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SUPPLY CHAIN EVOLUTION

Navigating Trade-Offs in Supply Chains: Strategic Pathways towards Viability

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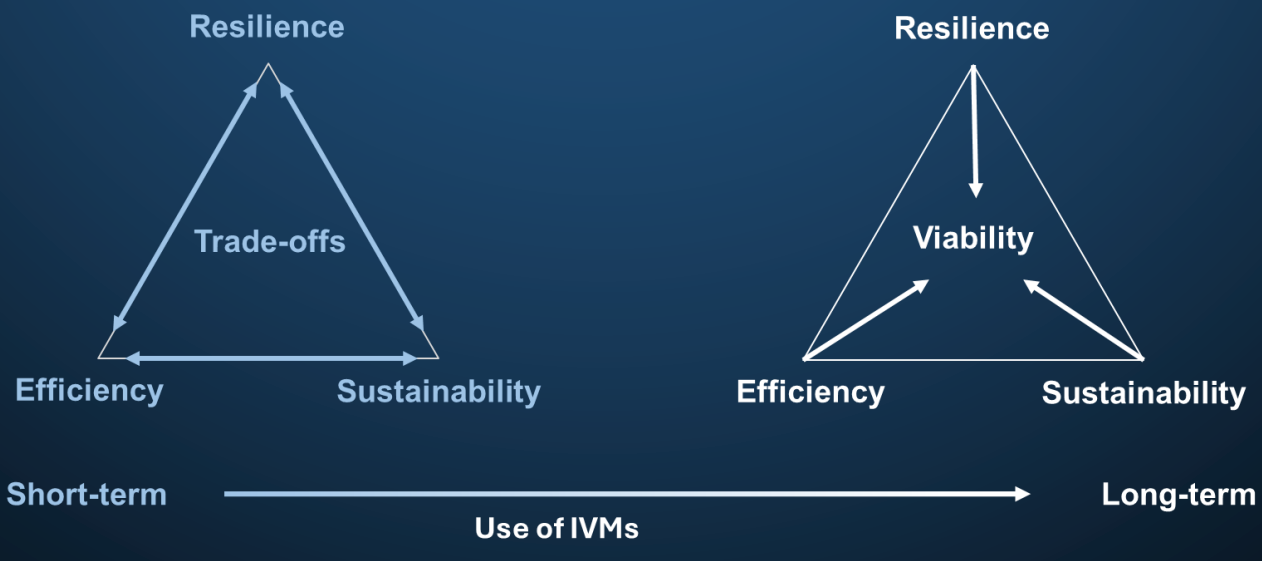
Executive Summary

Global supply chains are under increasing pressure. While efficiency dominated in the past, resilience and sustainability are now taking a central role, but often in conflict with costs. This is where the concept of supply chain viability (SCV) is useful, as it offers companies a way of balancing these three factors in an integrated manner.

This fourth report provides concrete recommendations. Based on a two-stage Delphi study involving 48 experienced supply chain experts and over 500 comments on 21 key trade-offs, strategy bundles were created. The result was six Integrated Viability Measures (IVMs): levers that can balance several trade-offs at once. Collaboration and ecosystem building; total cost optimization; risk analysis; inventory management strategies; supplier relationship management; and goal prioritization.

Another key finding is the discrepancy between public perception and operational reality with regard to sustainability. Although society demands sustainability, consumers and companies are reluctant to accept additional costs. A genuine transformation therefore requires an environment that incentivizes and innovates to make sustainability economically viable.

The strategies in the report provide practical guidance for decision-makers, showing companies how to manage conflicting goals for long-term competitiveness and viability.



