTH DISRUPTOR AND DISRUPTED"



John Ludlow
CEO Airmic

3. FOREWORD

WALKING THE ROAD TO REVOLUTION IS NOT AN OPTION

The exponential development of digital technologies and their rapid diffusion and adoption are triggering a paradigm shift of which we have only recently started seeing the deep institutional, social and economic implications. For firms, business opportunities are exciting.

Pervasive connectivity, artificial intelligence, “cloud” computing, distributed ledgers, robots offer firms with transformational opportunities for value creation, value delivery and value appropriation. The breadth and depth of these opportunities is so vast to open ahead of firms several “Roads to Revolution.”

The first point that this report makes is that walking these “Roads to Revolution” is not an option, it is an existential must.

Secondly, this report highlights the research findings on some of the business and organisational trade-offs that leaders and managers will have to grapple with while walking these revolutionary roads.

Thirdly, this report shows the implications of these trade-offs for risk, risk management and governance. This report makes the point that while at the face value some definitions and practices for risk management and governance

might seem unaffected by the digital revolution, the underlying business and organisational dynamics are so different from the past ones to trigger the need of a major rewiring of both risk management and governance. For instance, this report shows that boards will have to deal with the digital revolution not just as a cybersecurity

issue. Granted, cybersecurity is, and will be, key for any firms. Yet, as long with cybersecurity, boards will have to reskill and introduce new mechanisms to ensure effective and efficient management monitoring, strategic leadership and, ultimately, legitimacy for their organisation.

This report offers some principles for boards to deliver on this goal, with the hope that leaders and managers alike will fully consider the implications of the digital transformation and will not sleep walk the “Roads to Revolution”.

“BOARDS WILL HAVE
TO RESKILL AND
INTRODUCE NEW
MECHANISMS TO
ENSURE EFFECTIVE
AND EFFICIENT
MANAGEMENT
AND ULTIMATELY,
LEGITIMACY FOR THEIR
ORGANISATIONS”



Gianvito Lanzolla
Professor of Strategy
Cass Business School
City University of
London

4. FOREWORD

THE FUTURE IS NOW

Our profession must be fit to lead in the context of the transformation this report describes. It is a given to be competent in the risk management and insurance professional 'basics'. However in a world where there may be increasing optimism and a comfort in dealing with uncertainty, organisations are gearing themselves up to be more agile to seize opportunities in the Digital Age.

Risk professionals recognise these challenges, but at times have been reluctant to step up and step in to offer support to their business leaders. Yet boardroom risk including poor governance, the potential impact of breaches in laws and regulations including the GDPR, managing sanctions and pension exposure) will increase. These D&O-type risks are predicted to eclipse current market and political risk that top the ranking in the spring. Risks will change and new risks will emerge. Airmic members report that reputation risks continue to take centre stage, but risks directly associated with the Digital Age and transformation are catching up.

Risk professionals have historically been technical people. There is a need for risk managers to become business partners. They need to network, collaborate and become recognised as champions for changing and emerging risks. The

job of the risk professional will involve challenging the leadership team. Tools such as the risk register might be misleading and give a false sense of confidence as they will increasingly become out of date faster than risks can be re-assessed, recorded and reported. These legacy governance models largely based on risk registers, are event-oriented.

Organisations will move towards risk management systems and processes offering greater scope for agility. Techniques such as horizon scanning, scenario analysis and sophisticated risk radars will become the new normal of risk tools.

This report provides some clear signposts for the new knowledge and skills our members must have.

The Digital Age is not an option and it is not something to be filed away to be dealt with on another day. The Future is

Now and risk and insurance professionals and their professional acumen must reflect this.



Julia Graham
Deputy CEO and Technical
Director
Airmic

"THERE IS A NEED FOR
RISK MANAGERS TO
BECOME BUSINESS
PARTNERS AND
BECOME RECOGNISED
AS CHAMPIONS FOR
CHANGING AND
EMERGING RISKS"

5. RESEARCH PARTNER ORGANISATIONS

	<p>FM Global is a leading insurance organisation with a unique risk management focus. With blue-chip clients around the globe looking to develop cost-effective insurance and risk-financing solutions, taking a proactive approach to business risk management and minimising the financial impact if a loss occurs. Client-centric programs draw upon our: State-of-the-art loss prevention engineering, research and science; Predictive analytics capabilities; Tailored risk management and risk-transfer capabilities and support services; backed by Superior financial strength. Understanding and managing risk is more complex today than ever before. FM Global's services combine engineering, business modelling and financial analysis to develop flexible, tailored and efficient solutions to solve risk management challenges and strengthen resilience to maximise the value of risk management and stakeholder value. www.fmglobal.co.uk</p>
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	<p>Russell Group is the leading risk management software and services company that provides a truly integrated framework to help corporate and (re)insurance organisations model vulnerabilities from connected risk. Our products and services have been used by clients to quantify exposure, manage risk and deliver superior return on equity. Follow us on Twitter @russellgroupLtd; Facebook; and LinkedIn or subscribe to Connected Risk. www.russell.co.uk</p>
	<p>Zurich is a leading multi-line insurer that serves its customers in global and local markets. With about 54,000 employees, it provides a wide range of property and casualty, and life insurance products and services in more than 210 countries and territories. Zurich's customers include individuals, small businesses, and mid-sized and large companies, as well as multinational corporations. www.zurich.co.uk</p>

6. LEAD RESEARCH CASS BUSINESS SCHOOL



Gianvito Lanzolla, Professor of Strategy at Cass Business School, City University London

Gianvito Lanzolla is Professor of Strategy at Cass Business School, City, University of London, which he joined in April 2006. From January 2016, he serves as Dean of the Faculty of Management, the largest Faculty of the School. He is the Founding Director of the Cass's Digital Leadership Research Centre (DLRC). Before joining Cass, he was a Research Fellow on the Faculty of the London Business School (2004 – 2006). Professor Lanzolla's research revolves around the competitive, strategic and organisational implications of technological change. His research articles have been extensively featured in the media – e.g., FT, WSJ, the Economist - and published in leading outlets including Academy of Management Journal, Academy of Management Review, Production and Operations Management, Journal of Management and Harvard Business Review. An accomplished instructor, Professor Lanzolla teaches Strategy, Diversification, Growth and Digital Transformation in MBA and Executive Development programmes. Professor Lanzolla has also advised several boards, leadership teams and policy makers around the world on topics including growth, strategy execution, innovation and leading the digital transformation.



THE PROJECT ADVISORY GROUP

Name	Organisation
Suki Basi	Russell Group Limited
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David Broughton	Centrica plc
Philippe Cotellet	Airbus Defence and Space
Paul Goulding	Heathrow Airport
Tim Graham	GlaxoSmithKline
Paul McDonald	BAE Systems plc
Katie Moore	Vodafone Group Services Limited
Julia Graham	Airmic
John Ludlow	Airmic
Gianvito Lanzolla	Cass Business School, City, University of London

7. SUMMARY OF CHAPTERS

Part 1: Implications of Digital Transformation

Chapter 1: Rationale for the 'Roads to Revolution' research

- Purpose of the research
- Broadening scope of resilience
- Impact of digital transformation
- Corporate governance requirements
- Structure of the report

Chapter 2: Context of the 'Roads to Resilience' research

- Identifying the opportunities and challenges
- Digital transformation 'trade-offs'
- Risk Management in the digital age
- Business enablers and digital transformation
- Key findings and conclusions

Part 2: Digital Transformation and the Board

Chapter 3: Corporate governance and digital transformation

- Approaches to corporate governance
- Digital transformation and governance challenges
- Governance for the digital age
- Legacy approach to corporate governance
- open-source' governance model

Chapter 4: Governance of digital transformation by the board

- Threats to successful digital transformation
- Responding to digital risks
- Connected and contagious risks
- Strategic, tactical and operational technology risks
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Chapter 5: Leadership of digital transformation by the board

- Management of technology risks
- Resilience and Transformation Model
- Aligning resilience with digital transformation
- Matrix to illustrate resilience and transformation
- Achieving business resilience and digital transformation

Part 3: Digital Transformation and Risk Professionals

Chapter 6: Extending the Airmic resilience principles

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- Resilience and transformation principles
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 - Enabling 'strategy, tactics and operations'
 - Enabling 'people and culture'

Chapter 7: Transformation principles 6, 7 and 8

- Risk management in the digital age
- Summary of the transformation principles
- Components of the transformation principles
- Enabling enhanced resilience and transformation
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 - Enabling 'people and culture'

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Table 4.1: Technology 'trade-offs' and associated risks

Table 5.1: Features of the types of organisational resilience

Table 5.2: Business enablers, outcomes and relationship to the principles

Table 5.3: Achieving business resilience and digital transformation

Table 8.1: Outcomes of the four types of organisational resilience

Table 8.2: Achieving the resilience and transformation principles

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11. APPENDICES

Appendix A - Case studies

Appendix B - Interviews

Appendix C - Research templates



PART 1: IMPLICATIONS OF DIGITAL TRANSFORMATION

*Intelligence is the ability
to adapt to change*
Stephen Hawking

CHAPTER 1: RATIONALE FOR THE 'ROADS TO REVOLUTION' RESEARCH

This chapter provides an introduction to digital transformation and explains the rationale for the research, introduces the eight principles of resilience required in the context of digital transformation and explains the implications for governance.

The 'Roads to Resilience' report (Airmic, 2014) identified the five principles that need to be in place for an organisation to achieve resilience. However, now that the digital revolution is increasingly influential, organisations realise that resilience based on current resilience models is insufficient when undertaking digital business model transformation. The 'Roads to Revolution' research identified the need for enhanced governance arrangements to support resilience and transformation. In providing guidance for board members and risk professionals, this report concludes that there are four types of resilience required and these are described as integrative, structural, transformational and contextual. This report also considers the need to update the Airmic resilience model to embrace both resilience and transformation. The original resilience model had five principles and the research has developed these five principles by the addition of an extra component in each case. As well as enhancement of the existing five principles, the report also identifies three additional principles that are required to achieve digital transformation. It is important that all eight principles are implemented in full and embedded into the business enablers.

PURPOSE OF THE RESEARCH

Research question:

"How are organisations transforming their business models to ensure resilience, value and growth in the digital age?"

This report examines how risk and resilience are changing as a result of advancements in technology and sets out how digital transformation impacts board members; governance arrangements; and risk professionals. In particular, the report considers:

- Board skills, competence and effectiveness generally and non-executive director (NED) skills, competence and effectiveness specifically, to exercise prudent direction and control of an organisation with good judgement and wisdom in looking ahead;
- Board risk blindness, including the failure to recognise risks inherent in the business, including risks to the business model, reputation, and 'licence to operate'; and
- Governance requirements for the new digital world, including understanding how digital transformation and cyber risks affect governance structures.

This report also considers the role of risk professionals and the need for arrangements to be in place to ensure successful:

- Risk identification and digital dependencies, including risks to the organisation of connectivity, security, privacy and integrity of critical processes, services and assets;
- Crisis response and threat assessment, including exploring how organisations can evaluate the risks of digital transformation to the business model;
- Understanding of risks arising from digital delivery and third-party models, including applications, artificial intelligence, and combined data models; and
- Management of risk exposure from digital-enabled business models that fail to meet new national and international legal and regulatory requirements.

The digital revolution, or as it is sometimes called, the "fourth industrial revolution", is a marriage of physical and advanced digital technologies which is transforming the ways in which organisations develop and execute strategy. Several leading studies have highlighted the fundamental changes in risk connectivity and complexity that the digital revolution is bringing and the speed with which change is occurring. The need to re-purpose business models and enhance governance structures in response to digital transformation and a changing balance in the value of intangible assets and associated risks, is a fundamental outcome of the research and is emphasised throughout this report.

Airmic recognises that organisations must be aware of how the digital revolution changes the way in which businesses build resilience and, crucially, how they approach and manage risk. The Roads to Resilience report describes the 'five principles of resilience' and four business enablers (the qualities that enable resilience). The revised resilience and transformation model presented in this report brings into focus three core elements of the model – outcomes, principles and business enablers. The quote below from Richard Smith-Bingham at Marsh confirms the additional challenges for board members and risk professionals that arise from emerging risks in the digital age.

GETTING PRACTICAL WITH EMERGING RISKS

Risk leaders should devote more resources to grappling with emerging threats. While this doesn't mean tasking teams with predicting the future, it does call for a stronger role in challenging prevailing assumptions and giving shape to key uncertainties in a way that illuminates the impact of plausible scenarios and informs senior management decisions. It involves recognizing not just that new risks are appearing on the horizon, but that operational risks may become strategic risks, known risks may become unknown, controllable risks may become uncontrollable, and risks assumed to be acceptable may acquire "fat tails."

Three things are essential if work on emerging risks is to remain true to the messiness of these issues and also be truly integrated into corporate decision processes. These are: creatively exploring the sources of risk; embedding a thorough risk characterization in impact analyses; and being able to justify potential responses.

The search for emerging threats requires looking beyond the issues that can immediately and easily be anchored to business performance. Unpack hot risk topics and trends to see how different—often non-market—forces might surge or collide in problematic ways. Tease out pockets of volatility or uncertainty in the firm's commercial ecosystem. Apply a fresh lens to the firm's strategic and institutional vulnerabilities.

Management levers that address a range of top-tier emerging risk concerns may present a more compelling business case than multiple action plans targeting individual issues. However, overly generic recommendations will encounter pushback from company leaders as they will be unable to articulate what they will deliver and the (opportunity) cost of doing so. The threshold for mandating action is that much higher than for familiar risks, given the high levels of uncertainty, especially with regard to preemptive responses.

Richard Smith-Bingham

Director, Global Risk Centre, Marsh & McLennan Companies

THE BROADENING SCOPE OF RESILIENCE

The Roads to Resilience report explored the increasing importance of resilience for all types of organisations. However, resilience is mainly focused on returning the organisation to its previous state in terms of the efficiency and effectiveness of business processes. There is an increasing need for organisations to look beyond resilience and this report explores the need to move to successful business transformation. In many ways, this is similar to a business process re-engineering initiative. However, the combination of resilience and transformation extends beyond process re-engineering and can be represented as a revolution in the way organisations are managed and governed.

One of the most important drivers that requires organisations to embrace transformation is technology. There has been a digital revolution that requires a response from all types of organisations. The pace of change for organisations, both in terms of internal and external factors, has never been greater and is increasing in pace. The global financial crisis of 2008 demonstrated how rapidly circumstances can change.

The focus of this report is on the impact of technology and the digital age on the business models. The report focuses on the need to update and extend the Airmic resilience model in light of these changing technological capabilities. This report also recognises and provides commentary on the governance implications of digital transformation. The rapid pace of change faced by organisations in response to technology developments is not only concerned with the cyber security and the data protection. There is a much broader governance agenda associated with digital transformation.

Ultimately, organisations need to fundamentally review and reinvent their purpose and business model to respond to digital transformation. This requires governance of strategy, tactics and operations and these enhanced governance processes require a fundamental shift in the membership, operation and influence of the board. In the words of Charles Ewen, director of Technology at The Met Office "Transformation needs to be continuous. You have got to plan resilience and disruption on the go. It is about building a constant need for more transformation. It is different from adaptation.

RESILIENCE INDEX

The majority of loss is preventable, and sound research and data is crucial to identify and prioritise the risks facing your supply chain. By using data and financial analysis, we can recognise and avoid potential disruption, protecting revenues and supply chains, to stay resilient to changing risk dynamics. Having the right data on emerging markets can go a long way to providing multinationals with the knowledge they need to build a resilient supply chain. That's the reason we created the FM Global Resilience Index back

in 2014. The ability for businesses to use the Resilience Index to help build resilient supply chains is still a key differentiator for FM Global, even as the tool's remit has become wider – now being used as an enterprise risk tool rather than purely as a supply chain risk management tool.

Adriano Lanzilotto, Vice President, Client Service Manager,
FM Global

Transformation is never over. Transformation is a perennial part of our fabric. It is a permanent feature of business now."

This report evaluates the scope of what is required and explores the governance challenges faced by organisations, including the need to accommodate fundamentally important transitions that are discussed in this report as 'trade-offs'. The importance of digital transformation to the continued success of organisations is explored further in the quote below from Andries Terblanché at KPMG.

EXPECTATIONS OF RISK MANAGEMENT

This research reinforces the changing demands and expectations of risk management. It ascertains, consistent with other findings, that businesses are required to think differently about risk management in light of the unprecedented and unrelenting levels of change, of which digital transformation is one root cause.

Traditional risk modelling methodologies, such as heat maps, have served us to a point; but now more needs to be done. This was evidenced by a pervasive finding of "more is required to better understand the realities of today's risk environment". It was also echoed in boardrooms across the economic spectrum. As such, heat maps are increasingly being treated as a "first order" analysis of risks only.

Andries Terblanché, Global Lead of Dynamic Risk Assessment, KPMG

IMPACT OF DIGITAL TRANSFORMATION

To understand the business implications of digital technologies and their adoption, the first step is to understand the unique opportunities and challenges of digital technologies. There are many digital technologies and several terms and even esoteric jargons used to describe them, including Cloud Computing, Big-Data Analytics, Artificial Intelligence, Hyper-Connectivity, Augmented and Virtual Reality and Distributed Ledgers.

Navigation of what these terms and jargon mean for the organisation is key and that once identified, the language and meaning chosen is communicated and used consistently and clearly across the organisation.

The challenges of digital transformation cannot be over-emphasised.

The business models of well-established business sectors, including retail, have been fundamentally impacted by advances in technology.

The impact of technology has also been significant in business sectors that depend on physical assets, such as buildings. This is demonstrated by the extract from the CBRE case study included in full at Appendix A.

CBRE

CBRE is restructuring its internal technology function to meet the business requirements more effectively. Attempts are being made to shift technology from being a facility to becoming a business enabler and potentially a driver of the business. For CBRE, the digital transformation is about incorporating more digital and automation elements to either streamline its products or make them more sophisticated at each of its product lines.

CBRE senior management is aware of the need to invest in new technologies to enhance CBRE's business model. CBRE has started to acquire companies that only have technological products whereas historically CBRE was buying service capabilities. A recent acquisition is Floored Inc., a 3D virtual reality platform; Environmental Systems Inc.; and Forum Analytics, which predict future performance of buildings based on data and technology.

Extract from CBRE case study

In the absence of frameworks that can capture holistically the novelty of digital technologies, a more pragmatic approach is to focus on the transformational capabilities that the digital technologies introduce and identify their combined effect. Table 1.1 summarises the various digital technologies considered in this report and lists some of their salient transformational capabilities that have become available for organisations.

Digital technology	Transformational capabilities for organisations
Cloud Computing	On demand computing and on demand data storage
Artificial Intelligence	Intelligent automation
Big Data and Analytics	Informed decision making (for humans and machine alike)
Internet of Things	Pervasive, real time, connectivity of “everything”
5G connectivity	Pervasive, real time, connectivity
Augmented and Virtual Reality	Integration/blurring of the physical and digital worlds
Distributed Ledgers e.g., Blockchain	Disintermediation of trust (from institution-based trust to technology-based trust)

Table 1.1: Digital technologies and their business implications

Taken individually, some of the transformational capabilities described at **Table 1.1** are not particularly new. For instance, the first industrial revolution was spurred by automation, and organisations and businesses have sought connections and used “data” since the early days of human trading. But while these ‘capabilities’ in isolation are not particularly new, the research shows that, together, they shape some peculiar “born-digital” strategic and organisational challenges and risks for the case study organisations.

REAL-TIME MONITORING DATA A CRUCIAL COMPETITIVE DIFFERENTIATOR

Although monitoring and related analysis are still at an early stage of evolution, Zurich is expecting to see hugely impactful changes to risk management, including much more streamlined service offerings. Businesses will see a better return on investment in terms of how they manage risks. Generating more data on building use and physical infrastructure for example, will fundamentally improve how businesses present risks to insurers, increase operational efficiency and reduce dangers.

Zurich is assessing the most effective real-time data interfaces between insurers and clients, potentially including the use of secure, distributed ledger technology, such as blockchain, to share the information. Zurich has an advantage in this space given its investment in B3i, the industry’s blockchain initiative that has insurance broker and client support.

Greater risk management demands are expected to be placed on businesses and insurers in the coming years as the scope of data creation continues to grow. But for Zurich, the upside is that the changes are opening up these important opportunities for the industry to change fundamentally its ways of working.

Real-time monitoring data will prove to be a crucial competitive differentiator for firms in the industry.

Digital risk has myriad advantages from an insurer’s point of view, but for the traditional underwriters, if they don’t go into their own eco-systems and look at the monitoring available, they could get left behind.

David N Roberts, Head of Proposition RE, Business Analytics & Global Relationship Leader
Zurich Commercial Insurance UK

It should be emphasised that digital transformation is undertaken primarily for the benefits that can be achieved. Cyber risks and concerns about data protection have been identified as major risks or threats, but the positive benefits of digital transformation should be the main driver for organisations to embrace new technology. The extract from Intu demonstrates the opportunities associated with digital technology and also demonstrates that the scope for gaining benefit from digital transformation is as important to businesses with physical assets as it is to businesses that only exist as online digital capabilities.

IMPACT OF DIGITAL TRANSFORMATION

We’ve got a lot of digital infrastructure in our centres, such as wi-fi systems, monitoring systems etc. We are responsible for the data we capture through those systems. We own and manage that data. Depending on the permissions given, we could send customers who use our wi-fi special offers and event information. There is a lot of technical innovation involved.

We are working with several technology companies to provide services like bots, to help our customers find what they need on our consumer-facing website. This is part of Intu Accelerate, an incubator programme that we’re running so that we can work with exciting new start-up companies to help make retail better. The idea is that we are challenging the ways we operate and how shopping centres operate. We also investigate ways to support our retailers and customers, for example we’ve got hologram safety messages at the top of the escalators telling people to be careful when using the escalator. We are talking about AI technology for meet and greet service next to the door. There is a lot of innovative thinking here.

Extract from interview with Claire Combes
Director of Risk and Assurance, Intu

CORPORATE GOVERNANCE REQUIREMENTS

Governance becomes more important and more challenging in the digital age. There is a major requirement for organisations to have governance arrangements in place that are sufficiently robust for the digital age. Also, governance procedures need to operate successfully at all stages before, during and after digital transformation. This requires additional board technology skills, understanding and experience.

Traditionally, companies rely on their corporate governance systems for their strategic responses and to deal with business challenges. Corporate governance has long been based on the idea of aligning the interests of managers and shareholders within a closed-system approach. This traditional approach is referred to in this report as the 'legacy' system of corporate governance. This incorporates three distinct corporate governance functions:

1. Monitoring function, including control over managerial decision-making and discretion;
2. Strategy function, providing management with expertise and access to resources and support in delivering objectives; and
3. Legitimacy function, focusing on compliance with governance codes, and broader societal expectations.

Further analysis of these three functions is provided in Chapter 3. The multiple challenges that digital transformation brings to corporate governance functions are also explored further in Chapter 3. When considering the impact of digital technologies on governance functions some advantages seem increasingly evident.

Connectivity technologies might enable wider access to resources and better informed strategic decision-making. They might also make compliance functions of the board more routine and effortless. The business press, technology vendors and consultants have all highlighted these benefits. However, this may be too optimistic a view of the governance impact of digital technologies.



KEY TAKE AWAYS

Chapter 1: Rationale for the 'Roads to Revolution' research

- This chapter explains the rationale for undertaking the 'Roads to Revolution' research in view of the ever-increasing digital capabilities available to organisations. The following bullet points provide a brief summary of the three critical issues that should be evaluated in detail when deciding the implications of this research for an organisation.
- Table 1.1 provides a summary of the digital technologies that are available and their business implications. Digital transformation can only be achieved by embracing the opportunities presented by these enhanced digital capabilities.
- Organisations need to achieve resilience if they are to continue to be successful. However, resilience alone is insufficient when digital technologies offer organisations the opportunity to transform business models.
- Attempting to undertake digital transformation without oversight and understanding by the board is very high risk. The board needs to provide enhanced corporate governance of digital transformation in order to increase the chances of success.

CHAPTER 2: CONTEXT OF THE 'ROADS TO RESILIENCE' RESEARCH

This Chapter discusses the opportunities and challenges associated with digital transformation. Organisations undertake digital transformation to pursue opportunities. This scenario is forcing organisations to think differently which is changing the demands and expectations of risk management.

Ever-increasing digital capabilities enable organisations to update their business models. This is usually referred to as digital transformation. Almost all organisations are affected by the digital revolution and can take advantage of recent technological advances. It is essential for organisations to achieve successful digital transformation, in addition to enhanced resilience. The opportunities offered by the digital age are significant, but the challenges are enormous. These opportunities and challenges present organisations with a series of trade-offs that are discussed in this report. Given the significant implications of digital transformation, the need for enhanced corporate governance has become more critical and the report considers these governance challenges. Digital transformation is also increasing the interconnectivity, complexity and potential impact of risks and challenging organisations to think differently. This is changing the demands and expectations of risk management. Effective risk management requires taking interdependencies between risks into account and a truly holistic or enterprise risk management approach.

CONNECTED RISK BRINGS RISK AMPLIFICATION

If you accept that the world is connected, then you have to accept that risk is connected too. What connectivity brings is risk amplification. What this means is that the more connected you become, the more you're exposed to the unknown risk. The unknown risk includes cyber risk, political and geopolitical risk and the risk of all stakeholders involved in business. In the interconnected world, we see blurred industry sectors and overlapping business networks. The board and senior leadership team needs to develop a strategy that recognises this new reality and adapt accordingly.

Suki Basi, Managing Director
Russell Group Limited

VERTIV

It is important to highlight that as Vertiv grows into the predictive analytics and maintenance, several of the existing roles/capabilities may not be required. However, adopting digital technologies across the value chain and creating/merging platforms will require people to be comfortable in utilising these platforms, in learning new ways of working and dealing with greater transparency.

Vertiv has a great opportunity to update performance management systems and accelerate the strategy execution and goals alignment. A new performance management system would

IDENTIFYING THE OPPORTUNITIES AND CHALLENGES

There have been huge advancements in digital technology in recent times. These advancements have given existing organisations the opportunity to embrace digital technology and transform their business models. Other organisations or individuals have seen opportunities arising from developments in technology and set up new businesses to exploit the new and/or enhanced digital capabilities. Therefore, digital technology offers opportunities to existing organisations, as well as providing opportunities for new (referred to in this report as 'born-digital') businesses to be established and provide new services that did not exist before the digital revolution.

The extract from the Vertiv case study emphasises the benefit of improved customer offering that can only be delivered by digital transformation of the business.

Whether an organisation was established before the digital revolution, or is an existing organisation seeking to take advantage of enhanced digital capabilities, the Airmic resilience and transformation model described in this report is relevant. From the very outset, all businesses are in danger of disruption from further developments in digital technology. Therefore, all organisations need to identify the opportunities that arise from each new development in technology. Organisations need to be aware of the challenges that arise from adopting new technology and overcome the threats, such as cyber-risk and data security. There is no doubt that an organisation will have a limited lifetime if it fails to embrace digital technology and routinely reinvent purpose.

The opportunities associated with digital technology impact all aspects of the business model. Perhaps the most obvious opportunities arise from modifying the existing customer offering to take advantage of new technology or from developing new digital offerings that did not

have more frequent goal settings, coaching and developmental sessions. Recognition and feedback should be real-time fed into a digital data base across the organisation. This will involve the various stakeholders that this individual is collaborating with for goals/strategy/tasks execution (especially in such a matrixed organisation with multiple bosses and collaborators). Digital technologies can help in aligning and engaging cross-siloed teams.

Extract from Vertiv case study
Appendix A: Case Study A.6

exist before the digital capabilities were available. Many of the obvious enhancements to the customer offering are associated with changes to the customer interface and delivery mechanisms.

Customer interfaces in retail have changed substantially with an increasing percentage of purchasing being undertaken on the Internet through online ordering. This has reduced the need for physical shops in retail parks and in town centres. At the same time, the retailers are able to more easily access a greater number of potential customers online. Marketing costs are thereby reduced and the cost of running retail premises can be avoided by new 'born digital' organisations. The use of big data provides organisations with the opportunity to identify the preferences of potential customers and target their products and services to specifically identified individuals. This means that the success rate for converting individuals into customers is likely to be higher.

INSURANCE MOVES FROM REACTIVE TO PREDICTIVE

At FM Global, we know that our clients' business resilience relies on our ability to arm them with relevant and sound research that can help them make informed supply chain decisions. That is why we have developed a suite of digital tools and services, from Predictive Analytics, the Resilience Index and the Global Flood Map, to the recently released Cyber Risk Assessment Tool, which enable companies to identify where they are threatened by risk. Risk management strategies can then be developed to ensure that their business remains resilient.

Predictive Analytics, using sound science and research-based data enables companies to pinpoint exactly where they are vulnerable to risk. This makes it possible to create proactive solutions for the identified risks, creating resilience in the long-term.

Philip Johnson, Operations Senior Vice President, FM Global and Managing Director
FM Insurance Company Ltd.

Modifications to the customer offering or development of new customer offerings, together with the ability to gain easier access to customers are obvious opportunities that arise from digital transformation. Additionally, opportunities arise from the ability to maintain customer service levels at reduced resources. This is truly a time of digital revolution.

Whilst it is difficult to be certain about the impact of new digital technologies on businesses models, nevertheless, it is clear that digital

technologies represent significant transformational opportunities and new capabilities for all organisations. These new capabilities include:

- On demand computing and on demand data storage
- Intelligent automation based on artificial intelligence
- Informed decision-making (for humans and machine alike)
- Pervasive, real time, increased connectivity
- Integration/blurring of the physical and digital worlds

These individual capabilities may not be new, but the research shows that, together, they shape some specific strategic and organisational challenges and risks for the case study organisations. The threats associated with digital transformation are also important and should not be ignored. This point is well illustrated by the boxed text taken from an interview with John Ludlow, Chief Executive Officer at Airmic.

Therefore, digital technology has the capability to increase organisational resilience, both in relation to reputation and finances. By using enhanced digital communication capabilities, resilient organisations are better able to respond to adverse events and/or customer complaints. The importance of this enhanced ability to respond to crises is made by Andries Terblanché of KPMG below.

THE CONSEQUENCES OF THE DIGITAL REVOLUTION

This report discusses the transitions that businesses need to consider. This rings even more true now that the risks facing business have become interconnected to an unprecedented extent. Much of this is the result of the digital revolution. Yet it has become clear that the rapidly changing landscape necessitates risk modelling with forward looking as well as retrospective capabilities. Analysing past data is only part of the solution: You can only get so far considering there is no data for modelling the impacts of the unravelling of 'Quantitative Easing', or the energy revolution and/or the digital transformation. In terms of transitions, modelling and monitoring these events and associated risks is critical not only to the management of organisations, but also to inform business strategies. As we have recently observed again, corporate survival is as much about taking opportunities as it is avoiding dangers in the 'Fourth Industrial Revolution'.
Andries Terblanché, Global Lead of Dynamic Risk Assessment

Andries Terblanché
Global Lead of Dynamic Risk Assessment, KPMG

RESPONSIBILITY FOR RISK MANAGEMENT

In today's turbulent environment anytime you are not in a crisis, you are in a pre-crisis. In addition to connected risk, complex risks and concentrated risk you've got capability lag risk and blurred risk. This can arise when all risks – such as supply chain risk, strategic, human and technology risk all come together in a crisis.

When considering who is responsible for risk management, the answer comes if the culture is right. One needs to develop a business-collaborative approach to risk and break down the task into clear responsibilities with the people involved. It is rarely as

simple as it seems on first sight.

In addition to known risks which are changing and new risks which are emerging, there is an issue of legitimacy/governance, which goes side by side with trust and reputation. Sometimes, there is a lack of integrity between what we are and what we say we are and how others see us.

Extract from interview with John Ludlow,
Chief Executive Officer, Airmic

DIGITAL TRANSFORMATION 'TRADE-OFFS'

In order to achieve digital transformation, organisations need to undertake certain evolutions or transitions and decide the extent to which each evolution will be advanced. These evolutions identify the changes that need to occur for digital transformation to take place. They can also be considered to be a series of 'trade-offs' between the two extremes. The list of relevant 'trade-offs' is set out at Table 2.1. These 'trade-offs' underpin or facilitate successful digital transformation. In all cases, it is for individual organisations to decide the extent of each transition by taking account of the 'trade-off' represented by that transition.

Additionally, a shift is required in relation to governance arrangements. This is characterised by a shift from compliance to legitimacy in the governance approach. This is considered as part of a more general discussion about governance in Chapter 3. The 'trade-offs' listed in Table 2.1 are considered in more detail below.

1. Ownership vs. Access

The research shows that digital technologies, differently from previous information technologies, are becoming increasingly core in a business, not just a support function. Consider, for example, the CBRE and Vertiv cases where digital technologies are becoming a key part of their service and product offering, respectively.

It follows that the first evolution that companies face when dealing with digital technologies is the rather basic trade-off of 'make vs. buy', which in the digital context can be better described as ownership (of the technology) vs. access (to the technology). For instance, Network Rail, is building a cloud-based archive to protect data assets for future use. Zurich has built Artificial Intelligence (AI) capabilities using several external providers.

