DELIVERABLE D1.1
Lightweight opportunities and partnership competences

Project title: European Lightweight Cluster Alliance
Acronym: ELCA

WP1 – Intelligence, collaboration and joint actions planning.
Grant Agreement No 951158
Duration of the project: 1.09.2020 – 31.08.2022

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Work Package Objectives

The main aim of this Work Package (WP) is to prepare the ground for developing the rest of activities in a successful manner, by identifying the lightweight opportunities in different mature & less mature markets as well as the first contacts for engaging with the corresponding regional/local policy. To do so, the WP envisages to perform different exhaustive studies by leveraging the specific expertise of each partner across the value chains for the targeted sectors. This also includes consultation of specialised documents for ensuring that the outcome of the WP is aligned with future market opportunities. The first measures for start building a joint marketing strategy and common brand of “Lightweight made in Europe” are also performed.

For convenience in the following report, abbreviations have been used for the consortium partners:

- **AMZ** for Automotive Supplier Network Saxony
- **BIC** for Bydgoszcz Industrial Cluster
- **Clust-ER MECH** for Emilia-Romagna Mechatronic and Motoristic Cluster
- **MAV** for The Advanced Materials Cluster of Catalonia
- **POLYM** for Polymeris

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WP1 Task 1.1.

Identification of opportunities and relative positioning

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1. Task description

Task 1.1. Identification of opportunities and relative positioning

Leader: POL

Participants: AMZ, BIC, MAV, MECH

Duration: M1-M6

For analysing market opportunities, the action will take as starting point the USA and Japan, as mature markets, and India and Latin America as less mature markets. POL will lead this task to make sure that a further global market analysis is performed with the aim of i) identifying specific regions in the already targeted markets, and/or ii) identifying other countries in which lightweight will be relevant in next years. This is especially significant for those regions in which more stringent environmental regulations are likely to enter in force. Much information has been already exchanged between the partners in the action writing phase, but more work is needed to identify needs and expectations in each targeted country. For this purpose, the partners will complement their analysis by consulting specialised documents (e.g. specialised market and foresight studies). BIC will focus on aero, AMZ in auto, MAV in rail and MECH in maritime. PLA, besides being task leader, will focus on identifying opportunities for polymer-based raw materials across all sectors. An interregional workshop will be organised by PLA to discuss the opportunities per sector (M6), at the same time of first partnership meetings. The results from this task will be continuously coordinated with T1.2, in order to make sure that the competences of the partnership are at all times matching the identified opportunities. Each partner will use their existing contacts in the targeted countries to identify the market opportunities, but also within their regional stakeholders’ network to have knowledge exchange on the mature and less mature markets. This will lead to a table of opportunities, that will be based on three main inputs: countries and regions, markets and sector

2. The lightweight market

The recent interest for the lightweight market and its consequent growth can be mainly explained by:

- Legal restrictions, emission laws and standards (regulatory pressure to reduce carbon emissions)
- The race to improve performance (less fuel, more passenger, etc)
The new mobility generation often implying heavier energy storage which require consequent lightweighting solutions for higher mileage/distances

- Embedded functionalities for safety, efficiency,
- Request for sustainable, environmentally friendly and resource saving technologies
- Availability and development of key enabling technologies for efficient and scalable processing of advanced materials

Industry is looking for materials with higher strength-to-weight ratio which reduces weight, while improving performance. It is a quest to find the optimal material or compound for each application while adjusting to new global requirements (i.e. safety, connectivity, circularity of energy, structural health monitoring etc). These are the reasons why lightweight materials and designs are becoming increasingly popular across various industries.

The market value in general (all sectors and regions) is estimated at 189,076 million $. It is forecast to reach USD 276.81 Billion by 2027 according to a report which did not take into account the current pandemic. Indeed, many companies in the mobility sector have closed due to covid, which has caused a decrease in demand for lightweight products, but this market is growing and could change the mobility industry in the coming years.

Currently, Europe and U.S are considered the most mature and consolidated markets for lightweight materials in the world. Nonetheless, the highest dynamic is observed in Asia Pacific and Middle East (Figure 1). This can be linked to the growth of the automotive sector in these countries hence the increased purchasing power, a higher number of vehicles produced, a focus on EV-development and production, all of these calling for use of new lightweight solutions.