Towards Practical Solutions for SCV

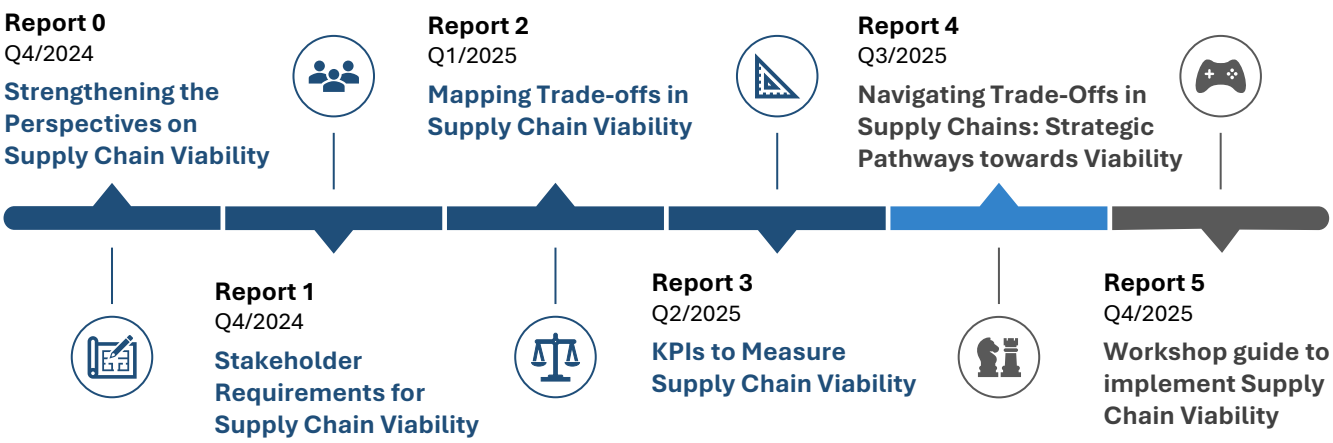
Supply chain networks are intertwined in complex and constantly changing supply systems and markets. At the same time, globalization is making both demand and supply much more vulnerable to risk. This was especially clear during the COVID-pandemic. Prior to the pandemic, companies focused on cost-efficiency improvements. During and after the pandemic, however, the concept of resilience became much more important: Companies need to be able to maintain their operations during times of crisis as well as in normal times.

Moreover, sustainability is now a key priority for many companies, with an increasing number of multinationals committing to working with suppliers that meet social and environmental standards. For small and medium-sized enterprises, becoming ecologically and socially sustainable is also vital if they want to stay competitive and survive in the long term.

As a response, the concept of Supply Chain Viability has been introduced to find the optimal balance between the three intertwined and sometimes conflicting targets of efficiency, resilience and sustainability. As part of our research project, we are developing practical SCV guidelines for companies.

While our previous reports (Reports 0 to 3) focused on analyzing the status quo and identifying trade-offs between efficiency, resilience and sustainability**, this report 4 presents concrete measures that companies can use to balance these trade-offs**. Please find all the previous and published reports on our project website (www.sc-evolution.ch). We hope you enjoy reading this report!