2. Science vs. Data science

Digital technologies facilitate decision-making based on big data. The evolution that arises here is science vs. data science. In order to address that, data-oriented risk analytics is now emerging as a new discipline in systems science and engineering. Systems need to be developed to distil useful information for systems security and reliability, theories on big data-driven industrial systems reliability, evaluation index and early warning systems, as well as measures that can properly handle and cope with security breach. Gradual improvement of data-oriented risk analytics and Enterprise Risk Management (ERM) are seen as a way of helping organisations adapt to the changing environment and develop necessary skills.

On the other end of the spectrum there is science, with its promise of universality. Despite the massive amount of data that The Met Office has, a purely data-based predictive approach is not likely to be successful and the Met Office is considering options to become a curator of science. Every time a new machine (supercomputer) is introduced, it increases data complexity. Science at the Met Office needs to be kept alive to understand what to do with data internally after 2020-2023 when The Met Office anticipates that the data will become too big to move.

3. Stability vs. Experimentation

The research shows also that companies are struggling in defining their core business and in driving execution accordingly. Thomas Cook has changed its strategy five times over the last seven years, from trying to replicate the Expedia.com business model to becoming a high-end travel company. Thomas Cook is experiencing increased disconnect between its strategy and required capabilities to execute strategy. Thomas Cook is mostly reacting to changes in customer behaviour on the broader environment triggered by digital technologies, although the

	Pre-digital status	Post-digital status
1	Ownership of the technology	Access to the technology
2	Science based on experience	Data science based on big data
3	Stability in capabilities and coordination	Experimentation to find product market fit
4	Slack or excess resources and capacity	Efficiency / optimisation of resources
5	Knowledge specialisation to identify specific solutions	Knowledge integration to break down organisational silos
6	Control within the organisation	Openness to extended networks

Table 2.1: Digital transformation and evolutions or 'trade-offs'

Source: Lanzolla, 2018

company is not transforming the whole business model. If Thomas Cook is successful in moving customers from physical to online channels, then its core business will also change, but the stability forces in the organisation are perhaps stopping the transformation. With the current pace of change, even senior managers do not always know how their company will evolve in the next five years. As organisation structures become more fluid and constantly evolve, stability in capabilities and coordination mechanisms become a dream of the past. Netflix, which started as a streaming service has reconfigured itself as a media and entertainment company. Netflix has not only changed its strategy several times, but also its capabilities and organisation several times.

4. Slack vs. Efficiency

Network Rail is embracing digitisation to improve optimisation. The vision for the future includes major changes and Network Rail expects that the digital railway project will increase network efficiency by 30%. 'Digital Railway' is the proposal for the UK to adopt modern digital signalling and train control within the next 25 years and create credible options to upgrade the railway to next-generation technology as it becomes available. Network Rail is undertaking several projects, all aiming to achieve better resource allocation, decision-making and delivery closer to customers.

While digital technologies enable a drive towards optimisation, optimisation often becomes over-optimisation and this has side effects. For instance, Network Rail accepts that their operating models are optimised within a certain range of variability of the external and internal parameters. The quote from Dr Jamie Saunders below considers the implications of over-optimisation.

RISK AND DIGITAL TRANSFORMATION

Digital transformation has a complex influence on risk management. It affects the way in which risk can propagate, including across borders, which can create cross-jurisdictional complexity. It means that we have to think differently about business continuity. For example, usually the thinking is that the same thing can't happen simultaneously in different parts of the globe. But with cyber it can. This issue is magnified as the priorities of business shift towards hyper-optimised systems. I'm not sure that those driving hyper-optimisation always realise the impact that this can have on assumption about the localisation of risk.

Extract from interview with Dr Jamie Saunders
Jamie Saunders, Independent consultant, former Director of the National Cyber Crime Unit, and a visiting professor at UCL

5. Knowledge Specialisation vs. Knowledge Integration

Another evolution highlighted by the research is the tension between knowledge specialisation that provides a specialised solution to a specific customer need and knowledge integration that provides integrative solutions to a wider set of customer needs. The strategic drift of digital technology adoption is towards knowledge integration.

While knowledge integration might decrease levels of organisational silo behaviour or "siloism", it can also blur the boundaries for responsibility and accountability.

For example, Vertiv's transformation into industry verticals has not yet been completed due to the difficulties in defining lines of responsibility and accountability. Also, Thomas Cook is moving towards an omni-channel strategy, to avoid losing customers when they move across channels. To become closer to the customer, Network Rail is transforming the entire organisation and undergoing a process of devolution, which will result in nearly all investment decisions being taken at route, or local, level as opposed to centrally.

6. Control vs. Openness

Digital transformation requires a new type of relationship with "the outside world". The reputation of an organisation depends on digital artefacts as they become more important for constructing relationships with the outside world. Business rules have changed due to digital 'disintermediation'. Industry boundaries have become fluid. The accelerating interdependence between ecosystems has not only created new business opportunities but also introduced new risks not sufficiently covered by the traditional approaches of risk management. Digital 'disintermediation' disrupts long-term partnerships and supply chains to the extent that a long-time business partner may become the biggest competitor if that partner starts serving customers directly.

Legacy businesses, such as CBRE, faces challenges from asymmetric competitors. These are businesses from outside the industry that are nothing like existing businesses, but offer competing value to customers. Therefore, organisational decision-makers have to identify, assess and manage these disruptive risks in a strategic manner. To make digitally enabled ecosystems both profitable and sustainable, risk management calls for new strategies that transcend the boundaries of a single organisation and build on collaboration between interdependent partners to create mutual value.

RISK MANAGEMENT IN THE DIGITAL AGE

Digital transformation does not change some of the core principles of risk management and resilience. For instance, the key principles of resilience: 'Prevent, Protect and Prepare' and 'Respond, Recover and Review' remain the same. However, as a result of the new digital context, the approach to risk management is changing. Risk should be managed across different roles, and many risk management responsibilities will be assigned to other positions and job titles. There has to be a collaborative business approach to risk management spread across the entire organisation. Given the multifaceted characteristics and "blurring" of risks brought forward by digital transformation, business operations or the "first line of defence", should be fully trained to understand and monitor all risks, including those associated with technology, information and strategy. This requires very different individual skills and knowledge, along with a different organisational culture, compared to that which exists in many organisations today.

Everyone in an organisation has a responsibility for managing risk and the culture of an organisation will affect the attitudes and behaviours of people and in particular, their decision-making ability. In an article published by McKinsey (Culture in the digital age, 2017) it was suggested that executives must be proactive in shaping and measuring culture, approaching it with "the same rigor and discipline with which they tackle operational transformations". This includes changing strategic, tactical and operational elements in an organisation that run counter to the culture change the organisation is trying to achieve. The critical cultural intervention points identified by respondents to a 2016 digital survey (McKinsey Digital Survey 2016) of risk aversion, customer focus, and silos endorse the findings of this report and the risks run by an organisation which does not recognise and overcome "silosism".

The result of the research for this report is the enhancement of the resilience model to produce the Airmic 'Resilience Transformation' model. The Airmic resilience and transformation model has eight principles, five of which are also included in the resilience model. The five existing principles are enhanced to include additional components relevant to digital transformation. The result is that the Airmic resilience and transformation model has eight principles, each of which has five components, as discussed in chapters 6 and 7. The principles are described in outline below:

1. Resilient organisations have exceptional risk radar. Transformational organisations additionally require that the risk radar capabilities are specifically focused on emerging risks.
2. Resilient organisations have resources and assets that are flexible and diversified. Transformational organisations additionally need to strengthen resource where they are insufficient to take full advantage of developments in technology.
3. Resilient organisations value and build strong relationships and

networks. Transformational organisations additionally examine the need to extend the existing relationships and networks.

4. Resilient organisations have the capability to ensure decisive and rapid response. Transformational organisations additionally require that communication barriers within the organisation are removed.
5. Resilient organisations review and adapt to changes and adverse events. Transformational organisations additionally require specific focus on protection and enhancement of the reputation the organisation.
6. Revolutionary organisations can also successfully redesign processes. This requires a forward-looking culture that successfully embraces new technologies to ensure business process improvement.
7. Revolutionary organisations retain stakeholders during the transformation. The ability to retain stakeholders is essential for successful digital transformation and this relies on analysis of customer-based big data.
8. Revolutionary organisations have the ability to reinvent purpose. Reinventing purpose is based on opportunity awareness, the active commitment of stakeholders and the availability of necessary people capabilities.

BUSINESS ENABLERS AND DIGITAL TRANSFORMATION

Making progress with robust implementation of each the resilience and transformation principles benefits the organisation and is the focus of activities by risk professionals. Focusing on the four business enablers represents the agenda for top management (both the board and the senior executives). It is essential to decide on the actions required to enhance each business enabler. Each of the business enablers has three groups of actions that increase organisational resilience and transformation, as described below.

1. Leadership and Governance

The intention is to ensure robust leadership and governance arrangements based on an established resilience and transformation agenda supported by a board mandate; appropriate risk governance, including proactive arrangements for receiving risk information; and sufficient resources exploit opportunities by seeking business synergies.

2. Business Structure

The intention is to establish an inclusive and open business structure with an established resilience architecture, including representatives from the extended eco-system; planned and rehearsed crisis management plans with nominated crisis management teams; and absence of communications barriers, but avoidance of confusion of roles and responsibilities.

3. Strategy, Tactics and Operations

The intention is to establish a resilience-based, well-informed and integrated approach to strategy, tactics and operations based on

established resilience approach to risk and opportunities; dynamic approach to resilience with a resilience and transformation action plan; and proactive approach that embraces technology and innovation.

4. People and Culture

The intention is to establish a learning people and culture based on trust and respect that increases awareness of opportunities and threats of technology; encourages board learning, awareness and knowledge of digital advancements; and develops or recruits people resources and capabilities to exploit developments in technology.

KEY FINDINGS OF THE RESEARCH

The research was based on a series of the interviews with subject matter experts and risk management professionals, including Airmic members. Extracts from the interview transcripts are used extensively in this report.

Three main conclusions arise from analysis of the case study reports at Appendix A and interviews conducted with those listed at Appendix B and our Project Partners.

1. Digital transformation requires greater attention as part of corporate governance

Successful digital transformation of organisations requires the analysis of six evolutions or trade-offs associated with digital transformation. The transfer of the governance model in full or in part from a 'legacy' to an 'open-source' model is key. One of the fundamental conclusions is the need to enhance board awareness of the digital opportunities, threats and challenges. However, without enhanced knowledge and awareness across the board, the board will be unable to lead successful development and implementation of digital strategy.

2. Digital transformation requires an enhanced model of resilience

The principles of resilience model developed by Airmic for the 'Roads to Resilience' report provide a framework for the comprehensive analysis of the activities for an organisation to become resilient. However, the research found that the existing five resilience principles need to be supplemented to include transformation activities. Also, three additional principles are required to specifically address the necessary transformational capabilities.

3. Digital transformation requires four types of resilience

It was discovered by the research that the eight principles of resilience and transformation operate as four pairs of principles. These four pairs of principles operate to enhance the business enablers within the case study organisations. The business enablers, in turn, lead to four sets of outcomes and these are discussed in detail in the report. The next stage in the analysis of the results led to the identification of four types of resilience, described in this report as integrative, structural, transformational and contextual. All four types of resilience need to be present if digital transformation is to be successfully achieved.



KEY TAKE AWAYS

Chapter 2: Context of the 'Roads to Revolution' research

This chapter explains the context of the 'Roads to Revolution' research in terms of the strategic importance of digital transformation and the associated need for enhanced corporate governance. The following bullet points provide a brief summary of the three critical issues that should be evaluated in detail when deciding the implications of this research for an organisation.

- Table 2.1 provides a summary of the challenges presented by digital transformation. Organisations need to decide the extent to which the business model will be transformed and this is represented by a series of evolutions or 'trade-offs'.
- Risk management activities require an enhanced level of seniority within an organisation undertaking digital transformation. All of the resilience and transformation principles described in this chapter need to be implemented in full.
- Risk professionals need to adopt a bottom-up approach driven by implementation of the eight principles. However, the board will need to adopt a top-down approach driven by the business enablers described in this chapter.

PART 2: DIGITAL TRANSFORMATION AND THE BOARD

A group of people are silhouetted against a bright, teal background, sitting in a meeting around a long table. They are viewed from behind, looking towards the light source. The scene is overlaid with a teal gradient and a faint world map pattern.

*“Don’t delude yourself
into thinking something’s
working when it’s not”*

Elon Musk

CHAPTER 3: CORPORATE GOVERNANCE AND DIGITAL TRANSFORMATION

This Chapter discusses corporate governance and digital transformation in detail. Organisations need to pay attention to the governance challenges associated with digital transformation and enhance their governance activities appropriately.

Digital technology provides organisations with the opportunity to be revolutionary in their transformation strategy. However, the scale of the transformation possible requires engagement of the Board in embracing and directing change, not avoidance of hard issues. Too easily and quickly responsibilities can be devolved to a digital committee or the equivalent. This chapter considers the scope and requirements for corporate governance and the need to redefine corporate governance approaches. This chapter also considers 'legacy' approaches to governance, including the more traditional three lines of defence model, and the requirements for 'open source' corporate governance that arise from digital transformation. Digital transformation represents new challenges which requires closer co-operation between different departments and functions within an organisation, as well as closer liaison with business partners and other stakeholders.

APPROACHES TO CORPORATE GOVERNANCE

Opinions on the impact of digital transformation on the three lines of defence vary. The research for this report indicates that the responsibility allocated to each of the three lines will change as a result of digital transformation. A critical aspect related to the need for enhanced corporate governance before, during and after digital transformation relates to the board. Members of the board will need to have a much better understanding of the digital age and the implications of digital transformation on the business model.

DIGITAL STRATEGY SHOULD BE A REGULAR BOARD AGENDA ITEM

One of the keys to an effective board is that it has a diversity of perspectives, based on a range of skills, knowledge and experience. Many industry sectors will change fundamentally in the next five to six years and a large part of that will be driven by technology. How does the board identify the opportunities and ensure that the risks that come with new ventures are managed within the risk appetite? Some of the best ideas may come from new recruits because they will have been thinking about it before starting a new job. People in the middle, who will be the future leaders, should be the ones thinking about how they can turn these ideas into money rather than avoiding risk. In their view, opportunity and risk are being dealt with elsewhere; they are just doing their job. But business will fail if they don't innovate and they've got to innovate in the IT space and governance as well.

Extract from a report by Airmic
Cyber Risk Governance, June 2018

The impact of digital transformation on business models is profound. The availability of big data and the increased ease of communication gives organisations the opportunity to undertake greater empowerment and delegation of authority. This point is illustrated by the extract from the Network Rail case study where the decision has been taken to allow individual regions (or rail routes) to have more control over local decision-making. This decision is one of the opportunities that arises from digital transformation, but it also represents a challenge to existing corporate governance arrangements and requires those arrangements to be enhanced.

NETWORK RAIL

Those involved in the Network Rail digital transformation range from drivers and signallers to managers, controllers and maintenance staff. Network Rail trained 21,200 drivers and signallers to use GSM-R, the international GSM-based wireless communications standard for railway communication and applications. The success of digital transformation depends on digital, secure and dependable communications between drivers and signallers. It helps to increase safety, reduce delays and improve performance – providing a better experience for passengers.

To successfully achieve transformation, the entire organisation of Network Rail is undergoing the process of devolution, which will result in nearly all investment decisions being taken at route (or local) level, as opposed to centrally, as was previously the case.

Extract from Network Rail case study
Appendix A: Case Study A.4

DIGITAL TRANSFORMATION AND CORPORATE GOVERNANCE CHALLENGES

When considering the impact of digital technologies on governance functions some advantages seem increasingly evident. Connectivity technologies might enable wider access to resources and better informed strategic decision-making. They might also make compliance functions of the board more routine and effortless. Suki Basi from Russell Group emphasises this point in the extract below.

REQUIREMENTS OF THE DIGITAL ECONOMY

Digital transformation facilitates the opportunities associated with connectivity. The more connected we are from supply chain side and demand side, the more reliant we are on one another. The whole threat of the connected system means that our businesses should be optimized to the extreme. From the corporate perspective, market sizing becomes key, however defining a landscape for your business gets harder. Everything is moving faster. The digital economy requires transparent, accurate and fast decision-making.

Suki Basi
Managing Director, Russell Group Limited

The business press, technology vendors and consultants have all highlighted the unquestionable benefits of digital technology. However, this opinion may be too hopeful a view of the governance impact of digital technologies. **Table 3.1** briefly summarises the multiple challenges that digital transformation brings to corporate governance functions.

Challenges for the monitoring function

The business press is full of examples of organisations which have failed to monitor and prevent serious managerial misconduct, even in those equipped with sophisticated automated monitoring systems.

Far from eliminating risks arising from managerial discretion, digital technologies can compound traditional risks associated with information systems. These new monitoring risks take three forms.

- First, monitoring via digital technologies is often based on “algorithms” that, no matter how sophisticated they might be, are based on “learning”, using available data, and on “learning sets”, which are not always transparent to the final users. The research shows that some company boards often have a “deistic” faith in the “objectivity” of such monitoring capabilities, sometimes with mixed results.
- Second, the outputs of this automated monitoring are not always fully transparent. Increasingly, even the developers themselves admit that the outcomes of their “learning sets” are unpredictable.

Functions of Corporate Governance	Challenges presented by digitalisation
Monitoring function	<ul style="list-style-type: none"> □ Misplaced confidence in computer-based monitoring processes and capabilities □ Results and outputs of automated monitoring are not always fully transparent □ Increasingly challenging to monitor risks in the inter-connected networks
Strategy function	<ul style="list-style-type: none"> □ New set of resources and capabilities, such as information management □ Boards may not have skills to respond to strategic challenges across the domains □ Companies need to adopt a culture of constant change and experimentation
Legitimacy function	<ul style="list-style-type: none"> □ What is legal in one institutional setting may be completely non-compliant in another □ New strategies and business models are often deployed in a regulatory “vacuum” □ Ambiguity about what failures might affect the effectiveness of legitimacy functions

Table 3.1: Corporate governance challenges in the digital age

Source: Filatotchev and Lanzolla, 2018

As such, these digital monitoring systems introduce a new degree of volatility in the organisations. It follows that it might be challenging to build alignment between such (unpredictable) automated monitoring systems and the company's monitoring goals.

- Third, it is increasingly challenging to monitor risks in the inter-connected "organic" ecosystems. For instance, organisations as self-contained entities with well-defined and well-guarded boundaries are becoming less prevalent. Companies increasingly find themselves more and more involved in ecosystems - i.e., the network of suppliers, consumers, and platforms that need to be engaged via digital technologies in order to (co)deliver and enhance the customer value proposition.

Challenges to the strategy function

- The "blending" of the digital and physical world triggers the need for a whole new set of resources and capabilities, such as information management, collaboration and orchestration, while reducing the value of many legacy resources and capabilities. Digital transformation challenges the very core of the "assets" of an organisation and, as such, puts an ever-increasing pressure on corporate boards in terms of their involvement in strategy and strategic decision-making.
- Digital transformation brings forward a new innovation paradigm whereby innovation will come at the intersection of once disconnected knowledge domains. The emergence of popular acronyms such as Fintech, Agritech, etc. is associated with entrepreneurial ventures that are created at the intersection of once disconnected industries, with often "disruptive" outcomes. As such, digital transformation increases the need for knowledge diversity, both for "born digital" and traditional companies. Therefore, corporate boards that traditionally involve members with a high level of specialisation in functional areas such as finance, accounting, marketing etc. may not have a right set of skills to respond to strategic challenges across the domains.
- The energetic pace of change driven by digital technologies requires companies and boards to adopt a culture of constant change and experimentation. Consider the UK national weather service, the Met Office, which since 2010 has already entered the "hockey stick" (increasing returns) part of the technology performance curve. The top management has embraced a state of constant organisational change, constantly re-setting purpose and exploring new work practices and organisational forms.

Challenges to the legitimacy function

- Digital business models are often designed to operate across national jurisdictions and are exposed to what institutional theorists call "poly-centric institutional settings". What is considered legal in one institutional setting may be completely non-compliant in another. By moving their business into new institutional domains outside traditional regulation, organisations take a huge gamble that their new business models will be unconditionally accepted by stakeholders. This gamble does not always pay off, and governance mechanisms do not always account for a potential loss of legitimacy even when strategic decisions are perfectly compliant with existing rules and regulations in a specific jurisdiction.
- New strategies and business models are often deployed in a regulatory "vacuum". But a lack of regulation today does not mean that regulatory or law enforcement agencies won't interfere with an emerging industry in the future. This creates a significant challenge for governance legitimacy functions to be forward-looking in order to anticipate when and how a newly created market segment may be subject to a regulatory response. An example is the evolving regulation around data privacy.
- The institutional "vacuum" challenge is augmented by another concurrent phenomenon: digital transformation is challenging even received legacy regulatory wisdom about what constitutes "market failure". Regulation normally targets areas where the government agencies perceive a "market failure". However, there is growing ambiguity about what these failures might be and this significantly impacts the effectiveness of the legitimacy functions. Depending on which orientation the regulator(s) will take, companies might find themselves grappling with completely different regulatory frameworks from what had been expected.

GOVERNANCE FOR THE DIGITAL AGE

The challenges described above and summarised in Table 3.1 can seriously undermine the effectiveness and efficiency of traditional or 'legacy' governance practices that are based on the principles of "shareholder supremacy" and alignment of interests between directors and shareholders.

Traditionally, when designing internal governance mechanisms and governance functions, organisations have almost universally used similar corporate governance practices that are generally informed by the principal-agent framework and have resulted in the introduction of internal monitoring and controls.

The 'legacy model' of corporate governance is known for its over-reliance on financial controls as a means of dealing with governance problems (Filatotchev and Lanzolla, 2018).

In this model, company shareholders are predominantly concerned with short-term profit maximization. They would rely heavily on structural corporate governance mechanisms related to monitoring and oversight, as usually is the case when a company is controlled by dispersed owners or "transient" investors such as hedge funds.

In summary, the board monitoring focus in legacy governance systems is on the financial performance of the organisation. In general, digital strategy development is "outsourced" to IT departments or external consultants. In 'open-source' governance systems, the board monitoring focus is on strategic objectives and execution, including long-term sustainability of the organisation. There is likely to be greater attention paid to cyber-security and possible digital threats when open-source governance is in place.

LEGACY APPROACH TO CORPORATE GOVERNANCE

In legacy governance, relationships with external stakeholders are based on 'shareholder supremacy' and achievement of shareholder objectives, such as short-term financial performance with maximisation of shareholder value. Accountability and reporting uses centralised systems of accountability and communications. Managerial incentives usually involve executive share options and incentive schemes linked to financial performance. Risk management and control tends to be focused on risks related to financial and economic factors.

In legacy governance, effective monitoring is associated with independent board members, information disclosure procedures, economic risk management, and internal and external audit.

Governance relies on a centralised, hierarchical system of accountability and reporting, and board monitoring and risk management extensively use financial performance indicators as key benchmarks. In terms of board member skills, financial literacy and experience with business strategies, such as divestment, M&A and re-financing are often regarded as paramount for effective board oversight.

These systems of financial control are effective to the extent that they reduce agency costs and are hypothesised to result in positive efficiency outcomes and better financial performance. Equity-based remuneration linked to the overall financial performance provides another pillar of effective governance within the 'legacy model'.

The fundamental principles of transparency, accountability and board oversight in the context of modern corporate governance should not be challenged. However, the design and functionality of governance arrangements are increasingly challenged by the realities of digitalisation. This calls for a radical re-think of the overall organisation-level governance design. For example, by focusing the attention of independent directors on economic risk and financial controls, the organisations risk introducing biases and distorted KPIs into their monitoring mechanism. Further, digital technologies impose new demands in terms of the skills required of directors, with more emphasis on knowledge recombination and integration as opposed to knowledge specialisation, such as accounting and finance expertise.

As very few directors currently have knowledge of building new resources and assets at the intersection of digital and physical, the strategy function of boards may be seriously undermined. This is especially the case with the widespread trend of outsourcing of IT developments to external, specialist providers. As organisations and their boards face an increasing need in experimentation, this should shift board attention from monitoring as a key board function to supporting corporate innovation and strategic experimentation.

The traditional, 'closed-governance' or legacy approach that puts emphasis on the manager-shareholder dichotomy has effectively disconnected organisations from their broader stakeholder constituencies. A lack of stakeholder influence in governance can significantly undermine its legitimacy function as there is no mechanism through which various constituencies can influence the strategy process.

Clearly, the 'legacy model' of corporate governance based on the principal-agent logic is ill-equipped not only to respond to new

opportunities, but also to deal with threats presented by the 'digital revolution'. As a result, there is a growing pressure on organisations not only to improve their IT and cyber-defence systems, but also to make changes in their governance mechanisms to become more resilient to pressures associated with technological changes.

As agency-grounded solutions to governance problems seem to break down in a digitally transforming world, a new approach to what makes governance effective is needed. Organisations in the centre of digital revolution should move to an 'open-source' governance structure. The principles of 'open-source' governance Filatotchev and Lanzolla, 2018)

- Higher scrutiny of data and digital logics - investors and boards should verify how these data were obtained, elaborated and used by the company;
- Closer involvement of the board in strategy and strategy making that embraces a long-term orientation;
- Recognition of broader stakeholder interests when setting governance objectives, including direct involvement of stakeholders in the governance process; and
- Stakeholder input into strategy decisions, risk identification and management, aggregated for the board to use.

Based on these principles, the last column in Table 3.1 outlines some challenges that the 'open-source' governance model needs to overcome. There is a shift in emphasis from the over-narrow agency perspective towards developing a system of interactions between the company and its eco-system. Therefore, 'open-source' governance describes the mechanisms that organisations should adopt to govern the digital transformation.

'OPEN-SOURCE' GOVERNANCE MODEL

In open source governance, relationships with external stakeholders include formal consideration of stakeholder interests within context of long-term sustainability. Shareholder objectives are recognised as including longer-term sustainability and organisational legitimacy. Accountability and reporting is based on non-hierarchical systems of communications, accountability to external constituencies with recognition of the impacts of digitalisation. Managerial incentives include, alongside financial performance, broader indicators, such as social performance and cyber security. Risk management and control includes a wide range of economic and social factors involving organisational legitimacy internally and consideration of reputation and trust externally.

A key part of 'open-source' governance is associated with evolution to a reliance on 'strategic' rather than financial controls within the governance mechanism. These 'strategic controls' are less concerned with short-term financial performance. They are focused instead on issues related to organisational long-term sustainability and growth in market share, and continued stakeholder support.

The 'openness' of the governance mechanisms ensures that stakeholder constituencies provide key inputs into the process of strategic control and provide context for the process of monitoring. Unlike formal, highly centralised systems of accountability and reporting based on financial indicators, 'strategic controls' deploy more informal systems of communication between managers and stakeholders, as well as risk-management systems focused on broader definitions of risk, including the broader risks of de-legitimization. The latter includes a wide range of economic and social factors, such as organisational legitimacy not only with shareholders and customers, but also broader social groups, such as user communities. In this type of governance, reputational and trust considerations, rather than market for corporate control, underpin external governance pressures on managers.

The 'open-source' model of corporate governance imposes new demands on the structure and functioning of boards. Improving board effectiveness in the context of digital transformation entails a systematic redevelopment of governance policies associated with board mechanisms and director skills. In the short-term, one of the most pressing issues is the new dimensions of board diversity, beyond gender, age and traditional legacy knowledge domains. For instance, while knowledge of cyber-security has improved on many boards, more 'resident' cyber-security knowledge for example – that is not outsourced to a consultant – is required.

Boards should also equip themselves with more knowledge integration skills. There is scope to redefine non-executive directors who can span functional boundaries to share knowledge and experience between and across subjects and sectors. Changing and emerging risks demand and organisational risks that should be considered and managed by the board. These include risks of business disruption; loss of organisational legitimacy; business ecosystem risks; and relational risks.

BOARD OVERSIGHT RESPONSIBILITIES

The primary reason for investing in the analysis of global and emerging risks is to strengthen strategic, financial, and operational resilience. This is vital both for large companies with complex footprints, business lines, and supply chains, and also for smaller firms, which increasingly face similar challenges. Thoughtful analysis and integration within corporate decision processes may additionally help firms harness any potential upside arising from sharp changes in the business environment.

Regular intelligence updates on emerging risks, their relevance for the business, and the response measures being undertaken help boards of directors carry out their oversight responsibilities and act as useful inputs for high-level decision making.

Richard Smith-Bingham
Director, Global Risk Centre, Marsh & McLennan Companies

In terms of managerial incentives, new business models and technological changes necessitate the incorporation of softer, intangible, and behavioural-based performance measures within an objective setting and performance appraisal process. The performance management system combines the extent of achievement of individual performance objectives ('the what') and the values and behaviours required to deliver those results in a sustainable manner ('the how'). Again, the 'open-source' governance mechanism may provide a channel for stakeholder involvement in evaluating managerial performance both in individual targets and in a complex context of digitalisation, taking on board views of stakeholders in the ecosystem of the organisation.

Some 'profit-with-purpose' enterprises have opted for innovative forms of 'open' governance to support their business models and represent an open governance system involving key stakeholders. Ultimately, these considerations shift the view of corporate governance from an essentially internal, formal mechanism associated with monitoring and control towards an 'open system' view of corporate governance that involves external, informal channels of influence. A key challenge for corporate boards is, therefore, to recognize these channels and integrate internal processes with these external factors. This is no small feat considering that corporate governance traditionally considered external factors exclusively in the context of compliance.

CYBER GOVERNANCE – NEW CHALLENGES

The challenges that digital transformation poses to corporate governance are daunting. Legacy corporate governance principles and factors based on the agency perspective and focused on financial controls do not seem adequate to provide effective monitoring, strategy and legitimacy to organisations. At the same time, national corporate governance codes are not always keeping up with the pace of change. This adds another layer of complication and that is the duality between what is required to govern the digital transformation and what is mandated by the national regulatory bodies.



KEY TAKE AWAYS Chapter 3: Corporate governance and digital transformation

This chapter explains the requirement for greater corporate governance associated with digital transformation. The following bullet points provide a brief summary of the three critical issues that should be evaluated in detail when deciding the implications of this research for an organisation.

- Corporate governance arrangements need to meet the challenges of the digital revolution. The corporate governance functions of monitoring, strategy and legitimacy (as outlined in Table 3.1) remain valid but need to be enhanced.
- Corporate governance arrangements need to extend beyond the traditional approach, described in this chapter as 'legacy governance'. Shareholders supremacy is no longer appropriate as the leading governance principle for the digital age.
- An 'open-source' model of corporate governance is required the digital age. Digitally transformed business models require greater attention to the broader environment (or ecosystem) within which the organisation operates.

CHAPTER 4: GOVERNANCE OF DIGITAL TRANSFORMATION BY THE BOARD

This Chapter discusses the threats to digital transformation and, in particular, the importance of connected and contagious risk. The increased requirements and expectations of governance are considered in detail.

There are many threats associated with digital technologies that accompany the huge opportunities that digital transformation offers to organisations. The challenges associated with digital transformation arise before, during and after the transformation itself. The need to align strategy, tactics and operations during digital transformation represents a major challenge that is considered in this chapter. In order to achieve a successful digital transformation, organisations need to evolve in a number of ways. Meeting the challenges associated with these evolutions provides a structure for managing the risks of digital transformation. Governance of digital risks by the board requires active board involvement and understanding of the options for responding to digital risks, including insurance.

The availability and benefits of insurance for operational risks, including cyber-risk and data protection are becoming well established. Boards need to ensure that the risk financing options, including insurance are fully aligned with the digital transformation that the organisation is undertaking.

THREATS TO SUCCESSFUL DIGITAL TRANSFORMATION

There are a wide range of risks associated with digital transformation, including cyber-risks. It is only by undertaking a risk assessment that an organisation can identify the greatest vulnerabilities; the likelihood that the risks will materialise; the costs that would be associated with

those risks materialising; and, finally, how those costs will be financed. The starting point for undertaking a risk assessment is to determine the structure or taxonomy within which the risks will be identified. Table 2.1 identifies digital transformation evolutions or 'trade-offs' that are associated with undertaking digital transformation. Using this list of 'trade-offs' as a taxonomy for undertaking risk assessment provides a valuable and structured approach to the process.

Related to the strategic and organisational 'trade-offs' described in Table 2.1, there are new digital risks. These are summarised in Table 4.1, based on the findings of the research on the strategic and organisational evolutions or 'trade-offs' triggered by digital technologies. Each of the new digital risks listed at **Table 4.1** is analysed further in the text that follows.

1. Technology and information risk

Technology and information risk is often equated to cyber-risk, but it is more than this, as it is about the wider range of issues resulting from the use of technology and information that are at the core of the organisation.

2. Black box decision making

Black box is a common term used in computing, science and engineering to refer to the system, object or a device which can be viewed in terms of its inputs and outputs, without any knowledge of its internal workings.