![Figure 1-Expected increase of the lightweight materials market by region from 2015 to 2026.](image_url)
Different lightweight materials exist like high strength steels, aluminium, plastics, sandwich materials which are various combinations of these three, magnesium, and to some extend carbon fibers. Their use varies according to their characteristics and their application.

The research so far has shown that the new mobility challenges cannot be met by a single material as it used to hence the development of new material compounds and composite/hybrid materials. Furthermore, lightweight materials themselves offer a weight reduction at a relatively high cost. For example: carbon fiber, the most discussed, allows the biggest weight reduction (50% lighter than steel) at the highest cost (570% the cost of steel today). This major drawback should be mitigated in the years to come thanks to advanced cheaper technology that should make the market more accessible.

For a practical example, structural parts (like seat structure) might be built out of aluminium or high-strength steel or even carbon fiber. Functional parts (e.g., transmission), where strength is the most important requirement, will be consist of high-strength steel or carbon fiber while interior parts, where plastics are the most used element today, will remain plastic.

But the lightweight technologies and materials market raises its own challenges. Among the recently developed technologies with advanced lightweight materials (3DP, rein transfer moulding, thin wall die casting, forms of technology fusion for mass production) many are not yet mature, not scalable and not yet ready to be introduced in industrial processes. Other challenges to overcome are the economic risk to bear with the introduction of new hybrid materials and processes as well as longer cycle times, certification and standardisation issues.

On the following study, we have considered every sector specific challenges as well as current and expected trends to determine the most relevant destinations for the ELCA internationalization project.

### 3. Aerospace & aeronautics

#### 3.1. The identified mature markets

Both markets are mature and very advanced on other countries. These two countries are looking to continually modernize, it is why their defense spending is constantly increasing, especially the United States which has the highest defense spending in the world, and the Japanese have increased their budget by nearly 2.75% from 2017 to 2020. Japan and the USA are also among the most important players in their region in this sector.
The Japanese aerospace sector is one of the largest in the world with a strong international reputation, particularly in the field of research and development (R&D). Japanese companies have great potential in the research and development of dual-use aerospace defense technology, such as helicopters and light attack aircraft. Prominent players in the Japan aerospace and defense market are Kawasaki Heavy Industries, Mitsubishi Heavy Industries, ShinMaywa Industries, Ltd, Japan Steel Works Ltd, and Toshiba Corporation.

There are many competitors in the lightweight markets and they are quite well established as for the carbon fiber market (Japan is a world leader in carbon fiber production, accounting for a full 70% of the global total, by 2030, it is hoped that Japan will earn some ¥3 trillion a year from the aircraft industry). The Japan Carbon Fiber Manufacturers Association (JCMA), currently a committee in the Japan Chemical Fibers Association (JCFA), was established in 1978. They will contribute to the achievement of the Sustainable Development Goals (SDGs) as international development goals for the year 2030. In the carbon-fiber composite material market, there is TOKYO R&D Composite Industry Co.,ltd. – (1982).

The advantage of Japanese aerospace market is a large number of industry which associate aero companies and try to develop aerospace industry in Japan, we can mention The Society of Japanese Aerospace Companies (SJAC) (with 140 members) and the Japanese Space Reseach Agency which includes the Institute of Space and Astronautical Sciences (ISAS), the National Space Aviation Laboratory of Japan (NAL) and the National Space Development Agency of Japan (NASDA), this cluster can also be a competitor. It can be a great opportunity for the project.

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USA

The American market is very mature and well established. Since the Wright Brothers’ first powered flight in 1903, the aerospace industry has grown by leaps and bounds and produced iconic achievements such as landing a man on the Moon. The US is a leader in the aviation industry. It is a concentration of many producers of composites and technologies related to them. The total industry sales revenue left a significant footprint on the American economy, contributing to a combined economic value of $396 billion that represented 1.8% of total U.S. GDP.

