

# The ResC4EU Digital Framework for Risk and Resilience Evaluation for European SMEs

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## About the ResC4EU Project

ResC4EU – Resilient Supply Chains for Europe is a European initiative designed to strengthen the resilience, sustainability and adaptability of industrial supply chains across Europe. The project responds to a strategic challenge faced by many European companies, particularly SMEs: supply chains are increasingly exposed to disruptions caused by geopolitical tensions, natural disasters, transport bottlenecks, pandemics, market volatility and structural dependencies. Against this background, ResC4EU supports companies in moving from reactive crisis management towards a more systematic, data-informed and technology-enabled approach to risk anticipation, resilience building and sustainable transformation.

The project combines collaboration, digital tools, training and cross-sector matchmaking to help SMEs better understand their supply chain vulnerabilities and identify practical pathways for improvement. A core element of the approach is the development of models and tools that support the detection and anticipation of disruptions, complemented by tailored support and training activities delivered through the ResC4EU consortium. In addition, ResC4EU brings manufacturing SMEs together with technology-oriented solution providers, thereby promoting the uptake of advanced technologies and fostering new forms of cooperation across European industrial ecosystems.

Within this wider project context, the ResC4EU Digital Framework for Risk and Resilience Evaluation provides an integrated analytical basis for assessing supply chain resilience, multimodal disruption risks and environmental impacts. It links three complementary perspectives: a Supply Chain Resilience Self-Assessment Tool, a Multimodal Risk Alert Tool and a Global Warming Potential Tool. Together, these components enable companies and support organizations to evaluate resilience not only as an operational necessity, but also as a strategic contribution to competitiveness, sustainability and Europe's long-term industrial robustness.

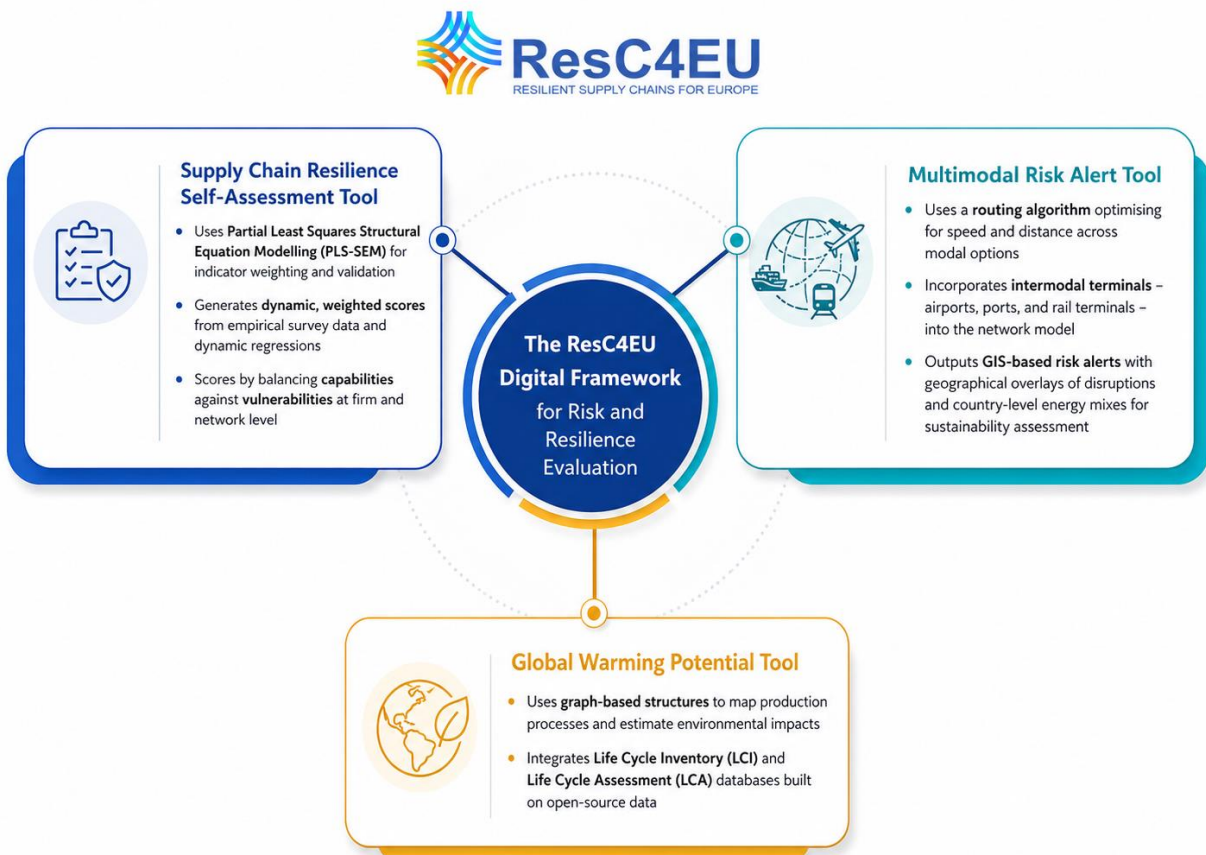
## Why Resilience Tools Matter in Multimodal Logistics and SME Supply Chains

