1 EXECUTIVE SUMMARY

As part of the tasks completed in Work Package 2 (WP2) of the ReSChape project, the consortium identified the major trends and challenges that global supply chains are. These shifts have been classified across six dimensions: political and economic (new geopolitical order, friendshorting – moving of production lines to countries considered friends and allies - and reshoring, global trade shifts, deglobalisation), legal and environmental (climate change, environmental regulations, resource scarcity), and technological and social (demographic change, urbanisation, rapid technological advancement and AI). These changes are vast and complex and have major implications for the world economy, the European Union and its member states.

In this deliverable, our aim is to analyse and quantify the macroeconomic effects of these changes as they impact key socio-economic variables like GDP and employment. Disruptions, whether caused by geopolitical tensions, pandemics, or natural disasters, can lead to shortages, price volatility, and production delays, ultimately affecting consumer spending and business investment. Furthermore, understanding these effects allows policymakers to anticipate potential economic shocks, design effective mitigation strategies, and adjust monetary and fiscal policies accordingly. In an increasingly interconnected world, the stability of global supply chains is essential for maintaining economic resilience and fostering sustainable growth.

Our approach to this complex task is to consider specific scenarios which overarch across the identified dimensions and cover key events, major trends, and important European policies and legislature. These scenarios have been formulated with the Consortium during the Model Design phase of this Task. More specifically we consider the macroeconomic effects of the following six scenarios from a supply chain perspective. The geopolitical fragmentation and the war in Ukraine, the effects from the European Chips act and economic scarcity, the competition in the technological advancement, demographic change, the Green Transition and more specifically the Carbon Border Adjustment Mechanism (CBAM) as well as the Corporate Social Due Diligence Directive (CSDDD).

In order to quantify the macroeconomic costs, we consider a multi-country multi-sector general equilibrium model with production networks. We can account for up to 64 countries and 45 economic sectors. To present our findings in a more concise manner we organize the 45 economic sectors into 14 ecosystems, following a classification of the European Commission. This approach makes our work coherent with other work packages from the ReSChape project. Thus, we are able to capture the effects across the global supply chains and correctly account for substitution effects across sectors and countries. More importantly, we are able to assess how the changes propagate along the supply chains and therefore quantify the aggregate and sectoral effects on the socio-economic variables while considering the heterogeneous supply chain structures of the countries.

We model the trends in SC as permanent shocks to the economy – a permanent change in the key economic variables. Each scenario is associated with a set of shocks that translate the identified trends that translate the SC change into model terms. For example, the Russian invasion in Ukraine led to a large negative supply shock and correspondingly positive price shock to a variety of goods that were exported from Russia and Ukraine, predominantly in the Energy and Agriculture sectors. In Table 1-1 and Table 1-2 we present an overview of each scenario and how it is modelled in the large multi-country multi-sector general equilibrium model.

In our analysis we find the following key results: While all scenarios analysed incur some economic costs, these costs are very heterogeneous across countries with some countries are more often affected than others, especially the larger EU member states that also have higher exposure to international supply chains due to their larger economies and higher international interconnectedness. Moreover, we find amplification effects across the supply chains. In the classical view in economics, sectoral effects are supposed to cancel out in the aggregate. However, we find that supply chain shifts in individual sectors not only propagate across the global supply chain but also get amplified and become a bigger concern in the aggregate. From all scenarios analysed we find that demographic change is economically the most impactful.