The prominent players in the US aerospace and defense market are The Boeing Company, Lockheed Martin Corporation, United Technologies Corporation, Honeywell International Inc., and General Dynamics Corporation. The US aerospace manufacturers are very competitive.
internationally. Hence, with the changing regulations, the companies must align their product portfolio to the evolving requirements of end-users. The U.S. government has an important role in the market. Indeed, the policy of USA provides guidelines and direction to ensure that the United States is a leader in providing a safe and secure environment as commercial and civil space traffic increases.

Main producers and competitor of lightweight materials and/or technologies are (particularly in the **composites market**): Airborne, Matrix comp, AeroComposites LLC, TxV Aero Composites, ACTA. **Advanced composite material applications** in the USA include: Lightweight, Structural adhesives, Toughened epoxy resin composites, Polyimide resin systems, Thermoplastic resin systems.

These are two very mature and competitive markets that have been strongly impacted in the aeronautic sector by the crisis of covid-19

### 3.2. The identified less mature markets

- **India**

Civil Aviation in India is the 9th largest Civil Aviation market in the world and the fastest growing domestic air market. By 2025, India is expected to become the third largest market for commercial airline operations. This type of robust growth potential has attracted major investment from aerospace industry giants to establish new facilities in India.

Several global defence giants and the world-leading plane makers, including Europe’s Airbus, US-based Boeing, America’s Lockheed Martin, Germany’s ThyssenKrupp Marine Systems and France’s Naval Group have invested or plan to invest in India. Some of them developing strong partnerships with Indian companies and Universities, developing local innovations, skills and education. Boeing especially is implanted in India for 75 years. To build an aerospace industry ecosystem in the country, manufacturers worldwide are partnering with Indian suppliers and SMEs. Active participation of global players is expected to further boost growth of the aerospace industry in India.

So part from the international investors, local aeronautic and aerospace key players are:

1) Hindustan Aeronautics Limited (HAL), the Indian state-owned aerospace and defence company,

2) Indian Space research Organisation, the primary agency under the Department of Space for executing space programmes
3) Defence Research Development Organization, a network of 52 Defence Laboratories in India

The Indian aerospace composites market is expected to see significant growth opportunities in both local and export market developing in the years to come. It is estimated that the market for aerospace composites in India including export potential is likely to reach a value of US$ 302.5 million in 2023. Currently, the market is still relatively small with only a few local players showing sufficient composite capabilities. However, the Indian market is expected to evolve rapidly to adjust to the growing local demand in technologies for commercial and military aircraft. Several initiatives like the Advance Light Helicopter or the existence of the Aerospace Composites Division (the top high-volume producers of advanced composite aerospace products in the country) show the advances in this market.

So far, execution of joint ventures and partnership as well as development of new composite applications are the key strategies adopted by the major players in the Indian aerospace composites market (i.e. Tata Group, Hindustan Aeronautics Ltd. (HAL), Kineco Kaman Composites - India Private Ltd., Valeth High Tech Composites Pvt Ltd, Taneja Aerospace and Aviation Limited, and Adani Defense and Aerospace Group).

This is why there is a real need for a larger number of skilled composite part moulders to produce composite parts using advanced manufacturing processes in order to bring better composite technologies competences in India. Moreover, Aerospace manufacturing needs special alloys of steel, aluminium, titanium and composites. Currently about 70% of these raw materials is imported into India. This dependency of DPSUs on importation of raw material is due to the failure in developing a strong vendor base and the low focus on in-house R&D. India needs far more research organizations and material development support to overcome the demand-supply gap. Most composites used in aerospace are imported.

To summarise, the main characteristics of this market are:

- A fast-growing aviation industry
- **Cost-effective environment**
- **Presence of international plane makers**
- government and local industry initiatives, new research facilities and start-ups being established driving innovation
- continuous surge in military expenditure by the global military powers in the last decade
- **Rising passenger traffic**
- Unfortunately, a very long procurement lead time (7-8 years)
- Only few local composites providers

This project was funded by the European Union's COSME Programme.
A external dependency on the lightweight raw materials and composites supply chain

- **The Latin American Market**

Countries like Brazil, Mexico and Chile have an industry ingrowth that offers an interesting future with business prospects. **Brazil is the best positioned**, on the other hand, **Mexico is making steady progress. The rest of the Latin American countries**, including Chile, **do not have a highly developed aeronautical sector**. They do not have their own airlines of considerable size nor large companies that could provide aeronautical maintenance services, but rather a smaller industry that allocates its resources mainly to the local demand for smaller aircraft.

