How to Increase Strategic Supply Chain Resilience in 5 Steps

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Recognizing that the reliability of the supply on the global market has been risky for some time has become an undeniable fac in times of disruptions. Big international supply chain players have been dealing with this issues for over a decade. If we want our supply chain to be resilient, we must be aware that to enhance resilience, we need to forecast potential disruptions and develop scenarios how to manage them. For flexible and resilient supply chain it is crucial to have clearly defined supply chain strategy based on a) Risk analysis; b) Value chain analysis and c) Maturity model and benchmarking. This helps us to identify priority measures and to develop an action plan to achieve greater resilience and adaptability, which are becoming foundation of business in the 5.0 society.

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1 Introduction

A supply chain (SC) encompasses the lifecycle processes defined as involving physical, information, financial, and knowledge flows whose purpose is to satisfy end-user requirements with products and services from multiple linked suppliers (Ayers, 2000). In line with this definition, the supply chain consists of supply, production, transportation, distribution, and product and service sales processes. It involves all stakeholders who are directly or indirectly involved in fulfilling customer demands (Chopra & Meindl, 2007). A supply chain is thus defined as a network of three or more organizations or individuals directly involved in the flows of products, services, finances, and/or information from the origin to the customer (Mentzer et al., 2001). A typical SC also represents a network of materials, information, and services that defines connections with the characteristics of supply, transformation, and demand (Chen & Paulraj, 2004). If we want our supply chain to be resilient, we must first acknowledge that increasing resilience requires anticipating potential disruptions and creating scenarios for how to manage them. But why don't all companies do this? Simply because it is not that easy, as a resilience strategy must involve various SC stakeholders, not just a single company.

Certain authors point out that the lifecycle can refer to both the market lifecycle and the usage lifecycle, which differ for durable goods and services. This distinction makes after-sales service an important component of the SC.

The SC can vary in complexity depending on the number of members and the diversity of business processes, but it usually has a central role and manages the entire supply process. According to Mentzer et al. (2001), three levels of SC complexity can be identified:

- Direct SC – composed of the focal company, its suppliers, and its customers.
- Extended SC – includes, in addition, the suppliers' suppliers and the customers' customers.
- Ultimate SC – encompasses all companies involved in all flows of products, services, finances, and information from the original suppliers to the final customers, as well as functional intermediaries such as third-party logistics providers (3PL).

Supply chain management (SCM) represents a fundamental and integral part of business operations. It can improve customer service and satisfaction, reduce operating costs, and simultaneously improve the company's financial performance (Orozco-Romero et al., 2020). SCM therefore plays a key role not only in logistics but in the broader economy (Liu et al., 2022). Adapting the SC has become a necessity, but for most companies, this remains a challenge due to the lack of real-time data availability and limited responsiveness of planning systems (Marmolejo-Saucedo et al., 2020). The continuous improvement of SCM systems has driven the development of various digital tools for business process automation (Marmolejo-Saucedo et al., 2020) As a result, supply chains are shifting from traditional hierarchical structures toward *value networks*, characterized by complex, interconnected, and interdependent relationships (Kajba et al., 2023). Therefore, knowledge flows, learning, and collaboration are gaining importance, in some cases even rivalling more established flows such as product movement, control, and coordination (Kalaboukas et al., 2021).

2 Phases of Supply Chain Management

The supply chain management process consists of five phases (see Figure 2.1):

1. SC strategy,
2. demand and SC planning,
3. sourcing and procurement,
4. production,
5. logistics and distribution.

Figure 2.1: Phases of the SC management process
Source: own source

To increase resilience to disruptions and ensure a flexible SC, it is essential for a company to first have a clearly defined supply chain strategy. For this reason, we will focus primarily on this phase.

2.1 Phase 1: Supply Chain Strategy[1]

2.1.1 Key steps and activities

Defining a robust SC strategy is typically a three- to six-month project and is often outsourced to a consulting company to avoid conflicts of interest. However, a company can also carry out this process internally by following the five steps below (see Figure 2.2):

1. Understand the current (existing) state.
2. Collect best practices and performance metrics.
3. Develop the desired future state.
4. Perform a gap analysis between the desired and existing state.
5. Create a plan to bridge the gap between the desired future and current state.