	Shocks	Country groupings	Macroeconomic effects	Ecosystem effects
Scenario 1. Geopolitical fragmentation and the war in Ukraine	- Price increase in the Agri-food and Energy intensive Ecosystems - Productivity decrease in the energy-intensive Ecosystems.	- 15 European Union countries individually. Ordered by GDP share, down to Greece representing 95% of EU Output. - Russia - Rest of the world: remaining 49 countries grouped.	- Heterogenous negative effects on Output (between 0% and 0.7%) and stronger negative effects on the labour markets.	- Energy intensive ecosystem strongly affected, losses down to 7%, particularly in Italy, Germany, Finland and France.
Scenario 2: The European Chips act and economic scarcity.	- Positive trade cost shock in scarce critical raw materials and other rare-earth elements needed for the production of digital integrated circuits (processor chips).	- 15 European Union countries individually. Ordered by GDP share down to Greece representing 95% of EU Output. - Australia, Chile, China, South Korea, Taiwan - Rest of the world: remaining countries grouped	- Negative effects on Output in the European Union and positive effects for the producers of rare-earth elements amounting to up to 0.5%-points (Spain) with a total cost of 1.8 billion euros without accounting for the necessary costs of establishing production lines. - Similar effects in the labour market.	- Largest negative effects in the electronics ecosystems as inputs' prices increase. Positive effects for the countries which have endowments of critical raw materials as their prices increase.
Scenario 3: Competition in the technological advancement	- Positive productivity changes in the Digital and Electronics ecosystem, where the changes in the US are larger than Europe reflecting the faster advancement in the digital sector abroad.	- 15 European Union countries individually. Ordered by GDP share, down to Greece representing 95% of EU Output. - United States - Rest of the world: remaining 49 countries grouped	- Strong amplification of these ecosystem shocks across the SC resulting in almost as equal effects on Output and Labour growth as a whole. - All EU member states countries grow markedly slower than the US (i.e. get left behind). - Effects on the labour market are less heterogenous between the US and Europe due to their different structures.	- Outflow of capital and human capital from the Electronics ecosystem as investments and the best minds go to the more profitable US electronics ecosystem.

Table 1-1: Overview of the simulations of the macroeconomic effects in this deliverable, scenarios one to three.

	Shocks	Country groupings	Macroeconomic effects	Ecosystem effects
Scenario 4: Demographic change	- Productivity change in all ecosystems, calibrated according to the demographic structure of each country and economic sector.	- 15 European Union countries individually. Ordered by GDP share, down to Greece representing 95% of EU Output. - United Kingdom - Rest of the world: remaining countries grouped.	- Large negative effects in both Output and Labour, particularly in Germany, Italy, Spain, and Greece, where the population structure leans more towards elderly people. - Largest effects from all scenarios (up to 2%-points of GDP)	- Strong amplification effects across the SC and all ecosystems – as productivity in an ecosystem declines it triggers negative effects downstream as production times increase.
Scenario 5: Green Transition and the Carbon Border Adjustment Mechanism	- Trade cost shock (akin to an import tariff) on CO2 intensive goods coming into the European Union, calibrated with an estimated the CO2 volume of the goods.	- 32 countries – major CO2 intensive goods producers from North and Latin America, Africa, Asia and the Middle East. - 13 large importers in the EU (representing around 85% of EU GDP)	- Very heterogenous effects across countries with member states that don't have strong domestic industry affected disproportionately of up to 5-7 times more. - Aggregate effects estimated around 0.05% of GDP for the CO2 intensive industries.	- The domestic CBAM sectors (steel, fertilizer, aluminium and cement industries) benefits as it works as a protectionist measure – it becomes more competitive as prices of importers rise. - Ecosystems that take CBAM goods as an input suffer, particularly the Energy and the Energy intensive ecosystems.
Scenario 6: The Corporate Sustainability Due Diligence Directive.	- Price increase for imports in the textile ecosystem, which is used as a case study. The price shock is formulated under the assumption that companies invest in their supply chains to make them CSDD conform increasing production costs abroad.	- - 12 EU countries with the large textile industries (representing around 83% of EU GDP) - The top 6 major outsourcing destination for textile production: China, India, Indonesia, Turkey, Taiwan, South Africa	- Uses the textile industry as a case study to highlight the complexity of the mechanisms through which the directive has to operate. For the example industry there are negative aggregate effects in in output and the labour market driven if the investments are made along the supply chain.	- Positive effects in the domestic textile sectors as they become more competitive with rising prices of producing abroad. This is an opportunity for domestic textile producers (and other sectors affected by the CSDDD) - Negative effects downstream, especially retail, where costs get past down. Larger effects for countries with larger textile and retail sectors.

Table 1-2: Overview of the simulations of the macroeconomic effects in this deliverable, scenarios four to six.

Finally, we note that the complexity of our approach generates also a large set of results. We generate estimates for GDP, Employment, sectoral value added, and sectoral working hours across 14 ecosystems for between 15-30 countries across six scenarios. In this deliverable we include and discuss the most important results for the aims of the ReSChape project. On the project website we will upload the complete set of results.