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EMERGING TOPICS FOR LONG-TERM RESILIENCE IN MANUFACTURING

GLOCALISATION IN MANUFACTURING: REDESIGNING SUPPLY CHAINS

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**EMERGING TOPICS FOR LONG-TERM
RESILIENCE IN MANUFACTURING**



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The views and opinions expressed by whitepaper contributors are given in their personal capacity and do not necessarily reflect the views of the organisations for which they work or committees of which they are members.

For more information on the project and to read other topic-focused whitepapers that are part of the initiative, please visit <https://worldmanufacturing.org/report/back-to-the-future-emerging-topics-for-long-term-resilience-in-manufacturing/>

INTRODUCTION

The COVID-19 disease has forced companies from all over the world to review their supply chains urgently. The pandemic has caused many issues for firms, which have suddenly faced a situation characterised by a lack of reliable sources of components, of continuity in product manufacturing, and/or the possibility of distributing products to customers.¹

Organisations have tried to react in multiple ways. For example, some of them moved their production activities or suppliers nearer to their home country. Others focused on **building capability** rather than just production capacity, focusing on being able to produce or source products as necessary rather than trying to set up new or additional production lines.

Thus, COVID-19 could be seen both as a **crisis** and an **opportunity** since, despite its dramatic impact on society and business, it also allows firms to transform and improve their operational models and supply chains.

In this context, the concept of “**glocalisation**” has acquired importance. Firms have sought to redesign their supply chain properly, intending to stay closer to suppliers and customers, increasing resilience and responsiveness worldwide.

This document aims first to analyse opportunities and risks related to supply chains worldwide and then to provide valuable insights about creating an end-to-end collaborative supply chain.

The document is organised as follows. The **first section** describes the context and how the pandemic has affected supply chains in different regions (Europe, US, China, India, and the Middle East). In this chapter, the importance of digitalisation and integration is also mentioned. The **second section** presents solutions for companies, considering the significant role of synchronised planning in a dynamic environment and ecosystem. Then, some insights related to the design

of collaborative supply chains are illustrated, considering different areas and topics (demand, product development, supply management, manufacturing, and fulfilment). In the end, the **last section** presents the conclusion.

CONTEXT

The Impact of Covid o the Supply Chain: The Concept of Glocalisation

Glocalisation (the combination of globalisation and localisation) is related to the fact that a company reaches **the global market** by adapting methods, products, or services which fit specific and **local markets’ needs** properly. To do this, proximity to and continuous interaction with suppliers and customers are significant. Integration with these parties allows firms to be more **effective** while **reducing operational risks**.² Thus, redesigning the supply chains based on these pillars by creating end-to-end collaboration, integration, and real-time visibility, makes firms more resilient.

Proximity to customers supports understanding their preferences, expectations, and what is happening in the market, allowing companies to organise their activities adequately and better satisfy their customers.

At the same time, **proximity to suppliers** favours the management of the other side of the supply chain, consequently influencing, in a positive way, the responsiveness of the market and the agility of the firms in a dynamic environment.

In other words, glocalisation and the redesigning of supply chains are significant for increasing **resilience, effectiveness** and guaranteeing **continuity**.

The foremost **vital drivers** enabling companies to succeed at “glocalisation” and redesigning supply chains include **digitalisation, automation, and supply chain integration**.³ Encouraging the supply chain’s integration and leveraging digital transformation and

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automation makes firms operate in a collaborative ecosystem where parties interact directly and continuously.

Before introducing the recommendations chapter, and looking at possible solutions in more depth, it is crucial to contextualise the opportunities and potential risks of “glocalisation” according to specific **regions and sectors**.

Opportunities and Risks in the World: Europe, USA, China, India, Middle East

Europe

COVID-19 has disrupted supply chains, highlighting their limits and their **insufficient level of resilience and flexibility** in European countries, especially in those characterised by a highly globalised supply and demand base.⁴

Before COVID-19, many companies had a manufacturing supply chain and logistics infrastructure focused primarily on **cost reduction**. COVID-19, highlighting the misalignment between supply and demand, showed the need to balance efficiency and scalability with **flexibility and robustness**. The way to find the balance between factors is to increase **end-to-end visibility in supply chains and integrate multiple parties**.