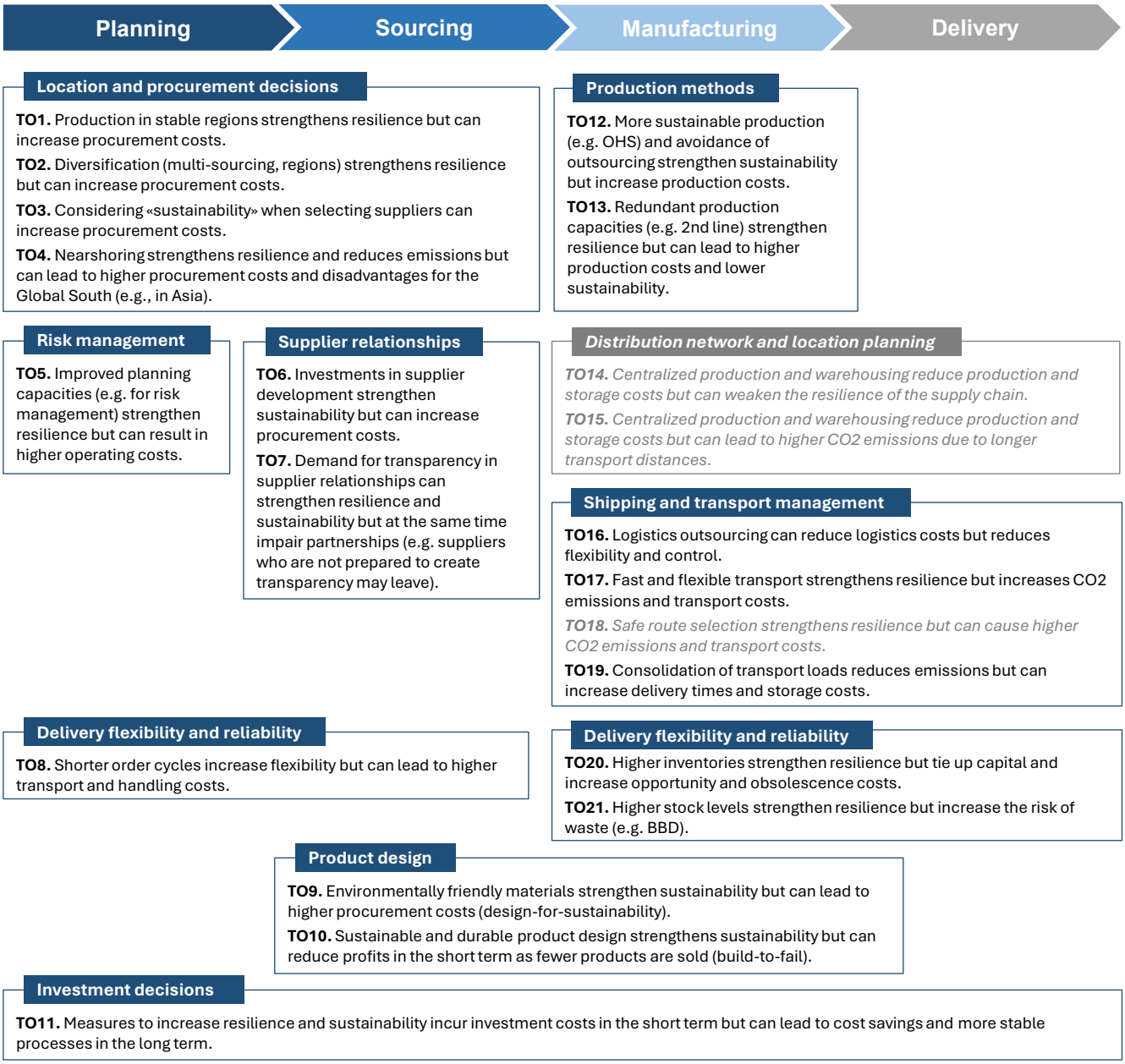
Figure 1
Roadmap of the report series



Review of our Trade-off Map

This study is based on the SCV trade-off map in Report 2. All trade-offs were reported as relevant, except TO14, TO15 and TO18, which were excluded from the Delphi study. Furthermore, the results show that TO1 and TO2 were the most important, with over 83% of participants reporting on each of them. TO20 followed with over 73%. Notably, none of the top trade-offs are directly linked to sustainability. Nine of the ten most relevant trade-offs are associated with efficiency and eight with resilience.

Figure 2
Trade-off Map for Supply Chain Viability



Research Methodology

As little research is available on this topic, we conducted a two-stage Delphi study to develop concrete strategies for managing SCV trade-offs. The study was guided by the following research question: “What strategies should companies implement to optimize the trade-offs between efficiency, resilience and sustainability within their supply chain, thus ensuring its viability?”

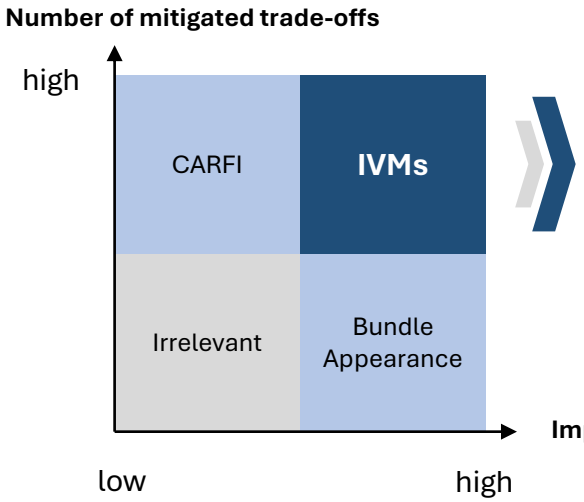
48 industry experts with an average of 18+ years' experience in supply chain management were surveyed. They commented on 21 trade-offs, providing 500+ comments and real-life examples. This feedback was evaluated and condensed into concrete measures for each trade-off. The three most frequently mentioned measures were combined into a "strategy bundle".

