

Developing an eco-system for supply chain success

How UK manufacturing can help
to build strong, resilient and
sustainable supply chains



— About this report



This IET Sector Insight provides an introduction to manufacturing supply chains and has been written for all those: studying or teaching the subject of supply chains; manufacturing practitioners, particularly those who may be new to or have responsibility for supply chain management; owners, managers and engineers of manufacturing/supply chain firms; together with all those who champion or share a passion for supply chain excellence.

Described by the author as 'utterly fascinating, dynamic and exciting', supply chains have been around for centuries, yet they are still, often misunderstood.

Published by the IET's Design and Production Sector, this IET document seeks to provide insight into key issues impacting supply chains, not least supply chain sustainability, supply chain finance and supply chain 4.0.

The document contains a summary of key messages, a case study and contributions from two world-leading supply chain experts - Professor Janet Godsell, WMG, University of Warwick and Emeritus Professor Martin Christopher, Cranfield University.

Inspired by the 2019 National Manufacturing Debate, this IET Sector Insight was written by John Patsavellas with contributions from fellow colleagues and students at Cranfield University.

The document was reviewed by members of the IET's Design and Production Sector Executive Committee - Jeremy Hadall (Chairman), Professor David Bagley, Professor Peter Ball, Steve Brambley, Ben Kitcher, Professor Alan Norbury and Shaun Williams.

Please note the views expressed in this publication are not necessarily those of the Institution of Engineering and Technology (The IET).

It is not intended to be a guidance note with a specified set of recommendations or actions but rather seeks to add to understanding of, and debate around this topic.

The IET Design and Production Sector Executive Committee would welcome any comments you may have on the contents / your ideas for future manufacturing and supply chain publications. Please send these to sep@theiet.org



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Key messages

1. As demand for goods and services rises, and as new markets in the developing world emerge, international trade and competition increases, and rapid digital transformation takes hold across many industries, supply chains are embracing disruption.

Engineering plays a vital role in harnessing that disruption through the development of an eco-system for supply chain success which is constantly adapting, learning and evolving.

4. The adoption of digital technologies within supply chains and manufacturing industries, often referred to as Industry 4.0 or the fourth industrial revolution, is helping manufacturers to reduce their costs and stay ahead of the competition. To benefit fully, firms will need to step up their levels of digital readiness. Blockchain technology has great potential to overcome long-standing supply chain challenges, most notably traceability and supply chain finance.

2. Political, economic, social, technological, environmental and legal factors have a constant, profound and often unexpected and dramatic impacts, both positive and negative, on supply chains and the wider manufacturing interests they serve. Certainty is an elusive commodity. An agile, data-driven supply chain ecosystem can absorb, react to and mitigate such impacts.

5. Sustainability is the ability for a business to operate successfully without compromising the ability of future generations to meet their own needs. To be sustainable, supply chains must become more flexible and responsive whilst incorporating increased resilience and traceability. Once again, technology and innovation will be the enablers with engineers at the heart of the ecosystem, delivering supply chain success.

3. Sharing assets and capabilities across supply chains will increasingly provide the foundation to achieve the greater flexibility necessary to cope with an uncertain future. Collaboration within the supply chain ecosystem is vital.

1. Stand by for... disruption

Ask a dozen or so engineers for their definition of 'supply chain' and you're likely to get as many different replies.



John Patsavellas
IET Design and Production Sector

Supply chains have been around for centuries. Without them, we'd be lost. Yet we take supply chains completely for granted.

Globally, supply chains have led a relatively settled existence for the last 50 years or so. All that is about to change.

As demand for goods and services rises, and as new markets in the developing world emerge, international trade and competition increases, and rapid digital transformation takes hold across many industries, supply chains are embracing disruption.

Thanks to the continuous evolution of manufacturing demand, supply chains are no longer limited to pure linear connections.

Today, they are highly sophisticated, complex multi-layered and interconnected distribution systems enabling companies and countries to balance supply and demand and trade more efficiently.

Utterly fascinating, dynamic and exciting, supply chain has become a vital, growing professional discipline, an essential contributor to the future success of manufacturing operations and the prosperity, resilience and sustainability of the global economy.

This IET Sector Insight, written in partnership with colleagues and students at Cranfield University, is an opinion-based thought leadership piece and does not necessarily represent the views or policies of the Institution (The IET).