Overall, a drastic reduction in globalisation is not expected in Europe, especially concerning world leaders (such as Germany). Rather, there will be a shift to a more resilient global manufacturing footprint, with more **localised physical value chains** within a regional framework.⁵

Many companies across Europe are increasingly focusing on **multi-sourcing strategies** and **suppliers' flexibility**, further investing in **digital technologies**, particularly automation and robotics. This shift was already taking shape before COVID-19, but the pandemic has considerably accelerated the phenomenon.

Proximity to customers and suppliers and **glocalisation** are, therefore, becoming more and more significant; companies that can optimise the relationship with suppliers and clients by defining more agile and flexible operations along the supply chains will increase sales.

USA

Also, in the United States, COVID-19 has highlighted many **issues** related to **supply chains** and their level of flexibility and digitalisation. Consequently, the development and improvement of **alternative procurement and supply chain strategies** have increasingly become top priorities in the USA.⁶

Over the years, American manufacturers across all sectors and sizes have generally based **production and procurement decisions on the total cost**. With particular attention to labour costs, cost reduction was the main driver leading to offshoring, especially to Mexico and China.⁷

However, even before COVID-19, two trends were arising, limiting the strength of this behaviour. First, there was a **rise in labour costs** and an increase in duties and tariffs. The second aspect is the increasing identification and consideration of **resilience, flexibility, and customer experience** within the total cost model.⁸ So, as in the case of Europe, the focus on exclusively cost-related factors has no longer turned out to be the unique aspect on which to leverage when defining procurement strategies.

In addition, COVID-19 significantly accelerated this trend to diversify production and supply chains and define and develop more **agile and flexible operations** that are both more **efficient and user-centric**.⁹ The three abovementioned drivers represent the foundation upon which redesigning supply chains should be based in order to meet these goals.

China

The pandemic has highlighted the weaknesses of supply chains worldwide and the **excessive depend-**

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ence on China for many products (personal protective equipment is an example).¹⁰

Two main factors are now influencing the building of the supply chain structure. The first factor is represented by **geopolitical frictions**, since it is impossible to neglect the current trade disputes between Washington and Beijing.¹¹ Second, COVID-19 has accelerated the existing supplier diversification trend; in particular, many foreign organisations are trying to rebalance their supply chains by including suppliers outside China.¹²

In this complex situation, companies should be able to satisfy Chinese and international demand. To do this effectively, it is crucial to optimise operations and performance, **reducing the vulnerability of supply chains to disruption**. For this reason, redesigning supply footprint is nowadays an essential element to consider, and geopolitical aspects cannot be neglected, not even in favour of cost reductions.¹³

India

Nowadays, India is among the top exporters of **digital technologies and skills**.¹⁴ These two elements represent the key pillars upon which to build effective and agile operations. More specifically, they are crucial for creating integrated and transparent end-to-end supply chains, by improving firms' capabilities to target customers effectively and responsively.

In India, the country's interior is characterised by a low level of integration, while coastal cities are more typical for a direct connection with **global supply chains**.

In addition, the pandemic has intensified the **low production flexibility, labour shortages, and the limited resilience and agility of supply chains**, widespread issues in the country in previous years.¹⁵

Consequently, COVID-19 has forced Indian companies to **rethink and redesign their operations and supply chains** to increase their performance. In the country, many firms are trying to enhance local "last

mile" capabilities, developing more agile and responsive service delivery models.¹⁶ To do this, they are also leveraging interaction and collaboration with other parties. This attitude could support India in **reducing its dependence on other countries** through domestic production.