	Strategic Evolutions	New digital risks
1	Ownership vs. Access	Technology and information risk
2	Science vs. Data Science	"Black box" decision makinga
3	Stability vs. Experimentation	Lag between external change and strategic change; Lag between strategy and strategy execution
4	Slack vs. Efficiency / optimisation	Risk concentrated in fewer assets
5	Knowledge specialisation vs. Knowledge integration	Blurring of organisational responsibilities and accountabilities
6	Control vs. Openness	Connected risk

Table 4.1: Technology 'trade-offs' and associated risks

Source: Lanzolla, 2018

3. Lag between strategy and ability to execute strategy

Lag risk comes in two forms: lag between external change and strategic change; and lag between strategy and strategy execution. The Met Office acknowledges that transformation is never completed, and the company must continually respond to (and cause) disruptions.

4. The risk is now concentrated in fewer assets

Because of hyper-optimisation, concentrated risk occurs when risk is concentrated in a relatively small number of assets. The new reality is about complex supply chains, hyper-optimisation and nested ecosystems. The geographic dispersal does not work for cyber. One needs to think in scenario-manner and look at every situation from different angles.

5. Blurring of units of analysis

Blurred risk is a term to describe the situation when in a hyper connected and geographically unconstrained environment, the lines between different types of risks such as financial risk, strategic risk, operational risk, reputation risk and others are blurred. One type of risk influences the other, and everything is moving in an organic way.

6. Connected risks

The old rules of business continuity suggested that two things cannot happen at the same time. However, with cyber-security it can. If there is an incident in Bulgaria, you would think a Bulgarian risk manager would have to take care of it. However, because of hyper-connectivity, it no longer works that way. The incident happened in one place, can affect the entire company and be detrimental for its reputation.

7. Blurring of units of analysis

Blurred risk is a term to describe the situation when in a hyper connected and geographically unconstrained environment, the lines between different types of risks such as financial risk, strategic risk, operational risk, reputation risk and others are blurred. One type of risk influences the other, and everything is moving in an organic way.

The extent of change that is associated with digital transformation is huge and it can be increased even further when organisations continually change their strategy. This is illustrated by the extract below from the Netflix case study.

NETFLIX

The Netflix CEO has stated that the biggest rivals for the streaming giant are not Amazon, YouTube or even traditional broadcasters. According to Reed Hastings, the need for customers to sleep is the primary barrier to greater consumption of Netflix services. Investors have permitted Netflix to operate near break-even on the expectation that the company will continue to proliferate, especially outside the United States.

In regard to the current business model, a lot has been in the trade press that Netflix reinvented what it means to watch, and create, TV. As 4G and more advanced networks are spreading, Netflix believes that TV will be based on internet streaming services. Downloading as well as watching content via standard TV set box is going to get irrelevant.

Netflix has disrupted the TV industry globally. The reason for such a significant disruption is that Netflix is an original content producer who has its international distribution network, partnerships with mobile network providers such as T-Mobile and Orange. By all these means it is posing a significant threat to the traditional players – the broadcasters – terrestrial, cable and satellite channels alike.

Extract from Netflix case study
Appendix A: Case Study A3

RESPONDING TO DIGITAL RISKS

Digital transformation offers substantial benefits. In the words of Claire Coombes of Intu Properties "Different aspects at the stores are a lot more experiential because of the digital effects. Those are provided by tenants rather than us. But there is a strategy to get those tenants to provide this exciting environment. The critical element of digital transformation is the speed of change. So, you need to change your risk monitoring processes. The real challenge is to keep up with the change, understand all that change."

Therefore, responding to digital risks is an ongoing process. Paying particular attention to emerging risks is essential. The quote below from Richard Smith-Bingham of Marsh provides insight into assessing options for risk response. Additionally, he states that "A truly strategic and efficient approach to emerging risks looks at the combination of measures that might collectively address the top-tier emerging risk concerns. Investment decisions regarding solutions should not only be based on a direct cost-benefit basis, but also take into account residual risk exposures."

ASSESSING OPTIONS FOR RISK RESPONSE

The existence of multiple, highly uncertain, downside scenarios means it is usually of limited value to develop detailed solutions for each one at the outset, especially as real-world events will always bring surprises. It's often more helpful to analyse the core management levers that might address a range of key threats. Acknowledging that industry and business model variations permit or restrict certain opportunities, a generic basket of levers might include strategic measures such as adjusting the business mix and country exposure profile; financial measures such as extending hedging and insurance arrangements; and operational measures such as tightening security and operational control systems. They should not all be negative in conception: aggressive market plays and investment in research and development can sometimes be more appropriate ways forward.

Richard Smith-Bingham
Director, Global Risk Centre, Marsh & McLennan Companies

Organisations should avoid implementing responses on an individual, stand-alone basis. Some emerging risks, such as cyber threats, require specific measures. Response to crises will be smoother when there is a framework based on established risk appetite criteria. The response needs to include 'Red Team' activation when the crisis is beyond the capacity of senior management in addition to their normal priorities. It is worth remembering that digital crises, especially those initiated by social media, may not be as anticipated. Therefore, the crisis management plan may not be relevant to the circumstances that actually arise.

CONTROL OF INFORMATION

How do you ensure financial and strategic resilience in the face of cyber security? You design the way you operate in a resilient way. One talks about security by design. One needs to talk about resilience by design. Again, companies may be making assumptions about their inherent resilience that are no longer valid in the digital world.

For example, spreading risk across multiple geographies or across multiple customers or suppliers may not provide protection if the same cyber incident impacts in multiple places at the same time. The way companies respond to incidents also needs to change – we live in a world where news (and fake news) travels very quickly, and so it would be a mistake to assume that its flow can somehow be controlled.

Chief Information Security Officer

CONNECTED AND CONTAGIOUS RISKS

Russell Group defines connected risk as: "The systemic exposure of commercial organisations, their partners, suppliers and clients to cumulative and cascading financial, operational and reputational vulnerabilities." The key issues for business are that the global economy is more inter-connected. Business risk profiles are more connected. This exposes business to increasing network of "connected risk". Strategy needs to be more connected to optimise opportunities and risks. Better quantification of opportunity and risk exposure is needed throughout the business network to optimize balance sheet risk.

The quote below from Russell Group confirms the increasing importance of connected risk and the need to redesign processes to take account of the potential impact of such risks. The relevance to digital transformation is that organisations need to be aware of the potential for connected and contagious risk to cause disruption. Appropriate control measures and required, together with crisis management plans to be activated when a serious incident occurs.

BUSINESS NETWORKS AND CONNECTED RISK

Connected risk is the systemic exposure of commercial organisations, their partners, suppliers and clients to cumulative and cascading financial, operational and reputational vulnerabilities. Connectivity brings risk amplification. What it means is that the more connected you become, the more you're exposed to the unknown risk. The unknown risk includes cyber-risk, political, geopolitical, the risk of all stakeholders involved in business.

Extract from interviews Suki Basi, Chris Don and Julian Kirkman-Page
Russell Group, Limited

Digital transformation involves closer links between organisations and can disrupt supply chains and delivery services. Contagion can occur locally between business partners or globally as the global economy becomes more integrated. Contagion is more likely to become widespread as dependencies between companies and the associated connectivity increases. Contagions can spread quickly and unexpectedly.

There is increasing awareness on the part of insurance companies that the coverage they offer for digital exposures needs to expand and

connected risk increases. The extract from the FM Global case study identifies a circumstance where an item of manufacturing equipment was destroyed following the hijacking of the control system. The willingness of the insurance companies to modify insurance policies acknowledges the changing nature of cyber risk exposures. This willingness to modify insurance coverage also extends to including reputational risk in insurance policies.

USING DATA AND FINANCIAL ANALYSIS FOR LOSS PREVENTION

The majority of loss is preventable, and sound research and data is crucial to identify and prioritise the risks facing your supply chain. By using data and financial analysis, we can recognise and avoid potential disruption, protecting revenues and supply chains, to stay resilient to changing risk dynamics. Having the right data on emerging markets can go a long way to providing multinationals with the knowledge they need to build a resilient supply chain. That's the reason we created the FM Global Resilience Index back in 2014. The ability for businesses to use the Resilience Index to help build resilient supply chains is still a key differentiator for FM Global, even as the tool's remit has become wider – now being used as an enterprise risk tool rather than purely as a supply chain risk management tool.

Adriano Lanzilotto, Vice President, Client Service Manager
FM Global

STRATEGIC, TACTICAL AND OPERATIONAL TECHNOLOGY RISKS

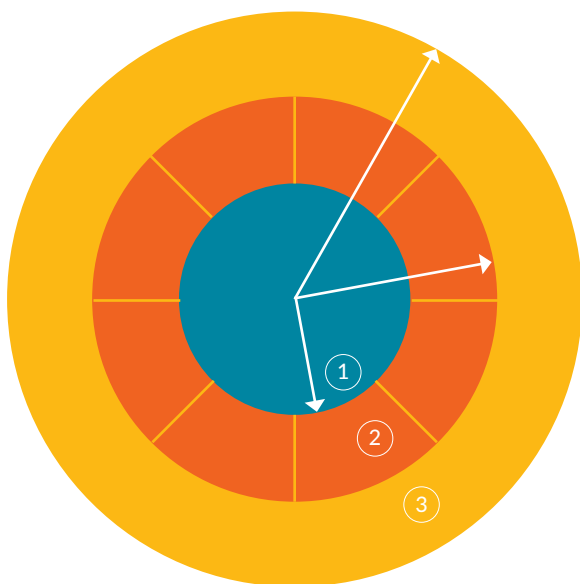
Strategic, tactical and operational technology risks must be synchronised to avoid the creation of lags. Risk management must synchronize the different speeds at which the strategic (or external) risk, tactical risk and internal (or operational) risk run. The job of the risk professional is to challenge the organisation to make sure that lags do not emerge. **Figure 4.1** illustrates the need to synchronise strategy, tactics and operations clock speeds. The quote from John Ludlow further explains how the figure can be used.

CATEGORISING DIGITAL RISK

The figure illustrates strategic risk (influencing the external context within which the organisation operates), the middle ring is tactical risk (representing the changing, dynamic business environment) and the inner ring is operational risk (relating to the risks driven by operational activities).

The lines between these rings are constantly moving and as such, risks can become transient between the three divisions and their boundaries, blurred.

Extract from interview with John Ludlow
Chief Executive Officer, Airmic



Internal (Operational risk)

Changing business environment (Tactical risk)

External (Strategic risk)

Figure 4.1:
Synchronise strategy, tactics and operations clock speeds

Source: Lanzolla, 2018

In the fast-paced external digital business environment, the outer strategic ring at 3 is speeding up and the hand of the clock is moving rapidly. This is "irritating" issues in the operational ring at 1 which are in a constant state of catch-up with external changes. As a result, the Tactical ring at 2 between the Operational and the Strategic is absorbing frictional pressures from both directions. All these "clocks" have to move smoothly and in the same direction. The role of the risk management professional is to help achieve synchronisation.

GOVERNANCE COMPLIANCE OR LEGITIMACY

In addition to the above 'trade-offs', organisations also require a shift in governance arrangements to support digital transformation. This is characterised by a shift from compliance to legitimacy in the governance approach. This is considered in more detail later in this chapter.

Robust governance standards are especially important to support resilience and digital transformation. This is demonstrated by consideration of the compliance vs. legitimacy governance debate. In an environment in which even being compliant is not enough for achieving institutional and social legitimacy, the role of social media is becoming more important. The digital age with its rapid pace of change of business processes, ecosystems and culture, requires organisations to make faster choices in terms of how to come to the same ground inside the organisation – how to make sure that all parties share the same views and aim at the same goals. The 'compliance vs. legitimacy' trade-off deals with the organisation cultures and the nature of power in organisations.

Compliance approaches risk in mechanistic ways. Many organisations continue to operate as they always used to, just adding a digital expert to the team. However, this approach is not sufficient and in some cases is potentially dangerous.

Legitimacy, trust, reputation, and governance are interconnected. Organisations need to ask themselves, "Is there a lack of integrity between what are and what we say we are?" For example, in the digital age, risk is propagated by cross-jurisdictional complexities of the polycentric approach (business orientation is based on the belief that each country is unique and needs different approaches tailored to its cultural norms). The whole structure of the polycentric environment is different, the central corporate shell being preserved whilst what's inside the shell is being eaten away. There is a global risk from multiple jurisdictions, cultures and languages. One must synchronise risk management activity across jurisdictions and still be able to make it locally relevant.

An example is how an organisation manages its logistics. Taking things off containers depends on the ability of the support systems. If the asset management system breaks, this organisation could stop dispatching. If it did, then it would lose integrity within its asset tracking system (and cash flow). To recover would require an enormous amount of work, so it is better for the organisation to keep its assets in containers.

And the digital age brings the risk of “fake-news” risk and unintentional bias. A rumour communicated through social media propagates very quickly and cannot be managed by the “legacy” approaches and systems. It is hard to anticipate and control and can undermine confidence in a product and the organisation that produces or is identified with it. Digital age enables organisations to see early warnings before it spikes in the news and recognise risks by considering interconnectivity. However, it takes a genius to put the right question and right radar to be able to catch the signals and react to it in a timely fashion. Therefore, social media changes the context of risk management. Managing brand and reputation becomes more important and more difficult.

Powerful inbuilt assumptions of boards can be a serious stumbling block to organisational agility. The way risk management is structured is tightly connected with a way business is organised. Boards often do not understand it. Not fully aware of technological change, the boards that make assumptions that are no longer valid. As a result, there is a dissonance going on.

Corporate governance systems have also been instrumental in ensuring organisational legitimacy, and this function, often, has been focused on compliance with national corporate governance codes and regulations. On the one hand, digital technologies can help with monitoring infringements or breaches of compliance. In fact, perhaps not surprisingly, organisations in highly regulated sectors such as telecoms, banking and insurance have the greatest adoption of Artificial Intelligence (AI), which includes techniques such as machine learning, for monitoring regulatory compliance.

Many organisations are using AI to comply with regulations such as the European General Data Protection Regulation (GDPR), where AI is being used to detect the flow of personal data through an organisation’s servers and to make sure that data use is compliant with the GDPR. However, as per the monitoring management function, digitising compliance is subject to the same risks. Furthermore, as well as these challenges, the combined effect of pursuing business opportunities in a changing institutional environment presents unique challenges for the compliance-focused, legacy governance practices.

Traditionally, a key legitimacy role of governance functions was to ensure that the organisation is in full compliance with rules and regulations presented by “soft” and “hard” laws in a particular country or sector. Digitalisation presents specific challenges to this governance function. First, digital business models can operate across national

jurisdictions and may find that what is legal in one institutional setting may be completely non-compliant in another. Second, new strategies and business models are often deployed in a regulatory “vacuum”. Depending on which orientation the regulator(s) take, organisations might find themselves grappling with completely different regulatory frameworks from the expected.



KEY TAKE AWAYS

Chapter 4: Governance of digital transformation by the board

This chapter explains the risks associated with undertaking digital transformation of the business model for the organisation. The following bullet points provide a brief summary of the three critical issues that should be evaluated in detail when deciding the implications of this research for an organisation.

- Table 4.1 summarises the risks associated with the digital technology ‘trade-offs’ identified in Chapter 3. These risks include blurring of organisation responsibilities and the concentration of risk in fewer assets.
- In particular, organisations need to be aware of connected and contagious risks associated with digital transformation. Businesses in the global digital economy are more interconnected and governance arrangements need to pay regard to this connectivity.
- Digital capabilities are developing at an ever-increasing rate. Accordingly, organisations need to establish the correct balance between business model stability and the need to develop new approaches by experimentation.

CHAPTER 5: LEADERSHIP OF DIGITAL TRANSFORMATION BY THE BOARD

This Chapter considers the implications of resilience and digital transformation for board members. The critical importance of board leadership in enhancing the business enablers and governance arrangements is discussed.

Board members need to understand that organisational resilience alone is insufficient in the digital age. Continuous business model reinvention is necessary not just for future success, but for the very survival of the organisation. Board members need to understand the importance of resilience and digital transformation of business models. Resilience and transformation is achieved by the eight principles described in this report. It is the responsibility of the board to ensure that the principles are embedded in a way that supports the business enablers and addresses the opportunities and challenges. This is the leadership role of the board in relation to resilience and transformation. The importance of the business enablers is described in this chapter, together with analysis of those business enablers. This chapter includes commentary on the four types of resilience that need to be attained if an organisation is to achieve resilience and digital transformation. The digital revolution requires that board members are capable of leading transformation, as well as ensuring adequate governance of the transformation. Finally, a checklist of objectives related to enhancement of the business enablers is presented for board members.

MANAGEMENT OF TRANSFORMATION RISKS

It is vital that information and technology risks are managed during digital transformation. Managing the risks of digital transformation does not equate to managing just information and technology risks. Indeed, managing risks in the digital age is much more than managing information and technology risk, often called cyber-risk. Cyber-risks can be existential risks that must be managed.

The illusion that managing these risks is sufficient should be dismantled and treated as a dangerous myth. In any case, in terms of cyber risk management, organisations are only just starting to understand how to manage the risks. Non-executive directors (NEDs) should not be involved in the direct management of the organisation. However, NEDs have a major responsibility in terms of providing leadership and governance.

Board members should oversee the management of cyber risks and the allocation of management responsibilities. It is worth emphasising that the allocation of responsibilities is more important than the awarding of job titles. However, job titles are important, but they can give rise to confusion and blurring of responsibilities. An emerging regularity sees three key figures involved in the management of cyber risk:

- CISO (Chief Information Security Officer);
- CIO (Chief Information Officer); and
- CRO (Chief Risk Officer).

THE CHIEF RISK OFFICER

In 2018, Airmic members reported that there was a need for risk professionals to upgrade some of their more traditional knowledge and skills and take a more progressive approach to risk management. They focussed on the key areas of: digital transformation; the balance between old and new skills; and integration of risk management across the business achieved by greater relevance and collaboration.

Risk professionals reported that they were up for the challenge to tackle emerging and increasingly intangible risks, to provide measurable results and more relevant risk financing solutions; and to play a leading role in crisis preparedness and response. They knew that a balance of the scientific and the artistic, the creative and pragmatic was necessary, to deal with an increasingly connected world.

THE RISK FITNESS TEST

Those who can pass the risk fitness test and who have strategic vision, influencing skills, and technological literacy as well as core risk management knowledge and expertise will be the best positioned to achieve management buy-in for helping their organisations manage a dynamic risk environment.

Richard Smith-Bingham
Director, Global Risk Centre, Marsh & McLennan Companies

It's common, even companies with well-established risk management practices, to describe their state of maturity as "we're on a journey." Championing the need to engage with complex uncertainties may take some risk professionals outside their comfort zone.

CHIEF RISK OFFICER

Airmic research in 2018 conducted into the role of the corporate CRO concluded there are various conditions where it's likely the organisation should elevate the risk leader job to being a CRO.

- If the organisation isn't taking risk seriously enough or doesn't seem capable of managing risk
- If the CEO or Chairman is looking for a trusted advisor on risk
- If the risks the organisation faces are particularly complex or uncertain
- If the risk leader is stuck in a compliance role and is unable to play a strategic role
- If the risk issues revolve around culture and behaviour
- If there is a problem with risk oversight at the board level

However, it matters more to have all the parts of a CRO in place, it matters less where those parts are. There are many groups that play a role in risk management including the board, board committees, the executive team, strategy, insurance, and internal audit. If the strategy function does a good job of scanning the horizon for risks then the risk management team doesn't need to do that. If board members hold each other to account for good risk oversight there will be less need for a CRO to push back. The important thing is ensuring all the necessary functions of risk management are happening somewhere and that they are coordinated.

Julia Graham
Deputy CEO and Technical Director, Airmic

There is no question that there are many ways to address risk management and the CRO is only one option, the issue to consider is whether the situation in your organisation causes you to lean towards or against having a CRO. In financial institutions, that's clearly been the case and outside the UK the naming convention is used more often by frequently interchangeable for what elsewhere might adopt a nomenclature of Director and/or a focus on enterprise risk management.

CHIEF INFORMATION SECURITY OFFICER

A lot of companies are trying to work out whether the CISO function should sit in the first or second line.. However companies decide to organise themselves, someone in the second line must have the competence to ensure that policies are in place to comply with cyber risk: if that is the same person as the CISO (which is true for many middle and large-sized organisations), then you lose the tension you need to have between CIO and CRO.. Of course cyber has unique characteristics, and therefore elements of cyber risk need to be managed differently, but this is not a good reason to lose some of the core disciplines of a proper Enterprise Risk Management approach.

Extract from interview with Dr Jamie Saunders
Jamie Saunders, Independent consultant, former Director of the National Cyber Crime Unit, and a visiting professor at UCL

In many organisations, the CISO still reports to the CIO. It is often the case that effective cyber risk management occurs when there is a healthy "tension" among these stakeholders. Responsibility and accountability tensions among these roles and their remits however be carefully designed. Indeed, one of the issues that rises in relation to digital transformation is the impact it will have the roles and responsibilities. The fact that more data is available as a result of digital capabilities and the increased ease with which that data can be shared will impact the dangers associated with a silo mentality. The importance of Big Data is illustrated by the quote from Andy Roberts of BAE Systems.

The functions responsible for technology, information security, data protection and physical security should be aligned to ensure the maximum opportunity for effective collaboration

DATA ESSENTIALS

Data is central to understanding operations, customers, suppliers. The ecosystems are changing, and companies are struggling to interpret data about their customers and competitors. As companies are forced to be more agile, they try to improve their data capabilities. To do so, they need to have modern platforms.

As companies are becoming more data-centric, they need to understand their ecosystems better. Data strategy and organisational integrity go side by side. There is an increasing role of Chief Data Officer or Head of Digital Transformation that ideally needs to report to the board. If there is no board representation of data, who will control the data?

Extract from interview with Andy Roberts, Director
Applied Intelligence BAE Systems

Therefore, there is a need to clearly define the role of the Chief Information Officer (CIO) and the relationship with the Chief Risk Officer (CRO). The importance of this issue is emphasised by the quote from BAE Systems. Related to the blurring of roles and responsibilities in an organisation is the need to ensure compliance with statutory obligations, that often vary in different territories around the world. The vital point for boards to understand and challenge is the allocation of responsibilities in relation to digital risks and the risks associated with digital transformation. Job titles may be necessary, but confusion of responsibilities must be avoided.

DANGER OF DATA SILOS

There is a problem for organisations in maintaining their legacy assets and making legacy work with digital technology. Organisations have some systems and data repositories in a disjointed fashion. There is an idea to create a golden data record which still has to be done. It is not merely an information and technology risk. It is a more significant issue. When your data from legacy and digital assets is disjointed, you end up having data-silos within an organisation.

Extract from interview with Andy Roberts, Director
Applied Intelligence BAE Systems

The range of skills available at the board becomes increasingly important as digital technology advances. Knowledge of the advances in technology and how these can be used to enhance business models needs to be present at all levels in the organisation including board members. Without adequate knowledge of technology at board level, it will be difficult to identify digital transformation opportunities and difficult to ensure adequate governance of the tactics being employed to exploit technology and implement digital transformation.

The boxed text from The Met Office annual report confirms the importance of digital skills at board level. The extract also indicates that enhancement of 'people and culture' business enabler (and the associated achievement of contextual resilience) starts from the top of the organisation.

MET OFFICE

Supporting all The Met Office's diverse activities is our multi-skilled board. I'm confident that the new appointments will equip our board with the skills and experience we need to support an ambitious programme of transformation and efficiency that will touch every part of our organisation.

The future inevitably brings challenge and uncertainty, both from financial and geo-political perspectives. But we face the future secure in the knowledge The Met Office can perform at the very highest level both financially and operationally. Our newly expanded supercomputing capabilities give us the tools to perform to an even higher level of world-class excellence, and so multiply the societal benefits from our services. Based, as we are, in one of the world's most interesting meteorological regions, we have every reason to celebrate the fact that what we do, we do extremely well.

Professor Sir John Beddington, Met Office
Chairman
Annual Report and Accounts 2016/2017

RESILIENCE AND TRANSFORMATION MODELS

Board members must achieve a balance between remaining informed on risks which might prevent achievement of objectives and being alert to digital opportunities presented by advances in technology. The rapid development of new technologies has resulted in the increased importance of corporate governance, but achieving robust corporate governance has never been more challenging. Boards should be alert to the fact that strategic decisions should not run too far ahead of the implementation of tactics and they should not leave operations lagging even further behind.

Technology provides significant opportunities for organisations to develop and enhance their business model. Failing to exploit these opportunities represents a threat to the survival of many organisations. In addition to the risk of failing to take advantage of advances in technology, the technology itself represents major threats to organisations, including cyber risk and data protection, loss or corruption of intellectual property and malicious disruption of operations.

However, in the digital age, resilience models, including the ability to detect, respond, and recover from gradually occurring ("creeping") or sudden events, must also adapt to ensure long-term survival and success.

This report confirms that organisations need to develop their resilience agenda to embrace technology and, in particular, digital transformation. The report identifies eight principles of resilience and transformation and these are discussed and presented in detail in chapters 6 and 7 of the report. The principles of resilience and transformation provide the focus of actions by risk professionals and other support functions. In summary, the eight principles for achieving resilience and digital transformation are:

1. risk radar focused on emerging risks and developments in technology
2. resources and assets able to take full advantage of developments in technology
3. relationships and networks that are constantly developed and extended
4. rapid response supported by excellent communication within the organisation
5. review and adapt to events to protect and enhance reputation
6. redesign processes to embrace new technologies and encourage innovation
7. retain stakeholders during the transformation by analysing big data
8. reinvent purpose by opportunity awareness, commitment and capabilities

The importance of the eight principles of resilience and transformation and the four business enablers, is illustrated at **Figure 5.1**. This figure provides an updated version of the Airmic resilience model that includes the additional principles required for digital transformation.

GLOBAL FLOOD MAPPING - BUILDING RESILIENCE

FM Global's Global Flood Map represents a significant departure from the majority of existing flood mapping tools. By identifying the physical properties of locations through hydrology and hydraulic science which considers factors such as rainfall, evaporation, snowmelt and terrain, rather than relying on outdated historical records, an advanced prediction for flood-risk can be created. This can allow for appropriate risk management strategies to be created, building resilience for all stakeholders involved.

**Russ Kirby, Assistant Vice President, Senior Account Manager
FM Global.**

Flood is one of the costliest commercial property risks, and it's only getting worse with climate change, globalisation and urbanisation. Companies with properties anywhere in the world can now quickly identify the base flood risk for all of their facilities on a globally consistent, apples-to-apples basis, at a resolution of just 90 metres by 90 metres.

**Brion Callori, Senior Vice President, Engineering and Research,
M Global**



KEY TAKE AWAYS

Chapter 5: Leadership of digital transformation by the board

This chapter explains the need for leadership by the board during digital transformation of the business model. The following bullet points provide a brief summary of the three critical issues that should be evaluated in detail when deciding the implications of this research for an organisation.

- Figure 5.1 presents the Airmic resilience and transformation model. The model identifies eight principles of resilience and transformation that provide a comprehensive framework for organisations to respond to the demands of digital transformation.
- A comprehensive approach to resilience and transformation is characterised by the need to achieve four types of resilience. These are identified as integrated, structural, transformational and contextual resilience.
- These four types of resilience are not presented as a hierarchy, but are all necessary to achieve resilience and transformation. Achieving all four types of resilience requires the 'bottom-up' approach from risk professionals, combined with the 'top-down' approach from the board.

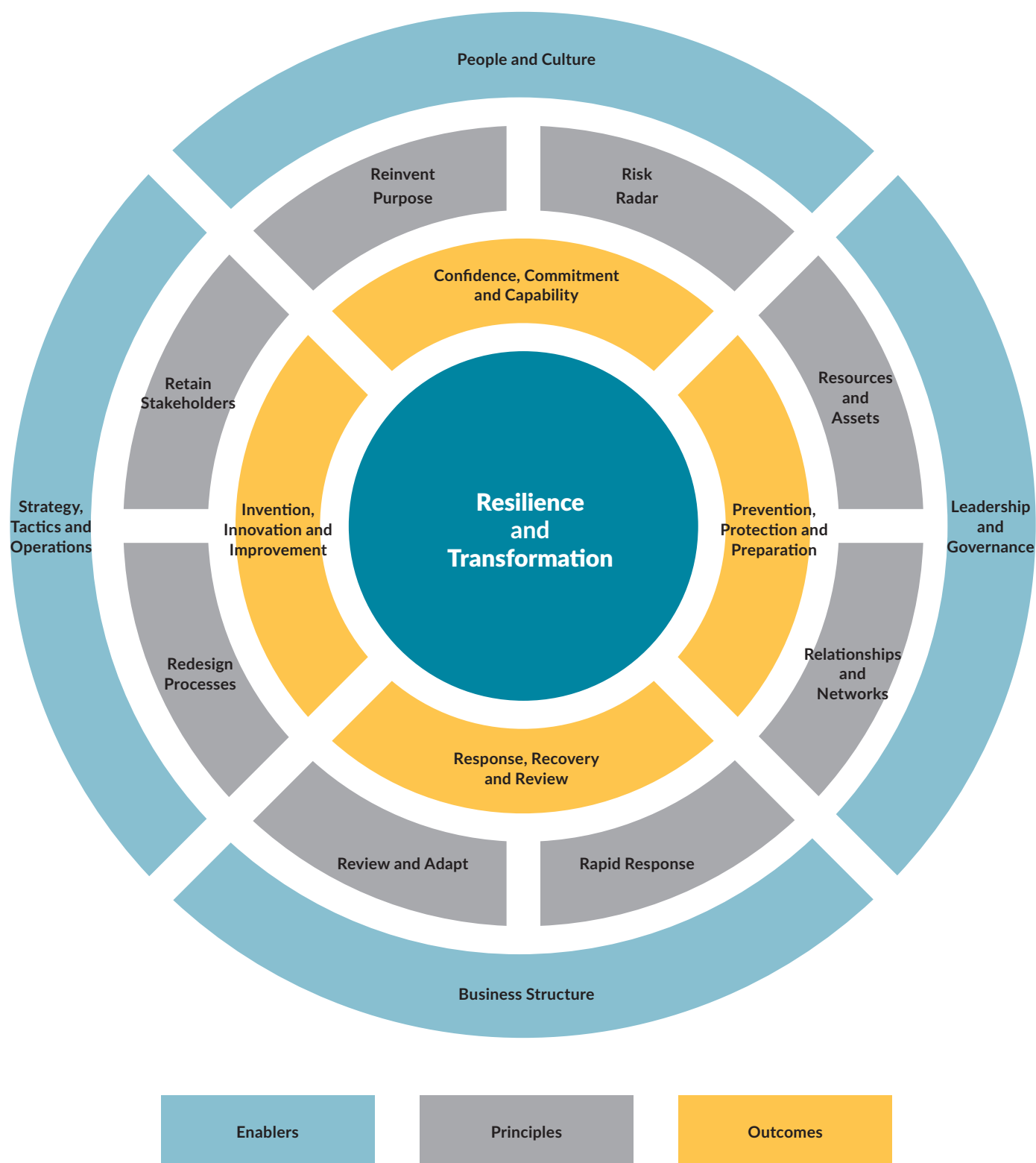


Figure 5.1: Resilience and transformation outcomes, principles and business enablers

IMPACT OF TECHNOLOGY ON RISK

Organisational structures, the economy, and society are evolving very fast. . Alongside this, the world of the risk manager has to evolve. Technology is driving great connectivity, interdependence, and speed, which in turn means that risk can become more connected, and concentrated. Risks that might previously have been considered distinct may need to be merged.

All this is happening in a multi-national context so companies have to synchronise risk management activity across several jurisdictions, while making it locally relevant.

Extract from interview with Dr Jamie Saunders
Jamie Saunders, Independent consultant, former Director of the National Cyber Crime Unit, and a visiting professor at UCL

Board members require assurance that the eight principles of resilience and transformation are implemented. However, the board conversation about resilience and digital transformation is more likely to focus on the associated business enablers within the organisation, rather than the principles. The business enablers identified in this report are (1) leadership and governance; (2) business structure; (3) strategy, tactics and operations; and (4) people and culture. The importance of these business enablers is explored further in this chapter.

Board members need to understand developments in technology and the critical importance of merged risk, connected risk, contagious risk and concentrated risk. The extract below from discussions with Dr Jamie Saunders, discusses the continuously developing nature of technology risks. When discussing digital transformation, board members need to understand the risks, and the associated risk management and governance challenges – in the environment of their business and sector. The positive message that the availability of Big Data represents new business opportunities needs to be viewed in the context of the board responsibilities for leadership and governance.

ALIGNING RESILIENCE WITH DIGITAL TRANSFORMATION

Building on the four business enablers, resilience and transformation can be summarised by considering four types of organisational resilience. Table 5.1 presents the features of the four types of organisational resilience and these can be used to guide the board conversation on resilience and transformation. Each type of resilience aligns with robust and dynamic implementation of one of the business enablers, as follows:

- Integrative Resilience aligns with the 'leadership and governance' business enabler and delivers the 'prevention, protection and preparation' outcomes for the 'resources and assets' and 'relationships and networks' principles.
- Structural Resilience aligns with the 'business structure' business enabler and delivers the 'response, recovery and review' outcomes for the 'rapid response' and 'review and adapt' principles.
- Transformational Resilience aligns with the 'strategy, tactics and operations' business enabler delivers the 'invention, innovation and improvement' outcomes for the 'redesign processes' and 'retain stakeholders' principles.
- Contextual Resilience aligns with the 'people and culture' business enabler and delivers the 'confidence, commitment and capability' outcomes for the 'risk radar' and 'reinvent purpose' principles.