It sets out basic information together with an examination of the prospects for an eco-system for supply chain success.

John Patsavellas
IET Design and Production Sector
November 2019

What is supply chain?

In the realm of manufacturing, supply chain is the process of the flow of goods from the upper echelons of value creation to the end customer consumption.

This could also be understood as a form of symbiotic connection in which customers and suppliers work together to achieve the best interests of each other, buying, converting, distributing and selling goods and services to create specific final products.

Through the control of information flow, logistics and capital, intermediate products and final products are prepared from the procurement of raw materials and are supplied to customers by distribution networks.¹

2. In search of certainty

Disruption is an everyday part of life arising from a myriad of circumstances. Invariably, normal service is restored relatively quickly. Supply chain flow remains constant and continuous, with just the odd blip, now and again. Overall, the impact is minimal.

Occasionally, disruptions caused by major incidents escalate to major shocks, with human, economic and environmental consequences.

The impact of such shocks, whether man-made or caused by nature, can be significant and take longer to recover from. In these circumstances, supply chain agility, flexibility and resilience are put to the test. There have been countless examples in the last decade alone.

Millions of air passengers were left stranded in 2010 after volcanic eruptions in Iceland grounded planes over Western Europe and North America. Amid fears that volcanic ash would damage aircraft engines, 90 percent of flights cancelled were in the worst-affected areas.²

Airlines lost \$1.7bn in revenues yet rallied their supply chains (hotels, catering, other transport providers etc) to minimise the impact on those customers, stranded away from home for many days.

And that's just the airline supply chains. The impact on the supply chains that use the airlines was significant too.

Natural disasters have been a constant throughout history. In today's connected world, news travels fast.

Global mass media and the ubiquity of mobile phones mean we're aware of emergencies on planet earth within minutes of them happening.

The impact of natural disasters can be cataclysmic, in some cases taking years to recover from e.g. Indonesia, Indian Ocean earthquake and tsunami (2004), Memphis floods (2011), California wildfires (2018) and many others.

That said, some disruptions are entirely man-made: wars, famine, coups, blockades, shortages, strikes and so on.

Here in the UK, deliberations over Brexit created uncertainty within industry. Concerns, felt across Europe about business continuity in the event of 'No Deal', sent shockwaves through supply chains.³

To help mitigate possible disruption, many manufacturers and suppliers took on additional premises, in order to stockpile the components and materials they would need, in the event of disruption, to continue production.⁴

External factors have a constant, profound and often unexpected and dramatic impact, both positive and negative, on supply chains and the wider manufacturing interests they serve.



External factors bring new challenges and opportunities for supply chains. Here are a few examples.

Politically

The Government's Industrial Strategy supports supply chains through sector deals. More are needed. Which sectors have the highest need or hold the greatest promise?

Economically

The power-balance within global markets is changing. Several countries in the developing world have taken significant strides forward with massive implications for supply chains. How should supply chains configure to best meet the challenge of increased global demand?⁵

Socially

Customers are demanding greater personalisation of the products they buy, paying a premium price in return.⁶ Into the future, what part could fully autonomous supply chains play in enabling customers to schedule the production of their orders themselves?

Technically

Technology has never been so cheap and plentiful. It fuels customer demand and sets expectations for supply soaring. Equally, it can inspire improved operations and new business models. Which technologies will provide the biggest boost to the operation of supply chains in the future?

Environmentally

Reducing the impact of supply chain operations on the environment is not an option, it's a given. How can supply chains become more resource efficient?⁷

Legally

Regulation, tariffs and taxes have played their part in administering global supply chains for decades. How can international standards help to maintain supply chain flow into the future?



In search of certainty, a supply chain system that is flexible, resilient and responsive is pivotal to sustain the UK's manufacturing industry position in the world, as after all 'it is not the strongest organism that survives, nor the most intelligent, but the one that is most responsive'.⁸

To promote a system, which demonstrates perpetual innovation and progression, requires a dynamic environment in which the composing actors interact in a collaborative and mutually beneficial way.

This leads to the concept of a supply chain ecosystem, which endorses virtuous and sustainable practices throughout UK manufacturing industry.

Far from trying to anticipate national policies, supply chain managers need to rely on their ability to build and maintain highly responsive and structurally flexible value chains, so they can adapt quickly to daily disruptions generated by political, financial or other challenges.

