Deliverable D1.3
Supply alerts for the future

Project acronym:	LEADER 2030
Starting date:	01/07/2023
Duration (in months):	30
Call (part) identifier:	HORIZON-ER-JU-2022-ExplR-06
Grant agreement no:	101121856
Due date of deliverable:	Month 6
Actual submission date:	14-03-2024
Responsible/Author:	Veronica Elena Bocci / ERCI
Dissemination level:	PU
Status:	Issued

Reviewed: Yes

This project has received funding from the European Union's Horizon Europe research and innovation programme under Grant Agreement No 101121856.

Document history		
Revision	Date	Description
1	14/03/2024	First issue

Report contributors		
Name	Beneficiary Short Name	Details of contribution
Veronica Elena Bocci	ERCI	First version

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1. Executive Summary

The previous deliverable "Map of disruptions experienced so far by the Rail Supply industry and lessons for the future" (D1.1) developed by the LEADER 2030 project[1] presented - along with a lot of other information - the map of disruptions experienced in these times by a sample of European Railway industries directly surveyed in the past months, mostly from the supply side and a few also from the customer side. This provided a snapshot of what is happening to the European Rail Supply chain at a time when **crises of various kinds and durations are affecting the regular flow of raw materials, processed materials and components needed**. At a time when - also in the wake of the recovery and resilience aid after the COVID-19 crisis - public investments are high and have very tight deadlines, this represents a trouble the European Rail Supply Industry has to face and manage with the necessary vision.

This Deliverable "Supply alerts for the future" (D1.3) goes into more **detail about the type of railway supplies affected by such disruptions**, going so far as to list which end products are suffering from these difficulties. The overview **confirms fears for future supplies not only of standard products but also for innovative products**. The latter are expected - in addition – to suffer from shortcomings at EU level in terms of dependency on foreign advanced technologies where the EU lacks behind. This will be better addressed in following project analysis.
This Deliverable represents therefore a further key contribution to the LEADER 2030 project analysis, as the project ultimate goal is to understand *if* the innovations resulting from the Europe's Rail-driven investments will have the necessary materials and components – both hardware and software – to reach the market in the *quantity* requested by the European Railway system in 2030 and thereafter, and *timely*.

To give the correct weight to the alerts provided by this analysis document it is important to highlight that, according to the results of the LEADER 2030 survey, **company size is not an element that automatically affects the ability to avoid or better resist such disruptions**. The ability to manage these difficulties through structured forms of risk management (stockpiling, contingency planning, suppliers' vulnerability assessment, suppliers' diversification, …) varies from case to case. The survey results show that (i) large companies have in general more tools to manage this but they are affected by many disruptions in parallel, which can also create and multiply cross-dependencies; (ii) SMEs, being more vertical, are affected by more specific disruptions, but usually resort to stockpiling and continency planning as their main strategy. Substitution of non-EU disrupted supplies with EU ones is not always possible due to the objective lack of closer and more certain alternatives (raw materials and electronics first and foremost), and, whenever possible, the cost difference - on average +30% in the EU - does not make this substitution possible due to the non-acceptance of the 'cost increase for greater security' by the end customer. In addition, to date, forms of intra-supply chain circularity are hardly considered at all. If the opportunity until recently was usually read as a 'contribution to the environment', for the foreseeable future this should strongly enter into supply chain strategies with a view to 'anti-disruption resilience'.

[1] Once published it will be accessible here: LEADER 2030 - ERCI (eurailclusters.com).

2. Abbreviations and acronyms

Abbreviation / Acronym	Description
EU	European Union
EU-RAIL / EU-RAIL JU	Europe's Rail Joint Undertaking
LEADER 2030	"Learning for European Autonomy to Deliver Europe's Rail in 2030"
SME(s)	Small and Medium-sized Enterprise(s)

3. Background

The present document constitutes the Deliverable D1.3 “Supply alerts for the future” in the framework of the Exploratory Research Project LEADER 2030 as described in the EU-RAIL AWP 2022. Ultimately, it aims to contribute with intelligence information to the execution of all Flagship Projects.

4. Objective/Aim

The purpose of this Report is to provide the list of supplies for the Railway sector having experienced impactful disruptions in terms of materials and components in the recent times within the European Rail Supply Chain, according to the results of the LEADER 2030 European survey run.
Such results help identify supply chains patterns within Europe as well as gaps, and will be used to identify possible upcoming/future harms to the European Railway market needs in 2030 according to Europe's Rail and EU-alike transformation and investment plans.