✔ **Chile**

Chile is the country from the Latin American region with the most competitive infrastructure, according to the Global Competitiveness Report 2018. The aerospace industry’s key players are local airline groups. There are very little maintenance activities both in civil and military aviation sectors. No data have been found on lightweight materials and technologies **production, nor importation in Chile** which is coherent with the low-level development of the aeronautic sector in this region. The advantage of this region is that Chile organizes the largest in Latin America, the FIDAE international aviation and space fair.

✔ **Mexico**

The aeronautical sector is a relatively new branch in the Mexican economy. Foreign investors like Airbus, Boeing, Safran, Bombardier etc have recently invested the market, inducing a fast growth of the sector. Though Industry experts identified several challenges facing the sector in Mexico including the availability of highly skilled experts, the need to further develop the supply chain, lack of government support and growing demands for a larger aviation fleet. Local SMEs need assistance to increase their capacity for specialized manufacturing by incorporating new technologies and providing technical training. In this respect, it is no surprise that lightweight materials do not seem to be a current priority in the Mexican aeronautical sector.

✔ **Colombia**

The aerospace industry has had significant growth in Colombia in the last decade for two main reasons. The government invested heavily in military equipment which proved to be effective during the recent internal conflict. Also, as a result of political stability, significant economic development has begun in the civil aviation industry. The Colombian government has increased investment in aeronautical infrastructure due to the increasing demand on airport
traffic from passengers and cargo both domestically and internationally. Important advantages of this market are reduced income tax and VAT exemptions which allow easier access to the local market. There are also no import duties. Free trade zones for different types of investors allows sales in the local market. Although Colombia equals or exceeds its neighbours in some of the indicators, the indices show that there are three issues in which the country scores low: infrastructure, cost competitiveness and appropriate regulation.

3.3. Other opportunities

- **United Arab Emirates**

The United Arab Emirates (UAE) is one of the largest markets in the world for aerospace and civil and military aircraft, with robust demand for aircraft equipment, parts and services. The UAE is focusing on advanced aerospace structure and composite part manufacturing facilities and capabilities, with the goal of being a key supplier to original equipment manufacturers (OEMs). The UAE is home to two aerospace clusters: Dubai World Central Aviation District and Nibras Al Ain Aerospace Park. **Government investment and strategic location make the UAE a global hub for aircraft MRO and space projects.** Potential export markets are: Airplane, helicopter parts, turbine engines, parts, spark ignition engines, landing gear.

- **Abu Dhabi**

the two largest players in the aviation and defense sectors are the EDGE Group and Mubadala Investment Company. Over the past few years these groups have formed partnerships with international companies such as Boeing, Airbus, Lockheed Martin, BAE Systems, Northrop Grumman, Rolls-Royce, the National Aeronautics and Space Administration (NASA), and Piaggio Aerospace, among others.

A central actor already established in the region has been identified: Mubadala is a government-created company which is developing a sustainable aerospace industry in Abu Dhabi through a division tasked to form international partnerships with leading aerospace players. One of the most important players in the development of a robust OEM segment is Strata, Mubadala’s composite aerostructures manufacturer. Strata’s specialization is light composite materials.

Mubadala and its lightweight division, Strata could be a powerful ally to a “Made in Europe Lightweight” initiative in the region.
Dubai

the Emirates Engine Maintenance Center (EEMC) is the leading service provider for aircraft maintenance, tests, repairs, modification and overhaul of a range of components, and engine service. The company has been working closely with Engine Alliance (EA), GE Aviation and Rolls-Royce to develop a better understanding of the technology involved in the maintenance of aircraft engines.