Certainty is an elusive commodity. Consequently, resilience, responsiveness and flexibility are becoming the key priorities for supply chain sustainability.

Expert view:

Supply chain agility and flexibility is paramount.

For quite some time now I have been concerned that many companies have assumed that the supply chain principles and practices that were developed in the second half of the 20th Century are good for all time.

I feel that there has been a 'business as usual' mindset in a lot of cases. This is exemplified by the lack of preparedness for the Brexit challenge that several surveys of UK business highlighted.

The fact that we are living in an age of turbulence and uncertainty is beyond dispute. As a result, organisations need to look again at their supply chain architecture to ascertain just how 'future proof' it is.

In a volatile trading environment, it is clearly vital that the business is capable of rapid and frequent change.

The sort of change that might be required could include the actual business model of the firm itself and the consequent organisation structure necessary to enable that model.

In addition, it is likely that the underpinning supply chain arrangements and the business processes that support them will need to be constantly reviewed.

In the context of today's business environment, the need for supply chain agility and flexibility must be paramount.



However, so many companies are constrained by decisions taken in the past which still bind them today e.g. investments in factories, distribution facilities, legacy information systems etc.

As a result, they are not always able to change direction quickly if demand or supply conditions change.

My view is that as the opportunity arises, organisations should fundamentally review their policy regarding the ownership of assets and be prepared to work in a far more collaborative way with other organisations.

Sharing assets and capabilities across supply chains will increasingly provide the foundation to achieve the greater flexibility necessary to cope with an uncertain future.

Martin Christopher
Emeritus Professor of Marketing and Logistics
Cranfield School of Management

3. Supply chain sustainability

Using a wider definition (beyond environmental aspects), sustainability, for any business is its ability to keep operating successfully.⁹

The United Nations Brundtland Commission outlined sustainable development as, 'meeting the needs of the present without compromising the ability of future generations to meet their own needs.'¹⁰

Combining these definitions, sustainability refers to the ability for a business to operate successfully without compromising the ability of future generations to meet their own needs.

The 'Triple Bottom Line' concept evaluates the success of a business based on its financial, environmental and societal impact.¹¹ This concept provides a useful framework for measuring the success of a business within this broader concept of sustainability.

The most important characteristics of sustainable supply chain are¹²: flexibility, resilience, responsiveness and traceability.

Flexibility

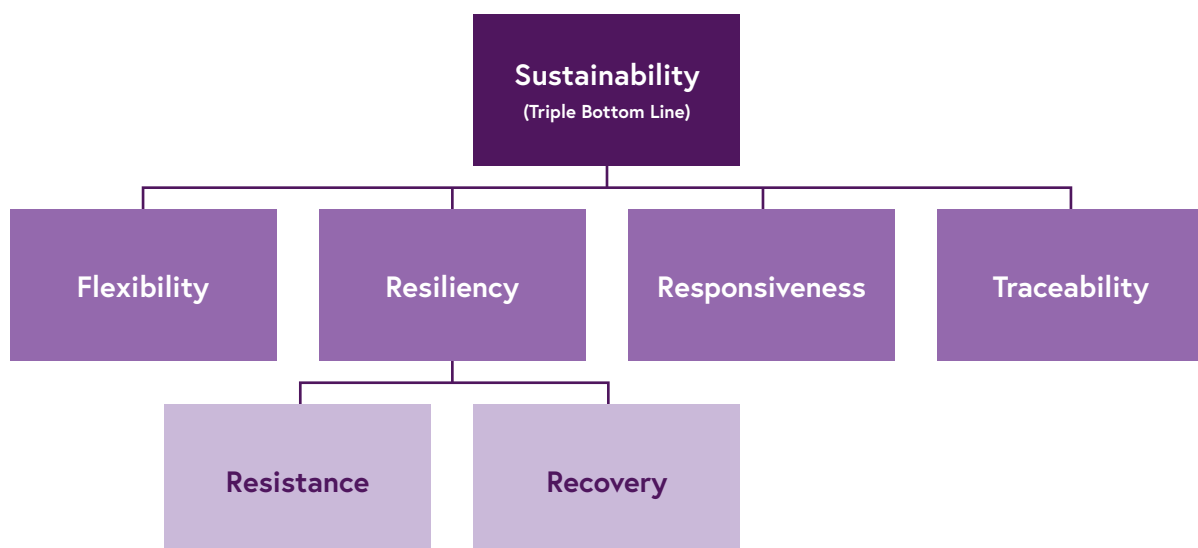
Supply chain flexibility can be defined as 'the robustness of the buyer-supplier relationship under changing supply conditions.'¹³ Recent events in the UK show that the call for flexibility is more urgent than ever.