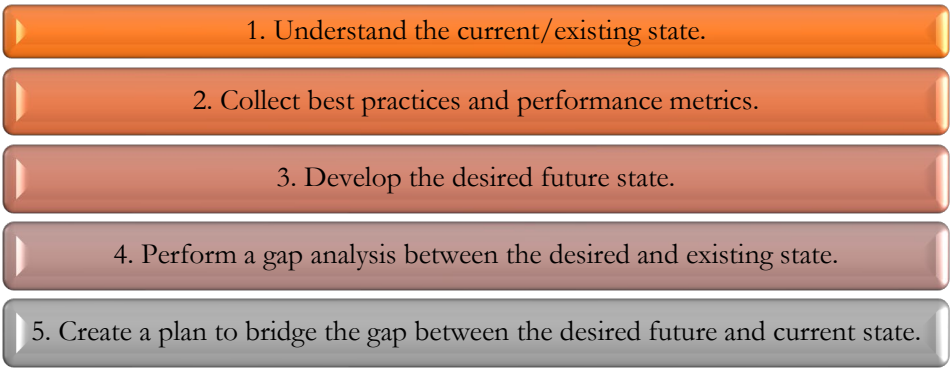

Figure 2.2: Key steps of SC strategy
Source: own source

The following section presents each step in more detail through their activities:

1. Understand the current/existing state:

– Define key data to be collected.
– Design and prepare questionnaires.

[1] Adapted from Obrecht, n.d.

- Select key stakeholders to be interviewed.
- Conduct interviews.
- Process collected data/information, typically using information technology (IT).
- Study, understand, and document the current state.
- Validate the current state with the company.

2. Collect best practices and performance metrics:

- Define relevant metrics and best practices to be collected.
- Select and analyze appropriate metrics, assess the maturity level of the company, and identify best practices.
- Interview experts and gain an understanding of the specific industry.

3. Develop the future state:

- Develop a SC management maturity model.
- Evaluate the company's SC management maturity.
- Define the desired future state based on:
    - the current state,
    - collected performance metrics and best practices,
    - SC maturity level of the company,
    - strategic vision of the company.

4. Perform a gap analysis between the desired future and existing state:

- Compare the existing and desired future states.
- Identify possible initiatives required to transition from the current to the future state.

5. Create a plan to bridge the gap between the desired future and current state:

- Utilize all possible initiatives identified in the previous step, including:
    - An explanation of how each initiative will help reach the target state,
    - a cost-benefit analysis,
    - prioritization of initiatives,

- development of a plan including priorities and a clear timeline,
- effective implementation of initiatives,
- tracking and measuring progress.

Some steps may be implemented by the organization with minimal effort, while others require more energy. The identification and analysis of potential risks–i.e., possible disruptions that could jeopardize SC operations–are of utmost importance.

Awareness that global supply reliability has long been at risk became undeniable during extraordinary events such as the coronavirus pandemic. Major international supply chain players have been dealing with unreliable deliveries for over a decade. Similar supply chain disruptions have already occurred during previous pandemics (e.g., SARS, Ebola, etc.), nuclear disasters (e.g., Fukushima), natural catastrophes (e.g., Balkan floods, Asian tsunamis, U.S. hurricanes, etc.), military conflicts (e.g., the Middle East, Syria, Somali pirates, Ukraine, etc.), trade wars and international diplomacy (e.g., China's economic expansion restrictions, the Iranian embargo...), and so-called revolutions like the Arab Spring. However, disruptions have never before affected so many countries on various continents simultaneously, impacting entire networks of competitors. Rethinking future business models that more actively incorporate supply disruptions and allow for more proactive intervention is increasingly relevant.

The focus and severity of business changes largely depend on the duration of disruptions and the perceived risk of recurrence. If a disruption is short-term (an "optimistic scenario"), organizations sometimes forget it too quickly and eventually become less cautious again. For example, they may once again equip their products with cheap global components of questionable origin, produced in uncertain working conditions and without insight into environmental impacts across the SC. If a crisis or disruption is long-lasting, responsible companies can be expected to place more emphasis on evaluating the origin of raw materials and their suppliers–not necessarily for environmental sustainability, but to increase supply security and resilience.

More and more global players are seeking alternative suppliers in geographically diverse regions, theoretically minimizing the chance of simultaneous supply outages. However, in the procurement world, this is still not a given–many EU companies do not even know who or where their primary material suppliers are, let alone understand the extraction conditions or potential supply risks.

Recently, there has also been a trend toward nearshoring–choosing suppliers located nearby, which enables shorter transportation routes and greater responsiveness in emergency situations. This, in turn, can present an opportunity for long-term value creation, revitalization of EU-based manufacturing, and increasing perceived product value in the eyes of the end customer. Additionally, in the euro area there are no currency risks, labor laws are better regulated, and social factors are considered (e.g., practically no child or forced labor), and we observe higher levels of quality control. On the other hand, this represents a major shift–de-globalization of business operations, and potential drivers of global instability, as unfortunately, nothing connects us more than money.