5. Map of railway products recently and currently affected by disruptions

5.1. Methodology and approach

The results presented emerge from the LEADER 2030 survey aiming to provide a fact-based analysis of disruptions and dependencies experienced by the European Rail Value Chain in the last years and currently. Such target was represented by:

- Transport Operators
- Infrastructure Managers
- OEMs
- Tiers from 1 to 3

from the EU Member States and from European countries not member of the European Union home to a national Rail Supply Industry.

It was launched on 6th November 2023 as online European Consultation, available in 9 languages (English, French, German, Italian, Polish, Spanish, Swedish, Serbo-Croatian, Turkish – i.e. the national languages of the Railway Cluster organisations members of ERCI[2]); the answers analysed in this Deliverable are the ones received until 29th February 2024.

The Survey was composed of a set of conditional questions: i.e., according to the respondent's answers, sets of questions were presented or by-passed. As a result, the participants having no disruptions to report had to answer 11 questions, and those having disruptions in all the four categories covered for supply-related disruptions (*Raw materials*, *Processed materials*, *Components*, *Assemblies*) had to answer 28 questions.
The questions presented were however all mandatory, except the last one for a possible final comment. The reason for this choice was to ensure that all the questions thoroughly selected could all be answered. For this, the pdf version of the survey questions was made available and suggested for pre-download, to provide transparency and reassure.

The survey was composed of 10 parts:

- Company information: email and role of the responding person, name of the company, size of the company, website, country location, region location
- **Company positioning in the Rail Value Chain**: Infrastructure Manager, Transport Operator, OEM, Tier 1, Tier 2, Tier 3
- Company **positioning in the Rail business segments**: Rolling stock + 4 sub-segments, Command Control Signalling + 3 sub-segments, Infrastructure + 7 sub-segments, Operations + 3 sub-segments
- Disruptions suffered since 2018: Yes / No (if No, a question about the reason for this was posed, and the last question on a final comment was then presented; if Yes, the survey continued)

[2] ERCI members - ERCI (eurailclusters.com).

- Type of supplies affected: Standard/state-of-the-art, Innovative, Both
- Type of disruptions ranking: **Supply-related**, Demand-related, Manufacturing, Economic/Financial, Logistical
- Focus on **Supply-related disruptions**: 4 specific focuses on *Raw Materials*, *Processed Materials*, *Components*, *Assemblies*[3], Reasons for disruptions, Provenance of affected supplies, Potential for substitution, Average price difference between EU and out of EU supplies
- Demand-related disruptions: Reasons for disruptions
- Logistical disruptions: Type
- Adoption of long-term strategies for risk mitigation: Yes / No / Which ones.

While all questions and answers were analysed and presented in the mentioned Deliverable D1.1, this document focuses on the results emerging from the parts highlighted in bold above, i.e. **supply-related disruptions**, and specifically on **product disruptions experienced by the surveyed European companies**, listing them **per Rail business segment** and **concerned Raw materials / Processed materials / Components / Assemblies**, and adding the information about the type of companies affected, i.e. **company positioning in the Rail Value Chain** (OEM, Tier 1, etc.) to show how horizontal the problem of supply disruptions is.

The answers given by the respondents were analysed furthered through:
- the visit and analysis of all the respondents' websites, to further detail the type of products/solutions developed by each respondent in order to complete the details and reconcile the information concerning the disrupted inputs and the relevant outputs
- final validation of the results also through some 1-to-1 dialogues with respondents and specialists.