Middle East

Middle Eastern countries are used to importing a considerable amount of goods. For this reason, even before the pandemic, they faced several threats, such as **fluctuations** in commodity prices, geopolitical frictions, and disruptions.¹⁷

In this context, COVID-19 has dramatically emphasised the need for producers to **strengthen resilience and sustainability** in production and supply chains. The pandemic has shown many critical supply chain weaknesses in multiple industries in these countries. An example is the healthcare sector, where inadequate supply chains accentuate the already huge problems that COVID-19 has generated. The Middle East region is now rapidly building and improving the local capabilities associated with providing pharmaceuticals and protective medical devices to face this challenge.

Despite these complex threats and the disruption of COVID-19, the countries in this region may be poised for a successful **"glocalisation journey"**¹⁸. To do this, they are focusing on **digitalisation**, intending to build sustainable and flexible operations and supply chains. In fact, in recent years, the countries of the Middle East_ in particular, the United Arab Emirates and Saudi Arabia _ have invested hugely in **information and communication technologies (ICT)**.¹⁹ Thus, appropriate technologies for improving supply chains and manufacturing are now more available, and the region should try to exploit them to face current and future vulnerabilities.

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OPPORTUNITIES AND RECOMMENDATIONS

Redesign Supply Chains Towards End to End Collaboration: Synchronised Planning

The increasing adoption of digital technologies allows firms to create **integrated and dynamic supply chains**, where both suppliers and customers become parties to an interconnected ecosystem. To do this, improving the organisational aspects is also crucial.

Many activities, such as needs identification, resource planning, scheduling, etc, benefit from **collaboration** and **connectivity** among multiple parties, improving performance in terms of responsiveness and effectiveness. At first, the **integration** and the **visibility** of the different functions of the company improve the execution of operations. Then, enlarging the concept outside the firm's walls and considering the whole **network of actors**, benefits and opportunities rise drastically.

The goal is **synchronised planning**, which reduces wasted time and errors and allows firms to plan supply based on real demand dynamically.²⁰ Synchronising the whole **ecosystem** and having (near) **real-time end-to-end visibility** is more and more important and valuable since it increases efficiency and effectiveness. These key points are quite divergent from the traditional sales and operations planning (S&OP) approach. Here, there is a silos structure so multiple plans are required for different functions. On the other hand, synchronised planning allows the firm to integrate strategic, financial, tactical, and operational plans and goals concurrently.²¹

Cross-functional planning activities and a **holistic view of the whole supply chain** lead to significant benefits, especially resilience and flexibility.²²

In other words, in a dynamic environment characterised by the request of people for customisation and

personalisation, considering customers' and suppliers' constraints in synchronised planning allows the firm to optimise performance and adequately **satisfy the market**.

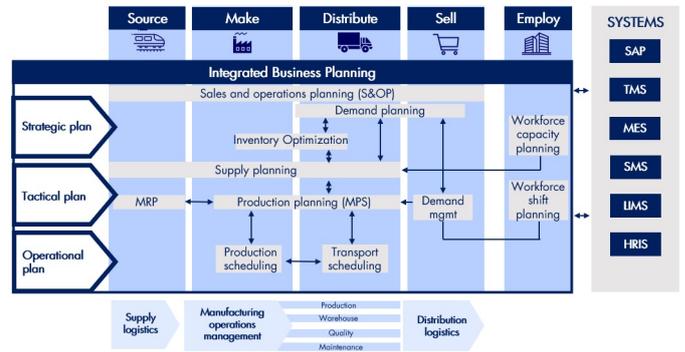


Figure 1 - Integrated Business Planning (Source: DIH Lombardia adapted from multiple sources)

The figure above summarises the main processes and the related systems that impact a typical Integrated Business Planning (IBP) approach. The IBP is being transformed into a more **collaborative, automated, and resilient process**. Synchronised planning is the continuous control of supply chain performance, and interaction and integration along the supply chain enable (near) **real-time planning adjustments**.²³ These activities can be supported by Artificial Intelligence, Machine Learning, and Robotic and Cognitive Process Automation solutions.