RAK

Innovative Composite Engineering is an advance composite manufacturing. Innovative Composite specializes in high strength & high-performance composite manufacturing solution. They have extensive experience in Fiber glass and Carbon fibers reinforced composites. Innovative Composite Engineering has the technology to process & manufacture advance composites along with the experience to undertake large volume projects. Innovative Composite Engineering aims at introducing advance composite solutions in industries and business segments traditionally unaware of the potential of advance engineered composites.

It is useful to note that the aviation entities in the UAE are government-backed, even though they conduct their business as a private enterprise. Another specificity of this market can be that the purchase plans of new business aircraft in the Middle East and Africa region have lately been impacted by the ongoing political tensions and other conflicts in the region. Furthermore, The UAE market is very competitive with connectivity and developed trade links to Europe, Asia and the Americas.

A strategic location and government investment are making the Middle Eastern nation into a global hub for aeronautics and aerospace sector. Added to a flourishing economy and light regulation, this makes the UAE market very attractive for a Made in Europe lightweight initiative despite cultural and political specificities to be overcome and a well-established local competition.

4. Rail sector

The passenger rail market continues to grow and innovate, posing attractive opportunities. Although the lightweight solutions (mainly composites) are expected to decline in 2020 due to global economic recession led by the COVID-19, the forecasts indicate that this market will recover in 2021, reaching around $0.9 billion by 2025 with a CAGR of 2% to 4% from 2020 to 2025. The major drivers of the passenger rail market are the development of high-speed trains, and mono and metro rails, which are increasingly demanding lightweight materials with
a superior mechanical performance, aesthetics features, and a high fire safety. An emerging trend in this sector is the development of green technology solutions with high-performance, which has a direct impact on the dynamics for innovating in composites.

4.1. The identified mature markets

Both Japan and USA have been identified as very mature markets for lightweight materials and technologies. For example, the U.S. rail system stretched across almost 150,500 km, making it the largest network in the world.

Our analysis shows that they are and are expected to remain in foreseeable future world leaders in:

- carbon fibre production (USA 30% and Japan 18% of global distribution in 2018)
- graphene composites (North America 28% and Asia Pacific 26% of market share forecast in 2026)

Rail composite material suppliers and rail composite part manufacturers are identified as key participants of the lightweight markets in these regions. Furthermore, the market is dominated by big companies like Toray Industries Inc. in Japan and Cytec Industries in U.S.

The composite market in these regions is then extremely competitive and is expected to remain so. Therefore, a « Lightweight Made in Europe » initiative has little chances to succeed in entering this market on the composite aspects. The other lightweight materials markets are less documented but as mentioned in this section introduction, the lightweight solutions in the rail sector are mainly composites.

On the other hand, the NAFTA and Asia Pacific rail technology market volume are expected to be 2nd and 3rd respectively between 2021 and 2023 while Western Europe’s is expected to be first. This data highlight that the European playing card in these mature markets has to be its high-level technologies and innovations. On the contrary, these regions already benefit from well implanted materials providers and it would be inefficient to compete on this level.
4.2. The identified less mature markets

- **India**
  
  The identified key player of the rail market is **Indian Railways** which is a government agency under the ownership of Ministry of Railways that operates India's national railway system. This railway system is the fourth largest railway network across the globe. Indian Railways is in the top Indian companies rated by % of Turnover in 2019 with 90%.

  The key participants and therefore direct competition in this market are **rail composite material suppliers** and composite rail part manufacturers: Kemrock Industries and Exports Limited.

  This market is more mature than we expected on the rail sector. The conclusion is therefore the same as for U.S. and Japan: the «Lightweight Made in Europe» brand has more chances to approach this market via new technology solutions than materials providers. A partnership on composite materials innovation is still possible and advisable with Kemrock Industries and Exports Limited.

- **Latin America**

  **Brazil** has been identified as the best documented market.

  Unlike Indian one, the Brazilian railway market is not dominated by a government agency. So, several companies are the key players of this segment covering logistics, subways and railroad network: Rumo Operadora Logística MultiModal S.A (20,6% of turnover), MRS Logistica SA (14,8%), Cia Paulista de Trens Metropolitanos (11,3%), Supervia Concessionária de Transporte Ferr póviario SA (5,7%)

  There is no information on direct local competition or possible obstacles in the legal frameworks.