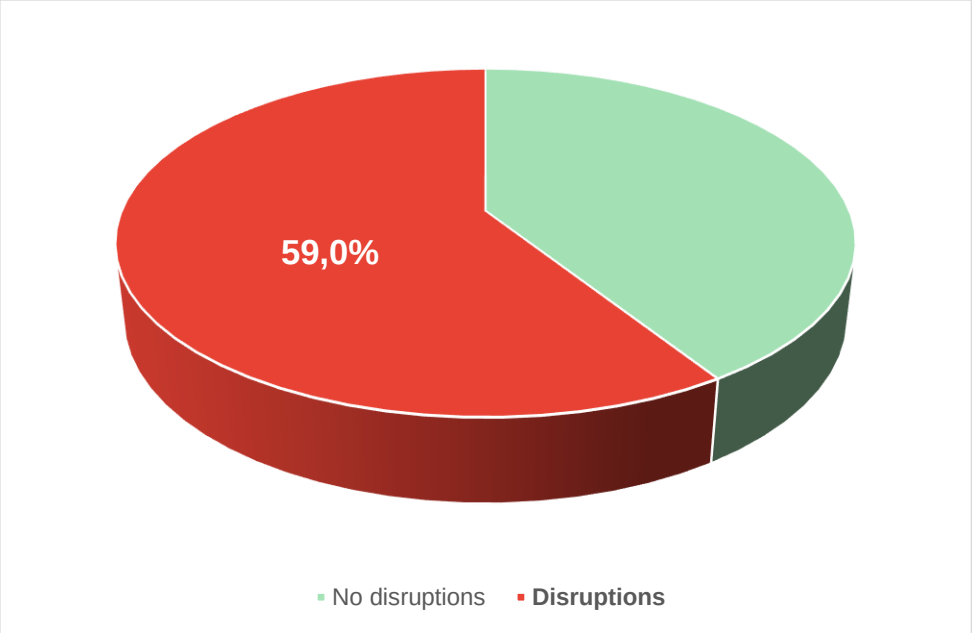
5.2. Results

5.2.1. Surveyed sample

105 companies from 37 regions in 16 countries (Austria, Belgium, Croatia, France, Germany, Italy, Montenegro, Netherlands, North Macedonia, Poland, Serbia, Slovenia, Spain, Sweden, Türkiye, United Kingdom) answered the Survey.
58,1% of respondents have suffered/are suffering disruptions in the supply system:

[3] Out of the several possible wordings for segmenting the production stages, the Author decided to use the wording used by JRC (2020), *Critical Raw Materials for Strategic Technologies and Sectors in the EU – A Foresight Study*, European Commission, p. 12.

Table 1 | Did you suffer/Are you suffering disruptions in supplies?" (n=105; source: Author)

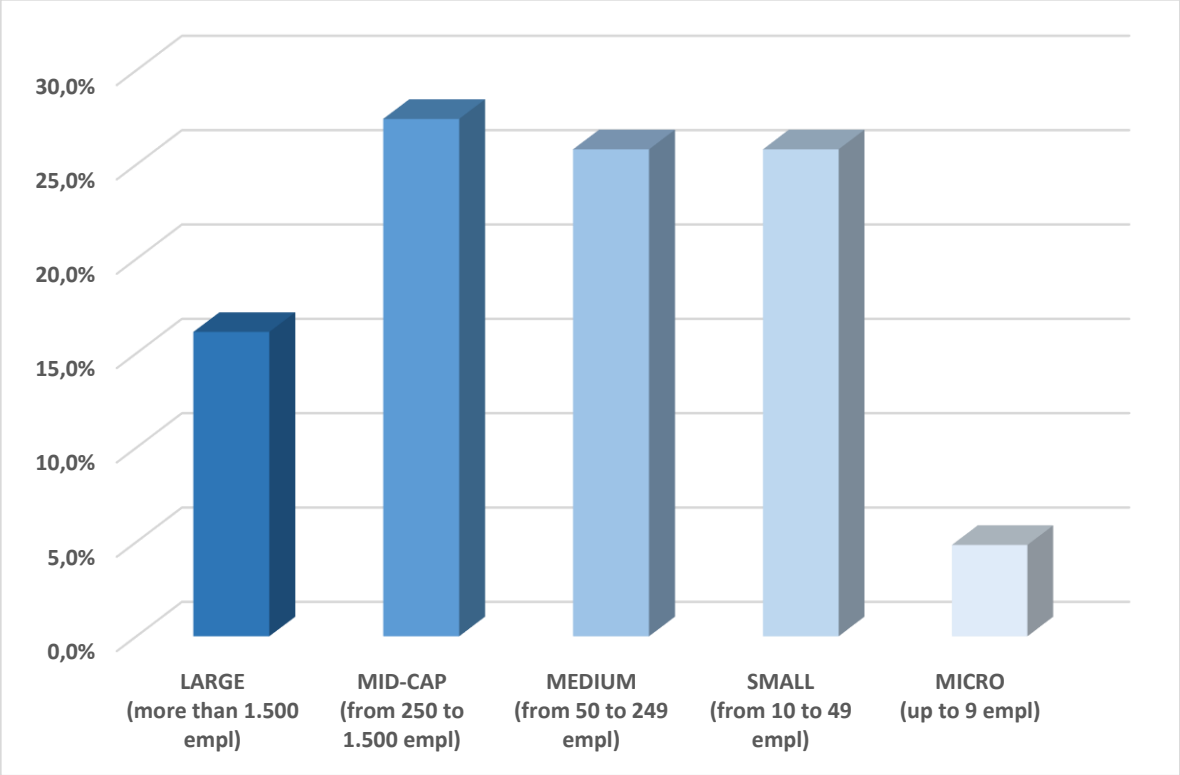


The sample reporting no disruptions (41%) consists of 41,8% *engineering companies* and *enterprises without critical supplies*, which brings the number of "real problem-free supply companies" to 23,8% only.