From Strategy Bundles to Integrated Viability Measures (IVMs)

In a second round, the experts evaluated the 64 strategies in terms of their relevance and impact. Two criteria were used for the analysis: First, the CARFI indicator, which shows how often a measure was mentioned by the experts (relative importance). The second was the bundle appearance, which measures the strength of a measure's impact across various trade-offs.

Combining these two criteria enabled us to prioritize the measures. The analysis resulted in six Integrated Viability Measures (IVMs). IVMs are cross-cutting levers that address a large number of conflicting goals simultaneously, making them the most effective way to ensure supply chain viability.

Figure 3
IVMs impact on SCV trade-offs



Integrated Viability Measures (IVMs) are strategic measures that address multiple conflicting goals within the supply chain simultaneously. Instead of considering individual measures in isolation, IVMs take an integrated approach to optimize (le)agility, resilience and sustainability.

Strategy Bundles per Trade-off

The following pages present the strategy bundles that have been identified for each trade-off. We also provide a brief, bullet-point description of each bundle to illustrate the types of strategy that could be considered. In total, we identified 24 strategy bundles to help balance and partially solve trade-offs. Based on the frequency with which the strategy bundles appeared, we later identified the six most important bundles, which we call “Integrated Viability Measures”. These are described in more detail at the end of this report.

TO1. Production in stable regions strengthens resilience but can increase procurement costs

Multi-Sourcing

- Resources from multiple sources and regions to reduce dependencies
- Competition between suppliers to lowers costs
- Mostly stable regions for security, some unstable for cost reasons

Collaboration & Ecosystem Building

- Long-term, strategic partnerships with suppliers to stabilize supply chain
- Shared ecosystems to reduce risks in unstable regions
- Stable contracts to create long-term cost advantages

Risk Analysis

- Multi-sourcing is complex, creates new dependencies
- Systematic risk analysis to select regions/suppliers
- Modern forecasting/analysis methods (data, AI) for decision-making

TO2. Diversification strengthens resilience but can increase procurement costs

Multi-Sourcing

- Reducing dependencies by sourcing from multiple suppliers and regions.
- Essential to avoid delivery failures; considered a “no alternative” strategy
- Tenders/Supplier scorecards to increase medium-term negotiation power

Risk Analysis

- Probability of delivery failures and their impact on production
- Analyzation of costs of lost sales to optimize TCO
- Balancing procurement costs against risk exposure

Collaboration & Ecosystem Building

- Flexible and stable contracts
- Backup supplier agreements for continuity if primary suppliers fail
- Cross-company networks to reduce costs through volume pooling
- Avoiding unintended cartel formation

TO3. Considering "sustainability" when selecting suppliers can increase procurement costs

Supplier Relationship Management

- Sustainability standards to ensure transparency across network
- Supporting suppliers in adopting sustainable practices
- High initial costs, but can generate long-term synergies

TO4. Nearshoring strengthens resilience and reduces emissions but can lead to higher procurement costs and disadvantages for the Global South (e.g., in Asia)

Risk Analysis

- Importing from distant regions depends on reliable routes
- Mostly, routes are difficult to plan & vulnerable to disruptions
- Nearshoring reduces such risks significantly

Total Cost Optimization (TCO)

- Operationalize criteria (e.g., flexibility), include in cost analysis
- Low-cost production does not always lead to low-cost products
- Simplified inventory processes can save time and money

TO5. Improved planning capacities (e.g., for risk management) strengthen resilience but can result in higher operating costs

Risk Analysis

- Risk management with dedicated units and supplier risk assessments
- Integrate risk management as a strategic advantage for competitiveness

Continuous Planning Optimization

- Increase productivity through better use of machines and personnel
- Apply data, pattern recognition, and AI to improve planning accuracy
- Collaborate with suppliers on annual demand estimates (minimum purchase commitments)
- Re-qualify redundant planners for other tasks in the supply chain