3 Tips and Recommendations for Increasing Supply Chain Resilience

3.1 RiskAssessment and Mitigation

To properly assess corporate or project risks, it is important to use the following dimensions:

- Probability – how likely it is that the risk will occur.
- Impact – what the potential effect of the risk is on business operations or the functioning of the organization.

To evaluate the probability of a risk, a probability scale can be used, which should also visually depict the levels of probability (see Table 3.1).

Table 3.1: Defining the Probability Scale

Probability Scale	Definition
Almost certain	More than 90% chance of occurrence.
Likely	Between 60% and 90% chance of occurrence.
Possible	Between 20% and 60% chance of occurrence.
Unlikely	Between 5% and 20% chance of occurrence.
Rare	Less than 5% chance of occurrence.

Source: own source

For assessing the potential impact of a risk, a scale is also used that visually illustrates the levels of impact (shown in Table 3.2).

Table 3.2: Defining the Impact Scale

Impact Scale	Definition
Extreme	The risk will cause project failure or business collapse.
Major	The risk will significantly affect the success of the project or company.
Moderate	The risk may affect the success of the project or company.
Minor	Almost no effect on the success of the project or company.
Negligible	No effect on the success of the project or company.

Source: own source

The risk value for the examined organization is calculated by multiplying the probability dimension by the impact dimension. If the resulting risk is high and its impact on the organization is significant, the company must prepare for it and develop a response scenario to address the potential disruption or risk. Organizations that prepare in advance emerge as winners during times of disruption, whereas those that do not anticipate potential future scenarios usually take too long to adapt or are unable to adapt at all—which can result in loss of market position or even business failure.

Table 3.3: Value Calculation

Probability		Impact		Value
What is the probability of the risk occurring?	×	What is the potential impact of the risk	=	The risk matrix helps to easily calculate the risk value.

Source: own source

Based on the calculation and the information on the **risk value** for each individual risk in a project or company, **priority actions** are determined. These actions help to assess **how important it is to address and prepare for a given risk** (see Tables 3.3 and 3.4).

Table 3.4: Defining the Risk Value Scale

Risk value	**Definition**
Very High	Risks that must be treated as **priority no. 1**.
High	Risks that must be treated as **priority no. 2**.
Medium	Risks that must be treated as **priority no. 3**.
Low	Risks that must be treated as **priority no. 4**.
Very Low	Risks that must be treated as **priority no. 5**.

Source: own source

The steps to be followed to determine the risk value are:

Step 1: List all identified risks in a table (or a more extensive Excel spreadsheet) titled "Risk Register Template" (Table 3.5).

Step 2: Assign the risks to the Risk Matrix Template (Tables 3.6 and 3.7).

Table 3.5: Risk Register Template (Example of a Partially Completed Template)

Risk No.	Risk Name	Risk Description	Probability	Impact
1	Slower website performance	Improving the resolution of our images will increase their size, which may slow down page loading time.	Likely	Major
2	New competitor entering the market	[Enter risk description]	[Enter text]	[Enter text]
3	[Enter risk name]	[Enter risk description]	[Enter text]	[Enter text]
4	[Enter risk name]	[Enter risk description]	[Enter text]	[Enter text]
5	[Enter risk name]	[Enter risk description]	[Enter text]	[Enter text]
6	[Enter risk name]	[Enter risk description]	[Enter text]	[Enter text]
7	[Enter risk name]	[Enter risk description]	[Enter text]	[Enter text]

Source: own source

Table 3.6: Risk Matrix Template 3 × 3 (Example Template)

Probability				
	Likely	– *Enter project name* – *Enter project name* – *Enter project name*	– *Enter project name*	– *Enter project name*
	Possible	– *Enter project name*		– *Enter project name*
	Unlikely		– *Enter project name*	*Enter project name*
		Minor	**Moderate**	**Major**
		Impact		

Explanation:

Risk treatment priority level #3	Risk treatment priority level #2	Risk treatment priority level #1

Source: own source

Table 3.7: Risk Matrix Template 5 × 5 (Example Template)

Probability	Extreme	Major	Moderate	Minor	Negligible
Almost certain	– *Enter project name*	– *Enter project name*			– *Enter project name*
Likely	– *Enter project name*				– *Enter project name*
Possible	– *Enter project name*	– *Enter project name*	– *Enter project name*	– *Enter project name*	
Unlikely					
Rare				– *Enter project name*	

Impact

Explanation:

Risk treatment priority level #5	**Risk treatment priority level #4**	**Risk treatment priority level #3**	**Risk treatment priority level #2**	**Risk treatment priority level #1**

Source: own source

3.2 Best Practices and Examples

Table 3.8 presents examples of companies and scenarios outlining what actions to take in response to specific risks.