As shown by the figure below, the management of the **end-to-end supply chain as a single ecosystem** is strictly linked to the interdependence of the following three blocks:

- **collaborative demand sensing**
- **internal synchronisation**
- **and collaborative supply planning.**

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Figure 2 - End-to-end collaborative supply chain²⁴

More in detail, companies should optimise their **demand sensing activities**, also directly interacting with customers. Organisations can leverage the high amount of data obtained through the use of multiple and digital channels. The integration allows **the real-time data flow** from the customer to the firm, improving its internal activities. Comprehensive scenario simulations can be realised and make it easier for the company to find appropriate responses. If, on the one hand, optimising the understanding of demand impacts on the firm's capabilities to schedule both internal activities and supplier relationships, on the other hand, enhancing the level of **integration with suppliers** can make the company more responsive and effective. Integrating suppliers in planning gives the firm the possibility of being more resilient and dynamic.²⁵

In the end, it is possible to conclude that the result of a collaborative, integrated, and automated end-to-end supply chain is highly beneficial in terms of **flexibility, predictability, and efficiency**. Enterprises can be closer to suppliers and customers and adequately adjust their initial real-time planning to make the execution effective and responsive.

These benefits can be further discussed in particular and more specific topics, starting from market demand and moving towards product development, supplier relationship, smart manufacturing, and fulfilment.²⁶

CONNECTED DEMAND AND CUSTOMERS

The rising adoption of digital technologies, online channels, and data-driven approaches also influences the supply side of the supply chain. Thus, the related processes have been transformed.

Traditional supply chains are generally designed to meet delivery requirements only, by focusing on **product availability**. Thus, they consider **aggregate demand** and aim to pursue scalability and minimise the unitary cost of the product.²⁷ Customers can be perceived as a mass of passive individuals. This makes it difficult for traditional supply chains to face problems related to omnichannel approaches and to undertake customer management effectively.

As mentioned above, nowadays, the supply chain process has changed, and the level of **involvement of customers** is higher. Customers interact with products and connect with firms, aiming to increase personalisation and receive a delightful experience. Technologies integrate customers and firms. They become active participants, and companies focus on single individuals rather than considering them as an aggregate.²⁸

Personalisation, convenience, and experience are currently the three main drivers for customers. To satisfy them, the collaboration between companies and clients is crucial. Integration of the demand side of the supply chain is essential and digital technologies are relevant for supporting data exchange and make the network collaborative. Synchronised planning and end-to-end visibility optimise the activities by understanding demand fluctuations and enhancing **resilience and effectiveness**.²⁹

In this context, a new **customer journey** structure emerges. It can be summarised by highlighting several stages. The first are **awareness and consideration**. Notably, digital technologies, platforms, and channels

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support firms in better targeting single individuals at these stages. Digital solutions and collaboration between the parties are also associated with customer-firm data sharing. At these stages, the firm's objective is to persuade the customer towards the **purchase**. After the transaction has taken place, firms should try **to build loyalty**. High customer engagement is crucial to retaining the client and creating a **profitable cycle**. However, during these steps, some issues can emerge. The company's ability to solve these problems effectively and efficiently makes the customer continuously involved in this cycle. Collaboration and integration between the parties support success along the whole customer journey.

To conclude, increasing the level of connection and collaboration with customers and understanding (near) real-time demand changes and signals is becoming more and more significant.

COLLABORATIVE PRODUCT DEVELOPMENT

New products and/or services development is changing, influenced by digital technologies, real-time data opportunities, and higher customer involvement.

Traditionally, time to market is not a key element on which approaches and new product development methods are focused. To explain this point, multiple reasons can be identified, but the traditional presence of functional silos and the poor level of integration and connection along the whole supply chain could be seen as primary causes of **long lead times**.³⁰

However, especially in a dynamic environment, it is not possible to neglect these topics. To cope with this traditional limit, the new product/service development process is associated with more **interaction with customers**. The continuous and significant involvement of clients, supported by digital technologies, introduces the concept of "digital and collaborative product/service development".³¹ The evolution of

this process impacts positively on time to market and effectiveness.

For the reasons above, connectivity and **integration along the supply chain** also characterise and affect this area. A collaborative supply chain enables **personalisation and customisation** in a dynamic environment where attention on the customer experience is higher and higher.