Example – UK Automotive Sector

The emergence of a world-leading supply chain in the automotive sector has been one of the unsung heroes of UK manufacturing over the last 20 years.

From the seismic changes endured in the industry at the end of the twentieth century, not least the demise and break-up of the Rover Group, the UK automotive supply chain has been transformed and is recognised as one of the most resilient, responsive and efficient in the world.

Today over 2,500 suppliers support mainstream car manufacturers (such as Honda, Nissan, Toyota) and premium and sports car brands (Jaguar Land Rover, MINI, Aston Martin, McLaren).¹⁴



Resilience

Defined as the degree of effectiveness with which a system can respond to disruptions,¹⁵ resilient supply chains are impacted less and recover faster from disruption.

There are two parameters of resilience:

Resistance:

is how well a supply chain can prevent disruption.

Recovery:

is about how expeditious the full recovery of a supply chain is, after a disruption.

Example – Fukushima disaster

A fantastic example of resilience in the supply chain comes from the Fukushima disaster in Japan.¹⁶

In 2011, after a 9.0-magnitude earthquake that caused a 40-metre tsunami and the Level-7 meltdown of three nuclear reactors in Fukushima Dai-ichi, automotive companies in Japan were forced to suspend production.

This resulted in a catastrophic 24.8% drop in productivity in the first six months for Japanese car makers and a full-year loss of 9.3%.

Nissan's productivity in the same six-month period reduced by only 3.8% and they closed the year with a productivity increase of 9.3%.

This outstanding result was achieved thanks to the strong risk-management philosophy and practice of the firm.

Nissan were able to quickly address risks and promptly apply countermeasures which were already standardised and documented.

Their Supply Chain Risk Management protocol included earthquake alternative scenarios and personnel were subject to periodic risk management training.

The decentralised, highly flexible and responsive supply chain allowed top managers to quickly rearrange value chains to recover from the loss of production from plants affected by the disruption. This effective power-action was possible thanks to the high-level of visibility of their supply chain.



Responsiveness

In an uncertain world, with many new opportunities emerging in the markets of the Far-East and increasingly Africa, responsiveness is paramount.

The North of England which gave birth to the first industrial revolution and home of the once-upon-a time prosperous textile industry is unlikely to see the return of heavy industries.

The re-shoring dream of once lost UK industry returning from China as overseas salaries merge closer to those at home is likely to be only that, a dream.¹⁷

Instead the UK needs to play to its strengths to sustain its manufacturing prominence. The World Economic Forum, Future of Production Readiness report puts the UK second on its Technology and Innovation driver metric.¹⁸

The innovative companies and world-leading higher education institutions within the UK can really fuel and reap financial rewards from the evermore complex, technical and digitalised manufacturing industry that is sweeping across the world.

Example – Linton Tweeds

The UK textile industry is enjoying something of a revival, supplying some of the finest worsted wool fabrics to the most prestigious luxury brands, designers and tailors around the world.¹⁹

Linton Tweeds has been producing quality fabrics for couture fashion houses across the globe for more than 100 years. All their fabrics are designed and woven at the company's mill in Carlisle.



However, for the UK to be able to be a part of this it needs to be responsive to external changes both in consumer demand and regulation.

The slow rate of response to external changes is something where UK industry appears to be vulnerable, one example of this was when China introduced its 'national sword' policy.

Example – Global waste

At the start of 2018, China commenced its 'National Sword' policy, banning the import of overseas waste in 2017.²⁰

Up until that point, China bought 60% of plastic waste exported from the G7 nations and 74% of the UK's exported paper in 2016.²¹

The fact that these countries had been shipping their waste halfway round the world was bad enough.

Whilst the Chinese Government's decision made eminent sense, it created some problems for waste exporting countries.