Inventory Management Strategies

- Hold sensible safety stocks of raw materials and reserves
- Combine JIT planning with buffers (with demand forecasting & IT tools)
- Cross-departmental cooperation to align inventory strategies

TO6. Investments in supplier development strengthen sustainability but can increase procurement costs

Supplier Relationship Management

- Focus efforts on key suppliers
- E.g., financial support, quality improvements, process innovations
- Controlled investment in long-term, strategic suppliers
- Internal controls for efficiency, keep supplier entrepreneurial freedom
- Development is often more effective than establishing new suppliers

Total Cost Optimization (TCO)

- Supplier development reduces long-term procurement costs
- Reliable supplier lower complaint rates & enhance customer satisfaction
- Reduced administrative/transport costs offset medium-term increases
- Productivity gains balance out initial higher investments

Collaboration & Ecosystem Building

- Build partnerships and strategic alliances for co-design with suppliers
- Covering delays or financial risks stabilizes long-term partnerships
- Requires upfront investment in personnel and systems
- Long-term: Fewer disruptions, less need for costly emergency transports

TO7. Demand for transparency in supplier relationships can strengthen resilience and sustainability but impair partnerships

Collaboration & Ecosystem Building

- Long-term partnerships, clear contracts, and participative approaches increase willingness to share information
- Stable contracts and standardized, people-independent processes are essential to ensure continuity of transparency efforts

Transparency among Stakeholders

- Transparency is critical for sustainable economic development
- Facilitates passing audits
- Address also employees' need for purpose/meaning
- Define shared transparency goals to create win-win situations
- Carefully manage supplier concerns about losing competitive advantages

Supplier Relationship Management

- Making transparency a core criteria in supplier selection and evaluation
- Reward transparent suppliers with increased order volumes
- If necessary, replace suppliers unwilling to meet transparency standards

TO8. Shorter order cycles increase flexibility but can lead to higher transport and handling costs

Total Cost Optimization (TCO)

- Balance transportation, inventory, and order quantities
- Use full truckloads, batch optimization, and pallet size alignment
- Longer cycles and reduced bureaucracy can minimize process costs
- Evaluate stockholding, transport costs, and pricing benefits

Collaboration & Ecosystem Building

- Process management, realistic timelines, and KPI monitoring
- Increase resilience with dual sourcing, consignment stock, and close coordination with distribution partners
- Lower costs through cross-company transport and warehousing alliances, bundling effects with suppliers, and long-term freight contracts
- Achieve economies of scale while maintaining shared strategic goals

TO9. Environmentally friendly materials strengthen sustainability but can lead to higher procurement costs (design-for-sustainability)

Price Compromises & Behavioral Shift

- Communicate clear benefits to consumers
- Test consumer willingness to pay more with smaller product launches

Corporate Social Responsibility

- Sustainable solutions can contribute to corporate culture
- Rooting sustainability at the executive level
- Increased reputation/stakeholder trust through CSR initiatives

TO10. Sustainable and durable product design strengthens sustainability but can reduce profits in the short term as fewer products are sold (build-to-fail)

Consumer Information & Transparency

- Position sustainability and durability as key selling points
- Show consumers how values align with company's philosophy
- Sustainability and durability = premium attribute

Corporate Social Responsibility

- Embed durability in a holistic approach with a clear purpose
- Adapt strategy to brand positioning and market context, where longevity can become a unique differentiator

TO11. Measures to increase resilience and sustainability incur investment costs in the short term but can lead to cost savings and more stable processes in the long term

Financing and Budgeting

- ROI calculations, separating one-time investments from ongoing costs
- Cash flow analysis & KPI improvement to track progress over time
- Quantifying long-term costs of not investing in resilience & sustainability
- Mitigate short-term burdens through smart budgeting

Risk Analysis

- Prioritize risks by estimating potential loss probability (mitigation costs)
- Direct investments toward sustainable solutions (e.g., electric trucks, eco-friendly shipping) that align with regulations and long-term goals
- Develop, test, & update emergency plans
- Start with small-scale initiatives to prove feasibility and build momentum