78% of the sample reporting disruptions (59%) reported them with *high+very high impact* (i.e. ratings 4 and 5 on a scale from 0 to 5; extending the results also to ratings 3, 89% of the sample reports as high the supply disruptions experienced).

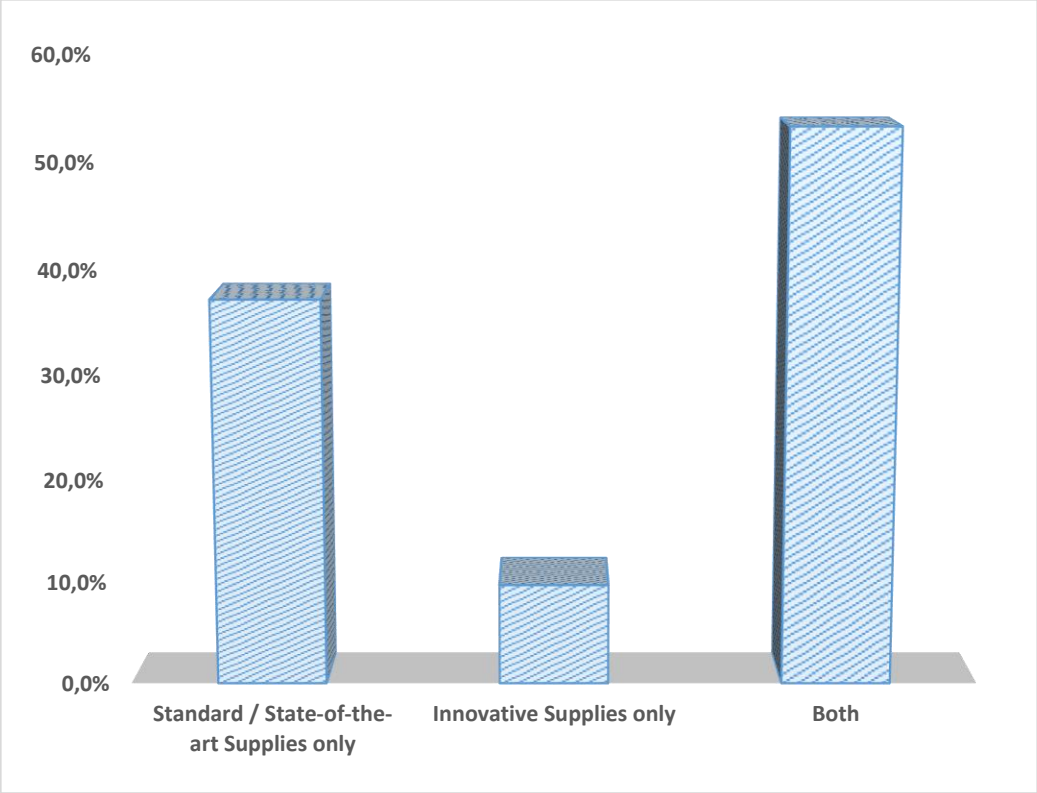
Concerning the **size** of the affected companies, the 'meta-groups' *larger companies* (i.e. Large Companies + Mid-Caps) and *smaller companies* (i.e. Medium + Small + Micro) are represented in a quite balanced manner: the former **43,5%**, the latter **56,5%**, this showing that both groups can be affected by disruptions and larger size doesn't automatically "protect" from supply risks.

Table 2 | Affected companies' size (n=62; source: Author)



In terms of **type of supplies disrupted**, the results show that **both standard/state-of-the-art supplies** and **innovative ones** are affected, with each respondent specifying own situation:

Table 3 | Type of supplies affected (n=62; source: Author)



5.2.2. Railway Supplies disrupted

The results analysed, further deepened, and then validated provide the following list, aiming to show **per each Railway business segment** (sections in green):