Here in the UK, already hard-pressed councils were forced to spend an extra £500,000 a year on plastic recycling.²² Hardly a massive sum, in the scheme of things.

Nevertheless, this additional cost is significant when you consider UK taxpayers already contribute 90% of the cost of recycling.²³

The Government's 'Resources and Waste Strategy', published in December 2018, handed to businesses and manufacturers the full cost of recycling or disposing of their packaging waste.²⁴

Traceability

Traceability along the entire chain is vital to ensure a sustainable and resilient supply chain. Laws and regulation are increasing the requirement for companies to be able to identify the source of all their materials.

An example of this is with the UK Government's guidance on conflict materials. Intel's efforts to ensure traceability of these minerals has included reformed audit protocols and an improved "track-and-chase" process in the supply chain allowing for the minerals to be traced back all the way to the mines they are extracted from.

New technologies and concepts such as blockchain and control towers are helping to bring greater transparency and traceability to the supply chain.

4. Supply chain finance

Supply chain finance is all about optimising financial flows between two or more players within a supply chain and includes:

- financing schemes to incentivise integration;
- the adoption of collaborative practices, such as vertical/horizontal integration and risk management measures; and
- the deployment of a digital platform to secure and protect information sharing.

Supply chain finance helps to create value across the supply chain by controlling the flow of financial resources²⁵, through the integration of financing processes with customers, suppliers and service providers²⁶, using the products and services of a financial institution²⁷ and technology service providers.²⁸

It exists to increase resilience and reduce the risk of bankruptcy by cutting the cost of accessing credit and leveraging responsibilities on the strength of supplier-buyer relationships.

UK industry has a couple of very useful incentives for growth and development. The broadly defined R&D tax credit scheme for SMEs and the annual investment allowance (AIA) set at £1m since the beginning of 2019. These are truly enlightened tax incentives, however they mostly address prospective capital investments.

SMEs in manufacturing supply chains are mostly concerned with the 'here and now' of their day-to-day cash-flow. Can they service their customers? Finance their inventory? Pay their staff? Materials? Business rates? Usually this means asking their bank for a short-term loan against some collateral.

Reliable and competitive supply chain finance, which enables the fast payment of invoices, so suppliers can minimise their cash flow risk, is the missing piece of the puzzle in the UK ecosystem.

The Carillion case study shows how supply chain finance may be misused. In that case, the benefit enjoyed by the main contractor was entirely detrimental to the cash flow and security of its suppliers.

When a main contractor imposes long payment terms on smaller suppliers, (e.g. 120 days) they are using their suppliers as a collective bank providing them with cheap short term loans.

This hugely impacts SME suppliers as the asymmetry of power in the supply chain's flow of cash tilts their attention to a short term survival mode, versus a long term investment and growth orientation.

Unless supply chain finance offerings are regulated fairly and a prompt payment code promotes 30 days payment terms, UK industry will ill afford to leverage the R&D tax credit and AIA incentives to drive an agenda of supply chain resilience and productivity growth.




Case study:

Carillion – Hubris in the supply chain

A major UK multinational construction and facilities management company, Carillion was a strategic supplier to the UK public sector with 450 construction and service contracts across government.²⁹

It maintained 50 prisons, delivered over 200 school meals services, provided 11,500 in-patient hospital beds and took on multi-million-pound construction projects such as the £745m Aberdeen bypass project.

The company employed around 43,000 people, including 19,000 staff in the UK, and engaged a highly diversified supply chain comprising some 30,000 direct and indirect sub-contractors and suppliers.

In January 2018, the company entered compulsory liquidation with liabilities of nearly £7 billion, including a pensions liability of around £2.6 billion and around £2 billion owed to its supply chain.

Back in 2012, the company had been a founding participant in the Government's Supply Chain Finance Scheme which provides a way for large companies to help their supply chain access credit, improve cash-flow and at a much lower cost.

Shortly after the launch of the Scheme, Carillion changed its standard payment terms to 120 days. Suppliers were able to sell their invoices at a discounted rate to Carillion's bank and receive their payment after 45 days.

Under this arrangement, often referred to as 'supply chain factoring', 'reverse factoring' or 'supply chain finance', Carillion would not be expected to reimburse the bank until the standard payment terms had expired, providing it with an extended repayment period and greater flexibility in terms of managing its own working capital.