Goal Prioritization

- Build business cases for investments, focus on long-term benefits

TO13. Redundant production capacities strengthen resilience but can lead to higher production costs and lower sustainability

Flexibility

- Redundant capacity should be designed to support multiple products
- Adaptable machinery and flexible workforce management
- Dual sourcing to improve workforce planning and responsiveness

Goal Prioritization

- Maintain sufficient capacity to prevent customer loss
- Define a clear strategic focus (growth, cost optimization, or stability)
- Align all production and investment decisions with this strategy

Efficiency Improvements

- Higher efficiency in overall production = higher production during crisis
- Connect production lines
- Optimize use of raw materials, energy, water, and heat

TO14. Centralized production and warehousing reduce production and storage costs but can weaken the supply chain's resilience

Nearshoring

- Local-for-local principles to cut transport costs, shorten lead times
- Regional hubs close to demand areas, suppliers, and logistics partners
- Mitigating risks tied to long global routes

Decentralization

- Find a balance between centralization and diversification
- Distribute inventory across regional providers to lower supply bottlenecks and dependency on single sites

Multi-Sourcing

- Support decentralization by diversifying supplier reliance
- Implement dual sourcing for critical products to enable fast ramp-up

TO16. Logistics outsourcing can reduce logistics costs but reduce flexibility and control

Collaboration & Ecosystem Building

- Build a strong logistics network through stable contracts and clear SOPs
- Build capable procurement organization to manage providers effectively
- Diverse portfolio of logistics partners to prepare for potential disruptions

Supplier Relationship Management

- Strengthen control via long-term, cooperative relationships
- Back relationships with open-book agreements, shared values, and KPIs
- Assess providers' competence and cost structures

Internal Structure and Responsibilities

- Apply Shopfloor Management and KPI tracking for transparency
- Base in- vs. outsourcing decisions on thorough analysis (human capital)
- In-source if you can achieve better cost, quality, or speed internally

TO17. Fast and flexible transport strengthens resilience but increases CO2 emissions and transport costs

Goal Prioritization

- Align transport strategies with customer needs
- Identify where customers value flexibility and speed to pay for it
- Flexible transport can be expensive but essential for competitiveness

Order Consolidation

- Group shipments and fixed routes to optimize volume and resources
- Educate teams that faster shipping is not always better (efforts/costs)

Continuous Planning Optimization

- Shift focus from pure speed to smarter planning & resource consolidation
- Collaborate with customers and suppliers to clarify priorities
- Maximize load factors for resilience and sustainability

TO19. Consolidation of transport loads reduces emissions but can increase delivery times and storage costs

Goal Prioritization

- Balance priorities and risks when deciding on consolidation
- Consolidated loads reduce costs/emissions but may cause delays
- Additional direct deliveries in urgent cases

Integrative/Conscious Decision-Making

- Consider all aspects and engage stakeholders in the planning process
- Conscious, transparent decisions
- Calculating feasible options for each customer

Long-Term Planning

- Early scheduling, clear communication
- Define which deliveries go directly to sites, which to consolidation points
- Secure long-term service contracts
- Negotiate payment terms to offset potential disadvantages

TO20. Higher inventories strengthen resilience but tie up capital and increase opportunity and obsolescence costs

Inventory Management Strategies

- Stocks must serve a defined purpose (no unnecessary accumulation)
- Maintain min. levels with automatic reorders triggered by thresholds
- Use USL and LSL based on demand data to balance shortages & excess

Data Analytics

- Inventory cost KPIs to detect forgotten stock or redundant reorders
- IT solutions to dynamically adjust USL and LSL
- Support decisions with quantitative stock analyses

Total Cost Optimization (TCO)

- Extend product shelf life to offset higher inventories
- Avoid a purely balance-sheet-driven reduction of stock, which often creates hidden costs (downtime, special freight, alternative sourcing)

TO21. Higher stock levels strengthen resilience but increase the risk of waste

Circular Economy & Waste Management

- Develop sales strategies before products approach expiration date
- Use recycling partners for items with short or slightly exceeded shelf life
- Track expiration dates and batches in master data