- 1st column: the **specific category of products affected**. The categorisation proposed is project-based and was chosen according to the results emerged from the survey as their suitable clusterisation. The information between brackets – where provided – is not for exemplification but rather aims to mention specific parts or types of outputs affected, when this was possible based on information.
- 2nd column: the **type of input disrupted due to supply problems**. The list is provided sub-divided per the four types of concerned inputs as mentioned in the survey (i.e. *Raw Materials*, *Processed Materials*, *Components*, *Assemblies*) plus a fifth one referring to *Final Products*, whose disruption is lamented by their buyers, which can be both OEMs and Transport Operators / Infrastructure Managers (here referred to respectively as "TO" and "IM"). The inputs mentioned are reported as written in the survey to show the specific disruptions, even though in several cases listed inputs could be clusterised under the same group (this mostly applies to electronic equipment, which

sometimes is generically mentioned as such and in other cases the specific equipment disrupted is mentioned).

- 3rd columns: the **role in the Rail Value Chain of the relevant companies affected** by the type of disruptions of such specific category.

Table 4 | Clusterisation and typology of disrupted inputs, and typology of affected companies (n=62; source: Author)

PRODUCTS AFFECTED	INPUTS DISRUPTED	ROLE IN THE RAIL VALUE CHAIN OF AFFECTED COMPANIES
ROLLING STOCK SUPPLIES (FOR ALL TYPE OF VEHICLES, INCLUDING HYPERLOOP-TYPE)		
Auxiliary Power Supply (Converters, Reducers, Transformers)	*Components* Semiconductors Switching regulators Analog-to-Digital converters	OEM Tier 1
Bogies	*Final products* Bogies	TO
Braking systems (Brakes, Control Systems)	*Raw Materials* Iron Nickel *Processed Materials* Cast Iron *Components* Solenoid Valves *Assemblies* Electric motors *Final products* Braking systems	OEM Tier 1
Cables (Ethernet, Bus, MVB-Multifunction Vehicle Bus)	*Raw Materials* Copper Rubber	Tier 2
Carbody assembly and sub-assemblies (Driver's Cab, Underframes, Roofs, Side Walls, Intermediary Floors)	*Raw Materials* Aluminium Iron Chromium Resins *Processed Materials* Carbon Steel Alloy Steel Aluminium Alloys	OEM Tier 1 Tier 2

	Other Metal Alloy Carbon Fiber Composite Materials *Components* Metal components Rubber parts *Assemblies* Welded assemblies Metal Assemblies	
Communication and On-board Networks (Ethernet, Backbone Nodes, Switches, HMI, Monitors)	*Processed Materials* Aluminium Alloys *Components* Digital electronic components Analogue electronic components	Tier 3
Couplers, Dampers, Gangways	*Processed Materials* Carbon Steel	Tier 1
Door Systems	*Raw Materials* Aluminium Rubber *Processed Materials* Stainless Steel *Components* Electronic equipment	OEM Tier 1
Electrical cabinets	*Assemblies* Electrical assemblies	Tier 1
Electro-mechanical components (Resistors, Insulators, Contactors, Sockets)	*Raw Materials* Copper Aluminium Graphite	Tier 1
Fire-protection systems	*Components* Active electronic components DC/DC switch converters *Assemblies* Cables Machining	Tier 1
HVAC-Heating Ventilation Air Conditioning (AC units, Fans)	*Processed Materials* Chemicals *Components* Plastic components *Assemblies* Fans	Tier 1

Interiors (Cover Elements, Structural Components, Supporting Components, Noise & Vibration solutions)	*Raw Materials* Rubber Resins *Processed Materials* Fiberglass Composites Glass Materials Plastic materials (standard) Glass-Reinforced Plastics (GRP) *Components* GRP articles Moulded articles *Assemblies* Wooden sandwich panels	OEM Tier 1 Tier 3
Measuring tools (Vehicle Dynamics, Fatigue Strength, Brake Tests, Acoustics)	*Components* Telemetry systems Electronic components	Tier 1
Mechanical components (Covers, Handles, Tanks, Tailgates, Carcass, Cabinets)	*Components* Rivet nuts	Tier 1
On-board Signalling including ETCS/ERTMS type	*Raw Materials* Silicon Metal *Processed Materials* Carbon Steel Steel Alloys Stainless Steel *Components* Microchips Semiconductors Storage	Tier 1
Other Monitoring, Maintenance, Surveillance and Information systems (Automated Obstacle Detection, Intelligent Video Surveillance, Condition-Based Monitoring)	*Raw Materials* Aluminium Heavy Rare Earths (HREE) Light Rare Earths (LREE) Lithium Germanium Copper Iron Rubber Resins *Processed Materials* Aluminium Alloys	Tier 1