To fulfil customer expectations, firms usually leverage the concept of **customer co-creation**. In addition, customers' engagement is favoured by **smart-connected products**, which makes it possible to acquire many data about the users. The aim is to optimise these data to develop and design products that satisfy the customer's needs and requirements. Digital technologies, data usage, and data analytics also make **servitisation** significant.³²

In detail, new product development is characterised by several steps, such as concept, design, and delivery.³³ All these three stages are being influenced by the increasing importance of collaborative end-to-end supply chains.

The availability and the ability to access and use a considerable amount of **customers' data** improve the accuracy and the quality of requirements.³⁴ Data favour a better comprehension of the market and provide concept opportunities.

Digitalisation and integration with customers are also influencing the design stage. The main elements to which it is possible to refer are data-driven automated design and digital testing.³⁵

Finally, thanks to the identification of the most appropriate insights, even commercialisation and delivery activities benefit from a high degree of **collaboration and data usage**.

To conclude, it is possible to highlight that collaboration in product development can be valuable, and real-time virtual connection along the supply chain and

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remote collaboration capabilities enable elements to optimise the activities.

COLLABORATIVE SUPPLY AND SUPPLIER RELATIONSHIP MANAGEMENT

In previous years, the traditional procurement and sourcing activities were mainly focused on **cost optimisation** and **risk mitigation**.

Nowadays, beyond the traditional cost optimisation and risk mitigation, supply also refers to **value maximisation**. To reach this goal, improving and formalising supplier relationship management is crucial. This cannot prevent data usage, supply chain integration, and operational automation. In this context, the concept of **“collaborative supply”** gains in relevance and the procurement function becomes strategical.³⁶

Collaboration with strategic suppliers and the real-time exchange of information can improve efficiency and effectiveness, both for the company and the other actors. **Real-time visibility** to transactions (orders, invoices, etc.) and monitoring of supply indicators increase the value generated and mitigate the risk.³⁷ For these reasons, **transparency** of the collaborative network and **end-to-end integration** between the parties are the most significant elements of successful supplier relationship management.

In other words, creating a **collaborative ecosystem** characterised by real-time data sharing and transparency between the company and suppliers maximises value creation.

In this context, **predictive strategic sourcing** and **proactive supplier management** can be introduced. Based on data and technologies, they support intelligent category management and spend analytics, optimising operations and supply chain performances.³⁸

In this context, **data analytics** acquire importance. They can provide a holistic view of the suppliers, and integration of synchronised planning and dynamic fulfilment capabilities for real-time demand sensing is favoured. Consequently, uncertainties and inefficiencies can significantly decrease. **Machine Learning** is quite significant for the identification of opportunities and prediction of failure.

At the same time, **automation procurement execution** and real-time tracking of demand, supply, and flows along the supply chain are enabled. Many activities such as order management and material tracking reduce manual components.³⁹ This consequently increases **efficiency and accuracy**.

To conclude, it is possible to highlight the fact that improving the supply side's performance by creating a collaborative network of suppliers enhances the firm's resilience and capabilities to respond effectively to the market.

DIGITALISATION AND INTEGRATION OF INTERNAL PROCESSES

Data-driven approaches and digital technologies are affecting manufacturing and all the firms' internal processes. Thus, companies are nowadays trying to understand the best way to adopt, implement and integrate smart manufacturing technologies.

Collaborative and integrated end-to-end supply chains provide a considerable amount of **data in (near) real-time**. Smart manufacturing and internal processes are strictly based on the value of data and on gathering and analytical capabilities. Notably, companies should be able to analyse and interpret them, obtaining **meaningful insights**.⁴⁰ In this way, thanks to digitalisation, integration, and data availability, competitiveness is also enabled in value creation maximisation, not just cost minimisation.