"Carillion relied on its suppliers to provide materials, services and support across its contracts, but treated them with contempt. Late payments, the routine quibbling of invoices, and extended delays across reporting periods were company policy."

House of Commons, Business, Energy and Industrial Strategy and Work and Pensions Committees report on 'Carillion', May 2018.

Carillion's demise impacted the lives of thousands of people and their families. The story of its fall from grace holds important lessons for supply chains everywhere.

5. The promise of Industry 4.0

The adoption of digital technologies within supply chains and manufacturing industries, often referred to as Industry 4.0 or the fourth industrial revolution, is helping many businesses to reduce their costs and stay ahead of the competition.

Whilst the take-up of digital technologies has been mixed across industry as a whole, both large manufacturers and sector-based supply chains have been applying their digital capabilities for many years.³⁰

What's more, the promise of digital technologies is enabling many others to solve some of supply chains greatest challenges, notably traceability, transparency and supply chain finance.



Connectivity, data, analytics

Put simply, Industrial Internet of Things (IIoT) works this way. Sensors connect disparate devices and equipment, whether across a manufacturing plant and or a supply chain, to a central hub.

Data collected from connected devices, potentially supplemented by disparate data drawn from other enterprise software systems within the business (e.g. finance, procurement etc) can then provide a complete 360-degree picture of what's happening throughout the factory and supply chain in real time, 24/7.

The application of analytics technologies provides the ability to interrogate the collected data to inform and maximise production and distribution activity.

This would typically include monitoring productivity, benchmarking performance, improving flow, identifying and acting on under/over-utilised equipment, waste and preventive maintenance.

The combination of connectivity, data and analytics provides the opportunity for manufacturers and suppliers to share data in real time and, as a result, help to build flexibility, resilience, responsiveness and traceability across the supply chain.

That said, manufacturers and suppliers keen to share data over an extended distribution network must ensure they are alert, vigilant and steadfastly protected against cyber criminals, at all times.

Building on secure IIoT infrastructure, several other established technologies are enabling manufacturers and supply chains to improve their operations, cooperation and collaboration not least:

- Robotics and automation for improved quality and speed³¹
- Additive manufacturing and 3-D printing for prototyping and specialist parts³²
- Virtual and augmented reality (VR and AR) for process design and technician assistance.³³

The rapid emergence of artificial intelligence (AI) and digital twin technologies promises to further supercharge manufacturing and supply chains.



Enter blockchain

Blockchain is a new way of permanently recording transactions within a secure peer-to-peer network.

It uses algorithms and strong encryption to track data, providing 'a single source of truth' to all those on the blockchain.

It's just one form of a wider group of database technologies, collectively known as Distributed Ledgers. This adaptable technology is being used to address a wide range of business needs across many industries.

The benefits of blockchain technology directly address key issues which have challenged supply chains for decades, notably the ability to drastically simplify security checks and transactions and exponentially increase the traceability of products, supplies and payments.

A recent survey (2018) by CapGemini Research Institute involving 447 manufacturers, consumer goods organisations and retailers revealed only 3% of organizations are deploying blockchain at scale with a further 10% at an advanced stage of experimentation, with pilots in progress at least on one site.

Early adopters identified cost saving (89%), traceability (81%), and transparency (79%) as the top three drivers for investing in blockchain technology.³⁴

Expert view:

Towards supply digital readiness.

In August 2018, WMG, The University of Warwick, in conjunction with JDA, conducted a study to understand the supply digital readiness of 179 major manufacturing companies in Europe.³⁵

Digital readiness was defined as:

- Level 1 = visibility
- Level 2 = predictive
- Level 3 = prescriptive
- Level 4 = self-Learning/autonomous

The study found that only 13% of companies were at Level 3 readiness, described 'as dynamic end-to-end supply chain optimisation supported by an advanced analytics capability, starting to leverage machine learning (ML) and artificial intelligence (AI)'.

52% were at Level 2 readiness, 'leveraging some specialist analytics tools to support functional optimisation'.

35% were still trying to get 'visibility of data and were using simple analytics tools (e.g. spread sheets) predominantly for reporting'.

By 2023, Level 3 readiness is predicted to more than double to 31%. However, the average level of readiness is only predicted to increase by half a level from 2.3 to 2.8.