	Aluminium Coatings Glass Materials *Components* Semiconductors Monitor Displays Chips for Printed Circuit Boards (PCBs) PCBA Boards Cameras Electronic modules	
Pantographs	*Components* Electronic components Solenoid valves	Tier 1 Tier 2
Power Electronics (Permanent Magnets, Batteries, Motors, Gear Box)	*Raw Materials* Heavy Rare Earths (HREE) Light Rare Earths (LREE) Lithium Copper Iron *Processed Materials* Carbon Steel Stainless Steel Aluminium Alloys *Components* Cast parts GGG Electronic components Switches Contactors *Assemblies* Batteries Electrical Assemblies *Final products* Motors	TO OEM Tier 1 Tier 2
TCMS-Train Control Management System	*Components* Opto-isolator transistors *Assemblies* Control panels	Tier 1
Wheelsets (Wheels, Axles, Driving Gear)	*Processed Materials* Steel *Final products* Wheelsets Driving Gear	TO OEM Tier 1

COMMAND, CONTROL AND SIGNALLING SUPPLIES		
Cables and Cabling components (Signalling and Control, Telecom)	*Raw Materials* Copper Rubber *Processed Materials* Plastic materials (standard)	Tier 1 Tier 2
Level Crossings (Protection Systems, Obstacle Detection)	*Raw Materials* Rubber Resinas Copper *Processed Materials* Glass Fiber	Tier 1
Signalling systems, including ETCS/ERTMS type (Balises, Signals, GSM-R radio, Cabinets)	*Raw Materials* Copper Aluminium Nickel Iron Rubber Resins *Processed Materials* Steel Stainless Steel Aluminium Alloys Fiberglass Plastic materials (standard) Techno-Polymers *Components* Printed Circuit Boards (PCB) Semiconductors Processors Electronic components Electrical equipment Optoelectronic equipment Transistors Switches Transformers Cloud Access *Assemblies* Cooling Fans Industrial computers *Final products* Balises GSM-R radio	IM OEM Tier 1 Tier 2

Telecoms	*Components* Electronic equipment Optoelectronic equipment	OEM Tier 1 Tier 2
Uninterruptable Power Supply (UPS)	*Raw Materials* Copper Nickel *Processed Materials* Steel *Components* Diodes Capacitors Inductors Microchips *Assemblies* Cooling Fans Batteries	Tier 1 Tier 2
INFRASTRUCTURE SUPPLIES (INCLUDING FOR HYPERLOOP-TYPE)		
Electric Traction (Catenary, Contact Cable, Electric Sub-Stations)	*Raw Materials* Copper Aluminium Iron Resins *Processed Materials* Steel Stainless Steel Carbon Steel Alloy Steel Composites Plastic materials (standard) Additives Cement *Components* Electric components Electronic components Isolation amplifiers *Assemblies* Assembled printed circuit boards	Tier 1 Tier 2 Tier 3
Stations (Lighting, Automatic Platform Doors, Electrical Systems)	*Raw Materials* Copper Nickel Iron *Processed Materials*	Tier 2

	Techno-polymers Cement	
Superstructure – Civil Works supplies	*Raw Materials* Iron Aluminium Chromium Copper Basalt Granite Limestone Resins Coal Crushed Stone *Processed Materials* Carbon Steel Alloy Steel Stainless Steel Aluminium Alloys Glass Fiber Glass Materials Ceramic Materials Plastic materials (standard) Additives Cement Asphalt Beton	Tier 1
Superstructure (Ballast, Sleepers, Dampers, Tracks, Tubes)	*Raw Materials* Granite Gravels Rubber Iron *Processed Materials* Steel Stainless Steel Alloy Steel Carbon Steel Plastic materials (standard) *Components* Screws and other standard components	IM OEM Tier 1 Tier 2
Switches (Points Heating, Terminal Boxes)	*Processed Materials* Plastic materials (standard)	Tier 1

OPERATIONS		
Maintenance, including Condition-Based	*Components* Electronic components Circuit boards Controllers Microcontrollers Electronic chips	Tier 1

6. Conclusions

The results show that - already as the things stand - the Railway sector should pay special attention to risks concerning the following categories of supplies:

- *Category Components*: **Semiconductors, Chips and a wide variety of Integrated Electronic Components**
- *Category Processed Materials*: **Any type of Steel, Aluminium alloys, as well as more innovative materials such as Glass-based and Composites**
- *Category Raw Materials*: **Copper, Aluminium and Iron above all, but also Rare Earths (both LREE and HREE) as well as other metals representing high-performing conductors**.