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Connectivity is crucial to gathering, communicating, and storing vast amounts of data from various operations. It is valuable to connect and **synchronise** data-gathering systems, manufacturing machines, and IT systems to obtain structured and reliable insights through analytics. Notably, in a digitalised and integrated environment, **real-time monitoring and plan visibility** is guaranteed. Integration and connection should include all the actors in the supply chains. Consequently, operations performance improves. Higher integration and digitalisation mean better transparency, planning, and automation. Thus, production, warehouse management, predictive maintenance, and overall operations are enhanced.⁴¹

The manufacturing schedule and execution improve. Thanks to synchronised planning, combining multiple elements such as demand, supply, resource constraints, etc, allow the firm to organise activities better and make real-time adjustments.⁴² In this context, the execution is also optimised, thanks to **analytics** and the abovementioned **real-time adjustments**.

To conclude, digital technologies and analytical capabilities enhance internal processes and smart manufacturing, which are needed to manage the considerable amount of data coming from the integrated supply chain.

DYNAMIC FULFILMENT

Traditionally, fulfilment and warehouse operations focus on efficiency.⁴³ However, integrated and collaborative end-to-end supply chains are more closely linked to flexibility and resilience.

In traditional supply chains, fulfilment is reactive, characterised by not-fully-connected processes.⁴⁴ Silos are dominant within the organisation, and **limited resilience** and agility make it challenging to manage unforeseen events properly. **Dynamic fulfilment** allows organisations to recognise customers' expectations and preferences. This supports real-time adjustments to optimise companies' responses.⁴⁵

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The starting point is market sensing and the identification of the customer needs. Then, integration and real-time synchronisation make more effective and efficient planning and distribution.

The **automated and simultaneous exchange of data** and signals across multiple chain parties gives higher transparency and increases customer responsiveness. At the same time, having **complete visibility** and tracing the flows makes the whole supply chain more flexible, agile, and responsive.⁴⁶ Data-driven approaches and digital technologies make **distribution and delivery operations** intelligent. Real-time demand, monitoring of assets and resources, real-time visibility of flows, and automated fulfilment activities are some of the main elements to consider. Thus, supply chains should be designed to support quick reconfiguration to satisfy customers' expectations.⁴⁷

To conclude, fulfilment planning is a continuous and real-time activity nowadays, and collaboration and integration along the supply chain make resilience higher at this level and scope.

CONCLUSION

The disruption caused by **COVID-19** has affected companies all over the world. While challenges and issues emerged, several opportunities appeared. Notably, supply chains have shown their unreadiness and low resilience, preventing organisations' continuity.

Glocalisation's growing importance influences the redesign of supply chains, enhancing attention to specific local needs in a global environment. Proximity to customers and suppliers increases and, even more importantly, integrating actors and visibility in the **end-to-end supply chain** becomes crucial.

Companies should interact with an ecosystem of actors along the supply chain by guaranteeing collaboration and, thanks to connectivity, **synchronisation of planning**. Improved understanding and management of demand makes it possible to optimise internal

activities. Real-time adjustments can be performed, and the supplier relationship is enhanced. This consequently allows the firm better responsiveness and effectiveness with customers. Digitalisation, integration, and end-to-end visibility along the supply chain improve performance.

Understanding and interacting with customers support the proper **identification of the demand**. In this dynamic environment, people are searching for personalisation and a great customer experience. Creating a collaborative and integrated network can favour companies in satisfying the market's expectations by leveraging on **co-creation**. So, **connectivity** is crucial, both within the single company and with external actors, such as customers and suppliers. Thus, real-time **end-to-end visibility and data usage** can support and improve product development activities. Transparency is crucial on both sides of the supply chain; therefore, the **supplier management relationship** should also be considered and optimised. **Transparency and traceability** increase efficiency and accuracy and make it possible to structure a network resilient to future disruptions. Digitalisation, integration and data gathering, and synchronisation allow firms to create and capture value by optimising **manufacturing schedules** and **real-time adjustments**. To conclude, market and user sensing and digital transformation support **product fulfilment and delivery**.

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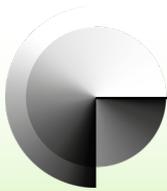
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