Table 3.8: Examples of Risks and Mitigation Measures

Risk	Mitigation Measures
1. HIGH SUPPLY RISK FOR COMPONENTS (e.g., supplier in Ukraine, China)	1. Search for alternative supplier(s). 2. Conclude contracts with existing suppliers to cover disruptions. 3. Prepare a list of substitutes.
2. UNRELIABLE SUPPLIER	4. Supplier evaluation (delivery time, costs, % fulfillment, reliability, flexibility).

Risk	Mitigation Measures
3. HIGH ELECTRICITY/ENERGY PRICES (e.g., why does a surge in gas prices affect electricity prices?)	5. Long-term contracts. 6. Investment in self-sufficiency. 7. Improve energy efficiency. 8. Reduce dependence on a single energy source.
4. INTEREST RATE (How does it affect project implementation?)	9. Increase the profitability margin of the project. 10. Secure financing with a fixed interest rate. 11. Finance in local currency. 12. Seek alternative sources of financing.
5. ENVIRONMENTAL RISKS (ESG) (e.g., products containing palm oil)	13. Obtain ISO 14000 certification. 14. Introduce and integrate ESG into strategic management. 15. Sustainability reporting. 16. Carbon footprint calculation. 17. Sustainability development strategy. 18. Avoid high-risk raw materials. 19. Prepare a list of substitutes.

Source: own source

To conduct such an analysis of risks, maturity, competition, and environmental impacts, accurate data is essential. When considering the supply chain (SC) concept and the product life cycle within it, data must be collected in a fundamentally different manner compared to an analysis based solely on internal company data. In this case, data is gathered across all tiers and levels of the supply chain. The desired information flow may also include sensitive business data (e.g., supplier margins), which companies have a legitimate interest in keeping confidential. Therefore, the collaborative component and partnership-based relationships are key.

When studying and monitoring risks, it is important to recognize the problem of the "tail event"—which refers to risks defined as events with an extremely low probability of occurrence but potentially very high impact on business operations, the supply chain, and the economy and society as a whole. A typical example is the COVID-19 pandemic, which affected the global economy and society through previously unimaginable measures, even though the likelihood of a global pandemic was considered close to zero.

3.3 Maturity Model and Competitive Benchmarking

The next step in preparing a strategy to increase supply chain resilience is to develop a supply chain management maturity model, illustrated with the example below (Table 3.9 and Figure 2.3). This model allows an organization to assess which areas are well-developed, where it performs above average, and where it is lagging behind its competitors.

Table 3.9: Example of a Maturity Model

	Basic	Below Average	Average	Advanced	World Class
Procurement Strategy	– There is barely a company-wide procurement strategy. – The procurement strategy has not been communicated. – Procurement is not recognized as a player in resource acquisition. – Supplier negotiations are primarily price-based.		– A company-wide procurement strategy exists, but it is not comprehensive. – Formal communication of the procurement strategy with suppliers and some parts of the organization. – Procurement is recognized as a player in resource acquisition. – Supplier negotiations begin to go beyond price.		– A comprehensive, company-wide procurement strategy exists. – Procurement strategy is formally communicated to suppliers and the entire organization. – Procurement is recognized as a leader in sourcing. – Customer service and cost performance are optimized through close supplier relationships.
Organization and Human Resources	– Procurement is viewed as a support function. • Procurement is tactically focused. • The function is mostly staffed with low-skilled resources. • Career paths are unclear.		• Procurement begins to be seen as a critical organizational function. • Procurement becomes more strategically driven. • The procurement team starts offering incentives to attract top talent with advanced education.		• Procurement has a seat at the table as a valued partner. • Procurement is strategically led. • The team includes highly skilled personnel with advanced education. • Career paths are clearly defined with performance expectations at each level. • Procurement is involved across most areas of company spending.
Procurement Process	• Few or no formal procedures. • Business units make purchases with no specific guidance. • No formal negotiation strategy is defined.		– Documented processes are known and mostly followed by staff – Business unit purchases follow defined guidelines. – Processes are rarely reviewed. – Process ownership is not centralized.		– Formally trained staff are familiar with and follow documented processes. – Business units follow defined and continuously improved guidelines. – Processes are regularly reviewed to ensure the

			application of best practices. – Centralized ownership of procurement processes.
Technology	– No global procurement system is in place. – Systems are manual and labor-intensive – Data is mainly in "paper-based" format.	– A global procurement system exists but is not always user-friendly. – IT procurement solutions have been identified, but most are not yet implemented. – Focus is on transaction automation.	– The global procurement system is intuitive for users. – IT solutions for procurement are identified and implemented. – Focus is on automation of interactions.
Supplier Relationship	– A win-win mindset is increasingly adopted. – Awareness of the need for trust-based relationships. – Cooperation guidelines and goals are defined. – Supplier selection criteria include cost, technology, availability, and flexibility.	– • A win-win mindset is increasingly adopted. • Awareness of the need for trust-based relationships. • Cooperation guidelines and goals are defined. • Supplier selection criteria include cost, technology, availability, and flexibility.	– A win-win mindset is fully embedded. – Collaboration agreements are in place, and benefits are realized. – Strategic alliances exist with suppliers who share risks and opportunities. – Suppliers are treated as a virtual extension of the organization.