Of course, such disruptions affect not only the Railway supplies, but in such a broader critical framework the Railway sector is ***competing*** with other sectors to access such **limited** supplies, and *this* represents the risk. In the coming years such a risk can only increase as long as:

- on the **demand side**, some more performant inputs will have their demand skyrocketed following global mega-trends that include among others Automation, Data-driven world, Digitalisation, Climate change and environmental transition (e.g. chips demand will double by 2030; aluminium demand will multiply more than 4 times by 2030; copper demand will multiply 8 times by 2030)
- on the **supply side**, elements going from Geology to Geopolitics will impact on the actual availability of what necessary to satisfy regional and global demand. To shortly list the **main ones** impacting – in the good or in the bad – on EU-based companies:
    - ***Semiconductors, Chips, Electronics equipment*:**
        - **Geology**: Critical minerals and metals necessary to produce these inputs are heavily concentrated in China (e.g. China controls 80% of the world's Rare Earths Elements supplies, is the main source country also for Gallium, Germanium, Arsenic, and Copper, and accounts for 79% of global raw silicon) and a few other countries. This creates very high dependency and risks having as multiplying factors other elements such as the below-mentioned Geopolitics and Climate change.
        - **World factories**: Taiwan, Japan and South Korea are oligopolists for this type of inputs (e.g. ~15 factories in Taiwan own >50% of chip foundry production capacity of about 45 nanometer or smaller chips used e.g. for logic chips; 9 factories in Japan own about 98% of manufacturing capacity of 350 nanometer and smaller optoelectronic chips used e.g. in image sensors, lasers, LEDs; 10 factories in South Korea own about 40% of memory chip capacity). This creates very high dependency and risks having as multiplying factors other elements such as the below-mentioned Geopolitics and Climate change.
        - **Climate Change**: The greater frequency and severity of climate hazards is interrupting productions, raising costs and prices. Far-East Asia and Western Pacific region will see such phenomena increasing in the future. The concentration of these inputs production in such region will bring to increasing disruptions in

supplies (e.g. by 2040 a European company using leading-edge chips can expect that hurricanes sufficient to disrupt their suppliers will become 2 to 4 times more likely, with lasting effects for several months).

- **China Geopolitics – Taiwan Invasion**: the feared invasion of Taiwan by China would destabilise key supplies from this country, with enormous repercussions for global supplies.
- **China-US Export War**: The export war US-China, with the former banning export of semiconductors and the latter the export of key minerals to produce them contributes to destabilisation along the supply chain.
- **US Protectionism**: The protectionist US policies to reduce the extreme dependency on China (i.e. "CHIPS and Science Act" of 2022, further tightened in October 2023) also play a role in changing the global market as US is aiming at *quantity over quality*, subsiding as much chip production as possible on American soil to regain supply autonomy[4].
- **EU Policy – Chips Act, Chips Joint Undertaking, IPCEIs and Industrial Alliances**: EU policies, instead, are aiming at *quality over quantity*, focusing on innovation in the semiconductor industry and on production of more advanced chips. The scale of the policy is nor comparable with US in terms of funding, neither with the state-of-the-art industry; however, it is a key effort to reduce EU dependency, above all for producing innovations which require more advanced chips[5].
- **EU and National Policies – Recycling**: The EU Directive 2012/19/EU on e-waste recycling is there since 2012; the Member States, however, should drastically increase their recycling capacity to recover and re-use fundamental inputs within EU boundaries.

▫ ***Processed Materials*:**

- **War in Ukraine – Impact on local production**: Russia's invasion of Ukraine has led to heavy disruptions in steel supplies from Ukraine. The situation has rebalanced but only half of Ukrainian production is now exported *vs* a previous 80%. On the contrary, the tightened economic relationships between EU and Ukraine have led to suspension of quotas on steel import in the EU and now 80% of Ukrainian steel export goes to the EU market.
- **War in Ukraine - Import bans from Russia**: Heavy and long-lasting are the effects on steel imports from Russia following the import bans imposed by the EU following the invasion.
- **EU and National Policies – Recycling**: A processed material such as steel is 100% recyclable, and EU yearly production is 56% composed by steel made from scraps. The supply disruptions reported, however, show the need to further increase such rates.

▫ ***Raw Materials*:**

[4] For further details on the topic, see the LEADER 2030 Deliverable D1.1, page 16-17.
[5] For further details on the topic, see the LEADER 2030 Deliverable D1.1, pages 42-44 and 49-51.