Inventory Management Strategies

- Store stock where risk of expiration is low
- Apply product lifecycle management between customers and suppliers
- Include agreed stock levels and take-back guarantees
- Use late differentiation (e.g., JIT material configuration) to reduce waste

Supply Chain Forecasting

- Apply frozen zones (fixed scheduling periods) to enhance accuracy
- Establish Centers of Competence for demand forecasting
- Combine leftover management processes with strong forecasting

Integrated Viability Measures (IVMs)

Based on the CARFI value of the derived strategy bundles, six integrated viability measures (IVMs) were created. While IVMs sometimes have only a relatively minor influence on a single trade-off, they can have a positive impact on a wide range of trade-offs. For this reason, they are considered the most effective measures for achieving supply chain viability. Below, we describe the six IVMs.

1. Collaboration and Ecosystem Building

Strong partnerships are one of the most effective ways to improve supply chain resilience. Close collaboration with suppliers, customers, and other stakeholders increases flexibility, reduces transaction and switching costs, and provides backup options in times of disruption. Furthermore, building long-term relationships creates stability and enables both parties to plan more effectively.

Above all, collaboration involves sharing timely and transparent information. This builds trust, which is essentially an investment that leads to fairer profit distribution, higher product quality and greater competitiveness. In practice, this involves shifting the focus from purely transactional relationships to building loyal networks that can adapt quickly, innovate together, and withstand crises.

2. Total Cost Optimization (TCO)

Cost remains a key consideration in supply chains. However, it is important to consider this not only in the short term, but also across the entire network. Eliminating bureaucracy improves efficiency and creates financial flexibility for investments in resilience and sustainability. A comprehensive cost analysis (TCO) reveals that measures to increase resilience and sustainability often lead to hidden savings, including a lower risk of failure, more stable supply flows, lower energy costs, and reduced losses due to disruptions.

Taking these effects into account makes it clear that investments in resilience and sustainability reduce costs and create value in the long term. In practice, TCO involves managing costs in such a way that resources are freed up and competitiveness increases sustainably rather than simply cutting costs.

3. Risk Analysis

Supply chains face many risks, ranging from shortages of supplies and fluctuations in demand to geopolitical shocks and climate events. The first step towards making better decisions is identifying and assessing these risks. By estimating the likelihood and potential impact of different scenarios, companies can develop mitigation strategies, calculate potential costs and design effective contingency plans.

Risk analysis also means learning from past disruptions and anticipating future challenges. It is clear, therefore, that investments in resilience and sustainability are protective measures for long-term performance, not only costs. Practical measures include redesigning supply chain structures, adding buffers and redundancies, and developing alternative sourcing options.

As outlined in the second IVM, a collaborative approach is the most effective: when partners share information and align their risk strategies, the entire supply chain becomes more resilient and adaptable.

4. Inventory Management Strategies

Inventory can be a powerful tool. Having too much stock can tie up capital, increase storage costs and cause waste. Having too little stock, however, increases the risk of shortages, lost sales and dissatisfied customers. The goal is to strike the right balance, hence optimize the inventory strategy.

Different strategies can be applied depending on the context. Vendor Managed Inventory (VMI) shifts responsibility to suppliers; Just-in-Time (JIT) reduces holding costs through precise timing; and safety stock thresholds (upper and lower limits) create buffers against uncertainty. The most appropriate approach depends on factors such as demand volatility, product criticality and supplier reliability.

Thanks to modern data analytics and digital solutions, it is now possible to manage inventories far more dynamically. Tools such as predictive analytics, demand sensing and real-time monitoring enable companies to continuously adjust stock levels, reduce waste and respond more quickly to disruptions.

In practice, effective inventory management means treating stock not only as a cost factor but also as a strategic resource that can improve efficiency, resilience, and sustainability all at once.

5. Supplier Relationship Management (SRM)

Strong supplier relationships are a strategic asset. As supply chains evolve into interconnected networks, the management of suppliers has shifted from being a transactional purchasing activity to becoming a core strategic function.

Supplier Relationship Management (SRM) involves planning and managing all interactions with suppliers in a structured way in order to create long-term value. Transparent, trust-based relationships improve reliability, reduce risk and facilitate the implementation of joint strategies to enhance efficiency, resilience and sustainability.