All four types of resilience are required for an organisation to achieve

1. Integrative Resilience

- controls in place for the expected risks, as described in the risk register
- robust risk awareness to assist with design and implementation of strategy
- optimal utilisation of resources and assets to take advantage of opportunities
- supportive relationships and networks to build successful brands and reputation

2. Structural Resilience

- ability to achieve rapid response to a crisis, cope with the unexpected and learn lessons
- knowledge of emerging risks to help develop and test crisis management plans
- crisis plans to respond successfully to adversity and achieve enhanced profile
- identified lessons to review and adapt business model to gain competitive advantage

3. Transformational Resilience

- procedures in place to encourage creativity invention and advancement
- ability to redesign processes and to achieve business innovation
- communication with all interested parties to retain stakeholders during changes
- governance of implementation of changes and measurement of improved performance

4. Contextual Resilience

- continuous alertness and awareness of emerging risks by robust risk radar
- involvement and commitment of stakeholders to identifying opportunities and concerns
- confidence and capability to progress changes and reinvent purpose
- constant awareness of context and willingness to challenge the assumptions

Table 5.1: Features of the types of organisational resilience

successful resilience and digital transformation. None of the styles of resilience is more important than the others, although they do represent an aspiration hierarchy. Arguably, integrative resilience is the starting point for successful resilience. Ultimately, the most successful organisations have strong people and culture business enablers and

this represents a position where resilience and transformation results from the confidence, commitment and capability of individuals. **Table 5.2** provides an overview of the alignment of the business enablers, outcomes and principles.

1. Leadership and Governance	2. Business Structure
Prevention, Protection and Preparation <p>Dynamic 'Leadership and Governance' business enabler results in robust implementation of the 'Resources and Assets' and 'Relationships and Networks' principles</p>	Response, Recovery and Review <p>Dynamic 'Business Structure' business enabler results in robust implementation of the 'Rapid Response' and 'Review and Adapt' principles</p>
3. Strategy, Tactics and Operations	4. People and Culture
Invention, Innovation and Improvement <p>Dynamic 'Strategy, Tactics and Operations' business enabler results in robust implementation of the 'Redesign Processes' and 'Retain Stakeholders' principles</p>	Confidence, Commitment and Capability <p>Dynamic 'People and Culture' business enabler results in robust implementation of the 'Risk Radar' and 'Reinvent Purpose' principles</p>

Table 5.2: Business enablers, outcomes and relationship to the principles

MATRIX TO ILLUSTRATE RESILIENCE AND TRANSFORMATION

Figure 5.2 provides a graphical representation of the four types of resilience that are required in order to successfully achieve resilience and digital transformation. Many organisations will have strong integrative resilience based on actions to protect their assets and networks. Starting from this point, organisations can then develop and enhance their resilience in three directions. By improving business models, operational processes and business structure, structural resilience will be enhanced.

Although all four types of resilience are required in order to achieve successful resilience and digital transformation, it is often integrative

resilience that is the strongest within an organisation. It is from this point that the three other types of resilience are developed towards structural, transformational and ultimately contextual resilience.

This progression represents developing maturity in the resilience agenda of the organisation. Transformational resilience will be enhanced by redesigning processes and retaining stakeholders. In many ways, the ultimate and most difficult to achieve form of resilience is contextual resilience. By developing people and culture and ensuring robust implementation of risk radar and reinvent purpose principles, risk and opportunity awareness will be improved and contextual resilience will be achieved.

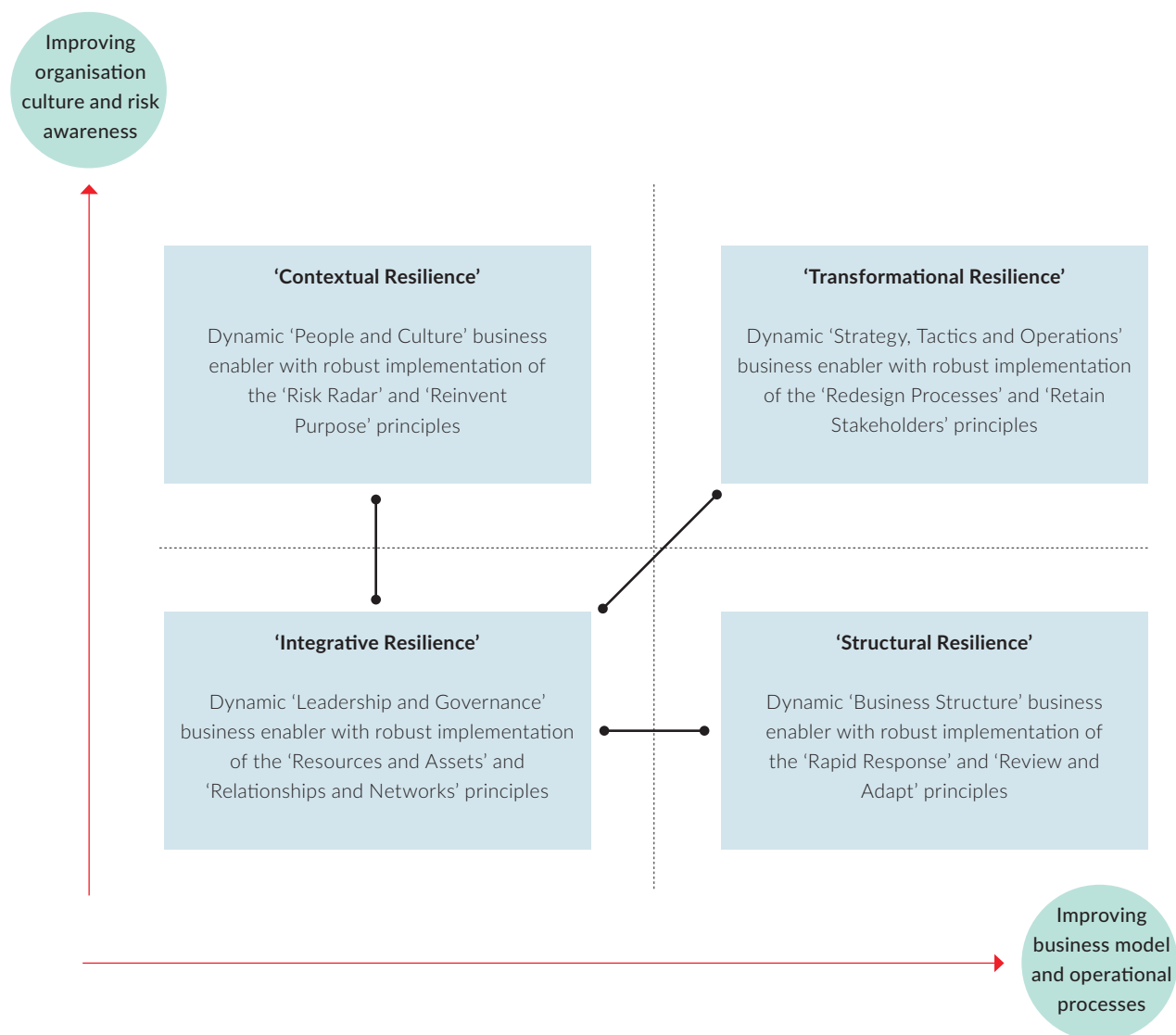


Figure 5.2: The Resilience and Transformation Governance Matrix

ACHIEVING BUSINESS RESILIENCE AND DIGITAL TRANSFORMATION

The board needs to understand digital technology, identify the opportunities that arise from digital technology and discuss strategy and plan tactics for implementing digital technology. In summary, the board needs to lead decisions on the implementation digital technology and also ensure governance of the planning, implementation, monitoring and learning stages associated with digital transformation of business models. Therefore, the board agenda for resilience and transformation is based on the business enablers.

Boards should concentrate on enhancing the business enablers to achieve all four types of resilience working from the top-down

through the organisation. **Table 5.3** outlines the typical activities that should be targeted in order to achieve business resilience and digital transformation. This checklist is provided in the format of enhancements of the four business enablers. Non-Executive Directors (NEDs) should view the items in the checklist as activities (or objectives) that should be overseen by the board, rather than actions that are the responsibility of the board. Risk professionals will support actions to implement the principles of resilience and transformation, so that all four types of resilience can be achieved. Risk professionals work from the bottom-up through the organisation.

Business enabler	Typical resilience and transformation activities
Leadership and Governance	<ul style="list-style-type: none"> • Establish a proactive, relevant and dynamic resilience and transformation agenda. • Ensure robust resilience and transformation governance protocols, procedures and reports. • Evaluate and enhance resources, assets, relationships and networks to achieve integrative resilience.
Business Structure	<ul style="list-style-type: none"> • Established a robust resilience architecture, including defined resilience and transformation roles and responsibilities. • Develop and rehearse crisis response plans and allocate crisis management responsibilities. • Remove communications barriers without blurring roles and responsibilities to achieve structural resilience.
Strategy, Tactics and Operations	<ul style="list-style-type: none"> • Establish the organisational attitude to resilience that includes opportunities as well as threats. • Undertake suitable and sufficient resilience assessment exercises and activities. • Embrace the opportunities offered by technology to achieve transformational resilience.
People and Culture	<ul style="list-style-type: none"> • Encourage high level of resilience awareness to identify opportunities and threats. • Ensure high level of awareness of board members to digital advancements and opportunities. • Enhance people resources, skills and capabilities to achieve contextual resilience.

Table 5.3: Achieving business resilience and digital transformation



KEY TAKE AWAYS

Chapter 6: Extending the Airmic resilience principles

This chapter explains the need for an organisation to extend resilience activities to include digital transformation. The following bullet points provide a brief summary of the three critical issues that should be evaluated in detail when deciding the implications of this research for an organisation.

- The extended principles of resilience together with the additional three principles of revolution supports resilience and transformation. The eight principles provide the structured for the 'bottom-up' approach required of risk professions.
- The five principles of resilience described in the Airmic 'Roads to Resilience' report remain relevant to digital transformation. However, the existing principles need to be extended to explicitly address digital transformation.
- Although risk professionals will be driven by the principles of resilience and transformation, the purpose is to enhance the business enablers in the organisation. These business enablers underpin the four types of resilience shown in figure 5.2.





PART 3: DIGITAL TRANSFORMATION AND RISK PROFESSIONALS

*It is hard to visualise
someone as a leader if
she is always waiting to
be told what to do.*

Sheryl Sandberg

CHAPTER 6: EXTENDING THE AIRMIC RESILIENCE PRINCIPLES

This Chapter describes the need to update the Airmic resilience model to take account of digital transformation. Enhancement of the existing five components of resilience is described, together with an outline of the three additional principles.

The 'Roads to Resilience' report published by Airmic in 2014 set out five principles of resilience, all of which need to be in place for an organisation to achieve resilience. However, the digital age introduces additional challenges and organisations must embrace digital transformation. Three additional principles covering digital transformation were discovered by the research.

An update of the five principles of resilience was also required to address digital transformation. This chapter describes the additional components that have been added to each of the five existing resilience principles:

Principle of resilience	Additional component
Risk radar	Creatively explore changing and emerging risks
Resources and assets	Strengthen and re-engineer resources
Relationships and networks	Extend networks
Rapid response	Remove internal communication barriers
Review and adapt	Focus on reputational concerns

Each of the eight principles of resilience and transformation is described in this chapter. This chapter also provides examples of the resilience and transformation practices discovered by the research to achieve each principle. Chapter 7 consider the three additional transformation principles in more detail. Table 8.2 in Chapter 8 provides a checklist of activities for risk professionals to achieve the resilience and transformation principles.

ANTICIPATING AND NEGOTIATING RISING THREATS

The search for emerging threats requires looking beyond the issues that can immediately and easily be anchored to business performance. Unpack hot risk topics and trends to see how different—often non-market—forces might surge or collide in problematic ways. Tease out pockets of volatility or uncertainty in the firm's commercial ecosystem. Apply a fresh lens to the firm's strategic and institutional vulnerabilities.

A thorough characterization of the top emerging risks involves assessing what's shaping each risk, their likely trajectory and its potential consequences, with a view to determining where it might touch the firm, the types of impact and the time profile of the damage. This helps clarify the materiality of each risk, and provides an initial steer for response planning.

With new risks swinging into view, senior-level demands changing, and new technological capabilities emerging, this is an exciting time for risk leaders to reframe their function for the new era.

Richard Smith-Bingham
Director, Global Risk Centre, Marsh & McLennan Companies

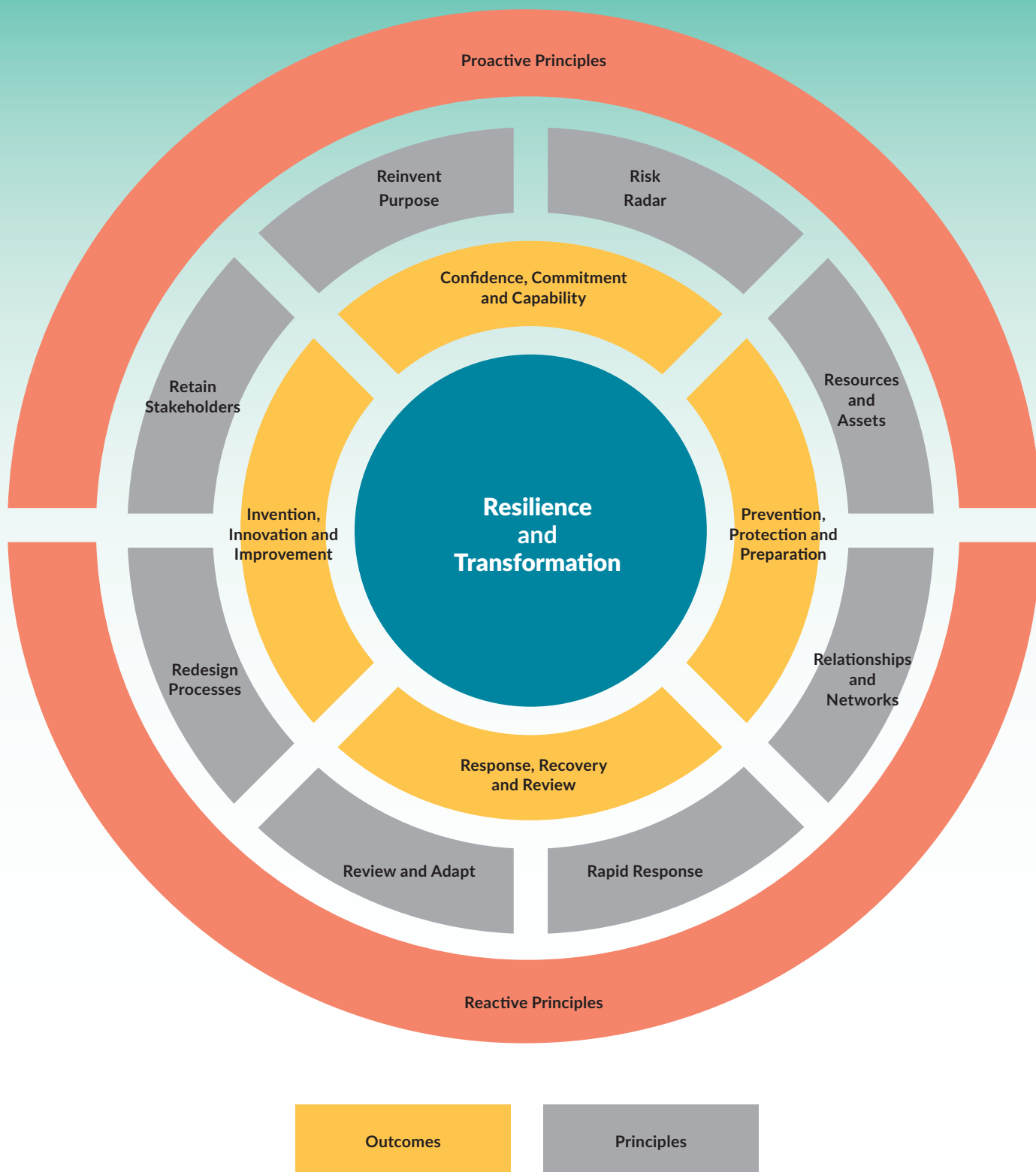


Figure 6.1: Resilience and transformation principles and outcomes

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RESILIENCE AND TRANSFORMATION PRINCIPLES

The result of the research is the enhancement of the Airmic 'Resilience Model' to produce the Airmic 'Resilience at Transformation' model. The Airmic resilience and transformation model has eight principles, five of which are also included in the resilience model. The five existing principles are enhanced to include additional components relevant to digital transformation. The Airmic resilience and transformation model has eight principles, each of which has five components. The full list of the eight principles and their components is included as part of **Table 8.2**.

Each of the eight principles is difficult to achieve. Every one of the eight principles is essential for achieving resilience and transformation. None of the principles is more important than the others, nor can any of them be ignored if an organisation wants to achieve resilience and transformation. The principles are described in more detail below:

Resilient organisations have exceptional risk radar. Transformational organisations additionally require that the risk radar capabilities are specifically focused on emerging risks. This will require enhanced risk radar with a focus on the developments in technology that offer opportunities for the organisation to enhance their business enablers.

1. Resilient organisations have exceptional risk radar. Transformational organisations additionally require that the risk radar capabilities are specifically focused on emerging risks. This will require enhanced risk radar with a focus on the developments in technology that offer opportunities for the organisation to enhance their business enablers.
2. Resilient organisations have resources and assets that are flexible and diversified. Transformational organisations additionally require specific focus on the need to strengthen resources where they are insufficient to take full advantage of developments in technology. The additional resources will be designed to ensure that the best advantage is taken of relevant developments in technology.
3. Resilient organisations value and build strong relationships and networks. Transformational organisations additionally examine the need to extend the existing networks. Joint-venture partnerships with organisations previously viewed as competitors is often a means of achieving transformational capabilities.

4. Resilient organisations have the capability to ensure decisive and rapid response. Transformational organisations additionally require that communication barriers within the organisation are removed. The need for greater cooperation and/or elimination of silos within an organisation is required in a way that does not create confusion of roles and responsibilities.
5. Resilient organisations review and adapt to changes and adverse events. Transformational organisations additionally require specific focus on protection and enhancement of the reputation the organisation. This can often result in more successful crisis management which, when successfully achieved, can build the reputation of the organisation by demonstrating the quality of management and governance capabilities within the organisation.
6. Revolutionary organisations can also successfully redesign processes. This requires the successful embracing of new technologies to ensure process improvement. Successful redesign of business processes is based on encouraging innovation, whilst retaining adequate mechanisms to validate decision-making. The requirement for successful implementation of the redesign processes principle is fundamentally based on a forward-looking culture within an organisation.
7. Revolutionary organisations retain stakeholders during the transformation. The ability to retain stakeholders is essential for successful digital transformation. Retaining stakeholders is based on engaging the stakeholders and analysing the big data available about the characteristics of those stakeholders. The key requirement is to discuss and share opinions with all interested parties and develop the options for digital delivery of the identified benefits.
8. Revolutionary organisations have the ability to reinvent purpose. Successful achievement of digital transformation is dependent on a willingness of the organisation to reinvent its purpose. Reinventing purpose is based on opportunity awareness, the active commitment of stakeholders and the availability of necessary capabilities. Confidence in the purpose of the organisation is required to ensure constant evolution. There is a strong link between the ability to reinvent purpose and the risk radar of the organisation.

EXTENDING THE EXISTING RESILIENCE PRINCIPLES

The components of each resilience principle identified by the 'Roads to Resilience' research is described in that report. This research identifies the need to extend the five resilience principles to include digital transformation. A range of resilience and transformation practices that extend the existing principles was identified by the research. One example under each of the existing resilience principles is provided below.

1. Risk Radar

The risk radar principle has been extended by the inclusion of the additional component 'Emerging Risks'. Risk doesn't stand a chance when one sees it coming. It's a lot more outward focused as well at Intu, risk horizon scanning, looking what's happening in the world, in other areas. It's a lot more important to understand what could go wrong.

2. Resources and Assets

The resources and assets principle has been extended by the inclusion of the additional component 'Strengthen Resources' in response to identified opportunities. CBRE is restructuring its internal technology function to meet the business requirements more effectively.

3. Relationships and Networks

The relationships and networks principle has been extended by the inclusion of the additional component 'Extend Networks'. CBRE has started to acquire companies that only have technological products whereas historically CBRE was buying service capabilities.

4. Rapid Response

The rapid response principle has been extended by the inclusion of the additional component 'Remove Barriers'. What you also need to prepare in advance is a list of trusted persons and companies you can rely on in case of disaster. Ask yourself, "who do I call to help me?". So, you form a trusted network of responsive partners, says Airmic.

5. Review and Adapt

The review and adapt principle has been extended by the inclusion of the additional component 'Enhance Reputation'. You need a true business partner in risk management and resilience, says FM Global and Schroders checks that all stakeholders adhere to the same standards, as described below.

THE POWER OF PREDICTIVE ANALYTICS

Businesses across the globe are operating on the cusp of the Fourth Industrial Revolution, a change that will inundate all types of organisations with a wealth of data. This data will create many opportunities and risks for businesses. For both insurers and risk managers, the focus needs to be: how can we prioritise useful risk management practices, when the trends and useful insight are buried in large data sets. The answer is predictive analytics.

**Owen Lewis, Operations Vice President, Group Manager, Account Engineering
FM Global**

Predictive Analytics, using sound science and research-based data enables companies to pinpoint exactly where they are vulnerable to risk. This makes it possible to create proactive solutions for the identified risks, creating resilience in the long-term.

**Philip Johnson, Operations Senior Vice President, FM Global and Managing Director
FM Insurance Company Ltd**

Table 2.1 identifies six digital transitions or 'trade-offs'. These trade-offs are not new, although digital technologies tend to shift the "solution" of such trade-offs away from the legacy, pre-digital, "solution". The research discovered that:

- First, organisations have to spend more time managing and coordinating across different inter- and intra-organisational boundaries. In a digital environment, these boundaries become more complex, uncertain, and ambiguous. For instance, Thomas Cook is now only catching up on the digital transformation and still tries to understand how to get its product and service right. The crucial part of current strategy is omni-channel, which means that there is an effort to create seamless customer experiences between digital and physical channels.
- Second, companies must become faster at decision making. Heading into its second year of independence after separating from former parent company Emerson, Vertiv and the leadership team are focused on enhancing customer relationships, streamlining information-sharing internally, and shortening innovation cycles across the company. At the core of these activities and goals there is a culture of speed.

- Third, companies must build a culture of experimentation, fast adoption and openness. For instance, CBRE has recently acquired several small digital ventures. The conservative culture of a large, legacy organisation can easily 'swallow' the new culture of these new small ventures it acquired, and then nothing will change. Instead, the large organisation should accept people with new type of thinking and build a culture of collaboration with them in order to be agile. CBRE is also trying to learn from smaller disruptors to become more agile.
- Fourth, talent and how to motivate and keep engaged such talents. Patty McCord, who worked for Netflix for 14 years as chief talent officer, and is now a leading consultant for start-ups, says that it is the culture that has helped Netflix get where it is now. The core aspect of managing culture at Netflix, is about how decisions are made. The new document introduced the concept of an 'informed captain'. The approach described can be explained by "For every significant decision there is a responsible captain of the ship who makes a judgment call after digesting others' views. "We avoid committees making decisions because that would slow us down and diffuse responsibility and accountability."

ENABLING ENHANCED RESILIENCE AND TRANSFORMATION

The business enablers define and support the business model for the organisation. They are 'leadership and governance'; 'business structure'; 'strategy, tactics and operations'; and 'people and culture'. As indicated by Figure 6.1, the enablers can, in combination, be used to support resilience and transformation. The ways in which the business enablers lead to increased resilience and transformation are context specific, as they are dependent on the size, nature and complexity of the organisation, as well as the business environment and organisational capabilities. The extract from the CBRE case study recognises the challenges of digital transformation.

CBRE

CBRE has the necessary resources, the company understands the market very well and has a massive presence geographically and excellent reputation with its clients. All these will make it very easy for the company to push technological solutions forward. However, there are 74,000 people around the globe working for CBRE. CBRE needs to become agile as an organisation to be able to respond to opportunities and perceived threats.

CBRE is the biggest commercial real estate company in the world. However, it cannot just rest on its accomplishments. The competition is fierce and for CBRE to stay at the very top, it has got to use all available tools. The company needs to identify suitable new technologies to improve business processes and create new ones. Also, the company needs to recruit talented people. CBRE must use technology as a competitive edge and thereby provide its talented personnel with more tools to compete.

Extract from CBRE case study
Appendix A: Case Study A.1

All organisations have these business enablers in place, but the different nature of the enablers in each organisation indicates why there are different roads to resilience and transformation. Every organisation has the capability to achieve increased resilience and digital transformation, but it requires risk professionals and boards to decide how each of the enablers can be managed, to change the way an organisation views risk management and the achievement of increased resilience and successful transformation. Risk professionals will adopt a bottom-up approach to improving resilience and transformation by facilitating the resilience and transformation actions listed in Table 8.2.

Table 5.3 lists the features that need to be incorporated into each business enabler to embed resilience and facilitate digital transformation within the organisation. Table 5.3 provides a list of the three key features of each business enabler. The questions that board members should ask about the business enablers are considered in Chapter 5. Directly enhancing the business enablers is the priority for the board and this is the top-down approach to improving resilience and transformation. However, risk professionals should be aware of the business enablers and how their activities support the enhancement of the business enablers, as demonstrated by the examples below from the case studies.

Leadership and Governance

The intention is to ensure robust leadership and governance arrangements based on an established resilience and transformation agenda supported by a board mandate; appropriate risk governance, including proactive arrangements for receiving risk information; and sufficient resources exploit opportunities by seeking business synergies.

Many examples of resilience and transformation activities that enhance the leadership and governance business enabler are described in the case study organisations. FM Global often puts teams together to examine emerging risks, like 3-D printing, or the use of robots in manufacturing. Netflix has disrupted the TV industry globally. The reason for such a significant disruption is that Netflix is an original content producer who has its international distribution network, partnerships with mobile network providers.

Business Structure

The intention is to establish an inclusive and open business structure with an established resilience and transformation architecture, including representatives from the extended eco-system; planned and rehearsed crisis management plans with nominated crisis management teams; and absence of communications barriers, but avoidance of confusion of roles and responsibilities.

Many examples of resilience and transformation activities that enhance the business structure business enabler are described in the case study organisations. Network Rail routes should also be required and empowered to find local sources of funding and financing from those who stand to benefit from new or additional rail capacity, including local businesses or housing developers. You need a true business partner in risk management and resilience. Where other insurance companies rely primarily on actuarial tables, FM Global uses a hands-on, engineering-based approach.

Strategy, Tactics and Operations

The intention is to establish a resilience and transformation based, well-informed and integrated approach to strategy, tactics and operations based on established resilience approach to risk and opportunities; dynamic approach to resilience with a resilience and transformation action plan; and proactive approach that embraces technology and innovation.

Many examples of resilience and transformation activities that enhance the strategy, tactics and operations business enabler are described in the case study organisations. Netflix has transformed from a technology-based company to a content company. For Airmic, the new model looks at context and the drivers of change. The old model is an inside-out model, in other words it looked at input, then followed by activity, then followed by outcome. The new one is reverse – it's an outside-in model, which starts with the outcome and all the way to the input.

People and Culture

The intention is to establish a learning people and culture based on trust and respect that increases awareness of opportunities and threats of technology; encourages board learning, awareness and knowledge of digital advancements; and develops or recruits people resources and capabilities to exploit developments in technology.

Many examples of resilience and transformation activities that enhance the people and culture business enabler are described in the case study organisations. Decision making will go hand in hand with the new company culture of greater innovation and adaptation to customer requirements by Vertiv. Schroders checks that all stakeholders adhere to the same standards. Yet, it is very difficult to react to things that are unknown. Reputational risk is not easy to insure. Good corporate governance is the solution to reputational risks.

In supporting resilience and transformation, risk professionals face many challenges. By adopting a structured approach, they will be able to help their organisation by supporting the enhancement of the business enablers. The structured approach identified in the case study organisations is based on implementation of the eight principles that support resilience and transformation, identified in Chapter 2.

Complex and connected risks demand collaboration by risk professionals across business teams in the organisation. Silos and barriers to communication need to be broken down.

There is also a need for risk professionals to take a more forward-looking approach and embrace available big data. Claire Combes from Intu Properties emphasises this point by stating “Traditional risk management is not applicable anymore. Risk management has become much less about measuring risk and much more about understanding risk. For example, this entails much more outward-looking, horizon scanning, talking to people and scenario planning.” The importance of data management is a key part of the digital revolution, as illustrated by the extract from the Network rail case study.

A substantial change in the skills of risk professionals is required. Many risk management roles are likely to become embedded in other positions. Moreover, there will be a collaborative function spread across entire organisations and existing silos. The risk professional will become the conductor of the orchestra, similar to the second line role of the Chief Risk Officer (CRO). As operations are digitised and automated, the responsibility to ensure that operations are efficient and effective will fall on the second line of business functions and the second line will need to expand its limit.

DIGITAL TRANSFORMATION CHALLENGES FOR RISK PROFESSIONALS

Risk professionals are well aware of the requirement for organisations to be resilient. The approaches summarised as ‘prevention, protection and preparation’ as well as ‘response, recovery and review’ are well-established for many risk professionals. Digital transformation provides new challenges and exciting opportunities for all types of organisations and their risk professionals.

Risk professionals now additionally need to embrace the requirements of ‘invention, innovation and improvement’, together with ‘confidence, commitment and capability’. The first two set of outcomes represent reactive outcomes familiar to risk professionals. The second two set of outcomes relate to transformation activities. Risk professionals need to develop their skills and increase their influence and contribute to the achievement of these proactive outcomes. This approach is illustrated in Figure 6.1 that shows the relationship between the resilience and transformation principles and outcomes.

NETWORK RAIL

Challenges exist in relation to data governance and ownership of the data. Wi-Fi is now provided on many trains, so that ownership of passenger data needs to be clearly established. The open data policy of the Department for Transport (DfT) is a very important policy. The data can be used to drive innovation in planning, to lower congestion, to provide cleaner and better services.

There are continuing developments in electronic ticketing. The network operators, service companies, the technology providers and other third parties have an interest in the technology and data collected. However, data collection and dissemination is still very fragmented and inconsistent. It is fair to say that the data are not yet big, but they are also of unknown quality. The benefits associated with the collection and analysis of big data have not yet been achieved.

Data are not yet seen as assets that must be maintained, nurtured and developed. Like all other assets, data have their own life cycle, but this is not yet a clearly recognised. In some parts of the organisation data are still seen as something that happen, rather than something that has to be actively managed. The newly appointed Chief Data Officer, as the head of data, innovation and knowledge management must tackle these challenges.

Extract from Network Rail case study
Appendix A: Case Study A.4



KEY TAKE AWAYS

Chapter 7: Digital transformation resilience principles

This chapter explains the scope and challenges of digital business process revolution and the associated transformation principals. The following bullet points provide a brief summary of the three critical issues that should be evaluated in detail when deciding the implications of this research for an organisation.

- The research identified one of the principles of digital transformation as a 'redesign processes'. A forward-looking approach to transformation that embraces technology to improve business processes was discovered in the case studies.
- The research identified one of the principles of digital transformation as a 'retain stakeholders'. Engaging stakeholders and sharing opinions, together with the use of big data to identify stakeholder needs was discovered in the case studies.
- The research identified one of the principles of digital transformation as a 'reinvent purpose'. Willingness to acquire additional capabilities to exploit available opportunities resulted in constant evolution in the case study organisations.

CHAPTER 7: TRANSFORMATION PRINCIPLES 6, 7 AND 8

This Chapter considers the three additional principles that are required to develop the Airmic resilience model to become the resilience and transformation model. The components of the three additional principles are described.

This chapter describes the additional principles added to the Airmic resilience model to cover digital transformation. Digital transformation requires the redesign of business processes. The research discovered that organisations undertaking digital transformation have a willingness to embrace technology and achieve process improvement. In addition, innovation is encouraged and redesigning processes requires a forward-looking approach. Transformation also requires the continuing support of stakeholders. The research found that retention of stakeholders involves active liaison with stakeholders. A major component of retaining stakeholders is utilisation of big data to help understand stakeholder expectations. Finally, digital transformation requires a willingness to reinvent purpose. Reinvent purpose is closely aligned with the risk radar principle of resilience. They combine to emphasise the importance of people and culture. Reinvent purpose has the components of opportunity awareness, active commitment and ability to acquire additional people capability. There is a need to reward confident forward-looking behaviour to ensure commitment to constant evolution.

RISK PROFESSIONALS IN THE DIGITAL AGE

Undertaking digital transformation does not change the core five principles of resilience, but does require further development of those principles and the addition of three new principles. The eight principles of resilience and transformation are described in Chapter 6. The additional transformation principles are discussed in more detail later in this chapter. In the digital age, resilience management should become part of the culture of every individual in the organisation and part of the organisational culture itself. This represents the achievement of all four types of resilience described in Table 5.1 with the achievement of contextual resilience being the ultimate goal.