On the surface this represents a relatively modest improvement. It reflects the difficulty companies face in overcoming entrenched ways of working and legacy systems. It reflects the change from a functionally siloed organisation to one with an end-to-end supply chain perspective.



It requires organisations to give equal importance to managing the supply chain, as an end-to-end business process as they do to new product development (NPD) and customer relationship management (CRM).

This requires a change in organisational structure, to overlay a business process perspective over the classic functional or matric structure.

A study in 2016³⁶ found that only 17% of organisations in Europe had a business process orientation reflected in their organisational structure.

This is critical as whilst they draw on functional resources, they break down the boundaries as they seek to optimise the business around strategic rather than functional goals.

Professor Janet Godsell

Professor of Operations and Supply Chain Strategy
WMG, University of Warwick

6. Ecosystem for supply chain success

The ongoing evolution of supply chain has solicited different attempts to define an underlying structure which reflects a complex and turbulent business context.

The case for the creation and management of a supply chain ecosystem to secure sustainable supply chain growth in the UK and abroad has now come of age.

A dynamic environment composed of different elements interacting collaboratively, a supply chain ecosystem requires leadership, a collaborative approach, aligned objectives, financial enablers and digital infrastructure.

Each component contributes to the growth of the whole system as well as mutually benefiting the other elements in the ecosystem, fostering a virtuous loop of benefits for the supply chain.

To be defined as an ecosystem, a business environment must possess:

Leadership

In the same way that interactive sector deals have led and informed the UK Government's Industrial Strategy, a coordination role exists within the ecosystem.

Orchestrating processes and providing momentum for the virtuous loop of growth, this role may best be performed by sector-specific organisations such as the Aerospace Growth Partnership, Construction Leadership Group and other such expert partnerships.

Acting as asset-free advocates, such subject experts are best placed to monitor the impacts of disruption, turbulence and uncertainty upon their sector and to act on the opportunities and options created by dynamic and fast-changing market conditions.

Preparing for a 'No Deal' may have tied up valuable time and investment. Deal or no deal, those businesses putting measures in place – building up their resilience and flexibility capability - may yet emerge stronger, as a consequence.

A collaborative approach

This refers to shared benefits, mutual trust and willingness to integrate processes, planning, objectives between all parties within the supply chain. Such enablers can be identified in vertical and horizontal integration of processes and resources, as well as the adoption of effective negotiation and contracting practices to improve the level of mutual commitment between supply chain partners.

Aligned objectives

Clear targets to drive growth and awareness, from each entity, of the benefits coming from integrated efforts. For a supply chain ecosystem, the objectives of integration, productivity, resilience, sustainability and traceability are key.

Financial enablers

Opportunities to simplify access to financial resources for every entity involved in the system; to support investments, reduce risk and increase interactions in the network.

This will include banks, venture capital funds, sector investments, UKRI / Innovate UK and industrial institutions committed to providing additional funds and advice for specific entities.

Digital infrastructure

A 'network platform' to rely on in case of unexpected disruption due to external factors. This includes digital networks for the sharing, storing and management of information; efficient physical infrastructure such as roads, rails, airports and ports to allow material movements on efficient paths; logistic networks to optimise closed-loops and integrated freight modes.

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| 35 | 16 | Digital dividend supply chain digital readiness. JDA and WMG University of Warwick, 2018. |
| 36 | 16 | Supply chain segmentation: A window of opportunity... JDA and WMG University of Warwick, 2018. |

8. About the IET

We are the IET - a charitable engineering institution with over 169,000 members in 150 countries – working to engineer a better world.

Our mission is to inspire, inform and influence the global engineering community to advance technology and innovation for the benefit of society.

As a diverse home across engineering and technology, we share knowledge that helps make better sense of the world in order to solve the challenges that matter. It's why we are uniquely placed to champion engineering.

We bring together engineers, technicians and practitioners from industry and business, from academia and research, and from government and the third sector. We are member-led, independent and impartial.

We cover engineering across industry from design and production, digital and energy to healthcare, transport and the built environment.

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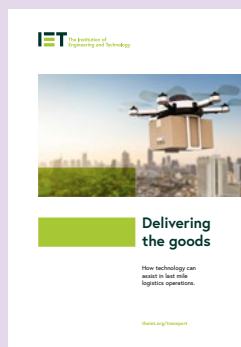
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