  Though, according to the information extracted from the Brazilian railway association Abifer, there were 1.672 carriages, 72 passenger cars and 29 locomotives in the country in 2020, representing the first increase in production of these units after 3 years on the descent. The forecast points out a production increase in 2021.

  The conclusion is that the Brazilian rail sector is developing right now. New lightweight materials and technologies will then be more and more in demand and it could be an opportunity for our European brand to flourish in this region. This positive analysis has to be mitigated by the Covid-19 unknown effects on this still fragile market.
4.3. Other opportunities

- **China**

  **China** is very advanced on the lightweight materials market. CRRC Corp Ltd, a Chinese state-owned and publicly traded rolling stock manufacturer; largely dominates the market with 77.4% of Turn Over in 2019. This company is particularly famous for being the leading manufacturer of metro rolling stock **worldwide** between 2014 and 2018.

  So, it is not surprising to find out that there is an existent serious local competition:
  - China Zhongwang is a key supplier for aluminium lightweight parts of the Renaissance EMU (electric multiple units bullet train designed by China Railway Corporation), trains. These include a variety of deep-processed aluminium products that meet the high standards in quality and performance.
  - Qingdao Victall Railway Co., Ltd is a specialized company to produce modular parts for high speed trains, trams and subway vehicles.

  China is a mature and protective market with well-established suppliers and a state-owned key player potentially difficult to convince on forming partnership with a foreign initiative.

- **Middle East**

  ✓ **Qatar**

  **Qatar** Railways Development Company (QRDC) has announced the launch of Qatar Rail Network Program, an integrated rail network valued at an estimated 36 billion US dollars. The QRDC is a 51% to 49% joint venture between state-owned property group **Qatari Diar** and the german leader **Deutsche Bahn International**. The project will include the Doha Metro system, a long-distance high-speed rail link and a freight line. The project is expected to be finished by 2030.

  ✓ **Saudi Arabia**

  **Saudi Arabia** is another interesting, still growing market. The Rail freight volumes are expected to be boosted by both the North-South Railway and the Landbridge initiative. Furthermore, a new port at Rabigh, serving a new economic city, will boost overall container handling. New smart cities and economic hubs, such as the King Abdullah Economic City on the Red Sea coast, will bode well for economic growth over the medium and long term. Nevertheless, there are serious down parts. One being that the Rail freight network is
underdeveloped considering the size of the country. Another one is the lack of industrial clustering acting as a deterrent for logistics firms and manufacturers. This dramatically increases the time and costs of operating in Saudi Arabia.

5. Automotive sector

The auto industry's most important industry segments include commercial vehicles and passenger cars. Growth of this industry slowed down caused by Pandemic-situation in 2020 but now resuming responding to new market challenges and technological opportunities. Furthermore, automotive manufacturers have to adjust to a growing environmental awareness and increasing efforts to connect vehicles.

Four disruptive technology-driven trends in the automotive sector have been identified: diverse mobility, autonomous driving, electrification, and connectivity. To address these challenges, new market trends are emerging such as the shift to lighter materials, as well as the trend towards electric and autonomous vehicles and they are set to revolutionize the industry.

Product engineers try to work on the philosophy of the right material at the right place. Figure 2 shows the current most commonly used materials for major structure components. Theoretically, a material can be used to make vehicle parts if it is commercially available, can be manufactured with an available technology, and meets the performance requirements.
Figure 2: up: Materials used most commonly for major vehicle structure components in the current fleet. Down: Current vehicle material based upon 14 major components from 42 mass produced vehicles.

One can notice that Vehicles today are predominantly steel structures with some use of aluminium. Magnesium and polymer composites are used in some components mostly on higher end vehicles. And the most common manufacturing technologies are cold stamping for steel, for plastics and carbon fibre composite parts, as well as injection moulding and resin transfer moulding.

The market is highly competitive. It is dominated by a small number of global players, which are often collaborating with smaller and or specialised partners in the different regions.
The leading players in the Lightweight Materials industry automotive sector include:

- Evonik Industries,
- Toray Industries Inc.,
- Aleris International, PPG Industries, Inc.,
- Thyssenkrupp AG,
- ArcelorMittal SA,
- Hexcel Corporation,
- Titanium Metals Corporation,
- Formosa Plastics Group,
- Bayer AG,
- SABIC,
- Cytec Solvay Group,
- Alcoa Inc.,
- Precision Castparts Corp.,
- Allegheny Technologies Incorporated,
- Novelis Inc. among others.