As a result of the digital revolution, the whole approach to risk management is changing. Risk should be managed across different roles, and many risk management roles are embedded in other positions. There has to be a collaborative business approach to risk management spread across the entire organisation. Given the multi-faceted risks brought forward by the digital transformation, the first line of defence should be fully trained to understand and monitor technology/information, tactical and strategic risks. This requires different individual skills and knowledge, along with different organisational culture. There is also a requirement to embrace emerging risks, as identified by the quote below from BP.

A shift of emphasis in managing risk

Taking advantage of the new opportunities requires a shift of emphasis in three areas:

1. **Better alignment with business priorities:** Risk teams need to demonstrate strong business or commercial acumen and engage more intensely with the company's strategic ambitions and major investments. This will sharpen their ability to develop valuable insights into emerging concerns and help scope innovative risk mitigation solutions.
2. **More flexible deployment of resources:** Revised analytical methodologies, including the introduction of new data science and automation techniques, should free up capacity in risk teams for more project-based (as opposed to routine) risk work and the provision of advice to business and functional leaders.
3. **Greater dynamism in stakeholder engagement:** A more creative lens with regard to emerging risks will enable risk teams to engage with institutional and individual biases and blind spots and help build an appreciation of threats for which evidence may be limited or conflicting.

To take this forward, some risk leaders may need to expand their comfort zone. But those who can mesh strategic vision, influencing skills, and technological fluency on top of their core risk-management expertise will be best positioned to help their firms negotiate dynamic risk environments laden with potential shocks and disruption.

Richard Smith-Bingham

Director, Global Risk Centre, Marsh & McLennan Companies

SUMMARY OF THE TRANSFORMATION PRINCIPLES

Introduction to 'Redesign Processes'

To take advantage of digital transformation, organisations need to have the ability to redesign their business processes. The requirement is to combine process improvement with the desire to fully embrace developments in technology. This can be achieved by encouraging innovation within the organisation, whilst retaining mechanisms to rapidly challenge and then validate business decisions. One of the key components of the redesign processes principle is to ensure that activities are always forward-looking to decide how new digital developments and capabilities can be implemented into future plans. Implementation of the redesign processes principle must always be aligned with the strategy, tactics and operations of the organisation, but with the emphasis on forward planning.

Introduction to 'Retain Stakeholders'

The ability to redesign business processes will not bring benefits unless the organisation also retains stakeholders. In terms of revenue, the most important set of stakeholders are customers. However, there are a wide range of other stakeholders, including suppliers, contractors, financiers and regulators. Engaging stakeholders in business process redesign should increase the chances of successfully retaining those stakeholders. The initial stage of digital transformation is often associated with digital delivery of products and services and it is important that stakeholder opinions of these changes are obtained. Organisations need to explain the benefits of digital transformation. Big data is increasingly available and analysis of customer preferences using big data will provide a proactive mechanism for identifying stakeholder expectations and thereby, more successfully, retain those stakeholders.

Introduction to 'Reinvent Purpose'

Reinvent purpose is a critically important principle that underpins digital transformation. In order to take advantage of digital capabilities, organisations need to routinely reinvent their purpose. A combination of excellent risk radar and a willingness to reinvent purpose develops a culture that creates opportunity awareness within the organisation. The components of the reinvent purpose principle are mainly concerned with the people and culture business enabler. There needs to be active commitment to digital transformation, together with well-resourced people skills and capabilities. A culture of supporting confidence in business decision-making is also necessary. Perhaps the most important component of reinvent purpose is the forward-looking acknowledgement that digital transformation requires a culture of constant evolution (or perhaps revolution) within the organisation, as demonstrated by the extract from The Met Office case study.

Met Office

The Met Office Informatics Lab will fulfil a central role in providing answers to the digital disruption. The scientists working in the Informatics Lab are not generating much value for the company yet, but it is anticipated that they will deliver value in future. Especially as they build critical capabilities that will contribute to knowledge integration.

It is vitally important that, during the digital transformation process, The Met Office has to maintain the support of stakeholders. Maintenance of 'trusted expertise' is fundamentally important, as the extract from The Met Office annual report and accounts 2016/17 demonstrates.

The Met Office's strategic advantage, compared to commercial market competitors, has been its privileged access to data paid for by the government. The task for the future is to synthesise information from around 740 forecasters and provide value for the end user(s). This has to be achieved at a time when weather data has become much more easily available.

Extract from The Met Office case study
Appendix A: Case Study A2

COMPONENTS OF THE TRANSFORMATION PRINCIPLES

Understanding 'Redesign Processes'

Three additional principles are required to develop a resilient organisation into one that can achieve resilience and (digital) transformation. The evidence from the case studies identified a need for the additional component 'redesign processes' which was found to have five components, as set out below.

1. The 'redesign processes' principle was found to have the component 'Embrace Technology'. CBRE is confident that the introduction of drones, robots and 3D printing will bring benefits as these technologies mature. Zurich says that there are two ways to approach AI. The first one is machine learning and data rich environment. The second one is graph technology.
2. The 'redesign processes' principle was found to have the component 'Process Improvement'. For Network Rail, the technological transformation of the railway will increase capacity and connectivity, allow trains to run faster, more reliably, more safely and with a smaller environmental footprint.

3. The 'redesign processes' principle was found to have the component 'Encourage Innovation'. FM Global, as a commercial property insurance and risk prevention, has to change itself, become more innovative and agile, in order to be able to offer valid and valuable help to its clients.
4. The 'redesign processes' principle was found to have the component 'Validate Decisions'. Vertiv could implement a digital engagement software tool or create an enterprise social network platform to increase both global and regional engagement in decision-making.
5. The 'redesign processes' principle was found to have the component 'Forward Looking'. Vertiv initiatives foster cross-functional problem solving, team bonding and help to open across silos strategic and transparent discussions visible to everyone.

Understanding 'Retain Stakeholders'

Three additional principles are required to develop a resilient organisation into one that can achieve resilience and (digital) transformation. The evidence from the case studies identified a need for the additional component 'retain stakeholders' which was found to have five components, as set out below.

1. The 'retain stakeholders' principle was found to have the component 'Digital Delivery'. The Met Office value chain is disrupted by the predictive analytics companies and is now required to bring more economic value to the UK economy.
2. The 'retain stakeholders' principle was found to have the component 'Engage Stakeholders'. Based on the data we already have, retailers could offer 5% off everything they have in the store if there is someone currently in the Intu shopping centre. It's not only physical environment, it's also the digital environment. (see extract below)
3. The 'retain stakeholders' principle was found to have the component 'Share Opinions'. Digital transformation strategy for Thomas Cook is omni-channel. This means that there is an effort to create seamless customer experience between digital and physical channels.
4. The 'retain stakeholders' principle was found to have the component 'Explain Benefits'. In the first year of implementation, Asset Analytics saved CBRE clients over £500,000 in energy costs by lowering consumption, driven by customer needs.

5. The 'retain stakeholders' principle was found to have the component 'Analyse Big Data'. At Lloyd's register, information is more readily available, although there are issues around blockchain. Blockchain is about sharing computer learning and it has massive implications for people.

One of the key things we found is that we took an approach that the operating model we utilise didn't work so we switched it. Strategy is still there, but it is a lot more flexible. And you must react to your environment. Developing things in a digital era is a bit more experimental whenever you don't have end-to-end solution. It's more like we will try it and let's see how to adapt our strategy.

The more digital parts of your organisation are working faster, in a more experimental evolutionary way. You still have got more traditional parts of your organisation who are working in an old-style operating model. So, if we are doing a system upgrade in our finance team, which looks very different than if we did it five years ago. On the digital side, what we are doing this week will be different from what we will be doing next week. There is sometimes less need for that from more traditional, support functions of the organisation. When you've got something like finance which is incredibly controlled and really important, that cannot make it adapt really quickly compared to experimental bits of the organisation, so I think there is something like the control mind-set as well as the actual part of the organisation.

Extract from interview with Claire Combes
Director of Risk and Assurance, intu

Understanding 'Reinvent Purpose'

Three additional principles are required to develop a resilient organisation into one that can achieve resilience and (digital) transformation. The evidence from the case studies identified a need for the additional component 'reinvent purpose' which was found to have five components, as set out below.

1. The 'reinvent purpose' principle was found to have the component 'Opportunity Awareness'. The Met Office help to protect UK armed forces as they plan missions around the weather, and to keep technology safe with space weather forecasts

2. The 'reinvent purpose' principle was found to have the component 'Active Commitment'. Those involved in the Network Rail digital transformation range from drivers and signallers to managers, controllers and maintenance staff. Network Rail trained 21,200 drivers and signallers to use GSM-R.
3. The 'reinvent purpose' principle was found to have the component 'Acquire Capabilities'. Netflix realises that digital transformation cannot be achieved without relying on additional professional experts with specific skills.
4. The 'reinvent purpose' principle was found to have the component 'Reward Confidence'. New people are coming into the company both at leadership and operational levels, complementing the fact that new revenue streams and business models are created by digital technologies.
5. The 'reinvent purpose' principle was found to have the component 'Constant Evolution'. There is much innovation in Thomas Cook. For example, there is the initiative to provide digital travel money. The crucial part of this strategy is omni-channel and this depends on a seamless customer experiences between digital and physical channels.

ENABLING ENHANCED RESILIENCE AND TRANSFORMATION

Leadership and Governance

The intention is to ensure robust *leadership and governance* arrangements based on an established resilience and transformation agenda supported by a board mandate; appropriate risk governance, including proactive arrangements for receiving risk information; and sufficient resources to exploit opportunities by seeking business synergies.

Some of the many identified examples of resilience and transformation activities that enhance the leadership and governance business enabler are referenced here. For Vertiv, digitization of the processes will be driven across the whole value chain by mapping all stages of customer interactions from sales to lifecycle. FM Global needs to think wisely what it can offer to companies apart from cyber protection tools they are using themselves already.

The interviews identified data enhancement and delivery of value to customers as the two issues for CBRE to develop. The more digital parts of CBRE are working faster, in a more experimental and

evolutionary way. The more traditional parts of Intu Properties are still working with an old-style operating model, but management recognises the need for further development. Technology is at the heart of The Met Office transformation and efficiency programmes to make the vast data banks practically useful. Creating and storing digital 3D images of properties will be a major development for CBRE. An augmented reality model will be available to technical personnel on site. In addition, Artificial Intelligence (AI) will provide predictive analytics.

The Met Office Informatics Lab will fulfil a central role in providing answers to the digital disruption. CBRE employed a new head of technology and rebranded the information technology function as Digital & Technology. There are products now being rolled out that are much more technology and digital related. PropTech is considered to be both a massive opportunity for the industry.

Business Structure

The intention is to establish an inclusive and open *business structure* with an established resilience architecture, including representatives from the extended eco-system; planned and rehearsed crisis management plans with nominated crisis management teams; and absence of communications barriers, but avoidance of confusion of roles and responsibilities.

Some of the many identified examples of resilience and transformation activities that enhance the business structure business enabler are referenced here.

The challenge of digital transformation for The Met Office can be characterised by a trade-off or compromise between science and data science – and avoidance of 'black box' decision-making. For Network Rail, challenges exist in relation to data governance and ownership of the data. Wi-Fi is now provided on many trains, so that ownership of passenger data needs to be clearly established. The newly appointed Network Rail Chief Data Officer, as the head of data, innovation and knowledge management must tackle these challenges.

Vertiv is transforming into a leaner, agiler and more transparent organisation with integrated knowledge, skills and enhanced digital capabilities. As you integrate knowledge at BP, the owner of risks becomes more blurred. Then there is more work for the second line that has to design governance system to deal with this blurred risk. Airmic believes that the risk professional has to ensure that strategy, tactics and operations progress smoothly and at the same pace.

Strategy, Tactics and Operations

The intention is to establish a resilience-based, well-informed and integrated approach to *strategy, tactics and operations* based on established resilience approach to risk and opportunities; dynamic approach to resilience with a resilience and transformation action plan; and proactive approach that embraces technology and innovation.

Some of the many identified examples of resilience and transformation activities that enhance the strategy, tactics and operations business enabler are referenced here. The current strategy of Netflix, focusing on innovation, sustainability and domination on the internet TV market, is to produce more original content.

CBRE recognise that the distribution approach has to be aligned with customer demands and preferences and be able to adapt to rapid changes in technology. If CBRE is unable to effectively execute our information technology strategies or adopt new technologies and processes relevant to our service platform, the ability to deliver high-quality services may be materially impaired.

The current strategy is to focus on core business and seek partnerships in areas where Thomas Cook do not have the capabilities to deliver. In other words, competitors are becoming partners.

People and Culture

The intention is to establish a learning people and culture based on trust and respect that increases awareness of opportunities and threats of technology; encourages board learning, awareness and knowledge of digital advancements; and develops or recruits people resources and capabilities to exploit developments in technology.

Some of the many identified examples of resilience and transformation activities that enhance the leadership and governance business enabler are referenced here.

FM Global tries to convince clients to use its predictive analytics services, and, indeed, more and more clients see these services as valuable to their property risk management team. For instance, in order to create such culture of camaraderie, FM Global offers state-of-the-art technology systems and resources that help streamline work processes. Challenge of creating a shared solid set of values, based on teamwork, trust and flexibility. By paying particular attention to people and culture, FM Global has already achieved some solid results.

Organisations recognise the overarching importance of people and culture in achieving resilience and transformation. In the words of Network rail "Actions should be taken to develop skills and improve diversity in the workplace."



KEY TAKE AWAYS

Chapter 8: Digital transformation and risk professionals

This chapter explains the transformed role of risk professions and the associated extended responsibilities. The following bullet points provide a brief summary of the three critical issues that should be evaluated in detail when deciding the implications of this research for an organisation.

- Table 8.1 describes the approach of risk professions to the four types of resilience. Risk professionals will be familiar with integrative and structured group resilience, but need to develop greater awareness of transformational and contextual resilience.
- In order to implement and/or enhance the achievement of the resilience and transformation principles, risk professions will adopt a 'bottom-up' approach based on the resilience and transformation practices outlined in Table 8.2.
- At the same time as organisations are undergoing transformation, the role of the risk professional needs to involve challenging the leadership team. Reliance on producing a list risks in a risk register can be helpful but is no longer sufficient.

CHAPTER 8: DIGITAL TRANSFORMATION AND RISK PROFESSIONALS

This Chapter considers the implications of digital transformation for risk professionals. Discussion of the implications also include the need for risk professions to better engage and support the enhancement of governance arrangements.

Resilience and transformation are related topics that need to work together to support the future success of the organisation. Risk professionals can make a significant contribution to successful digital transformation. This report extends the five principles of resilience identified in the Airmic 'Roads to Resilience' report (2014) to include an extra component in each case. Three additional principles of transformation are identified as 'redesign processes', 'retain stakeholders' and 'reinvent purpose'. Figure 6.1 illustrates that the eight principles of resilience and transformation are related and interdependent. This chapter sets out the actions to ensure successful implementation of these eight principles. The eight principles are linked to the four business enablers to achieve four types of resilience, described as integrative, structural, transformational and contextual. Risk professionals should focus on achieving the eight principles and this represents a bottom-up approach to resilience, as identified by the practices listed in Table 8.2. The board should focus on the business enablers to achieve a top-down approach to resilience. This will ensure that risk professionals and board members work together to successfully deliver resilience and (digital) transformation.

PRINCIPLES OF RESILIENCE AND TRANSFORMATION

Resilience remains a critical attribute for all organisations. At all times, there is the potential for disruption to the efficiency and effectiveness of routine business processes. Therefore, the Airmic resilience model remains relevant to all organisations. However, the increasing pace of change represented by digital technology requires organisations to revisit their resilience activities, as well as consider the additional capabilities and resources required for achieving successful digital transformation.

Rapid Response

The major problem organisations have with the digital transformation is that they have to go back to basics. There is a bunch of things that are basics such as supply chain management or data phishing, for instance. It is the old problems that have to be addressed much quicker in the digital age. And the impact of not addressing these problems quicker is going to be more visible and painful for companies.

Extract from interview with Andy Roberts
BAE Systems

Figure 6.1 illustrates that there are strong links between the eight principles and the four business enablers. These strong links can be represented by considering that the eight principles operate as four pairs. Resources and assets and relationships and networks work together to provide a dynamic leadership and governance business enabler that results in 'prevention, protection and preparation'. Rapid response and review and adapt work together to provide a dynamic business structure business enabler that results in 'response, recovery and review'. Redesign processes and retain stakeholders work together to produce a dynamic strategy, tactics and operations business enabler that results in 'invention, innovation and improvement'. Finally, risk radar and reinvent purpose work together to produce a dynamic people and culture business enabler that results in 'confidence, commitment and capability'.

A description of the eight principles of resilience and transformation is set out in Chapter 6. By embracing the principles of resilience and transformation organisations achieve the status of the 'revolutionary' organisations. Revolutionary organisations place themselves in the best position for future success based on successful achievement of digital transformation.

MANAGING EMERGING DIGITAL OPPORTUNITIES AND RISKS

The recent advances in technology have given existing organisations an opportunity to transform their business models. Other organisations or individuals have seen opportunities arising from developments in technology and set up new businesses to exploit these new and/or enhanced digital capabilities. Therefore, digital technology offers opportunities to existing organisations, as well as providing opportunities for businesses to be established that provide new services that did not exist before the digital revolution.

Whether an organisation was established before the digital revolution, or is an existing organisation seeking to take advantage of enhanced digital capabilities, the Airmic resilience and transformation model is relevant. All business models are in danger of disruption from further developments in digital technology. Therefore, all organisations need to identify the opportunities that arise from each new development in technology. Organisations need to be aware of the challenges that arise from adopting new technology and overcome the threats, such as cyber risk and data security. There is no doubt that an organisation will have a limited lifetime if it fails to embrace digital technology and routinely reinvent purpose.

The opportunities associated with digital technology impact all aspects of the business model. Perhaps the most obvious opportunities arise from modifying the existing customer offering or developing new digital offerings that did not exist before the digital capabilities were developed. The scope to enhance the customer offering is initially based on changes to the customer interface and delivery mechanisms.

Customer interfaces in retail have changed substantially with an increasing percentage of purchasing being undertaken on the Internet through online ordering. This has reduced the need for physical shops in retail parks and on the high street. The digital opportunities for retail businesses are based on the increased ease with which customers can be accessed and, therefore, marketing costs are reduced. The use of big data provides organisations with the opportunity to identify the preferences of potential customers and target their products and services to individuals. This means that the success rate for converting individuals into customers is likely to be higher.

Modifications to the customer offering or development of new customer offerings, together with the ability to gain easier access to customers are obvious opportunities that arise from digital transformation. Opportunities also arise from the ability to maintain customer service levels with reduced resources. The extract from the Centrica annual report and accounts describes the development of the 'Hive' digital thermostat and the intelligent boiler management system and the evolution of that system to include lighting and security, as enhanced digital technology becomes available.

Centrica

What we are doing is not a radical departure from our roots; it is a natural extension of who we are and what we are good at. Through installing boilers, heating systems and their controllers we have always been in the 'home energy management' business. Our development of Hive, starting with the digital thermostat and the intelligent boiler, is the next phase in the evolution of home energy management and a direct extension of our in-home services business.

We are finding that consumers want these propositions and are willing to pay for them. We are also finding that many customers value receiving these services from the same provider as their energy supply. The same principles apply to our business customers. The new propositions and services we have developed are not a distraction or somehow unrelated to our legacy businesses. They are at the heart of what our legacy offerings have to incorporate and what the most valuable customer segments are demanding.

**Iain Conn, Group Chief Executive, Centrica plc
Extract from the Annual Report and Accounts 2017**

FOUR TYPES OF ORGANISATIONAL RESILIENCE

The eight principles of resilience and transformation function as four pairs of principles. **Table 5.1** describes how the principles operate as pairs to deliver integrative, structural, transformational and contextual resilience and this is further illustrated in **Figure 6.1**. **Table 8.1** aligns integrative resilience with the outcomes 'prevention, protection and preparation'. Structural resilience is aligned with the outcomes 'response, recovery and review'. Transformational resilience is aligned with the outcomes 'invention, innovation and improvement'. Finally, contextual resilience is aligned with the outcomes 'confidence, commitment and capability'.

These four types of organisational resilience should not be considered to be alternatives or represent a scale or progression from one type of resilience to the next. All types of resilience are required if an organisation is to achieve a successful digital transformation.

From the perspective of the risk professional, integrative resilience is the most comfortable and the major focus for many risk professions. Structural resilience based on rapid response and review and adapt is another type of resilience that is very familiar to risk professionals.

1. Integrative Resilience

- Prevention of adverse events that may cause disruption to the routine operational business processes
- Protection of resources, assets and relationships to minimise impact if an adverse event takes place
- Preparation in advance of adverse events to define business recovery plans and arrangements

2. Structural Resilience

- Response to the particular circumstances of an event in accordance with the existing contingency plans
- Recovery of routine operational business processes by successful implementation of business continuity plans
- Review of events that have occurred with the and adaption of business processes to improve resilience

3. Transformational Resilience

- Invention of alternative business processes to improve existing operations and business models
- Innovation involving the use of new technology to embrace the opportunities of digital transformation
- Improvement of the existing business model and evaluation of the scope for further improvement

4. Contextual Resilience

- Confidence in the ability to cope with unexpected opportunities and adverse events and developments
- Commitment from all stakeholders to the digital transformation strategy, tactics and operations
- Capability to deliver and sustain successful resilience and digital transformation

Table 8.1: Outcomes of the four types of organisational resilience

Providing support for transformational resilience is achieved when risk professionals align their activities with the strategy of the organisation and contribute to successful development of digital business models. Risk professionals may be involved in the development of strategy and are always likely to be involved in tactics or implementation of strategy by projects. Project risk management is one of the best develop areas of risk management. The requirement is to enhance the strategy, tactics and operations business enabler and, thereby, achieve transformational resilience.

Contextual resilience is heavily dependent on the culture within an organisation.

A culture of confidence, commitment and capability will ensure that an organisation is fit for purpose and more likely to be successful. Contextual resilience is the ultimate challenge in terms of the types of resilience. That is not suggesting that contextual resilience is the most important, so much as identifying the type of resilience that is the most difficult to achieve. But, it will also provide the greatest contribution when it has been fully acquired. The extract below from the Vodafone annual report recognises that the outcomes of confidence, commitment and capability result in the organisation being considered to be a great place to work.

Great Place to Work

Our people are behind every aspect of our strategy, so it is important that we attract, develop and retain exceptional people. We also want our employees to act in 'The Vodafone Way' – by operating with speed, simplicity and trust. Therefore, we have initiated three people programmes.

First, initiatives focused on female employees to support our goal of building a diverse and inclusive organisation. Second, our enhanced CARE training initiative to ensure front line employees act with empathy for our customers and take ownership to solve their problems. Third, incorporating digital technology to improve our hiring process, career development tools and the workplace experience.

Vodafone Group Plc
Extract from the Annual Report 2017

GOVERNANCE CONSIDERATIONS FOR RISK PROFESSIONALS

In order to achieve digital transformation, organisations need to undertake certain evolutions or transitions and decide the extent to which each evolution will be advanced. These evolutions identify the changes that need to occur for digital transformation to take place. They can also be considered to be a series of 'trade-offs' between the two extremes. The list of relevant 'trade-offs' is set out in Table 2.1. These 'trade-offs' underpin or facilitate successful digital transformation. In all cases, it is for individual organisations to decide the extent of each transition by taking account of the 'trade-off' represented by that transition.

Airmic members responding to a recent survey about these digital trade-offs indicated that they are witnessing first-hand the organisational implications of the digital transformation. However, they are not fully involved in the digital transformation and may not be fully aware of the risk implications of the transformation. In relation to the risks associated with the trade-offs, as identified in Table 4.1, Airmic members indicated the following:

1. In relation to technology and information risk arising from the 'Ownership of the technology vs. Access to the technology' trade-off, only 37% agree/strongly agree that digital technologies are making it easier to manage risk in the ecosystems, although it is hard to monitor risk in ecosystem due to the existence of connected risk and nested risk.
2. In relation to the "Black box" decision making risk arising from the 'Science based on experience vs. Data science based on big data' trade-off, there is strong evidence of black boxing: 38% agree/strongly agree that digital technologies will not let them down, so there is evidence of over-reliance on digital logics. 35% agree/strongly agree that big data is used to understand and manage risk.
3. In relation to the lag between external change and strategic change; lag between strategy and strategy execution risk arising from the 'Stability in capabilities and coordination vs. Experimentation to find solutions' trade-off, only 30% agree about the disconnect between strategy and execution, although the respondents may not be fully aware of the shifts in strategy.

4. In relation to the risk concentrated in fewer assets risk arising from the 'Slack or excess resources and capacity vs. Efficiency / optimisation of resources' trade-off. Only 27% agree/strongly agree that few assets could trigger a disproportionate amount of harm, despite the fact that the research discovered that concentration of risk in fewer assets is a consequence of optimisation. 59% agree/strongly agree that digital technologies have enabled optimisation.
5. In relation to the Blurring of organisational responsibilities and accountabilities risk arising from the 'Knowledge specialisation to identify specific solutions vs. Knowledge integration to break down organisational silos' trade-off, 49% agree/strongly agree with the blurring of the functional boundaries.
6. In relation to the Connected risk arising from the 'Control within the organisation vs. Openness to extended networks' trade-off, 59% of the respondents agree/strongly agree that in their organisations there is a full understanding of current regulatory risks in all markets in which the organisation operates and they have a system for responding to them. 56% of the respondents agree/strongly agree that there is a link between their risk radar and response system. 39% agree/strongly agree that their organisations the corporate governance and risk management systems are well equipped to deal with the digital transformation.

Risk professionals are familiar with the three lines of defence model. This model forms the basis of corporate governance arrangements within many organisations. The management of risk as part of this model is based on the first line responsibility for operational staff, second line professional advice from risk professionals and the third line retrospective checking of compliance by auditors. The role of risk management in the traditional three lines of defence model is based on an approach that is inside the organisation looking out.

Increasingly, there is a need for an additional approach to risk management that is based on the view from outside the organisation looking in. This 'outside-in' risk management approach can be characterised by answering the question: "who outside the organisation is seeking to disrupt our activities". Asking that question and answering it successfully will require all components within the organisation to work together with no silos.

It is by adopting the 'outside-in' and 'inside-out' approaches together that will enable risk professionals to liaise more closely with colleagues including those involved in information technology, data protection, copyright protection, strategy development, audit and compliance. This approach gives rise to the recognition of the resilience and transformation principles as being divisible into reactive and proactive principles. There is an equivalence between the reactive principles as traditional or 'inside-out' risk management and the proactive principles as forward-looking or 'outside-in' risk management. This classification of the principles is illustrated in Figure 6.1.

Many legacy risk management models are centred on the concept that risk management was 'inside-out'. To tackle the multiple risks that digital transformation poses, companies should move towards an 'outside-in' risk management approach. What this paradigm shift means for the risk management profession is that the risk professional becomes a business partner. It is not a technical/accountant type of job anymore. Now being a risk professional is about understanding context and business. Risk professions now need to do what CROs used to do before the digital transformation. They need to go and talk to people and champion the new types of risk. The extract from the Thomas Cook case study illustrates the changing approach to risk and risk appetite.

Thomas Cook

This change in customer behaviour has implications for the UK branch network. According to the 2017 Annual Report and Accounts, despite closing 101 stores at a cost saving of £12 million, retail sales have remained broadly flat. Crucially, Thomas Cook has increased the proportion of holidays sold through its channels by a further 1.5 percent to 83.5 percent.

This is evidence that the company has improved contact with its customers whenever and wherever they need it. The board of Thomas Cook Group is aligned on the relative risks and has agreed on the appetite for risk-taking in digital delivery. As confirmed in the 2016 Annual Report and Accounts, this position aligns with strategic aims and targets.

**Thomas Cook case study
Appendix A: Case Study A5**

ACHIEVING THE RESILIENCE AND TRANSFORMATION PRINCIPLES

To achieve resilience and transformation, organisations need to adopt appropriate practices and Table 8.2 provides examples from the case studies. These example practices provide a checklist of actions that can be used to embed the resilience and transformation principles throughout the organisation.

Implementation of these actions will be the responsibility in many cases of operational or first line of defence. Some of the actions will be designed and facilitated by the second line of defence, such as risk professionals. Auditing compliance with these practices will then become the responsibility of the third line of defence.

Principle and Components	Resilience and Transformation Practices
Risk Radar <ul style="list-style-type: none"> • High Involvement • Constant Vigilance • Avoid Complacency • Challenging Questions • Emerging Risks 	<ul style="list-style-type: none"> • Liaison and cooperation throughout the extended eco-system • identify weak signals that changes are occurring • learn from the experience and mistakes of other organisations • establish a forum to discuss and challenge business presumptions • undertake horizon scanning to identify business trends
Resources and Assets <ul style="list-style-type: none"> • Risk Appetite • Limit Dependencies • Build Flexibility • Scenario Planning • Strengthen Resources 	<ul style="list-style-type: none"> • Establish risk appetite positions for operational risks • identify excessive dependency on specific assets • incorporate resilience considerations into resource allocation • identified foreseeable scenarios and reverse crisis response • procure additional resources in response to opportunities
Relationships and Networks <ul style="list-style-type: none"> • Purpose and Values • No-blame Culture • Open Communications • Customer Focus • Extend Networks 	<ul style="list-style-type: none"> • Involve suppliers and contractors in resilience planning • encourage reporting of near miss incidents and potential losses • ensure absence of risk information 'glass ceiling' and 'glass walls' • involve top management in discussions about customer experience • evaluate scope for extending existing partnership networks
Rapid Response <ul style="list-style-type: none"> • Decisive Actions • Teams and Processes • Empowered Responses • Reaction Plans • Remove Barriers 	<ul style="list-style-type: none"> • Receive, investigate and respond to whistleblowing reports • establish separate nominated crisis management teams • establish authority levels for empowerment of stakeholders • establish a schedule of crisis reversal activities based on scenarios • improved communications without blurring responsibilities
Review and Adapt <ul style="list-style-type: none"> • Structured Learning • Near-miss Reporting • Independent Review • Desire to Improve • Enhance Reputation 	<ul style="list-style-type: none"> • Develop a reporting format for risk and resilience information • report resilience activities to internal and external stakeholders • considers the scope for a control risk self-assessment procedure • include resilience as part of supplier and contractor reviews • recognise the importance of resilience to reputation

Principle and Components	Resilience and Transformation Practices
Redesign Processes <ul style="list-style-type: none"> • Embrace Technology • Process Improvement • Encourage Innovation • Validate Decisions • Forward Looking 	<ul style="list-style-type: none"> • Identify opportunities for digital enhancement of processes • Map all stages of customer interactions from sales to life-cycle • Reward innovation and encourage experimentation • Use of objective and analysis to avoid 'black-box' decision making • Cross functional problem solving to provide broader prospective
Retain Stakeholders <ul style="list-style-type: none"> • Digital Delivery • Engage Stakeholders • Share Opinions • Explain Benefits • Analyse Big Data 	<ul style="list-style-type: none"> • Analyse value chain to bring more economic value • Align business model with customer demands and preferences • integrate knowledge, skills with enhanced digital capabilities • identify and explain market needs and market trends • analyse big data to provide predictive analytics
Reinvent Purpose <ul style="list-style-type: none"> • Opportunity Awareness • Active Commitment • Acquire Capabilities • Reward Confidence • Constant Evolution 	<ul style="list-style-type: none"> Encourage identification of digital enhancement opportunities involve all stakeholders in digital awareness training recruit new people with particular digital skills and expertise support development of new revenue streams and business models recognise that resilience in the digital age depends on innovation

Table 8.2: Achieving the resilience and transformation principles

A PROFESSION IN TRANSFORMATION

A cultural change is required because risk professionals have historically been technical people. There is a need for risk managers to become business partners. They need to go and talk to people and champion the new type of risk. The job of the risk professional will involve challenging the leadership team. Tools such as the risk register might be misleading and give a false sense of confidence.

In these legacy governance models based on risk registers, risk used to be concerned with events. Therefore, organisations are moving away from static risk registers and towards horizon scanning / scenario analysis. In the words of John Ludlow: "The risk professional is someone who understands context and business and becomes a business partner."

MYRISK

MyRisk is an industry leading digital portal which allows clients, brokers, and authorised business partners to access real-time information for facilities and locations across the world. This information can help manage risk improvement efforts, preparing businesses for impending weather events and/or natural hazards. This is a tool to get the risk manager started. It's just one tool in the armoury, but it brings hazard identification quickly into the hands of risk managers. Once the exposure has been identified, they can take the next step to understand the potential consequences and damage. And where the exposure is significant, they can look at solutions and ways to mitigate.