Effective management of supplier partnerships can drive innovation, improve product quality and create fairer cost and profit structures across the network. Companies that actively invest in supplier relationship management (SRM) benefit from a more stable supply, faster problem-solving and greater competitiveness in global markets.

6. Goal Prioritization

Supply chains are constantly faced with conflicting objectives, such as cutting costs, increasing resilience and meeting sustainability targets. Without clear priorities, daily decisions may pull in different directions.

Setting goals involves establishing a strategic direction that reflects the company’s business model, stakeholder expectations and market environment. No matter whether the focus is on growth, cost leadership, stability or sustainability, these choices must be clearly defined and consistently communicated.

Having clear priorities helps to align sourcing, production and logistics decisions across the organization. They also ensure that trade-offs are made consciously rather than by chance. Integrating these priorities into the company's culture and governance makes them actionable in every decision, from supplier selection to network design.

Conclusion

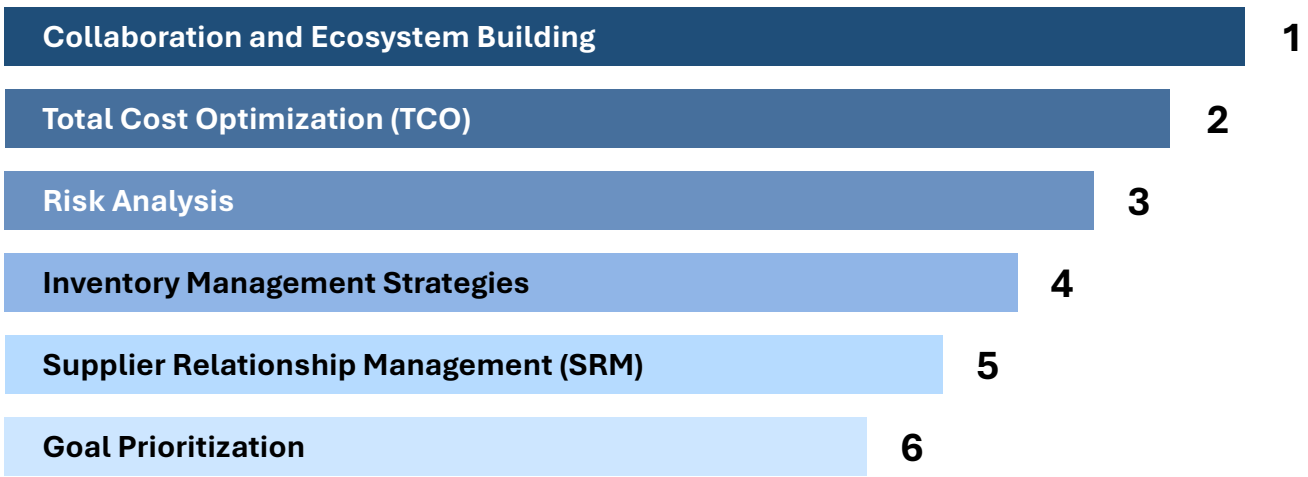
This study is one of the key outcomes of our Innosuisse project. In essence, this report is therefore a “guide to supply chain viability” for decision-makers and answers to the question of how trade-offs can be resolved.

The core of the report consists of strategy bundles for each trade-off, which were developed using the two-stage Delphi study. In addition to the strategy bundles, several other findings emerged. One important finding is the list of six IVMs that can be described as the most relevant practical concepts overall. When choosing where to allocate resources, these IVMs should be prioritized in the order shown in Figure 4.

Another finding is the significant discrepancy between public perception and practical reality regarding sustainability. Although society demands sustainability, practice shows that additional costs are hardly accepted. Consequently, sustainability considerations often take a back seat to efficiency and resilience considerations.

For the further development of SCV, it is essential to create framework conditions and innovation environments that allow sustainability to be embedded more firmly in real economic decisions. Only when incentive systems and structures actively support this integration can perception and reality be aligned, and the three dimensions of efficiency, resilience and sustainability be reconciled for long-term viability.

Figure 4
IVMs visualized by relevance



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