There is high entry barrier for SMEs and new players in this market due to stringent decision paradigms. Indeed, final decision on use of new materials and related manufacturing processes are exclusively taken at OEM’s / 1st tier supplier level.

5.1. The identified mature markets

The Asia Pacific and North America lightweight materials market were the largest in 2015 and are forecast to remain the leaders in 2026. With Japan and the USA are among the most important players in their region in this sector. It is a market that also has many opportunities.

- Japan

The Asia Pacific lightweight materials market was the largest in 2015 and is forecast to remain the leader in 2026. This region represents almost half of the global lightweight market. Japan is a leading manufacturer rubber and carbon fibre and also one of the world’s largest consumer of rubber but most of its rubber is used for its tyre production, one of the main products exported. Japan is also the world leading manufacturer of carbon fibres and of CFRP but there is a tough competition to expect in which Toray Inc are among the leading players in both...
fields. The majority of domestic FRP production in Japan is destined for the construction sector, followed by automotive and other industries.

Some global players in automotive are Nissan, Toyota, Mitsubishi Fuso, Hino, Mazad, Isuzu, UD Trucks that have strong links with the European manufacturers like Renault, BMW, Daimler AG or groupe PSA.

Emerging trends, which have a direct impact on the dynamics of the industry, include increasing use of composites and lightweight materials in vehicles, development of new silicone-based electrically conductive adhesives in automotive sensor applications. Very strict and “top runner” regulations for CO2 emission reduction are set up by Japan. Moreover, from that follow high efforts to increase fuel efficiency and alternative-energy vehicles. This can be a good opportunity for this market.

The major drivers of growth for this market are government regulations concerning fuel economy and emissions, and increasing utilization of lightweight materials by manufacturers. This shows that the government has an important role in this sector.

- **USA**

The United States is the second largest automotive market worldwide. The U.S.-based automakers General Motors (GM) and Ford are among the leading manufacturers by U.S. market share, alongside Fiat Chrysler Automobiles (FCA), Toyota, Honda, and Hyundai. In the electric vehicle segment, California-headquartered Tesla is the most successful manufacturer by far. The automotive manufacturers have already well-established value chains a collaborate with material providers. Nevertheless, they might be open for joint innovation and techtransfer projects with ELCA.

Next, North America automotive lightweight materials market is the second largest in 2015 after Asia Pacific and is poised to expand at 8.5% CAGR during 2020 to 2026. The most produced automotive lightweight materials are metals, plastics, composites and elastomer. An important player who could be interesting to contact is AMZ a branch/office in Detroit which collaborate with local suppliers and manufacturers in a project on automated driving and e-trucks.

Regulatory bodies in the U.S. are coming up with new standards and requirements to lower fuel emissions and reduce greenhouse gases emissions. Growing awareness of CO2 emissions is pushing customers toward more efficient and superior electric & hybrid electric vehicles. This is evident from the fact that the sales of electric vehicles in the U.S. grew
by 10% in 2019 as compared to 2018. Also, upcoming electric vehicles from prominent car
makers, including Toyota, General Motors, Volkswagen Group, Fiat Chrysler Automobiles,
Bavarian Motor Works, Renault, and Tata Motors, are expected to increase the demand for
lightweight materials in the estimated period.

On the other hand, light trucks account for two-thirds of light vehicle sales in the United States
and the Ford F-Series was the best-selling light truck in the United States in 2020. Indeed, US
Consumer tastes shift towards larger vehicles (like vans, pickups, SUVs) and American brand.
After years of recovery in demand for vehicles, U.S. car and light truck sales growth slowed
down in 2019, compared with the year before. Due to customer preferences the segment of
commercial light vehicles and e-truck show high potentials for EU-US (ELCA) collaboration.

There are no real barriers to entry, in the U.S. territory. All possible and available lightweight
materials and technologies are somehow available.