Russ Kirby, Assistant Vice President, Senior Account Manager, FM Global

THE CONCEPT OF CONNECTED RISK

Risk does not operate in isolation: it is connected to multiple causes that in turn drive multiple opportunities. Identifying risks and maximising opportunities – that is the Russell Group mission. Taking a deeper dive into connected risk, Russell Group's team of researchers and data analysts have been exploring this concept in a series of thought leadership papers since 2013. Digital transformation is at the flipside of opportunity and connectivity. Yet, for an organisation to take full advantage of digital transformation, they must be connected from the supply chain side and the demand side. Only, then can an organisation be optimised to maximise the benefits of digital transformation.

Suki Basi, Managing Director, Russell Group Limited

NEW ADVANCES HAVE IMPROVED THE ABILITY TO IDENTIFY TRENDS

At company level, resilience is required as interconnected risks may adversely affect company's results and can be existence-threatening. It is the interconnected and systemic nature of risks that creates surprises when their impacts are felt not only locally but also globally. Against this background, it is important for businesses to understand the triggers, trends and scenarios to look out for, and to prepare for the possible consequences of any of those risks, and therefore determine the best holistic response. Over the years, Zurich has developed a number of practices and tools to support its customers in this regard.

One such tool is the Zurich Risk Room – Zurich's proprietary country risk assessment tool. Using this, risks and their interactions can be visualized in an intuitive way. The Zurich Risk Room can support board members, senior managers and strategic advisors of multinational corporations cutting through the fog of country risk. It is a fact-based management tool, helping facilitate strategic decision-making and risk mitigation in the face of difficult and constantly changing business conditions and risk environments. It helps companies place their strategic decisions and priorities within a consistent and holistic country risk management framework.

The Zurich Risk Room aims to illustrate the impact of business, economic, political, social, infrastructure and environmental risks on individual countries. One of the core strengths of the tool resides in its ability to display the results of complex risk modelling in an intuitive way, displaying relative risk positions across countries and regions. In its current version, the tool includes more than 100 risk factors for more than 170 countries, with monthly data going back to January 2007.

New technologies and advances in data science have improved our ability to identify trends, assess risks and generate early warnings. But if businesses are to take full advantage of these new tools, we need a firmer handle on the reasons why people are more likely to react to some risks and ignore others. This behavioural element is crucial to managing risks effectively – to both recognizing the risks that confront us and then translating that knowledge into effective action. This is why Zurich believes that effective risk assessments also require the management of cognitive and behavioural biases.

**David N Roberts, Head of Proposition RE, Business Analytics & Global Relationship Leader
Zurich Commercial Insurance UK**

APPENDIX A: CASE STUDIES

- A.1 CBRE
- A.2 Met Office
- A.3 Netflix
- A.4 Network Rail
- A.5 Thomas Cook
- A.6 Vertiv



A.1 CBRE CASE STUDY

Introduction to CBRE Group

CBRE Group, Inc. is the most prominent commercial real estate services and investment company in the world. It is based in Los Angeles, California and operates more than 450 offices worldwide and has clients in more than 100 countries. CBRE is the world's biggest commercial real estate and investment company. Services provided by CBRE include facilities management services to occupiers of the commercial real estate as well as property management, leasing, capital markets, appraisal, and brokerage services to owners of the commercial real estate.

The CBRE Global Investors division sponsors real estate investments via investment funds and direct investments that it manages. As of 31 December 2016, the unit had \$86.6 billion in assets under management. The company is ranked #214 on the Fortune 500 and has been in the Fortune 500 in every year since 2008.

Founded in 1906, CBRE is a legacy business. It is disrupted by asymmetric competitors of the digital age like the lodging platform Airbnb. Airbnb is an American company that operates an online marketplace and hospitality service for people to lease or rent short-term lodging. It is a company from outside the real-estate industry offering a new way of managing property. In general, the digital age has brought a wave of new attitudes towards property, including arguably the death of the "buy-to-let" concept.

There is a significant movement within the real estate sector towards mobility, smart cities and sustainable energy production. A city can be defined as 'smart' when investments in human and social capital and traditional (transport) and modern Information and Communications Technology (ICT) infrastructure support sustainable economic development and a high quality of life.

The approach to company culture and the importance of digital transformation within CBRE is demonstrated by the extract from the CBRE Group, Inc. Annual Report 2016.

CBRE Annual Report 2016

In the midst of this transformational integration, we also continued to advance the key elements of our value proposition – our market-leading team of professionals around the globe and the operating platform that supports them. Our talent pool was enriched by attracting new professionals to our company, focusing on training programs for our existing people and fostering a more collaborative culture. Our operating platform benefited from concerted efforts to strengthen our technology and data analytics, research, marketing and other critical functions.

Edited extract from CEO message

1. Professor Lanzolla led the development of the case. This case study builds on interviews and work conducted by Boris Segal for his MBA dissertation (Cass Business School, 2017). Cases are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective management. We apologize for any errors or omissions.

NEED FOR DIGITAL TRANSFORMATION

The world is heading towards the 'machine economy' where machines can transact automatically with other machines. In this sense, 'machine' stands for artificial intelligence and this means that Artificial Intelligence (AI) will be at the centre of new value creation opportunities. As a result, new machine-centred business models are rapidly emerging, with the interaction between machines creating value. These trends cannot shake the current positions of a giant like CBRE, but they inevitably have long-term consequences for the real-estate market.

The IT infrastructure is very reliable these days; the only reason a client would buy new IT networking devices is when there is a real benefit for its business. CBRE is pressured by its clients to deliver more value to them, but this pressure is less about new technologies and more about the outcomes of these new technologies.

CBRE is restructuring its internal technology function to meet the business requirements more effectively. Attempts are being made to shift technology from being a facility to becoming a business enabler and potentially a driver of the business. For CBRE, the digital transformation is about incorporating more digital and automation elements to either streamline its products or make them more sophisticated at each of its product lines.

CBRE senior management is aware of the need to invest in new technologies to enhance CBRE's business model. CBRE has started to acquire companies that only have technological products whereas historically CBRE was buying service capabilities. A recent acquisition is Floored Inc, a 3D virtual reality platform; Environmental Systems Inc; and Forum Analytics that predict future performance of buildings based on data and technology. At the same time, CBRE acknowledges that it is not ready for full digital transformation because it cannot yet be certain how the company or its clients can benefit from these new technologies.

Unlike insurance or finance, for real estate, the physical element always prevails. Therefore, CBRE can digitally transform once digitization becomes a powerful changing factor of the physical environment. At present, there is a lack of clear vision at CBRE of how digital transformation will work. CBRE is confident that the introduction of drones, robots and 3D printing will bring benefits as these technologies mature.

The ultimate goal may be fully robotised, fully automated maintenance of buildings, although this is not yet on the horizon. Because of the level of investment required, it can be argued that only the organisations that reached the digital age as big companies like CBRE can benefit fully from future developments and further diversification.

Development of strategy

It brings relatively easy scalable opportunities to disrupt what we do through information aggregation. So, the philosophy is either you are going to be part of it, or you going to be disrupted by it. I think as all big companies; we are behind in that game because it does take time for large organisations to get develop and implement strategy.

Mike Gedye

CBRE recognises the danger of failure of digital transformation, as demonstrated by the extract below from the Annual Report 2016:

CBRE Risk Factors

Failure to maintain and execute information technology strategies (... ..) could materially and adversely affect our ability to remain competitive in the market.

Our business relies heavily on information technology to deliver services that meet the needs of our clients. If we are unable to effectively execute our information technology strategies or adopt new technologies and processes relevant to our service platform, our ability to deliver high-quality services may be materially impaired. In addition, we make significant investments in new systems and tools to achieve competitive advantages and efficiencies. Implementation of such investments in information technology could exceed estimated budgets and we may experience challenges that prevent new strategies or technologies from being realized according to anticipated schedules. If we are unable to maintain current information technology and processes or encounter delays, or fail to exploit new technologies, then the execution of our business plans may be disrupted.

Edited extract from the CBRE Annual Report 2016

APPROACH TO DIGITAL TRANSFORMATION

Asset management services provided by CBRE include property management, real estate accounting and funds accounting. The CBRE team in the UK recently introduced a new service, Asset Analytics, to improve sustainability performance through big data. The service is a cloud-based platform that has the capability to connect to any modern building, thereby providing real time understanding of building performance. The platform was developed in-house to provide landlords and tenants with a streamlined approach to monitor key energy and occupier comfort information, to allow faster identification of faults and to enable the management of healthier, more sustainable buildings.

In the first year of implementation, Asset Analytics saved clients over £500,000 in energy costs by lowering consumption. The platform is deployed across 2.5 million square feet in the U.K. and is now expanding into mainland Europe. They recently started to provide reporting and analytics services to their customers. This is a new digital-only revenue stream that CBRE have added to their portfolio of client services.

Profitability of digital services

If you look at that range of services you will find that property management service works on about 10% margin, accounting services are working on about 15% margin, fund accounting because its specialist type of work is a little bit more profitable and works on about 20% margin basis. The digital service could work on up to 60%-70% margin basis. What we have done is created this business model where we are trying to promote the management of the buildings and add these additional digital services. However, what imagine is that in the future because the digital piece is so profitable perhaps in 3-4 years we flip the business model around and concentrate on the digital revenue.

Lionel Hill
Chief Digital & Technology Officer

There is a shared view at CBRE that the company is acknowledging the need to invest and develop technologies. CBRE acquired companies like Environmental Systems Inc. and Forum Analytics that are using data and technology to predict future performance of buildings and retail networks.

Also, CBRE has acquired an interest in the venture capital fund called the Fifth Wall. It is a \$200 million dollar fund investing in PropTech. PropTech is considered to be both a massive opportunity for the industry, but it also is a potentially disruptive threat for traditional companies like CBRE.

CBRE is not yet entirely prepared to adopt full digital transformation. Like all big companies, CBRE is behind in adopting digital, because it takes time for a large organisation to understand the implications of digital transformation. Also, CBRE senior management is not yet ready to answer questions about digital strategy. At the same time, senior management thinks that there are opportunities in embracing new technology. Moreover, therefore, new people with particular skills are being hired by the company.

New talent and new technologies

We employed a new head of technology and rebranded our information technology function as Digital & Technology. There are products now being rolled out that are much more technology and digital related. For example, in our Advisory and Transactions service line, we have a product called portfolio optimiser which is a predictive analytics tool that identifies opportunities for portfolios performance. We have technologies that can track utilisation of sites. It is done through digital connected technologies, and we are piloting other examples with Sony and other clients, looking at digital workplace using technologies location awareness and wayfinding. To conclude, we absolutely see the opportunities in embracing technology but also the threat of not doing it.

Mike Gedye

There is a significant ongoing shift towards digital technology within CBRE. There is much ambition, but sometimes it is not fast enough for the people on the ground. They need to realise that CBRE is a 74,000 employee company that cannot instantaneously switch to digital. There is an understanding at CBRE that the current changes will have a massive effect on the company in the long run.

Transformation of business models

New people are coming into the company both at leadership and operational levels, complementing the fact that new revenue streams and business models are created by digital technologies. You can see that it is quite possible that in very near future (5-7 years) CBRE will be completely different. Look at IBM and the way they work; they have professional services, hardware and software. 20-30 years ago, IBM was mainly hardware manufacturing company, today the professional services part is massive in terms of revenues, but the actual part that runs the whole company is software because the margins on software are so much higher.

Lionel Hill
Chief Digital & Technology Officer

CBRE is doing quite well in moving ahead on the digital path, but there is still a long way to go. In general, the real estate industry is not an early adopter of digital technologies. The main challenge of real estate when adopting digital technology, compared to insurance or finance, is that the insurance and finance are dealing with non-tangibles. Real estate is about bricks and mortar. It's about tangibles like balconies, windows, roofs and structures, so there will always be physical element in it.

INVESTMENT IN DIGITAL TRANSFORMATION

For the real estate business digitisation goes beyond the features of the finance sector. For example, digital transformation is not complete for CBRE when the company has managed to get better data using smart sensors and smart analytics. These changes are necessary, but digitisation should also become a powerful changing factor of the physical environment. At present, there is lack of clear vision at CBRE of how this will work.

According to company representatives, CBRE is not aware of what would be the cost of doing nothing. Also, there is some scepticism in the company towards the threats of digital transformation. The future is uncertain at this stage, but there is a fair chance that the business at whole would not be completely disrupted by competitors, if CBRE failed to adopt digital technologies.

Commercial real estate is a complex business sector that cannot easily be replaced by automation. Some CBRE employees suggested that it is unlikely that CBRE will be out of business in 10 years' time. They have diversified their portfolio so much that even if one business unit is whipped out completely (brokerage, for example), it will be painful, but the company will survive.

CBRE acknowledges the need to invest and develop new technologies to enhance its business model. This understanding exists at the most senior ranks of the company. CBRE product managers in each service line are thinking about the range of services and identify what is being offered. The challenge is to decide whether the company should change and incorporate more and more digital and automation elements. These changes need to either streamline its products or make them more sophisticated. Answering these questions will determine how CBRE understands and responds to digital transformation.

The interviews identified data enhancement and delivery of value to customers as the two issues for CBRE to develop. There is a significant movement within the real estate sector towards mobility, smart cities and sustainable energy production. Also, the world is heading towards the machine economy, whereby it will be the interaction between machines that will be creating value.

3D images of buildings

Creating and storing digital 3D images of properties will be a major development. This will eliminate the need to go to paper files to check the maintenance record of an elevator. The information will be accessible from a desktop computer or mobile phone. An augmented reality model will be available to technical personnel on site. In addition, Artificial Intelligence (AI) will provide predictive analytics.

Thomas Herr

There already are companies specialising in the detection of specific parameters like energy consumption, temperature, vibrations and noise of machinery. Data collection and communication using smart sensors will become standard. Data collection, data abstraction and data analytics will improve CBRE databases. Analysing the data over time will enable a specialist to predict the next volcanic eruption, for example, or when and where machine will breakdown.

Development of Artificial Intelligence (AI)

I don't think that we will not encounter true AI in our lifetimes, but moving towards it is very important. We have a lot of data, and we have the data analysed, but we still need to build machine interfaces to utilise that data. I am talking about immersive rooms, augmented and artificial reality, 3D ways of presenting information. I think the blockchain will become quite big and bring a lot of change. We are heading towards is machine economy, where a machine can communicate with and trigger actions of another machine. Much research is still to be done, but it is certainly an important technology.

Thomas Herr

CBRE customers expect more and more from the company. However, there is a view that pressure from the customers is less about new technologies and more about outcomes. Although digital transformation is important, customers are much more interested in the value that CBRE adds. CBRE needs a better view of their customers, as well as bringing them enhanced technology. That is the real change more than everything else.

Customer expectations

I think the pressure from the customers is less about new technologies and more about outcomes. Companies want to make sure what the technology is going to do to their business. From an IT perspective, people are happy to continue with their current IT equipment unless they see an outcome delivered by an equipment upgrade. The IT infrastructure is very reliable these days. The only reason you would buy new IT networking devices is that it is a real benefit for your business.

Mathew Smith

CHALLENGES OF DIGITAL TRANSFORMATION

When you have an organisation that has been very successful in doing things the "old way", and the decision makers of that organisation have been made successful in providing familiar established services, getting them to disrupt themselves is quite difficult. They do not see the urgency for change. A start-up will look at the industry and identify what is ineffective and/or inefficient. The start-up then goes straight to the solution without all the legacy. This represents part of the political and governance challenge for CBRE.

Complexity of large companies

The technical hurdles are more around the complexity of a company that gowned up through organic growth and acquisitions. It is multi-service, multi-vertical, multi-markets, with a hugely complex range of things to fix simultaneously. A small company in a single market providing a single service can digitalise their proposition quite quickly. One of the main questions for CBRE is how to prioritize investment for the digital transformation.

Mike Gedye

Another complexity for digital transformation is that many of the technological solutions have not yet been standardised. So, CBRE must decide which technology to utilise. CBRE could set the standards, and there is an opportunity for CBRE to become a platform provider and leader, as opposed to a follower. There is a view that CBRE has an opportunity to release and test things before they are perfect and maybe fail occasionally and adjusting them.

Setting marketplace standards

We are in the position to be able to set the standards. We do not have to be a producer of every single product that sits on our platform. Products must be good enough to sit on our platform but not necessarily prevent others from joining us. So, it is about open architecture, it is about preparing and being ready to fail to innovate, and it is about dealing with ambiguity. So, if you do not necessarily have all the answers when you launch a product, but you intuitively think it is the right thing to do you release the product. Then, the consumer advises you how to evolve and improve it.

Mike Gedye

Businesses exist to deliver value to their customers, and a 360-degree view of customers influences everything from where you position your offices, what is your distribution chain, how do you manufacture things. Businesses that are going to be successful are going to be the ones that focus their output on customer demands. So, starting with the customer and working back to deliver what they need is the best way to go forward. Having a plan is the first thing, but one also must make sure that the talent is available to implement the plan.

CBRE has the necessary resources, the company understands the market very well and has a massive presence geographically and excellent reputation with its clients. All these will make it very easy for the company to push technological solutions forward. However, there are 74,000 people around the globe working for CBRE. CBRE needs to become agile as an organisation to be able to respond to opportunities and perceived threats.

Competing against disruptors

We just won a pitch in facilities management for Nike's new headquarters. The two finalists were us and WeWork. Note, not CBRE and another traditional competitor, but a disruptor – WeWork. To be able to compete with WeWork we invited Nike to sit down with us to explain what they are looking for and what sort of problems they need us to solve. Using technology, we produced three models within a week to address their demands. Being agile enough in a sustainable way and being able to manage everything else (the existing business model) is really the challenge.

Lionel Hill
Chief Digital & Technology Officer

CBRE is the biggest commercial real estate company in the world. However, it cannot just rest on its accomplishments. The competition is fierce and for CBRE to stay at the very top, it has got to use all available tools. The company needs to identify suitable new technologies to improve business processes and create new ones. Also, the company needs to recruit talented people. The company must use technology as a competitive edge and thereby provide its talented personnel with more tools to compete.

Recruiting talented people

One differentiator for CBRE is that we have 5,000 extremely qualified brokers who are supported by technology to deliver a competitive advantage. Secondly, CBRE is a company with the largest geographical spread within the industry. We have a presence in almost every country in the world operating in every line of business of commercial and residential real estate. We have accumulated an enormous amount of knowledge both specific to geographies and lines of business. Using all this knowledge to provide better service to our customers must be at the core of our operations.

Anish Mehta

SUMMARY AND REVIEW

The real estate industry is moving towards a digitised platformization business model. CBRE aim to become the most significant platform in the market. However, there is not enough room for too many platforms. Therefore, CBRE must move very fast and invest in data collecting capabilities and companies. Data analytics capabilities and Artificial Intelligence (AI) capabilities are then required, followed by accessibility and presentation capabilities.

In the digital economy and platform economy, the only people that will make money are the platform owners and users, but not the investors anymore. The company currently operates as occupiers and investors and needs to decide which side of the business will most benefit from digital transformation. CBRE are developing the view that in the digital economy, the occupier becomes the substantial part of the business and not the investors or the owners. Digital transformation has to deliver this change in the CBRE business model.

Therefore, the company needs to differentiate its strategy. First, they should try to strengthen the current business model as much as possible to protect it. They should develop an alternative structure

within the company. The new digital CBRE will act as a disruptor challenging the value chain and the business model of the existing company. During the digital transformation, digital CBRE will function as a start-up that will critically analyse the current operational models of the existing company and find new ways of doing business.

Cost of digital transformation

I think we should be the first real estate company to have strong research and development (R&D) function and budget. Mid-range technology companies annually invest about 3.5% of their turnover into R&D. In CBRE terms it means that we have to invest approximately \$500 million annually in R&D. Having said that you have to consider that this company operates on an average of 10% margin so that it will be taking about 30% of the margin away. The question is whether the stakeholders are willing to accept that? Then again, of course, the other question is "can I afford not to do it"?

Thomas Herr



A.2 MET OFFICE CASE STUDY

Introduction to the Met Office

The Met Office is the United Kingdom's national weather service. Headquartered in Exeter, Devon, it is an executive agency and trading fund of the Department for Business, Energy and Industrial Strategy. It operates on a commercial basis under set targets, meaning that it needs to generate revenue. The company is led by CEO, Nick Jobling and chief scientist, Professor Stephen Belcher. The Met Office makes predictions across all timescales from weather forecasts to climate change.

The Met Office prepares weather forecasts for broadcast, print and digital media, including apps. It serves as an advisor for UK armed forces, government agencies, and weather-reliant businesses, in particular, those in energy and retail sectors, on how weather might affect their operations. The Met Office collaborates with international partners to deliver more accurate weather and climate advice.

The Met Office provides its services based on world-leading science and enhanced by the close working relationships with partner organisations around the globe. It collects and makes sense of massive amounts of data every day, using cutting-edge technology for the benefit of humanity - and the planet.

About the Met Office

Right across the world, every single day, people make decisions based on the weather. Met Office weather and climate forecasts help with those decisions, so people can be safe, well and prosperous.

Everything we do is based on world-leading science and enhanced by close working relationships with partner organisations around the globe. We collect and make sense of massive amounts of data every day, using cutting-edge technology for the benefit of humanity – and our planet.

Annual Report and Accounts 2016/17

Need for digital transformation

The Met Office currently generates most of its value from the following activities:

- Environmental monitoring;
- Scientific research;
- Technology operation; and
- Forecasting and Simulation.

The Met Office's value chain is disrupted by the predictive analytics companies such as Panasonic, or IBM's Weather Company. Similarly, the Met Office is continuously required to offer better value for money, delivering same or better quality of service at lower costs.

In-depth semi-structured interviews with key decision-makers responsible for technology at the Met Office were carried out at the company headquarters in Exeter in October 2017. The interviews aimed at identifying what is involved in the process of digital transformation at the Met Office: the reasons behind the transformation; and the aims and challenges.

The key message from the interviews is that, in order to survive, the Met Office needs a sustainable digital business model, curating and aggregating science. In any case, the Met Office faces fierce competition from private weather companies approaching the forecasting problem not from the traditional "solving-the-physical equations" approach but from a "data analytics" approach.

2. Professor Lanzolla led the development of the case. Cases are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective management. We would like to thank Charles Ewen, Alberto Arribas, Phil Evans and Nick Jobling of the Met Office for the generosity with their time and knowledge during the interviews conducted when preparing this case. We apologize for any errors or omissions.

Every time a new machine (supercomputer) is introduced, it increases data complexity and size. Therefore Met Office scientific developments need to be considered alongside with technology changes (particularly new cloud technologies such as Amazon Lambda or Google Functions) in order to understand how to manage the data internally after 2020/23. It is anticipated that data will become too big to move after that time.

Digital transformation strategy

Technology will also be at the heart of Met Office transformation and efficiency programmes. Examples of making the vast data banks we have at our disposal practically useful include the powerful new Met Office weather app and other innovation yet to emerge from our 'blue sky thinking' Informatics Lab. Up to date weather and climate information, tailored to individual need, is making the world not only safer but more resilient and prosperous too.

Annual Report and Accounts 2015/16

Approach to digital transformation

During the interviews at The Met Office, the following views were put forward. These views form the basis of the approach to digital transformation being adopted by The Met Office:

- There is a limit to the accuracy of predictions based only on "data analytics", so there is a need for a blending of physically based forecasting capabilities and data analytics;
- Digital capabilities may be beneficial where these particular skills are required, but they may also create complexities and slack if not applied rightly;
- The Met Office has its own Informatics Lab comprised of people with backgrounds in data science, technology and design.

The Met Office Informatics Lab will fulfil a central role in providing answers to the digital disruption. The scientists working in the Informatics Lab focus on solving problems with a 1-3 years' time horizon and it is anticipated that they will deliver substantial value for the organisation in the future. Especially as they build critical capabilities that will contribute to knowledge integration.

It is vitally important that, during the digital transformation process, The Met Office maintains the support of stakeholders. Maintenance of 'trusted expertise' is fundamentally important, as the extract from The Met Office annual report and accounts 2016/17 demonstrates.

Trusted expertise

Many people know us best as the people behind the weather forecasts that feature on TV, online and on your phone – keeping you in touch with our ever-changing weather. Regularly ranked as one of the most accurate forecasters in the world, we are responsible for the UK National Severe Weather Warning Service.

We are also trusted to help protect UK armed forces as they plan missions around the weather, and to keep technology safe with our space weather forecasts. Met Office science and technology enables significant socio-economic benefits. For example, we provide value and help improve productivity through our business partnerships. This includes advising energy and retail sectors of weather that might affect consumer trends. We also help airlines reduce costs and run safely and on schedule.

Annual Report and Accounts 2016/17

The Met Office's strategic advantage, compared to commercial market competitors, has been its stability to continuously develop sophisticated scientific codes for decades and access to data paid for by the UK government. The task for the future is to make the huge amount of data produced easier to process by around 740 forecasters internally and many others externally in order to provide value for the end users. This has to be achieved at a time when weather data has become much more easily available.

Investment in digital transformation

Under the combined effect of competition from private weather companies, such as Accuweather and Google Weather, and economic pressure, The Met Office has embarked on an in-depth transformational process. The Met Office has been asked to bring £1.2bn of economic value to the UK economy. There is a challenge of delivering the same quality of service, if not better, for cheaper.

Need for digital transformation

"What we call transformation [at The Met Office] is about efficiency and value."

Charles Ewen
Director of Technology

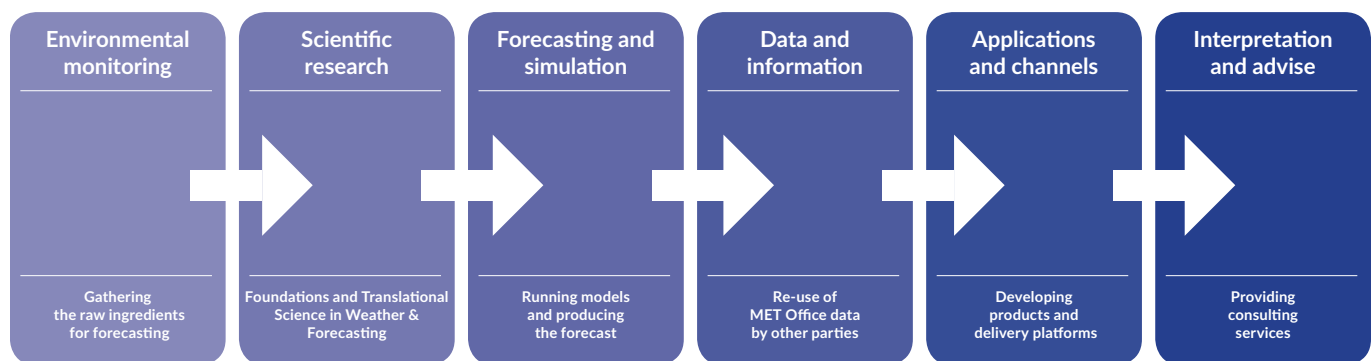


Figure 1: The weather value chain

The investment in digital transformation is driven by analysis of the weather value chain, as illustrated in Figure 1. 80% of value is currently generated within the first three blocks of Environmental monitoring (EM), Scientific Research (SR) and Forecasting and simulation (FS). Data and information (DI) produces 2% of value, Application and channels (AC) produces about 15% of value, and the remaining block of Interpretation and advice (IA) contributes 3%.

Future opportunities

"We are missing an opportunity in data, which currently contributes 2%. In future, data could contribute up to 20% at the expense of application and channels."

Richard Carne
Chief Digital Officer

The requirement for The Met Office to invest in digital transformation arises because the value chain is being disrupted by predictive analytics in computer power and open data, being offered by Panasonic, IBM Weather Company and others. The weather value chain can also be represented as a value platform as in Figure 2.

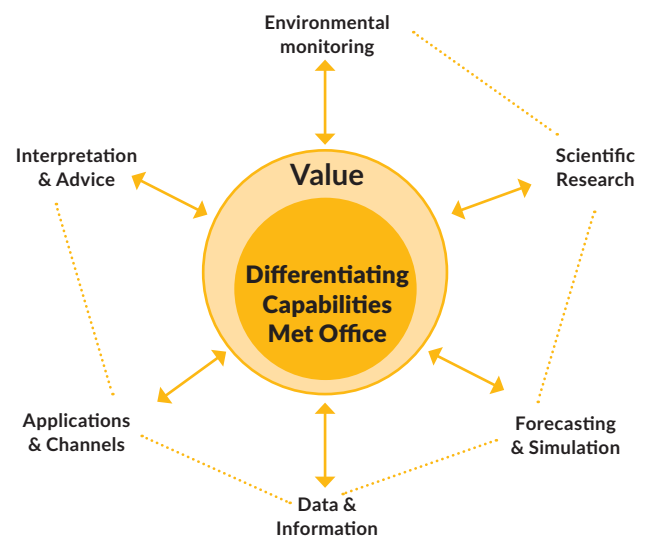


Figure 2: The weather value platform

The drivers of the weather value platform help to identify the need for digital transformation. These drivers are identified by The Met Office as follows:

- The increased number of sensors from Internet of Things and Smart Cities are making be-spoke environmental monitoring less critical. Smart cities use digital information and communications technology to support sustainable economic development and a high quality of life.

- The Met Office does numerical weather forecasting to predict weather in a grid of ~10 km globally and ~1 km in the UK. Competitors like Accuweather use output data from Met Office's models and combine it with data analytics to generate higher resolution data (the Met Office also does this but to a less extend than commercial competitors).
- The role is moving from providing weather forecast to providing information about a specific problem of the clients. The Met Office is already experiencing the "increasing returns" part of the technology curve.

The new winners identified by analysis of the weather value chain and value platform are the engineers. The scientists are increasing in importance as they build critical capabilities that will contribute to knowledge integration. To survive, the Met Office needs a sustainable digital business model. One of the options is to become a curator of science for science generated inside and outside.

There are two alternative models for The Met Office. To act as an aggregator of information or to act as curator, as illustrated in Figure 3.

When making strategic digital decisions, The Met Office are aware of the extent and influence of big data. Every time a new machine (supercomputer) is introduced, it increases data complexity and size. Therefore Met Office scientific developments needs to be considered alongside with technology changes (particularly new cloud technologies such as Amazon Lambda or Google Functions) in order to understand how to manage the data internally after 2020/23. It is anticipated that data will become too big to move after that time.

Data management

"The problem must come to the data, not the data to the problem."

Charles Ewen

Director of Technology

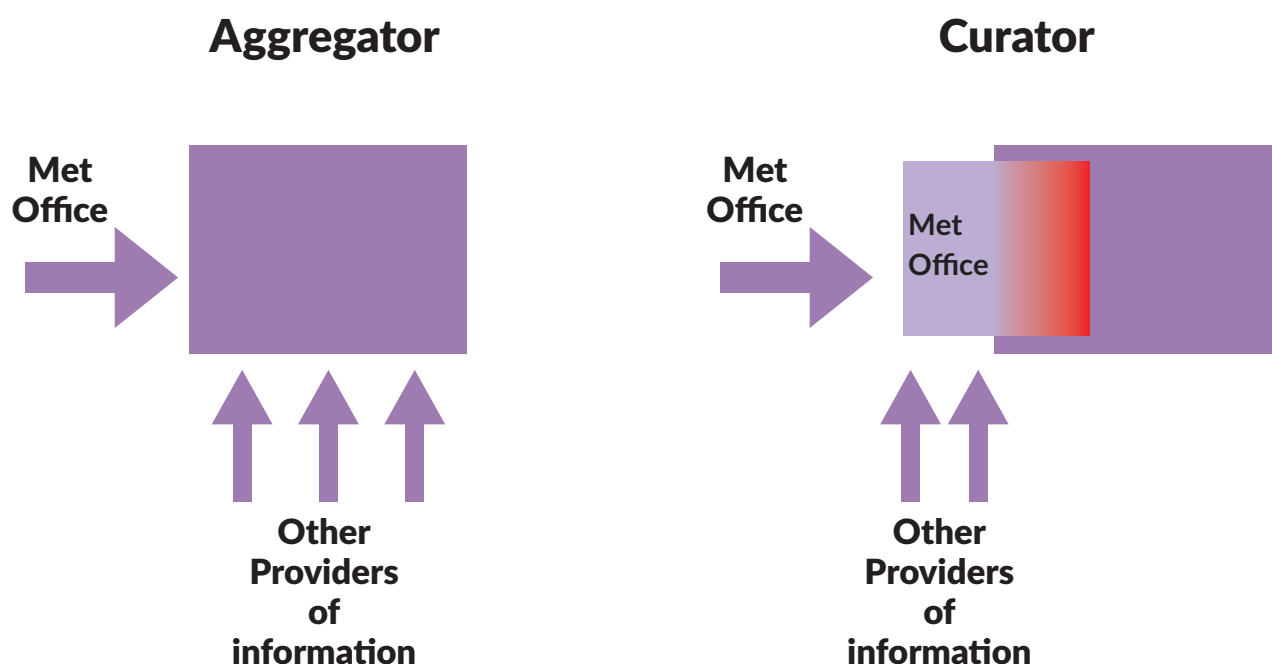


Figure 3: Alternative models for The Met Office

Challenges of digital transformation

To facilitate internal disruption the Met Office created the Informatics Lab in 2015. The mission of The Met Office Informatics Lab is to solve strategic problems for the organisation so Met Office's data and science remains useful to end users. The department comprises ten staff with backgrounds in science, technology and design. They rapidly develop prototypes solutions and work with others internally and externally (e.g. NASA, Amazon, academia) to scale them up.