Source: own source

As shown in Figure 2.3, it is less worthwhile to invest in "Organization and Human Resources," as we are already above average in this area and significantly outperforming our competitors. However, we are lagging behind in the areas of "Supplier Relationship" and "Technology." Therefore, it is more strategic for the organization to focus on improvements in "Supplier Relationships" and the development and integration of "Technology" into business processes, as this will enhance our resilience and operational capability during disruptions.

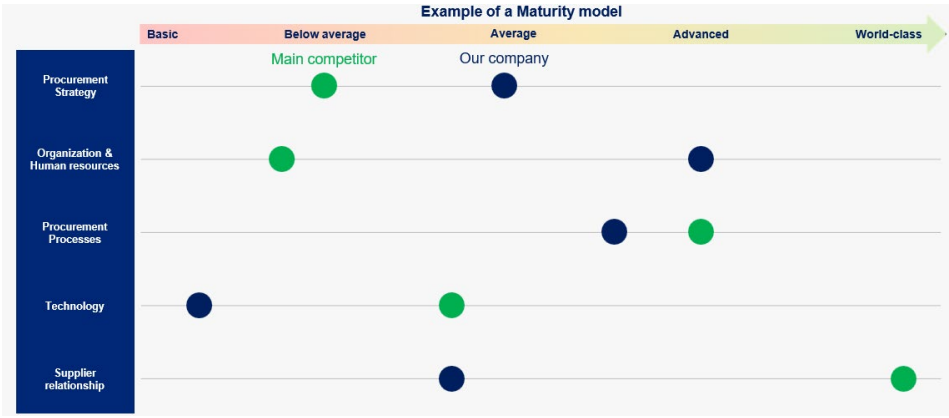

Figure 2.3: Example of a maturity model
Source: own source

3.4 Value Chain Analysis

Within the preparation of a supply chain strategy, attention must also be given to the value chain. The value chain describes the individual components and activities that enable value creation for the customer. If we spread our focus too evenly across all components and activities, we may run out of time, energy, and resources to make improvements in the key areas. It is therefore necessary to first identify the critical value-creating areas and allocate more attention to them than to the remaining, possibly supporting or unnecessary activities. In companies, we often encounter time constraints, which can be effectively resolved by defining the key areas of strategic importance and eliminating those that consume excessive resources without delivering sufficient benefits. The value chain is thus what enables us to generate profit margins (see Figure 2.4).

An example from the dairy industry shows that a major Slovenian dairy processing company discovered that certain products (such as cheese and butter) bring significantly higher added value compared to yogurt. Their butter and cheese are also more well-known, requiring less investment in marketing than yogurt. They found that, given the current demand, they could sell significantly larger quantities of butter and cheese, but they lacked sufficient production capacity. Yogurt, on the other hand, brings lower margins, incurs higher costs, and they do not believe it has strong sales potential.

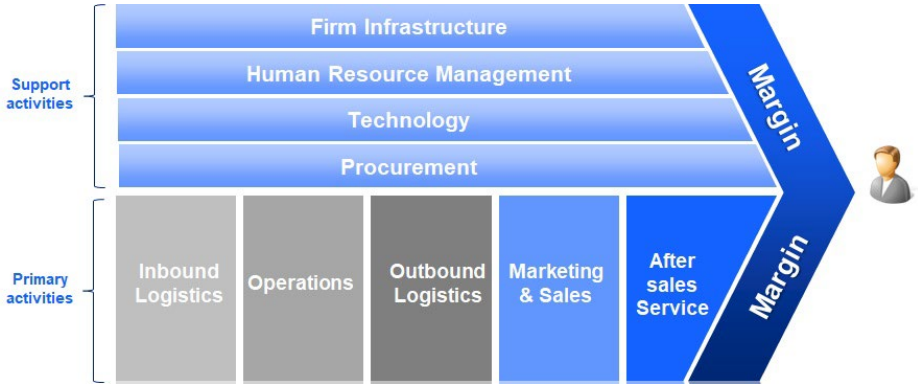

Figure 2.4: Representation of the Value Chain
Source: own source

What should be done in such a case? The company decided to discontinue yogurt production and prioritize cheese and butter. By withdrawing yogurt from production, they freed up capacity for butter and cheese, reduced marketing costs, and increased their profit margins. They were able to do this relatively quickly, as these are similar products that require comparable workforce skills and machinery.