- **Geology**: The supply of similar materials, considered Critical or Strategic, is concentrated in a few supplying countries, many of which "non-like-minded", which creates heavy dependency for global extraction and/or production[6].
- **Climate Change**: As described above, the increasing frequency and severity of climate events will have a strong impact also on the supply of raw materials in the affected regions. For the supply of critical raw materials such as the ones required in this project, once again the Far-East Asia and Western Pacific regions – home to relevant mines – will see a very strong increase of such events (e.g. the probability Heavy Rare Earths production to be severely disrupted from extreme rainfall may increase 2 to 3 times by 2030, as their production is concentrated in Southern China, which is increasingly exposed to such extreme climate events; this could cause at least a 20% drop in Heavy Rare Earth outputs, and potentially much more in a worst-case scenario, which includes also increasing landslides in mines).
- **China Geopolitics**: China is not only very rich in Critical Raw Materials but also pursues strategic international relationships with the African continent aimed (also) at the purchase and exclusive exploitation of mines rich in such materials (e.g. copper and cobalt in the Democratic Republic of the Congo-DRC; lithium in Zimbabwe, Namibia and Mali; nickel in Zimbabwe; etc.). Such 'aggressive' behaviour - in addition to aspects of environmental mismanagement and disregarded human rights - limits the capacity of other players such as the EU to sign agreements with such countries.
- **War in Ukraine - Import bans from Russia**: EU bans will continue to affect also raw materials imports from Russia, such as iron, coal, cements, rubber.
- **EU Policy – EU Strategic Partnerships**: Signing strategic partnerships with similar countries is becoming key also for the EU, whose approach is however constructive also for the target country. Currently, the EU has signed Strategic Partnerships for Raw Materials with the Democratic Republic of the Congo (DRC), Namibia, Zambia, Rwanda, Chile, Argentina, Canada, Greenland, Ukraine and Kazakhstan, while Partnerships with Norway and Australia are in the pipeline.
- **EU Policy – Critical Raw Materials Act**: Expected to enter into force in May 2024, the new Regulation defines several types of actions to increase EU autonomy in this field. This includes, among others, minimum benchmarks in extraction (≥10%), processing (≥40%) and recycling (≥25%) of the EU consumption, as well as diversification rules (i.e. not more than 65% of EU consumption of each Strategic Raw Material should come from a single third country)[7].
- **National Exploration Programmes**: With the Critical Raw Materials Act the Member States will be tasked to draw National Exploration Programmes on Critical Raw Materials to help increase the geological knowledge of the EU potential and de-risk targeted and private exploration campaigns. Such Programmes will have to

[6] For further details on the topic, see the LEADER 2030 Deliverable D1.1, page 34-42.
[7] For further details on the topic, see the LEADER 2030 Deliverable D1.1, page 46-48.

be reviewed every 5 years. This renewed attention towards local mining as industrial priority should lead to mobilisation of European territories, which can be stimulated 'bottom-up' also thanks to the intermediation work of European industrial cluster organisations such as the LEADER 2030 partners represent.

All this and much more will be further strategically analysed in the next LEADER 2030 activities. For the time being, also for this Deliverable the overall conclusion that can be drawn confirms the risk and likelihood of disruptions in Railway Supplies necessary to produce the innovations targeted by Europe's Rail programmes by 2030.

7. Next project steps

The next project steps will be:

- to study in detail *what specific* raw materials and components will be required by the *specific* innovative solutions that EU-RAIL plans to bring to the market by 2030 through its projects. → *This study will be the object of a dedicated conference that will be organised in collaboration with Europe's Rail during the InnoTrans railway exhibition in Berlin (24-27 September 2024)*[8]
- to study *what specifically* the European supply capacity of such components and raw materials will be
- to study *what* elements will impact on such supply capacity (enablers, obstacles)
- to study *how* enablers can be further boosted, and obstacles can be fixed/mitigated to foster autonomy and resilience
- to study *what* will go out from the Rail supply chain in terms of demand in 2030, and (i) *whether* this can be used to free-up components and raw materials useful to the new innovations (ii) *how* to support the reconversion (total/partial) of affected companies
- to understand *how* to get the Rail supply industry ready for 2030 demand, with specific attention to SMEs and start-ups
- to propose/recommend policy-level actions and industrial-level actions as result of all the intelligence analysis made during the project, to foster the *actual* achievement of EU-RAIL vision for a radically transformed European Railway system by 2030.

[8] InnoTrans 2024.