Current projects include (1) petabyte-scale data analytics platforms to enable sophisticated data analysis; (2) natural language interfaces and chat-bots to facilitate human interaction with big data; (4) machine learning to improve forecasting models and post-processing; (4) visualisation and design to improve user experience.

There are roughly between 20 and 30 days of high-impact weather in the UK which bring additional demands on top of standard day-to-day activities. If not managed properly, digital capabilities can encourage people to develop unnecessary complexity which, in situations of high pressure - i.e. high-impact weather in the case of Met Office - can introduce a slack. This means that that some critical resources (the "go-to" people) become even more in demand.

The challenge of digital transformation for The Met Office can be characterised by an increased need to mix traditional physically-based science and new data-driven algorithms (e.g. machine learning). However, it must be noted that, although recent observations combined with Machine Learning can be extremely useful to predict the weather for the next three hours, physically-based numerical models are necessary to predict the weather further ahead.

Summary and Review

The Met Office has substantial vertical knowledge of scientists, but the challenge then extends to horizontal spread of information by creating and distributing weather related data. Part of the challenge is to make the data as interesting and engaging as possible. This is being achieved by increased use of graphics and provision of information relevant to specific work, social and leisure activities.

The Met Office has information relevant to the retail and transportation sectors and a challenge for the future is provide this information in a way that is commercial valuables for clients / customers of Met Office services. In order to continue with this digital transformation, the following are examples of transformations that The Met Office needs to achieve:

- a) Change from people-based KPIs to behavioural KPIs and output measured at the team level (multifunctional/multicompetence team).
- b) Engineer humans out of the loop and transform from weather forecasters to commercial or business advisers.
- c) Achieve greater value from the Data and information (DI) and Interpretation and advice (IA) blocks of the weather value chain shown in Figure 1.

Transformation needs to be continuous

"You have got to plan resilience and disruption on the go. It is about building a constant need for more transformation. It is different from adaptation. Transformation is never over. Transformation is a perennial part of our fabric. It is a permanent feature of business now."

Charles Ewen
Director of Technology



A.3 NETFLIX CASE STUDY

Introduction to Netflix, Inc.

Netflix is an American entertainment company founded by Reed Hastings and Marc Randolph on 29 August 1997, in Scotts Valley, California. It provides streaming media and video-on-demand online and DVD by mail. In 2013, Netflix expanded into film and television production, as well as online distribution. As of 2017, the company has its headquarters in Los Gatos, California.

The original business model for Netflix was DVD rental by mail. In 2007, Netflix expanded its market with the introduction of streaming media, while retaining the DVD and Blu-ray rental service. The company developed internationally, with streaming made available in Canada in 2010.

Netflix entered the content-production industry in 2013, debuting its first series, *House of Cards*. It has dramatically expanded the production of both film and television series since then, offering original content through its online library of films and television. Netflix released an estimated 126 original series or movies in 2016, more than any other network or cable channel. Netflix headquarters is in Los Gatos, California, USA. They also have other offices in the Netherlands, Brazil, India, Japan and Korea. By January 2016, Netflix services operated in over 190 countries and by July 2017, Netflix had more than 100 million subscribers worldwide, including 52 million in the United States. Netflix has 3,500 employees and a revenue of nearly \$9 billion in 2016 and rising.

Technology and competition

While consumers may maintain simultaneous relationships with multiple entertainment sources, we strive for consumers to choose us in their moments of free time. We refer to this choice as our objective of “winning moments of truth.” In attempting to win these moments of truth with our members, we are continually improving our service, including both our technology and our content.

Netflix, Inc.

Edited extract from Form 20-F (2016)

Need for digital transformation

Netflix has transformed from a technology-based company to a content company. This case study observes the paradoxical strategic transformation of Netflix through the change in how the company management has defined Netflix over time and how its business model has changed since its origin in 1997. The data in this case study is based on the extensive desk research of the company website with the use of open-access Web Archival tools, and comprehensive analysis of the trade press and other relevant professional publications such as DTVE Reporter.

This case study also looks at the most recent Netflix move to internationalise its audience, the decision to produce more original content on the backdrop of competition with the traditional TV channels such as the BBC and American cable TV, and the way Netflix uses customer data to address the changing customer preferences.

Founded in 1997 as a DVD mail-order business. In 1998, Netflix announced a new business plan: For just a few dollars per rental, members could log on to NetFlix.com and choose from more than 900 movies, which could be rented via mail for up to seven days. In 1999, Netflix launched subscription: For \$15.95 a month, users could keep four movies for as long as they would like (a \$19.95 unlimited option would be introduced the following year).

In 2002, Netflix went public at a time when Wall Street was not treating tech companies very well after the dot-com bubble. In early 2007, Netflix made a significant move into the digital sphere.

3. Professor Lanzolla led the development of the case. This case Cases are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective management. We would like to thank Marianna Rolbina and Dina Tokbaeva for their support in collecting the evidence on which this case is based. We apologize for any errors or omissions.

Netflix began streaming by introducing its video-on-demand service. Digital distribution was the most transformative chance at that time. Netflix envisioned the future where users would be able to view footage from personal computers, cell phones and television screens.

In late 2007, the company had also been experimenting with building its Netflix-brand set-top box and launched Roku, a streaming hardware platform. Netflix hired a pioneer of the digital video recorder, to help Netflix develop a device of their own. This point supports the view that digital transformation cannot be achieved without relying on professionals with specific skills. However, later Netflix abandoned the idea of producing its hardware.

Strategic decisions

"It was totally the right decision. Licensing [digital content] has been hugely successful for Netflix. [The Netflix Player] would've created tension with partners, and increasingly decisions would come up where Netflix would have to decide, 'Should we make decisions based on what's best for licensing, or what's best for our own hardware?'"

Anthony Wood, then Roku CEO,
in an interview to Fast Company in 2013

Netflix decided that developing hardware was not the best option and in 2008, Netflix had a significant strategy shift with the aim of becoming a movie channel. In 2008, Netflix was still a DVD-by mail company with 7 million customers. The company had contracts with electronics companies that will let it send movies straight to TV screens over the Internet. The strategy was that Netflix would soon be viewed as a movie channel that might appear on the myriad of devices.

Future strategic direction

"We want to be integrated on every Internet-connected device, game system, high-definition DVD player and dedicated Internet set-top box." "Eventually, as TVs have wireless connectivity built into them, we will integrate right into the television."

CEO and co-founder
Reed Hastings (2008)

Netflix established international video streaming using multiple devices. Even cable networks could not achieve this because they did not offer their content on various devices. In this way, Netflix is revolutionary. The new service was designed to combine the benefits of an Internet browser with the luxury of watching movies and TV shows on large, high-definition TV screens. This significant change in strategy meant that the online service was provided free to subscribers and the company did not have to spend money mailing a DVD.

In 2013, Netflix entered the content-production business. It launched its first original production House of Cards. Netflix financed its production for \$100 million. House of Cards became the first streaming-exclusive TV series to win multiple TV awards. The success of the show confirmed that the streaming platforms are leading the TV sector into the future. In 2015, Netflix released a major motion picture Beats of No Nation. It the picture for \$12 million and it was run simultaneously on Netflix and in cinemas.

In 2016, Netflix was driving toward having half the content on its streaming service as original productions, with the other 50% representing licensed TV shows and movies. The strategic aim was that Netflix would not be a streaming service that offers the same content as can be seen on competitor networks.

Range of content

We have been on a multiyear transition and evolution toward more of our content. The original TV series and movies will continue to be a mix of content owned and produced by Netflix, as well as co-productions and acquisitions. Not every show needs to be a breakout hit. We can also live with singles, doubles and triples especially commensurate with their cost.

David Wells
Netflix CFO (2016)

Approach to digital transformation

In 2017, Netflix partnered with mobile network provider T-Mobile. T-Mobile customers on unlimited family plans were granted Netflix subscription. It was a new content-fuelled front in wireless wars.

The Netflix-T-Mobile deal is the right move at the right time – for all the right reasons.

“More and more fans are bingeing on mobile, so we are bringing together Netflix’s award-winning TV shows and movies with T-Mobile’s award-winning, unlimited network.”

Netflix CEO Reed Hastings
September 2017

In 2017, Netflix launched its first foreign-language series in Polish with more languages to follow in 2018. Netflix also signed a deal with the French telecom giant Orange. Netflix service will be available to Orange customers across Europe, Africa and the Middle East. The telecom giant has 269 million customers worldwide, including 207 million mobile customers and 19 million for its internet services.

Establishing digital partnerships

“This partnership builds on our strong relationship with Orange in France, offering in the future, the possibility for millions of our customers in multiple countries to enjoy the world’s leading internet entertainment service seamlessly, in one place.”

Netflix CEO
(September 2017)

Consumer preferences drive Netflix ambition to expand internationally. In fact, people demand local content service offerings in local languages. Netflix had been pursuing aggressive international expansion in Europe, Asia-Pacific, and all around the world, mainly through organic growth initiatives.

CEO Reed Hastings believed that the novelty of the strategic plan and the constant efforts of the company to improve the services would pay off in the long run. However, there are many stumble blocks as well. Regulatory restrictions, local adaptation and financial costs of competing at global markets are all challenges.

Investment in digital transformation

Planning for the future

Movies over the internet are coming, and at some point, it will become big business. Netflix started investing 1 percent to 2 percent of revenue every year in downloading, and it fundamentally lowered mailing costs. The company wants to be ready when video-on-demand happens. That is why the company is called Netflix, not DVD-by-Mail.”

Netflix CEO (2005)

In its early years (the late 1990s and early 2000s), two co-founders considered Netflix to be a single rental service. Years later, in the 2010s, Netflix noticed that Hollywood production companies were making less television series, and the decision was taken to produce the first original Netflix content. The fundamental idea was to find the right audience for this original content, and Netflix did this by using data to determine the potential audience.

Product decisions were made by extremely fine-tuned measurements of current user activities. Netflix has been good at Big Data, and it benefits from knowing their customers. It tracks subscriber viewing patterns and uses its algorithm to offer personalised recommendations. Netflix proprietary movie recommendation software is called Cinematch. Netflix movie-matching algorithm merely is too difficult and expensive to replicate. Netflix acquires a lot of unique customer data, which is used to create a personal movie profile for each user. This information allows the company to predict, with astonishing accuracy, quarterly subscriber growth, content usage patterns, operations costs and even postage for those who still rent DVDs.

Netflix calls itself an internet TV service and it is sensitive to the competition it poses to traditional broadcasters. In what seems to be an attempt to smooth over the differences, Netflix has indicated that because of the largely exclusive nature of each service’s content, we are not direct substitutes for each other, but rather complements.”

Netflix began building healthy co-production relationships with broadcasters around the world by co-producing content with them. For instance, in Britain Netflix is co-producing a raft of British TV series including Red's crime drama *Paranoid* with ITV, Urban Myth Films' comedy horror series *Crazyhead* with E4 and *Watership Down* with the BBC.

It seems that this collaboration with broadcasters is a strategic move rather than a necessity for Netflix. Netflix wants to keep healthy relationships with its competitors, at the same time, as it has been stated many times by company key figures, Netflix's goal is to rely on its original programming. Netflix has already got a long list of original series, including *Lilyhammer*, *Hemlock Grover*, *Orange is the New Black* and *House of Cards*.

Netflix CEO has stated that the biggest rivals for the streaming giant are not Amazon, YouTube or even traditional broadcasters. According to Hastings, the need for customers to sleep is the primary barrier to greater consumption of Netflix services. Investors have permitted Netflix to operate near break-even on the expectation that the company will continue to proliferate, especially outside the United States.

In regard to the current business model, a lot has been in the trade press that Netflix redefined what it means to watch, and create, TV. As 4G and more advanced networks are spreading, Netflix believes that TV will be based on internet streaming services. Downloading as well as watching content via standard TV set box is going to get irrelevant.

Netflix has disrupted the TV industry globally. The reason for such a significant disruption is that Netflix is an original content producer who has its international distribution network, partnerships with mobile network providers such as T-Mobile and Orange. By all these means it is posing a significant threat to the traditional players – the broadcasters – terrestrial, cable and satellite channels alike.

The traditional players are all losing audience to Netflix, in particular, the younger audiences and the economically active people. The traditional TV channels have also so far been unable to compete with Netflix for creative talent since Netflix can beat them on price. There is heightened competition for talent and purchase of TV series.

Furthermore, as Netflix began to acquire rights to more international programs, it has driven up the costs of those acquisition rights by as much as 50 percent. In late 2015, when Netflix outbid the BBC for a new television series about the life of Queen Elizabeth II, titled *The Crown*. (Furness, 2015), BBC Director of Television Danny Cohen lamented that he "just couldn't compete with the money."

Increased acquisition costs

"It is a classic BBC subject, but we could not compete with the amount Netflix were prepared to pay for that production, even though we would have loved to be a co-producer."

Danny Cohen
BBC Director of Television (August 2015)

As far as BBC is concerned, it is struggling to generate cash outside of the licence fee. It has acknowledged competition from Netflix, Amazon, YouTube and Facebook many times in the past two years. UK public service broadcaster BBC is going to spend £34 million (\$44 million) on children programming to face off competition from global media giants Facebook, Amazon and Netflix.

Challenges of digital transformation

The BBC announced it would shut down its BBC store for good from November 2017. BBC Store launched 18 months previously. It allows customers to buy and download classic TV shows, including Doctor Who and Sherlock. However, the store will close because of a 'growing appetite' for streaming services. Hit shows such as Sherlock and Doctor Who are available on subscription sites Netflix and Amazon Prime, meaning the demand for download programmes to keep has diminished.

Demand for digital services

Since the appetite for BBC shows on SVOD (streaming video on demand) and other third-party platforms is growing in the UK and abroad, it does not make sense for us to invest further in BBC Store where demand has not been as strong as we had hoped in a rapidly changing market.

BBC spokesperson (May 2017)

The BBC mobile apps strategy is under review. The iPlayer needs reinventing too, BBC's head Tony Hall said in January 2017. However, budget restraints and public duty stand in the way and mean that the outcome of any reinvention may not be successful. So far, iPlayer has been losing the battle of on-demand streaming television services to Netflix and Amazon. Netflix and Amazon are better at using their customer data than BBC iPlayer. Also, it is much easier for a company like Netflix to make technological changes to how its service is delivered or try new business models because it does not have as many political and legal constraints as BBC does.

Competition and digital transformation

The BBC would have to “ride two horses” over the next decade by managing its traditional TV and radio stations while facing “huge competition” online from Amazon and Netflix.

BBC iPlayer must be re-invented entirely with new technology such as artificial intelligence, voice recognition and personalisation if it is to keep its lead in online video. The BBC needs to “reinvent public broadcasting for a new generation.”

**Lord Tony Hall
BBC Director General (2017)**

So far, the broadcasters enjoy exclusive broadcasting rights for major sports events like the Premier League. However, if large cable firms continue to be weakened by the likes of Netflix, their spending power will decrease. At which point the new players, like Netflix, could see the prospect of getting a far better deal on sports events than if they were to go after it today.

Netflix says that there is a place for everybody in the new environment. Netflix is aware that streaming services primarily dictate the new environment. Moreover, given the moves from BBC and American cable channels, such as shutting some of their services and re-arranging investment, they are not only losing audiences to Netflix and other digital giants, but their entire business models are now under threat.

Netflix and HBO arguably transformed the VOD industry. It can also be stated that the competitive forces in the VOD industry were stirred by their Ambitions. Both Netflix and HBO business model is based on technology. VOD services are based on an interactive technology for sharing video content through personal computers and televisions.

The VOD market had a high potential to optimise profits for cable operators and content providers.

The rise of Netflix in such a competitive industry started way back in 1997 through DVD rentals by mail, a first of its kind in the market. Being an early entrant, Netflix gained relatively high market share in the online DVD rental market. Netflix started its business model transition from 2007 by entering into a video streaming model.

Summary and Review

The transformation of Netflix came at a time when the market was bombarded with 'broadband penetration', and 3G wireless services. Netflix business model was based on the prediction that Internet-based video streaming was destined to stay while DVDs would become obsolete. In 2013, the company deployed 'cloud architecture' and emerged as a major player in the VOD market.

During the same period, the company had also started to produce its own content. Netflix was quite content rich and provided a 'good mix' of media platforms at a competitive price. The company had an added advantage regarding accessibility on various devices such as laptops, tablets, smartphones, smart TVs, and some Blu-ray players.

In 2013, Netflix invested \$2 billion in order sharpen their focus on original content. By 2014, Netflix had spent \$3 billion on original content and was ready to pay \$6.2 billion by FY 2017. Netflix was keen for a dual existence in the market of 'high-quality originals' besides 'third party content'. In the same year (2013), Netflix generated 21% revenue growth to exceed \$4 billion.

In 2014, CNBC confirmed in relation to the CNBC digital business model that the subscription model is ideally positioned to take advantage of developing technologies in the consumer marketplace. In 2015, based on revenues accrued, HBO and Netflix generated similar revenues. Both the brands were capable of churning original contents driving a maximum entertainment value.

As of 2015, business analysts concluded that Netflix and HBO were rather supplementary to each other than substitutive. It was because each of them was offering high-quality universal and original content for a relatively similar price. Therefore, the current strategy of Netflix, focusing on innovation, sustainability and domination on the internet TV market, is to produce more original content. Netflix COO specifically commented that Netflix would be more focused on content production to address the changing consumer preferences.



A4. NETWORK RAIL CASE STUDY

Introduction to Network Rail

Network Rail is the owner (via its subsidiary Network Rail Infrastructure Ltd which was known as Railtrack plc before 2002) and infrastructure manager of most of the rail network in England, Scotland and Wales. Network Rail is an arms-length public body of the Department for Transport and is owned by the Government. It has no shareholders and reinvests its income into the railways. Since 1 September 2014, Network Rail has been classified as a “public sector body”.

The company headquarters is in London. It employs 34,000 people with revenue in 2013 of £6.2 billion. Network Rail is funded partly through a direct grant from the government (£3.8 billion in 2015/16) and partly by train operating companies paying access charges to use the rail network (£1.6 billion in 2015/16). Network Rail chairman is Sir Peter Handy, and CEO is Mark Carne.

The primary customers for Network Rail are the private train operating companies (TOCs), responsible for passenger transport, and the freight operating companies (FOCs), which provide train services on the infrastructure that the company owns and maintains. To cope with rising passenger numbers, Network Rail is undertaking a £38 billion programme of upgrades, including Crossrail, electrification of lines, upgrading Thameslink and a new high-speed line.

Network Rail is undergoing a large-scale digital transformation that to build the so-called Digital Railway. Digital Railway is the proposal for the UK to adopt modern digital signalling and train controls within the next 25 years and create credible options to upgrade the railway to next-generation technology as it becomes available. Network Rail's Digital Railway Programme is expected to increase rail network efficiency by 30%.

Railway capacity

The biggest challenge for the railway is capacity. We forecast that the number of people wanting to travel on our network will double in the next 25 years. Much of our network is already full and we need to look at ways of meeting this demand affordably. The speed with which we can implement digital train control will be a large part of the answer. The technological transformation of the railway will increase capacity and connectivity, allow trains to run faster, more reliably, more safely and with a smaller environmental footprint.

Network Rail Limited
Annual report and accounts 2016

Need for digital transformation

There are socio-demographic and economic reasons behind the need for transformation at Network Rail. Quality infrastructure underpins national prosperity and that is why economic growth has gone hand in hand with a doubling of rail use. However, without reform, a lack of railway capacity will hold growth back.

Passenger journeys have nearly doubled since the early 1990s. Parts of the network are so full they run at almost 200% of planned capacity at peak times and performance has stopped improving. As capacity is so limited, trains are crowded, reliability has stopped growing, and there is less space for transporting freight. However, there will be 1 billion more passenger journeys by 2030, so Network Rail recognises that immediate action is required.

4. Professor Lanzolla led the development of the research and of the case. Cases are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective management. We would like to thank Jeremy Axe and Mike Howard of Network Rail the generosity with their time and knowledge during the interviews conducted when preparing this case. We apologize for any errors or omissions.

The industry has already agreed a plan to address this through digital modernisation, but it extends into the 2060s and hasn't been designed to prioritise capacity. The Network Rail'- Digital Railway programme is building the case to bring forward its delivery in a faster and more focused way.

Digital Railway programme

A modern railway with improved connectivity and capacity is essential to a successful economy for Britain. With the railway already full on some major routes, and with passenger numbers set to grow significantly in the next 20 years, Britain needs a strategy to unlock capacity from existing infrastructure that allows regions to benefit from more trains, better connections and greater reliability. Digital technology enables this by allowing trains to run closer together. It will allow us to achieve more from what we already have.

Historically, the most effective way to keep trains separated safely from each other has been to divide tracks into fixed sections (blocks) and use signals to only allow a train to enter a block once the preceding train vacated. Technology and innovation now offer us the opportunity to move beyond analogue signalling and train control.

The Digital Railway programme has already delivered a framework business case and proposed rollout plan for an accelerated programme of digital infrastructure. Whilst the Digital Railway is underpinned by technology, it is a transformation programme that will impact all parts of the railway industry from driver training to the specification of rolling stock. Implementing the Digital Railway vision through an accelerated programme is vital to meeting the future growth in passenger demand and providing the capacity needed on the rail network for the benefit of passengers and freight users.

Network Rail Limited
Annual report and accounts 2016

Approach to digital transformation

Conventional upgrades to the network are vital. However, they cannot deliver the significant increase in capacity the UK needs without excessive cost, disruption and delay. This capacity can only come from making the infrastructure the railway already has more productive, which is what proven digital technology does.

By using in-train signalling (called the European Train Control System) and traffic management systems, which optimise the speed and movements of trains on the network, they can be run closer together without supervision.

The aims of the digital transformation at Network Rail are: (1) to have a safe and cost-efficient rail system; (2) to better meet the needs of the ever-increasing number of passengers and freight shippers who use the railway; and (3) (from the government perspective) to help the country develop economically and socially as identified in the Shaw Report, March 2016.

Specific actions are required to achieve these aims. These actions include:

1. place the needs of passengers and freight shippers at the heart of rail infrastructure management and introduce scorecards to help Network Rail achieve its action plans;
2. devolve the routes to deliver service in a more flexible and responsible way to customers;
3. create a route for the North and let them manage themselves locally;
4. clarify the role of Government in the railway and Network Rail, and coordinate with the Governments of Scotland and Wales;
5. routes should be given the freedom to build up their plans based on passenger and freight shipper needs; and
6. explore new ways of paying for the growth in passengers and freight on the railway.

Further options for involving private sector finance should be explored to release government capital, encourage innovation, and speed up delivery of improvements for passengers. This will include letting a concession, or involving suppliers in technological investment. Routes should also be required and empowered to find local sources of funding and financing from those who stand to benefit from new or additional rail capacity, including local businesses or housing developers. Finally, actions should be taken to develop skills and improve diversity in the workplace.

The Global System for Mobile Communications-Railway (GSM-R) delivers digital, secure and dependable communications between drivers and signallers. This helps to increase safety, reduce delays and improve performance – providing a better experience for passengers. Network Rail expects that using GSM-R wireless technology will help achieve the following goals:

- Improve safety because GSM-R ensures direct radio driver-signaller communications at all times. It includes areas such as tunnels and deep cuttings, where radio communications have not previously been possible. The system ensures faster and more efficient responses to potential hazards with applications such as Railway Emergency Call. It also eliminates the need for drivers to exit the train in the event of a problem.
- Reduce operating costs by replacing the patchwork of increasingly inefficient and expensive legacy systems, GSM-R reduces ongoing maintenance costs, improves reliability and delivers the foundation for a digitally enabled railway network.
- Move away from analogue because previous radio driver-signaller communications relied on analogue radio networks. These had limited functionality and had become increasingly expensive to maintain.
- Comply with EU regulation and this was particularly necessary at the times when GSM-R was first introduced in the UK. It was an EU requirement to introduce this communication system to follow European common standard for digital data and voice communications in railway applications as well as recommendations from major incident enquiries.

New digital technology also means Network Rail can keep pace with industry developments such as ERTMS (European Rail Traffic Management System) and ETCS (European Train Control System). The European Train Control System (ETCS) is the signalling and control component of the European Rail Traffic Management System (ERTMS). It is a replacement for legacy train protection systems and designed to replace the many incompatible safety systems currently used by European railways. Network Rail embarked on ETCS in 2006.

Trains find their position themselves using positioning beacons and via sensors (axle transducers, accelerometer and radar) and must also be capable of determining train integrity on board to the very highest degree of reliability. By transmitting the positioning signal to the radio block centre, it is always possible to determine whether the train has safely cleared the route. The following train can already be granted another movement authority up to this point.

Investment in digital transformation

To achieve digital transformation, Network Rail has invested £1.86 billion into GSM-R, the international GSM-based wireless communications standard for railway communication and applications.

GSM-R allows secure and reliable driver-signaller communication by bringing together the most effective combination of technology, processes and people. It is achieved using a customised fixed telecoms network alongside mobile technology.

100% of the UK rail network is now covered with wireless technology. GSM-R processes include:

- journey registration;
- operational messaging; and
- prioritising driver-signaller communications.

Those involved in the Network Rail digital transformation range from drivers and signallers to managers, controllers and maintenance staff. Network Rail trained 21,200 drivers and signallers to use GSM-R. The success of digital transformation depends on digital, secure and dependable communications between drivers and signallers. It helps to increase safety, reduce delays and improve performance – providing a better experience for passengers.

To successfully achieve transformation, the entire organisation of Network Rail is undergoing the process of devolution, which will result in nearly all investment decisions being taken at route (or local) level, as opposed to centrally, as was previously the case.

The rail network is divided into eight routes (or geographic areas) across the country. All routes have new structure and organisation. Currently, the routes are:

- Anglia
- London North Eastern and East Midlands (LNE&EM)
- London North Western (LNW)
- Scotland
- South East
- Wales
- Wessex
- Western (Network Rail, 2017)

The change Network Rail is undergoing involve several projects, all with the aim of moving resources, decision-making and delivery closer to customers. All routes have an increasingly commercial role, which requires a different leadership structure. Network Rail now has chief operating officers appointed, providing an increased focus on operational delivery.

Different leadership structure

“We have transformed what were operational divisions in Network Rail into integrated businesses, accountable to customers for all aspects of delivery.”

Mark Carne
Network Rail CEO

The local teams are now responsible for the operation, financial management, and development of the railway. Devolution has not just been about a reporting line change – it represents a shift towards a more customer-focused team. The relationship between “the centre” and the routes has become more customer-focused.

By April 2017, 99% of decisions are made locally by route teams. These decisions deal with managing the customer and business expectations; planned works such as station upgrades and track improvements; and liaising with relevant train and freight operating companies. Each of eight routes is run by a managing director and their senior leadership team to deliver a safe and reliable railway for passengers and the business’ customers. The routes are supported by central services that provide a national framework, such as standards and services, where economies of scale or specialist expertise make it sense to offer these from a central point in support of the routes.

As part of the Digital Railway cross-industry partnership, Network Rail has a national Group Digital Railway function within its business. This group delivers information and telecommunication services to a broad range of customers and stakeholders to keep the railway running. It works with industry partners to introduce new technology and digital solutions across the network.

Two areas of Network Rail provide these services for Group Digital Railway in addition to their other functions. They are Asset Information Services and Network Rail Telecom. Asset Information Services collects, evaluates, collates, analyses and communicates information about infrastructure assets to support improved business decisions. Network Rail Telecom provides national operational and corporate telecommunications capability, so that systems and people can talk to each other effectively.

Group Digital Railway runs two programmes. These are:

1. Offering Rail Better Information Services (ORBIS), which is developing better ways to collect and manage data, and deliver it via tools and apps; and
2. Digital Railway Programme (DRP). DRP works with the broader rail industry, supply chain and Government to develop technology solutions and deliver the transformation needed to provide the one billion railway journeys anticipated over the next 35 years.

Challenges of digital transformation

In-depth semi-structured interviews with key decision-makers responsible for technology at Network Rail were carried out at the company headquarters in Milton Keynes in October 2017. The interviews identified the main components of the digital transformation at Network Rail; the reasons behind the transformation; and its aims and challenges. The key digital transformation challenges discussed during the interviews were as follows:

- A significant increase in data use and storage as a result of the new electronic ticketing system has led to the governance question “who owns the data?”
- Managing expectations of passenger experience has become the key capability for Network Rail. In a digital environment, increased connectivity and public access to information has created unrealistic expectations from customers.
- One more crucial new capability of Network Rail is coordinating different units of the organisation. As a result of the transformation, more decisions will be made locally by the routes, rather than taken centrally as it had been before.
- Organisations have become more fluid to the extent that organisations become “processes” and it is a constant work in progress when even key figures do not always know for sure how it will evolve even in short-term.
- The digital transformation for Network Rail is about IT and operational technology or managing more data of unknown quality, shifting power from the centre to the routes, and requiring skills in knowledge management and knowledge integration from its staff.

Passengers firmly believe that services can be delivered faster and of better quality. Their increasing demands are a consequence of the increase of the pace of life for most people. This is the reason that Network Rail is under more public scrutiny when delays occur. Therefore, there is an urgent need for digital transformation.

The transformation at Network Rail is not only about adopting new technologies. It is about adapting to a new world and the process of adaptation is presenting the company with several new challenges.

The balance of power is moving towards the routes, resulting in devolution with decisions taken closer to the customers. Shifting power from the centre to the routes also requires different skills. There is an appointed Route Asset Manager in each route who reports to a director of route assets. The Route Asset Manager is a knowledge integrator. Early indications are that routes perform better as they have more autonomy.

Challenges exist in relation to data governance and ownership of the data. Wi-Fi is now provided on many trains, so that ownership of passenger data needs to be clearly established. The open data policy of the Department for Transport (DfT) is a very important policy. The data can be used to drive innovation in planning, to lower congestion, to provide cleaner and better services.

There are continuing developments in electronic ticketing. The network operators, service companies, the technology providers and other third parties have an interest in the technology and data collected. However, data collection and dissemination is still very fragmented and inconsistent. It is fair to say that the data are not yet big, but they are also of unknown quality. The benefits associated with the collection and analysis of big data have not yet been achieved.

Data are not yet seen as assets that must be maintained, nurtured and developed. Like all other assets, data have their own life cycle, but this is not yet a clearly recognised. In some parts of the organisation data are still seen as something that happen, rather than something that has to be actively managed. The newly appointed Chief Data Officer, as the head of data, innovation and knowledge management must tackle these challenges.

The new central role of technology is likely to enable a more coordinated approach to technology investments. Digital transformation is also changing the relationships among internal functions and this has increased the focus on digital governance because technology is taking centre stage.

Digital governance

"There is no business project that does not have a digital component. Before there was no IT project that did not have a business element."

Jeremy Axe

Principal Enterprise Architect at Network Rail

On the other hand, there are plenty of duplications and conflicts at multiple levels within the organisation. For instance, at the HQ-level, the Digital Railway team and the legacy IT team are establishing their respective remits. There is duplication between central HQ functions and equivalent functions at the route level. In particular, there are significant coordination challenges in relation to data collection and data integrity.

Summary and Review

In July 2016, Network Rail embarked on a transformation to become a public-sector organisation that behaves like a private sector business.

The goals for this transformation are to become:

1. customer focused;
2. competitive; and
3. attractive to investors.

As envisaged by Network Rail, digital transformation will mean less bureaucracy and more delegated authority for local managers. By completing this transformation, Network Rail is planning to achieve reliability of its service at a lower cost. Reduced cost together with improved customer relations will allow Network Rail to compete more effectively with low-cost airlines, for instance, on the Anglo-Scot route.

A recent risk management report, summarised the challenges of the digital transformation further. Network Rail continues to work on the development of its Asset Management System and it is essential at this stage to ensure the completion of the ongoing initiatives. Network Rail has embarked on devolution that touches upon other spheres such as asset information, asset management strategy, planning and decision-making, as well as lifecycle delivery, organisation and people, and risk and review.

In summary, Network Rail is facing the following issues and developments related to the digital transformation of the company:

1. confusion regarding those responsibilities split between the centre and the route and concern that the routes may have inadequate management capabilities to undertake effective decision-making;
2. Network Rail capabilities in decision making continue to improve, particularly (on the capital side) with respect to whole life cost models and the application of Asset Policies;
3. defining maintenance requirements, given that the new maintenance strategy was launched in autumn 2016 and so is not yet fully tested;
4. Network Rail is currently implementing a major improvement programme based on the Portfolio, Programme, and Project Management Maturity Model (P3M3) that is an ongoing transition until January 2018;
5. Asset Information Standards have a good foundation, but require greater clarity on the suite of documents and models that define the Network Rail Asset Information Model; and
6. Network Rail now has a fully defined and increasingly well embedded Risk Management Framework, but more improvement is necessary.



A5. THOMAS COOK - CASE STUDY

Introduction to Thomas Cook Group

Thomas Cook Group plc is a British global travel company listed on the London Stock Exchange and is a member of the FTSE 250 Index. The group owns tour operators, as well as airlines based in the United Kingdom, Germany, Scandinavia and Spain. Thomas Cook Group operates four main divisions, UK, Continental Europe, Northern Europe and Group Airlines. It has 190 own-brand hotels and resorts and operates a fleet of 93 aircraft. It employs 22,000 people and serves a total of more than 20 million customers.