This move optimized their operations, reduced production variability, simplified processes, and achieved higher added value. However, they also reduced their resilience by lowering the diversity of their production. For example, if demand for cheese or butter were to decline, the decision might be questionable. In this particular case, the likelihood of that happening is extremely low, so the decision was bold. Still, if they were producing both traditional and vegan cheese, even with lower added value, it would make sense to continue producing vegan cheese, given the rising trend in plant-based diets. This means that future market conditions must also be taken into account—not just the current ones.

3.5 Assessment of Priority Areas

It is important to create a simple matrix to prioritize all potential initiatives that need to be implemented to transition from the current state to the desired future state. Two criteria used in most prioritization matrices are (Table 3.10):

Table 3.10: Factors Used to Select Priority Activities

Impact	Effort
An initiative with high impact would mean one of the following: – The initiative must occur to achieve the desired future state, – The initiative will significantly reduce costs or increase revenues.	**The "Effort" criterion is assessed based on the following factors:** – Ease of implementation, – Required time frame, – Required resources (number of people, capital investment, etc.).

Source: own source

Focus should be placed on initiatives that have the greatest impact and require the least effort (Tables 3.11 and 3.12).

Table 3.11: Priority matrix

Impact			
High	**Long-term initiatives** (actively strive to reduce the required effort)	**Priority initiatives**
Low	**Unattractive initiatives** *(do not pursue)*	**Low-value initiatives** *(pursue opportunistically)*
	High	**Low**
	Effort	

Source: own source

Table 3.12: Matrix of Proposed Priority Initiatives

Impact			
High	1. Enter the name of initiative 2. Enter the name of initiative 3. Enter the name of initiative 4. Enter the name of initiative 5. Enter the name of initiative	1. Enter the name of initiative 2. Enter the name of initiative 3. Enter the name of initiative 4. Enter the name of initiative 5. Enter the name of initiative
Low	1. Enter the name of initiative 2. Enter the name of initiative 3. Enter the name of initiative 4. Enter the name of initiative 5. Enter the name of initiative	1. Enter the name of initiative 2. Enter the name of initiative 3. Enter the name of initiative 4. Enter the name of initiative 5. Enter the name of initiative
	High	**Low**
	Effort	

Source: own source

The availability of accurate and reliable data is essential for conducting comprehensive analyses of risks, maturity, competition, and environmental impacts. When applying the supply chain perspective and considering the product life cycle within it, data collection processes differ substantially from those based solely on a company's internal information. In such cases, data must be gathered across all tiers

and at every level of the supply chain. The intended information flow may encompass sensitive business data (e.g., supplier profit margins), which companies have a legitimate interest in protecting. Consequently, fostering effective collaboration and establishing strong partnership relationships is a critical prerequisite for the success of such analyses.

3.6 Development of a Business Case Study

Every project an organization undertakes should be clearly defined in terms of its goals for achieving the desired state of increased supply chain resilience. Some projects within companies are executed at a strategic level, while others are more spontaneous and based on perceived business opportunities. The proportion of each depends largely on the organizational culture and the values the company supports.

Table 3.13: Objective of the Business Case

Objective	Partial objective
The objective of the business case is to complete a thorough analysis of the potential project to facilitate the decision on whether to proceed with it. The business case is a differential analysis that compares the current state ("as-is") with the target state as the result of the project ("to-be").	Determine whether the project supports the overall business strategy. Identify the potential value and value drivers of the project. Define the costs and expected benefits of the project. Determine the time-distributed effect of net cash flow, return on investment (ROI), and the payback period of the project.

Source: own source

Nonetheless, it is important to recognize that some non-strategic projects may offer financial benefits, but they also burden organizational resources, tie up financial capital, and require human capital. If such projects align with the strategic directions and capabilities of the organization, they are certainly welcome. However, if they unintentionally increase exposure to risks and disruptions and negatively impact

resilience, it is worth reconsidering whether to proceed with implementation (see Table 3.13).

If the aforementioned dairy processing company identified an opportunity in the vegan cheese market, the project would likely make sense, as it would enhance their resilience, differentiation, supplier and segment diversification, and open access to new customers in a highly trending market. On the other hand, if they decided to develop a low-fat or fruit-flavored yogurt instead of the poorly selling current yogurt, it would be questionable whether that would be worthwhile. Similarly, the dairy company would not engage in selling cars, even if sales figures in 2022 were excellent, because it lacks the necessary expertise, information, and resources–and most importantly, such a venture is not aligned with its strategic direction.