European Small and Medium sized enterprises (SMEs) operate in supply chain ecosystems shaped by relentless geopolitical, environmental, and regulatory pressures. Multimodal logistics- spanning road, rail, maritime, and inland waterways - magnifies these risks, where a disruption in one transport mode often cascades throughout the network. These disruptions have underscored the vulnerability of global supply chains and the critical need for transport and supply chain resilience for businesses. However, companies well on their sustainability goals, also increasingly face what can be termed as the resilience paradox when maneuvering the disruptions. The Supply Chain Resilience Paradox is an empirical phenomenon in global supply chains, experienced by companies during crises characterized by high environmental uncertainty. It captures the tension between two interdependent yet competing goals, namely: economic resilience, which prioritizes cost efficiency and operational continuity, and social-ecological resilience, which seeks to enhance societal well-being and ecological sustainability. The problem is exacerbated for that lack resources for capability development.

Open-source, Public, or Nonprofit digital supply chain platforms, which can aid in the resilience self-assessment and disruption mitigation, can present a robust solution but are yet to be empirically developed and tried in different industrial settings. Thus in this presentation, we discuss the development of our innovative data driven digital framework under ResC4EU initiative.

## The Methodological Gaps and the ResC4EU Digital Framework

Conventional risk management tools [3] [4] [5] relying on historical data or enterprise-level IT infrastructures often exclude SMEs by design. Existing self-assessment tools and platforms for supply chain resilience predominantly relies on static models that fail to adapt to dynamic risks, leading to a false sense of security. Resilience is now about more than operational and behavioral continuity - it must integrate emissions accountability, sustainability targets, and regulatory reporting under frameworks like the EU Green Deal [2]. There remains a critical gap in platform-based approaches that provide real-time alerts when resilience thresholds are breached.



Recognizing these realities, ResC4EU developed a tailored, data-driven framework based on three interconnected digital tools specifically for SME supply chains embedded in multimodal logistics networks [1]:

- A Supply chain Resilience Self-Assessment tool, which is a diagnostic instrument designed to benchmark organizational resilience.
- A Multimodal Transport Risk Alert tool that is based on providing real-time alerts on multimodal transportation disruptions.
- A Global Warming Potential (GWP) Assessment tool calculating emissions footprints of supply chain and logistics operations

## Outcome of our Framework

The Resilience Self-Assessment tool assigns weighted resilience scores, matching vulnerabilities with capabilities to help SMEs prioritize investments in supplier and production flexibility, supplier diversification, and risk mitigation. It enables SMEs and industry stakeholders to evaluate their capacity to withstand disruptions by (a) providing a comparative resilience score, (b) identifying critical vulnerabilities and existing capabilities, and (c) aligning the right capabilities with organizational gaps. It is based on self-assessment perceptual input data based on responses on organizational vulnerability and capability parameters from the users (representatives from the various SMEs) and some of the company metadata (anonymized). The tool users feel that capabilities like visibility and collaboration enhance situational awareness, while adaptability enables firms to respond effectively to disruptions. This interpretative logic allows organizations to identify specific areas of strength and weakness, providing a foundation for tailored resilience strategies.

The Risk Alert tool dynamically identifies and mitigates potential risks in multimodal logistics networks by leveraging Geographic Information System (GIS) data for real-time risk assessment and optimized routing. It enhances supply chain resilience by delivering proactive alerts and actionable mitigation strategies to stakeholders. By integrating user-provided network-level data on transportation nodes with real-time risk event data across multimodal routes, the system generates timely alerts to support informed decision-making.

Finally, the GWP assessment is able to identify emission hotspots, comparing supply chain configurations and transport routes based on Global Warming Potential (GWP)

scores, and optimizing emissions calculations using structured input systems and open-source country-specific and process-specific data from different layers of players within an organization. The process-based GWP approach calculates emissions by linking a supply chain node to a specific production process and using a predefined emission factor from a database. Users need to select the product, enter its mass (kg), and specify key process details such as process type, production process, country, energy source, and technology. Based on these inputs, the system automatically matches an emission factor and calculates the GWP.

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