Thomas Cook was founded in 1841 and was sold to the German company C&N Touristic AG in 2001 to become Thomas Cook AG. In February 2007, Thomas Cook AG announced a merger with MyTravelGroup plc. The merged company was then listed on the London Stock Exchange as Thomas Cook Group plc. Thomas Cook is the second largest tour operator in Europe after TUI.

This case study concentrates on the UK division of Thomas Cook Group. It is based on interviews with (1) the Digital platform director; (2) Head of e-commerce and CRM; (3) Group Head of Insurance; and (4) Head of Retail Portfolio and Innovation.

Risk Appetite

The board are aligned on the relative risks and have agreed that the appetite for risk taking for digital delivery, product, new operating model and talent is entrepreneurial. This position aligns with the strategic aims of the transformation programme and targets set for the business.

Thomas Cook Group
Annual Report and Accounts 2016

Need for digital transformation

Planning a holiday used to entail a visit to a local travel agent. Digitisation has empowered customers by giving them tools for independent holiday-planning. Customers can now book flights, hotels and restaurants online, rent from other people via Airbnb. They can browse through the myriad of online reviews, social media and business websites before making a choice.

The Thomas Cook Group annual Report and Account 2017 mentions Digital Strategy among the principal risks faced by the company. The board of Thomas Cook thinks that their distribution approach has to be aligned with customer demands and preferences. The approach must also be able to adapt to rapid changes in technology. If Thomas Cook is not successful in adapting its approach, it may hurt its market share, profitability and future growth.

5. Professor Lanzolla led the development of the case. Cases are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective management. We would like to thank Mark Dawson, Keith Andrews and Brian Hogg of Thomas Cook Group for the generosity with their time and knowledge during the interviews conducted when preparing this case. We apologize for any errors or omissions.

Principal Risks

We continue to improve our websites, which is leading to strong growth in web bookings for our major markets:

- Our OneWeb platform is now fully operational in the UK, Belgium and The Netherlands;
- The web platform used by our German market was recently ranked as one of Germany's best online portals; and
- We are currently upgrading the technology utilised on our Northern European platform, which will make the website faster and more responsive

Thomas Cook Group
Annual Report and Accounts 2017

Approach to digital transformation

At present, Thomas Cook is mostly reacting to changes in customer behaviour on the broader environment triggered by digital technologies. The company is not yet transforming the whole business model.

Digital transformation strategy for Thomas Cook is omni-channel. This means that there is an effort to create seamless customer experience between digital and physical channels. To be precise, there is a plan to reduce the number of physical stores to 600 in 2018. This represents a 50% reduction from the 1,200 stores of five years ago.

However, according to the 2017 Annual Report and Accounts, 47% of holidays booked through Thomas Cook are currently booked in its stores. Moreover, two-thirds of Thomas Cook customers continue to come into stores to speak to experts. Therefore, Thomas Cook is still very dependent on its physical estate of stores. The company acknowledges the importance of stores and reports that, throughout 2016-17, the company refurbished and rebranded 51 stores and closed 101 ones. This means that, as at early 2018, the network comprises 691 stores.

Customers now have online tools at their disposal to arrange low-cost travel and accommodation. Therefore, Thomas Cook has been pushed upstream by the digital transformation, especially in the past seven years of experimenting with digital transformation. New entry and smaller competitors are better geared up to attract customers through an array of digital tools such as social media and company websites. As a premium tour operator, Thomas Cook needs to get the product and sales right.

Investment in digital transformation

Thomas Cook is committed to deliver a seamless experience to its customers, both in person and online. In this regard, the company is reshaping its contact with customers and meeting the changing customer needs. According to the 2017 Annual Report and Accounts, mitigation actions are being taken at Thomas Cook to address the risks and uncertainty arising from the digital transformation.

Thomas Cook is adapting to the changing behaviour of customers by investing in its websites and the ways it attracts customers online. With this aim in mind, Thomas Cook has improved its websites to make them faster and more responsive. This is leading to strong growth in web bookings for its primary markets, as described earlier. To attract more customers to the websites, the company has developed rich and inspirational content. In 2017, the company has added 80,000 images and 130 hotel videos. In addition to that, the Companion App is available for the customers to support them during their entire journey.

There has been an increase in mobile bookings by Thomas Cook UK customers. Mobile bookings now account for 45% of all online bookings, up from 40% the previous year. This move has led to an increase in overall UK digital sales by 27% on top of the 9% growth achieved in 2016. If one looks at results for the entire Thomas Cook Group, online bookings rose from 43% in 2016 to 46% in 2017.

This change in customer behaviour has implications for the UK branch network. According to the 2017 Annual Report and Accounts, despite closing 101 stores at a cost saving of £12 million, its retail sales have remained broadly flat. Crucially, Thomas Cook has increased the proportion of holidays sold through its channels by a further 1.5 percent to 83.5 percent. This is evidence that the company has improved contact with its customers whenever and wherever they need it. The Board of Thomas Cook Group is aligned on the relative risks and has agreed on the appetite for risk-taking in digital delivery. As confirmed in the 2016 Annual Report and Accounts, this position aligns with the strategic aims and targets set for the business.

Thomas Cook has been developing its approach to digital transformation for the past seven years. The changes in strategic direction have been striking. For instance, seven years ago Thomas Cook was pursuing the start-up culture to become better than Expedia. Expedia is an American travel company that owns and operates several international global online travel brands, primarily travel fare aggregator websites and travel metasearch engines. The Thomas Cook strategy was to beat them in their own game.

This aggregator strategy lasted for 18 months. However, seven years and three changes of technical platform later, Thomas Cook is no longer following the strategy of defeating Expedia and has gone back to its core activities. The current strategy is to be a tour operator and the company has now partnered with Expedia. Expedia provides inventory and technology and Thomas Cook runs and delivers the experience.

The current strategy is to focus on core business and seek partnerships in areas where Thomas Cook do not have the capabilities to deliver. In other words, competitors are becoming partners. For example, Thomas Cook has closed its Belgian airline and they now partner with Brussels airlines. The same approach has been taken in China, where Thomas Cook now have a partnership with Fosun.

Opportunities and challenges of digital transformation

The core business for Thomas Cook is that of a tour operator. It allows customers to choose many aspects of their holiday from the website, including the room location or book a sunbed. Also, the company focuses on providing quality experiences. Four years ago, Thomas Cook contracted with around 10,000 hotels, which has reduced to around 3,500 hotels today.

Thomas Cook has a relentless focus on performance that will preserve and enhance the customer experience. To this end, the company has increased its quality assurance by improving inspection of holiday facilities. Instead of competing on price, the company competes on customer experience and wants to be a leading leisure travel provider. There is much innovation in the core business. For example, there is the initiative to provide digital travel money. The crucial part of this strategy is omni-channel and this depends on a seamless customer experiences between digital and physical channels.

Customer Relationships

This includes developing rich, inspirational content that stands out in a crowded online marketplace and will grab customers' attention to drive higher conversion. By investing in our websites, we can grow our online presence and reshape our retail estate to create a true omni-channel approach to how we sell our holidays.

Thomas Cook Group
Annual Report and Accounts 2017

The retail activities of Thomas Cook in their stores are currently experiencing the following decisions and challenges:

1. Correct capacity and the optimum size for a store;
2. Location of the stores to best meet customer needs;
3. Relevance of the stores and what should be in the store, rather than on the website); and
4. How to make customer store experience more pleasant.

In order to follow this strategy and cater for the different needs of customers, the retail experience has to be reinvented. Moreover and in connection to that, the in-store IT has to become more relevant. Apart from that, it requires significant changes in mindsets and organisational culture towards more cross-functional teamwork. This requires collaboration between, for instance, IT and marketing, as well as retail and digital. A significant programme in the UK is underway to better optimise the on-line and off-line channels.

This strategy is designed to help Thomas Cook get its product and sales right, and to answer big strategic questions. For example, what kind of travel products the company should offer to customers in the coming years; and whether the company can remain competitive in the longer-term.

For the UK division of Thomas Cook, customer-base end-to-end digital-only sales account for 32% of all sales. The goal is to grow the part of the digital business at a rate of 3% per year. In 2020, the goal is that 60% of transactions will come through digital channels. It is not entirely clear at the moment, whether both the growth rate and ultimate transaction target are achievable.

Whatever targets are set must take account of the fact that technology becomes obsolete very quickly; perhaps every three years. Choice of technology is a challenge for both scalability and flexibility. Therefore, the most prominent challenge for Thomas Cook is aligning its business and IT objectives. Technology is required to facilitate the changes required at the business level.

Digital Transformation

It doesn't matter whether change is driven by IT, Marketing or elsewhere, Digital teams can only succeed by not working in silos, but embracing that cross functional teams deliver success.

Digital Platform Director
Thomas Cook

Summary and review

The big question for Thomas Cook is what kind of travel products will its customers require in the coming years. Changes in mindset and culture towards more cross-functional collaboration is what drives change and innovation. For instance, Thomas Cook has to create stronger bonds between its product development, customer experience, marketing and IT departments to have a better product-customer fit. Thomas Cook also has to intensify cooperation between its retail and digital segments.

One more challenge of digital transformation for the company is how it uses its customer data. Thomas Cook is behind in the use of predictive analytics and is falling behind on digital transformation. It is not making full use of its technology capabilities. The company is mostly reacting to changes in customer behaviour, rather than being proactive in using digital technologies to enable the changes required at the business level.

In summary, if Thomas Cook is successful in digital transformation, it will move customers from physical to online channels, and this will require changes to the core business.

Digital strategy

Our distribution approach has to be aligned with customer demands and preferences and be able to adapt to rapid changes in technology. If we are not successful in adapting our approach it may have an adverse effect on our market share, profitability and future growth.

Thomas Cook Group
Annual Report and Accounts 2017



A6. VERTIV CASE STUDY

Introduction to Vertiv Corporation

Vertiv designs, builds and services critical infrastructure that enables vital applications for data centres, communication networks and commercial and industrial facilities. Vertiv has a global footprint via several manufacturing and assembly facilities, service centres, customer experience centres, and sales offices.

Vertiv was formerly known as Emerson Network Power and was part of Emerson Electric before its leveraged buyout by the Platinum Equity investment firm in a \$4 billion deal that saw Rob Johnson as the new CEO to drive the rebranding and transformation journey. Platinum Equity is a global investment firm specializing in mergers and operations. In 2015, Platinum portfolio companies generated more than \$14 billion of revenue.

When asked to define the core business and industry Vertiv is currently in, Vertiv leadership team were all aligned on the answer. "We are in the business of protecting and optimizing the critical data center infrastructure. We have plenty of products from cooling to power supplies and software" Rob Johnson, CEO, Vertiv. Data centres are secure sites containing information technology equipment that computes and stores large quantities of data equipment that requires continuous precision cooling and backup power supplies.

Risk Factors

Failure to anticipate technology shifts, market needs and opportunities, and failure to develop appropriate products, product enhancements and services in a timely manner.

We believe that our future success will depend in part upon our ability to enhance existing products and services and to develop new products and services that meet or anticipate technology changes, which will require continued investment in engineering, capital equipment, marketing, customer service and technical support. Our primary global competitors are sophisticated companies with significant resources that may develop superior products and services or may adapt more quickly to new technologies, industry changes or evolving customer requirements.

Vertiv Corporation Information Statement (2016)

Need for digital transformation

From the heritage of Emerson Network Power, Vertiv was equipped with a strong portfolio of products in both power and thermal management in addition to Racks, enclosures and infrastructure management, monitoring, controls and software solutions. These products go into three primary markets: Data Centers (Hyperscale/ Cloud, Colocation and traditional enterprise infrastructure), Communication Networks and Commercial/Industrial environments markets.

This portfolio of brands and products was a result of acquisitions of various companies by Emerson since 1985. Though these acquisitions came under the Emerson Network Power Division and strengthened the position of Vertiv in the market place. However, operationally majority of these acquisitions and their corresponding manufacturing facilities were operating as stand-alone businesses with individual accounts, sales channels and reporting systems and software.

6. Professor Lanzolla led the development of this case. This case study builds on interviews and research work conducted by Rabih Najjar for his MBA dissertation (Cass Business School, 2017). Cases are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective management. We apologize for any errors or omissions.

This inherited siloed structure was an opportunity for Platinum Equity to increase company value by integrating, merging and transforming the whole organisation starting with the customer requirements and driving it back to the operating roots and cores. Vertiv products and brands carried a big legacy of reliability and customer satisfaction, but market requirements for stand-alone products were changing, and individual products that once gave Vertiv its strong competitive differentiator were facing risks of commoditization if not coupled with a higher value creation for the customer.

Digital can help lower the barriers to entry which is a threat to the former market competitors, but also lower the exit barriers for companies not embracing a digital transformation journey. In other words, laggards will simply be pushed to exit the market into a steep decline cycle. The new owners and leadership team of Vertiv were driving a multidimensional transformation across the company. The ultimate goal of achieving higher company valuation and trying to formulate a strong digital strategy to drive a single vision for a digital strategy and digital transformation.

Internal interviews with key company executives have been conducted to understand company strategy and targeted business outcomes. It is evident how Vertiv as a private company now under Platinum Equity is taking the opportunity to drive a multidimensional change renovating itself to achieve its goals, as follows:

1. Increase speed, efficiency and reduce waste throughout the organisation value chain
2. Focus on innovation to keep up with competitors and changing market trends and needs
3. Elevate the customer service level through innovative service/solutions offerings

A thorough analysis was conducted to analyze each stand-alone transformation and to examine how all these transformations blend together as they are very much interdependent. These transformations could easily create or destruct value if their interdependency and trade-offs were counteracting and not reinforcing.

Approach to digital transformation

There was a bold move and drive to shift from individual products sales into solutions and multiproduct sales with a focus on defined market verticals, such as Telco, Cloud/Colocation, Industrial, Channels and Enterprise. The existing sales structure was a hybrid of products and regional structure linking products sales force to their respective manufacturing facilities.

Although this structure helps local management guide their sales regionally and fosters product specialization and expertise. It creates organisational complications and hurdle regarding coordination when various product sales leads are following up on the same project or region. Each product line facility was being treated and measured as a separate business. The lack of coordination was preventing product lines from being aware of certain projects in the market.

This siloed structure was embedded in company culture and presented a huge opportunity cost for Vertiv to shift into a multiproduct sales organisation whereby existing sales leads now sell the full Vertiv product range within their assigned market in a specific geographical region. Moving into market verticals would shift organisational power from local management to the commercial market verticals and create organisational tensions in the transition period.

With this strong embedded organisational Centre of Excellence (COE) power and products siloed structure, organisational culture developed over the years to be a closed, risk-averse and internally focused one. There were no incentives for information sharing and coordinating across the local COE structure. The move to multiproduct sales culture would call for external orientation, understanding where opportunity may exist for other products. Sales force would need to learn about all products and have the excitement, motivation and courage to engage with customers in a discussion involving Vertiv portfolio and not only their historical core responsibility. Driving this organisational alignment and the cultural shift will be key to ensuring a successful transition.

With the above structure and culture, sales resources across the organisation developed strong and powerful product expertise that helped in creating a competitive differentiation in the marketplace. However, with the increasing number of competitors and enhancement and advancement in technology and the risk of commoditization of the products, technical expertise alone cannot be viewed as the only source of competitive advantage, especially when competitors are changing their business models to shift conversations into solutions and ecosystems.

Performance management and incentive structure is an important lever that organisations use to drive strategy execution, organisational goals and values alignment, behaviour change and skills development. The current model helped to focus the efforts and activities on driving the product lines strategies, but was limited in encouraging knowledge sharing.

There was no proper knowledge integration across the silos of the organisation, and hence this was a great opportunity to build a new dimension of competitiveness and innovate through combining and integrating the siloed and dispersed knowledge base throughout the chain.

Products were designed, configured and sold by the specific COE sales, and engineering arm and technical design accountability remain under that COE. Hence when products are not operating as per the design specs, technical design accountability is traced back and escalated to the responsible COE. With a shift in the new multiproduct organisation, there would be no change in the technical accountability as it will still be traced back to the respective COE. There would be requirements to add new multiproduct resources into certain verticals that lack resources, or move resources across verticals based on their market and application knowledge not only on products knowledge.

Before its buyout, Vertiv leaders have been shaped and grown under Emerson to focus on numbers, results. They have developed plenty of skills in decision making and management in an attempt to maximize the values of shareholders. Moreover, the specialized COE culture and heritage of experience made those COE's more powerful and ring-fenced their decisions and way of thinking and managing. Teams, single product specialization boosted their confidence and ego, narrowed down their comfort zones and fuelled the "we know what is best for the customer" thinking. Above assured the leaders of the team's capabilities to drive results and in a way "self-manage" their business and departments and units.

Moving into multiproduct sales, suddenly that comfort zone of specialized knowledge and power vanishes and was replaced with anxieties of different forms, to learn new products, industries etc. Leaders would have to understand all the above disruption in the status quo of the organisation, lead change by example, motivate and engage stakeholders in the change outcomes, rebuild commitment by adapting their leadership style to the equivalent developmental stage of the individual and the team as a whole.

As the first transformation was evolving and restructuring of the organisation from single to multiproduct sales culture, a new global solutions organisation was created within Vertiv, impacted by the market trends, reporting directly to the CEO to strategically focus on the growing demand of Prefabricated Modular Solutions and to leverage the expertise in each region to respond faster to full solutions requirements.

As per the Senior VP of Global Solutions "Our solutions are complementary to our existing robust portfolio of products and services and will be delivered to our customers through our existing strong relationships". Solutions sales continued to be housed within the regional sales organisations. Also, new solutions engineers and solutions architects were deployed in regions.

Impact of the solutions group on the company culture required more openness driven by customer needs and market trends requirements. Selling multiproduct would be a first step towards building solutions and consultative selling capabilities. Teams that can articulate and sell to the customer Vertiv products would need to sharpen up their cumulative consultative selling skills. Hence this transformation would require the organisation to address this skill shortage and identify means of bridging this gap, both internally and externally.

Solutions selling by default calls for knowledge integration to be able to design and architect. It calls for engagement of multi capabilities and hence knowledge factors in both the multiproduct and the solutions transformation positively influence and reinforce the direction of change. Technical accountability would shift towards the solutions architects team who are sizing, configuring and designing these solutions which contain various COEs products.

Resource allocations are ongoing, and the go to market model is taking shape. What is clear is that solutions engineers and architects would be more required. They will need high integrating and solutions design capabilities to support in the volume of new business that will be generated, including capability to offer a full-fledged prefabricated data centre and solution.

Investment in digital transformation

Vertiv software and remote monitoring products were embedded in their relevant Centre of Excellence (COE). All related equipment gathered data was dispersed and shattered within the organisation. Each COE had its own range of monitoring hardware and software for its related products and in most of the cases – overlapping and duplicated.

Hence, the CEO of Vertiv formed a new software business group "Global Management Systems" operating with a separate P&L and a direct reporting line to the CEO. This was an attempt to give strategic focus to the Data Center Infrastructure Management and other software and communications hardware. It had the potential to move the organisation more towards software orientation rather than hardware.

This strategic and operational goals of the Global Management Systems group were:

1. "Cleaning up" of overlapping, underdeveloped or in decline software products. The existing software brand "Trellis" was continuously updated and could become an open source platform to enable third-party applications interaction.
2. Integrating the spread-out and historically acquired IT management products and hardware (sensors, communication cards) into the data centre portfolio under the responsibility of the Global Management Systems.
3. Working with various COE's (including the solutions group) to ensure their products are more "software enabled" and standardised and ready to be connected for future data mining and analytics.
4. Collecting new and historically spread data that was handled by dispersing teams and COE's. This data to be consolidated in a central "Data Lake" and used to create more value for customers regarding equipment performance, energy efficiency etc.
5. Evolving "Trellis" into the next generation of services that will lay down the roadmap for true real-time connectivity to strengthen the position of Vertiv as a software and services organisation delivering higher value to its customers.
6. Concentrating existing resources and capabilities into this new software organisation to generate more value and sell all the portfolio of monitoring, hardware, software and other services.

Achievement of these goals required more knowledge integration and cross COE collaboration, so Vertiv created a new position and appointed a Chief Digital Officer (CDO) to drive the planned digital transformations. The intention was to re-engineer the customer experience and journey in addition to increasing employee productivity. This key task for the CDO, integrating all the various inherited platforms into one would enhance information sharing, real-time data and faster decision making.

Digitization of the processes would be driven across the whole value chain by mapping all stages of customer interactions from sales to lifecycle. This would utilise digital technologies to deliver richer

customer and employee experience and establish global strong business processes. These processes would be based on unified operating platforms that would offer speed, agility and real-time decision making through connected devices and organisational resources.

Adopting digital technologies throughout the core value chains positively impacts operational objectives and goes well beyond that to reform a new work culture. It will foster the open and collaborative culture that is driven by the multiproduct and solutions transformations and enable team connectivity and information sharing. Moreover, it would have a significant positive effect on customer service and support enabling interactions through digital platforms and fast updates and interactions and sharing new ideas.

Challenges of digital transformation

Digital transformations create challenges. Integrating platforms across silos and connecting workers through different business units and time zones reshapes how individuals interact with each other. Digitizing processes and converging platforms for real-time data mean more transparency. The impact of this transparency may have ramifications across departments and processes that may stimulate further questioning, analysis or discussions that could disturb the status quo.

The global management systems group would as well face some internal friction between fast learners and service or sales individuals who cannot quickly leap to the new data centre software sales model. Strong digital governance and innovative leadership are key in balancing this impact and driving towards a global digital culture in addition to absorbing the resistance created by the resistance groups who would still fight for the old ways.

The newly created digital group, the Management Systems Group, will need to develop new sets of skills to sell now outcome-based solutions. Selling outcome-based solutions and cloud-based services is a different approach from selling standard hardware/services. This transformation calls for an even higher level of integration of all capabilities and abilities. Business units need to be able to innovate and keep up with the fast and agile digital culture and market changes.

Resources in the digital culture are strongly linked to the digital skills and capabilities required of the workforce. Some resources may need to be made redundant, either because some would not be able to adopt to the transformation and learn new skills or because the new future predictive maintenance model would need reduced resources, such as for routine service and preventive maintenance site visits.

The organisation will need to acquire a new type of resources, such as data scientists. These new resources will be in addition to growing the digital capabilities resources pool to ensure the success of the digital transformation. Also, decision making will go hand in hand with the new company culture of greater innovation and adaptation to customer requirements. The new digital company culture will be opening more channels of communications and interactions with customers across all the digitized company value chains.

Executing transformation in organisations is a long-term process that requires committed leaders at all levels to be fully engaged in utilizing as many tools as necessary to influence stakeholders across the whole organisation to bring in the perfect alignment with strategy and the markets. The multidimensional transformation in Vertiv requires higher levels of commitment and governance, as well as awareness of the impact of change throughout the organisation.

The company could implement a digital engagement software tool or create an enterprise social network platform to increase both global and regional engagement. This will create enhanced levels of information sharing and generation of new ideas. These types of initiatives foster cross-functional problem solving, team bonding and help to open across silos strategic and transparent discussions visible to everyone.

It is important to highlight that as Vertiv grows into the predictive analytics and maintenance, several of the existing roles/capabilities may not be required. However, adopting digital technologies across the value chain and creating/merging platforms will require people to be comfortable in utilizing these platforms, in learning new ways of working and dealing with greater transparency.

Vertiv has a great opportunity to update performance management systems and accelerate the strategy execution and goals alignment. A new performance management system would have more frequent goal settings, coaching and developmental sessions. Recognition and feedback should be real-time fed into a digital data base across the organisation. This will involve the various stakeholders that this individual is collaborating with for goals/strategy/tasks execution (especially in such a matrixed organisation with multiple bosses and collaborators). Digital Technologies can help in aligning and engaging cross siloed teams.

Summary and Review

Vertiv strategy and transformational changes calls more for "one Vertiv", involving selling multiproduct and integrated solutions and software. There is an emerging trade-off between knowledge specialization and knowledge integration. This trade-off must be actively managed, and its evolving impact has to be controlled and shaped in the direction that the company sees fit with its longer-term strategy and evolution.

Knowledge specialized resources are valuable and the current source of the Vertiv sustainable competitive advantage. Moving to multiproduct and to solutions selling culture, this knowledge specialization would be the base of future success.

Transformation is driven from the top by the CEO and the board, putting the customer at the heart of the organisation. Strong from the top governance coupled with the new style of leadership, changing KPI's and performance management and embedding transformation and change committees will ensure successful transition in company culture.

The creation of Vertiv from Emerson Network Power into a young independent private company requires leadership practices and accountability to be widely spread across the organisation for the transformations to be sustainable and successful. Change cannot be driven by people who do not believe in it and don't have enough contagious passion to drive the required discipline and to foster coaching, support and development.

Leadership should be a top priority on the Vertiv board agenda. Critical roles for the successful transformations across the organisation have to be evaluated and assessed to place the right people at the right place at the right time.

Strong top-down support starting from the CEO and board is essential to create the right environment for these new critical roles to kick off.

Vertiv is transforming into a leaner, agiler and more transparent organisation with integrated knowledge, skills and enhanced digital capabilities. The shift from vertical into a more horizontal support will help in maximizing the returns and sales from the market verticals. This shift must be supported by greater digital capability.

It is important that the organisation does not transform from the existing to new, but different silos. Digital processes and capabilities should reduce the chances of this happening. It will all depend on the longer-term strategy of Vertiv and how they see the organisation evolving and transforming under the evolution of the market and competitors.

If Vertiv decides to grow and transform into a software organisation, the software organisation would be driving the market verticals supported by the rest and resource allocations and the support structure should be designed to support this model.

APPENDIX B: INTERVIEWS FOR THE RESEARCH

- John Ludlow, Chief Executive, Airmic
- Stephen Wakerley, Group Risk Director, BP
- Andy Roberts, Director, BAE Systems Applied Intelligence, and Alexandra Anisie, Head of Regulatory and Compliance Services, BAE Systems
- Claire Combes, Director of Risk and Assurance, intu Properties
- Aileen Lowe, Senior Insurance Manager, KPMG UK
- Daniel Evans, Head of Group Insurance, Lloyd's Register
- Russell Group (Suki Basi; Julian Kirkman-Page; Chris Don; Manvir Basi)
- Jamie Saunders, Independent consultant, the former head of the cyber unit of the National Crime Agency, a visiting professor at UCL
- Gero Gunkel, AI Group lead, Zurich Insurance Company Ltd

APPENDIX C: TEMPLATES

INTERVIEW SCRIPT

(1) PART A – Introduction

- (1.1) how would you define your current core business and the industry you are currently in?
- (1.2) what are the current Key Success Factors in your industry?
- (1.3) where does your current competitive advantage come from?
- (1.4) what will be the Key Success Factors in a digitally transformed world?
- (1.5) where your competitive advantage will come from in a digitally transformed world?
- (1.6) what will be the winning business models?
- (1.7) what is your overall vision for the digital transformation of your business?

(1b) PART B - Technology and strategy (with reference to the selected level of analysis

- (1.1) what digital technologies have you adopted?
- (1.2) what strategic goals did you wish to achieve?
- (1.3) please break down the strategic goals into the following two categories (sum =100%)
Cost reduction / operational efficiency _____%
- Building differentiation vis-à-vis competitors _____%

(2) LEVERAGING DIGITAL TECHNOLOGIES

- (2.1) how have you leveraged connectivity to achieve your strategic goals?
- (2.2) how have you leveraged data to achieve your strategic goals?
- (2.3) how have you leveraged automation/AI to achieve your strategic goals?
- (2.4) how have leveraged distributed computing/ "cloud" to achieve your strategic goals?
- (2.5) how have you leveraged open innovations to achieve your strategic goals?
- (2.5) what other digital technologies have you leveraged? How?

(3) ORGANISATIONAL CHANGES

- (3.1) what resources and capabilities have you had to develop? What organisation's resources and capabilities have become irrelevant?
- (3.2) how did you change your business model (defined as activity-system)?
- (3.3) how did you change your structures (e.g., processes, structures, policies) and governance?
- (3.4) how did you change your people strategy and performance management (accountability) systems?
- (3.5) how did you change your culture and values?
- (3.6) how did you change your leadership style?

(4) LESSONS AND BEST PRACTICES

- (4.1) with reference to the dimensions discussed at point (3), what have you learned about best practices that work well in a digitally transformed business?
- (4.2) with reference to the dimensions discussed at point (3), what have you learned that does not work in a digitally transformed business?
- (4.3) what are the critical risks in running a digitally transformed business?

(5) LINKS WITH OTHER PARTS OF THE BUSINESS

- (5.1) what are the key challenges in coordinating parts of your business that have been digitally transformed with parts of your business that still run as legacy?
- (5.2) what are the key challenges in terms of aligning culture?
- (5.3) what are the key challenges in terms of aligning people?
- (5.4) what are the key challenges in terms of harmonizing governance?
- (5.5) what are the key challenges in terms of accountability?

(6) Please express the extent to which you agree/ disagree with the following statement

(1 completely disagree, 7 completely agree)

Because of digital transformation of our business:

- (6.1) we are losing our differentiation in the market place
- (6.2) we are improving our organisational efficiency
- (6.3) we are losing organisational slack and we now run our business on a "razor thin" blade
- (6.4) we are becoming more innovative
- (6.5) knowledge integration is becoming more important than knowledge specialization
- (6.6) we are able to locate exactly where strategic and organisational risks are
- (6.7) we are changing our approach towards our "suppliers" that are increasingly becoming partners in value co-creation
- (6.8) we are able to deliver personalized services/products
- (6.9) or strategic choices are changing at a fast pace and the gap between strategy and organisation that should deliver on them is widening
- (6.10) our organisational functions are becoming less defined in our organisation
- (6.11) competition is becoming more unpredictable
- (6.12) we run in an institutional vacuum and how license to operate is at high risk
- (6.13) the bedrocks of our competitive advantage are being eroded
- (6.14) we are becoming an open organisation

(7) PART C – Closure

Based on the conversation we have had, would you like to amend any of the answers given to the initial questions 1.4, 1.5, 1.6 and 1.7?

- (1.4) what will be the Key Success Factors in a digitally transformed world?
- (1.5) where your competitive advantage will come from in a digitally transformed world?
- (1.6) what will be the winning business models?
- (1.7) what is your overall vision for the digital transformation of your business?

C2: AIRMIC 2018 MEMBER SURVEY QUESTION

The question:

Thinking specifically about your organisation's digital transformation strategy, please indicate whether you agree or disagree with the following statements.

Respondents were asked to indicate whether they:

- I Agree strongly
- II Agree slightly
- III Neither agree nor disagree
- IV Disagree slightly
- V Disagree strongly
- VI Don't know/not applicable

1.	Due to the increased level of adoption of digital technologies in my organisation, the responsibility and accountability boundaries across functional roles are becoming less defined
2.	My organisation has full confidence in the reliability and effectiveness of the digital technologies that have been adopted ("digital technologies will not let us down")
3.	Digital technology adoption has enabled my organisation to run optimised operations and processes
4.	In my organisation we use big data and analytics to understand and manage risk
5.	In my organisation, there is a full understanding of current regulatory risks in all markets in which the organisation operates and we have a system for responding to them
5.	In my organisation we have a "risk radar" which identifies all new regulatory risks in all markets in which the organisation operates and we have a system for responding to them
7.	In my organisation a very small number of tangible and intangible assets have a disproportionate importance in the sustainability of the organisation
8.	In my organisation, we have a very small number of critical tangible and intangible assets, each of which could cause a disproportionate amount of harm to the organisation
9.	Digital technologies are making it easier for my organisation to understand and monitor risks in our ecosystem of suppliers, distributors, clients and wider stakeholders
10.	In my organisation there is an increasing disconnected between our intended strategy and the required organisational capabilities to deliver on the intended strategy
11.	In my organisation the corporate governance and risk management systems are well equipped to deal with the digital transformation

C3: CASE STUDY REPORT TEMPLATE

Introduction to case study organisation

1 page description of the case study organisation, including brief information on the business sector, history, size, nature and complexity of the organisation and any particular issues specific to the organisation and/or business sector. Need for digital transformation

2 or 3 pages on the specific business imperatives for digital transformation, including a brief extract from the latest Annual Report and Accounts, if digital transformation is identified as a key business risk and/or driver.

Approach to digital transformation

2 or 3 pages describing how the organisation identifies the scope and extent for digital transformation and the specific features of the organisation and/or business sector that require additional planning and careful implementation.

Investment in digital transformation

2 or 3 pages providing explanation of actions already taken and benefits achieved, including information on any enhancements to existing risk management processes and governance procedures that have been implemented or are planned.

Challenges of digital transformation

2 or 3 pages describing the specific difficulties and barriers that need to be overcome in order to achieve digital transformation, additional resources that will be required and examples of success and details of any failures to date.

Summary and Review

1 page providing an overview of the importance of digital transformation to the organisation, the nature of the transformation that is required and (especially) the lessons that have already been learned.

NOTES

[illegible]

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



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