Due to the scarcity and limited availability of resources–whether raw materials, energy, or human capital–companies are increasingly aware that the future well-being of both the organization and society as a whole depends on how successfully they address the challenges of sustainable development today. The economic component can no longer be separated from or in contradiction with the environmental and social components. Rather, through risk analysis, maturity assessments, and identification of priority areas, we can reduce potential harm and focus on business operations that yield the best outcomes environmentally, socially, and economically. As previously mentioned, interdisciplinarity requires strong cooperation throughout the entire supply chain. Transparency, flexibility, and readiness for change are the core characteristics of a resilient supply chain (SC).

4 Disruptions and Resilience in Supply Chains Today and Tomorrow

4.1 Disruptions in Supply Chains Will Become the New Reality – Building Resilient Chains Remains a Major Challenge

Disruptions are a specific combination of various factors in a rapidly changing period. There is no single answer as to what causes supply chain (SC) disruptions, as they are usually a mix of more (e.g., labor shortages, reduced availability due to lower production during COVID lockdowns) or less predictable factors (e.g., international conflicts, pandemics).

Recent reasons for disruptions include the following:

a) Much has been written about the job crisis, tourism, and hospitality industries during COVID, job losses, etc., but we often overlook that the situation is not one-dimensional—it is more about the stratification of the population. On one hand, a portion of the population did lose their jobs and income; on the other hand, a significant part accumulated substantial savings while working from home, with restaurants, tourist facilities, and stores closed. Their income remained the same or even increased, and they are now driving demand and spending more than before COVID. The pandemic also changed people's habits: in the past, we bought more business attire; now, we buy more sportswear—mostly online. We don't go to gyms, but we buy more fitness equipment. Hotels reduced capacity, and part of the workforce moved to other sectors, which means that the level of tourism demand we saw in 2022 and 2023 can unfortunately only be addressed by raised prices. The higher the demand, the higher the price of a product or service—this is basic economics. On the other hand, camping gear and motorhomes have seen unprecedented growth, indicating that demand has shifted even within tourism segments.

b) Manufacturing plants in Asia and Europe operated at reduced capacity from 2020 to 2022 due to decreased demand (in industries such as automotive, white goods, and textiles). This affected the entire SC, as orders for components and parts from manufacturers and suppliers decreased. Consequently, raw material orders also dropped, leading supply chains to function at reduced capacity. When demand returned (e.g., in the automotive industry during the second half of 2022 and the first half of 2023), the rebound was sharp. Given the known bullwhip effect in SCs, it's clear that such global shifts in production and consumption cannot be reversed overnight. In early 2021, companies were still complaining in February and March about tough conditions, low order volumes, reduced demand, and potential layoffs. Then a surge in demand hit, and within two to three months, these same companies couldn't keep up with orders. They increased their procurement of materials, raw inputs, and components. However, returning to the previous state is always more difficult than scaling down, which is financially painful, whereas scaling up presents organizational challenges. When demand returned, companies were cautious at first, didn't overstock, and underestimated planning and forecasting. This led to the so-called bullwhip effect—small fluctuations led to massive impacts at the end of the SC. That's why many companies are now rightly concerned about how to meet

demand given current uncertain supplies. Rapid adaptation and planning will become essential even for small and medium-sized enterprises.

c) Price is no longer the only key factor. In 2022, the most important thing was to ensure the delivery of the ordered goods. The importance of partnerships in SCs became evident. In some sectors, component prices changed daily. SC partners now realize that long-term purchasing relationships and cooperation matter more than short-term profit, and relationship-building doesn't happen overnight. Responsiveness and reliability are reflections of SC relationships. In 2023, with increased corporate caution and uncertainty about future business volumes, building resilient and responsive SCs is no longer optional. We have moved from a buyer-driven market to a supplier-driven one, and now we are returning to a more balanced reality where the buyer again plays a greater role—but now on a more cooperative, partnership-based level.

d) China better anticipated certain long-term risks and future business conditions. It secured raw materials and supplies at much lower prices during a period of low demand, while demand from the EU and U.S. was dormant. China made better use of strategic investments in rare materials, resources, and processing industries abroad (mainly in Africa), while the EU, despite criticizing the double standards of Chinese investments, has been inconsistent in its own investment approach in Africa. As a result, China secured a more resilient and reliable supply of key resources for transport, electrification, and the growth of electronic device production. There are also speculations that one of China's goals is to flex its economic muscle and position itself as the new leading global economy—even at its own (financial) expense. The same approach applies to Chinese internet giants (e.g., Baidu, Alibaba), which the Chinese Communist Party also regulates under "higher" goals. Resources that supply demand in the EU and U.S. are disrupted due to factory shutdowns, reduced output, and distribution bottlenecks, causing headaches for companies worldwide. A more diversified and geographically closer supplier base—even at slightly higher prices—can significantly reduce exposure to long-term disruptions, but only if it's part of a pre-planned strategy and not a panic-driven reaction when it's already too late.

4.2 Ports and Maritime Transport

Disruptions in ports—caused by halted production, followed by increased cargo volumes, labor shortages at ports, and high transportation costs—are not something that can be resolved overnight. Just clearing the backlog of delayed deliveries and orders at Chinese ports and shipping them onward to ports in, for example, the U.S. (with the most well-known case being the Port of Los Angeles, where there was usually one ship anchored, but now dozens of ships are waiting for days to unload) takes several months—even under optimal conditions. Practically all logistical resources are in short supply, from containers to trucks. On the other hand, shipping companies are reporting record profits, yet global freight rates and shipping volumes are already declining. In the meantime, the balance of power has shifted. A logistics service provider that a year ago would have been quickly replaced and held liable for contract penalties due to delays or unfulfilled orders, is now being politely asked to deliver goods at all—otherwise, production could halt (e.g., Audi).

Because of port delays, ships often opt to reroute to another port, which is mostly a matter of business optimization for shipping lines. But when multiple shippers (or vessels) make the same decision, it causes real chaos—some containers are unavailable, some end up in the wrong ports, and others are still on ships headed back to China. In such situations, further optimization of distribution via trucking becomes impossible, creating a domino effect. Chaos is also evident within the ports themselves. Where previously containers were often loaded directly onto trucks with a 3-day wait time, they now get moved two or even three times, manipulated, and wait up to 12 days for an available truck—consuming time, capacity, and delaying the much-needed return to normal operations.

4.3 Solutions on the Horizon

One of the solutions lies in rail transport, which is increasingly being invested in worldwide (in the EU, the Balkans, China), although logistics companies are not yet as accustomed to using it. To some extent, rail transport could, in the long term, provide part of the solution due to its reliability and more stable pricing. For example, in the U.S., certain previously closed rail terminals have already been reactivated.

Last year, much was said about localizing supply chains, finding alternative suppliers, and assessing supplier risk, but as conditions partially normalized this year, there's a risk that companies will too quickly forget these adjustments until the next disruption strikes. The reality is that some component and parts manufacturers no longer exist in Europe—they were moved eastward due to unprofitability, lower costs, and environmental concerns. Rebuilding such production capacity would take time (at least 2–3 years), higher prices compared to Chinese products, and bring new environmental burdens in the EU. This again raises questions: what will the situation be like in 2–3 years? Will demand remain high? Will such an investment pay off?

However, if we don't prepare now, we will be in the same position at the next disruption as we were last year. Even if we succeed in establishing replacement production and significantly shortening supply chains, the problem of material/raw material shortages remains. The cause of this lies not only in increased demand and supply chain disruptions but also in financial speculation and market manipulation. In Q2 and Q3 of 2020, capital flowed into financial markets, mainly stocks and ETFs. By the end of 2020, this momentum slowed, and capital moved into cryptocurrencies. When growth also stalled, the next refuge became raw materials—but not in the traditional form like gold, which is typically a crisis hedge.

Prices soared, some commodities fluctuated wildly (e.g., lumber rose by over 400%, then dropped 150%). Electricity prices surged and then, in summer 2023, we even saw extremely negative electricity prices for the first time. The same happened with natural gas in Croatia. Such volatility is enormous. The underpricing of raw materials over the last decade is one of the overlooked factors—we have driven constant demand growth over the same period, which is fundamentally unsustainable. Other contributing factors include global population growth, rising living standards, especially in developing countries, which means that raw material exporters are increasingly becoming importers themselves. For example, oil from South Africa. We're all fighting over the same limited resources.

The circular economy and bioeconomy are EU priorities not just for sustainability reasons but for pragmatic ones. The EU must focus even more on circularity, efficient material use, and transitioning to a bioeconomy. The reason isn't just the well-known push for sustainable development and EU leadership in fighting climate change, but also the practical limitation of resources and the region's vulnerability. The EU is not rich in strategic raw materials and has repeatedly been caught off

guard by shocks (e.g., the oil crisis in the 1970s, supply chain interruptions in the automotive industry after the Fukushima disaster, dependence on Russian gas...). We did not learn enough from those events. Building more resilient and adaptive supply chains, which will form the foundation of a reliable future supply, must therefore be based primarily on accessible resources and a diversified supplier network.

Notes

Adapted from (Obrecht, n. d.). Some tables and figures are adapted from lectures of Obrecht from slides which themselves were derived from insights based on Deloitte, BCG & McKinsey Consultants.

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