5.2. The identified less mature markets

- **Brazil**

Brazil is the world’s seventh largest economy and the 8th biggest automotive producer. When
it comes to producing new light vehicles, Brazil is the 6th largest producer. This industry
comprises 5.5% of the GDP of the country contributing an amount worth BRL 266 bn. Brazil is
the leader of the automotive composite market and the largest producer of light and
commercial vehicles in Latin America.

Like shown Figure 3, companies have started using materials like carbon fiber and glass fiber
composites to make vehicles lightweight and fuel-efficient. The lightweight materials the most
used in the automotive sector are Carbon fiber, HTSS, plastics, glass fiber and aluminium.

![Figure 3: Brazilian automotive lightweight materials market CAGR, by type.](source.png)

This project was funded by the European Union's COSME Programme.
Emerging trends, which have a direct impact on the dynamics of the automotive lightweight materials industry, include:

- increasing use of aluminum in chassis and structural applications,
- advanced manufacturing technology,
- development of aluminum-air battery,
- third generation AHSS, and
- pre-oxidation to galvanize AHSS,
- development of recycling technologies for plastics and
- replacement of PA 66 with cheaper and advanced PA 6.

Source: [Automotive Lightweight Materials Market in Brazil | Market Research Report | Lucintel](https://www.elcainternationalization.eu)

Moreover, companies are trying to invent new composites that can reduce the total weight of the vehicle to much lower proportions. For example, companies like BMW and Audi use carbon-fiber-reinforced plastic in their car to reduce the weight of the vehicle.

The Brazilian automotive composites market is anticipated to register a CAGR of over 13% during the forecast period (2020 - 2025). Presently, composite materials, like thermoplastics and reinforced glass, have drawn the attention of carmakers, making them focus on sourcing better, tensile, and lighter components in the manufacture of automobile units. There are barriers to the use of lightweight materials like higher cost for the carbon fiber composites and the low recyclability of composites.

The top 5 automotives producers for passenger cars include Volkswagen, Fiat, General Motors, Ford, and Renault. Despite the economic crisis, OEMs still continue to invest in the country. In fact, Sao Paulo, Brazil still receives the highest share when it comes to investments. Regarding the electric vehicle market that is interesting market, Chinese companies like BYD and Japanese company like Mitsubishi are also investing. Moreover, Volvo has been producing hybrid buses here since 2012.

As shown Figure 4, some major players in the Brazilian Automotive composites market are Hexcel Coporation, Toho Tenex (Teijin Ltd), Toray Industries Inc, Mitsubishi Chemical Carbon Fiber and Composites, Inc., and SGL Carbon.
In Brazil, the automotive industry is expanding rapidly, especially the demand for lighter vehicles, because of the environmental benefits and emissions regulations. Moreover, with the rapid growth in manufacturing capacities in the country, the consumption of carbon fiber composites is expected to increase during the forecast period.

- **India**

India is part of the Asia-Pacific Region and this region as a whole accounts for the largest share in the global Lightweight Materials industry.

Furthermore, first, growing disposable income and improving living standards have increased the demand for vehicles in the region (Figure 5). And secondly, the introduction of stringent government regulations regarding vehicular safety and development of autonomous vehicles are factors expected to provide growth opportunities in the Asia-Pacific market.
India became the fourth largest auto market in 2019 displacing Germany with about 3.99 million units sold in the passenger and commercial vehicles categories. India is expected to displace Japan as the third largest auto market by 2021.

The two-wheeler segment dominates the market in terms of volume owing to a growing middle class and a young population. Moreover, the growing interest of the companies in exploring the rural markets further aided the growth of the sector.

India is also a prominent auto exporter and has strong export growth expectations for the near future. In addition, several initiatives by the Government of India and major automobile players in the Indian market are expected to make India a leader in the two-wheeler and four-wheeler market in the world by 2020.

In order to keep up with the growing demand, several automobile makers have started investing heavily in various segments of the industry during the last few months, becoming the key players on this market. The industry has attracted Foreign Direct Investment (FDI) worth US$ 24.53 billion between April 2000 and June 2020, according to the data released by Department for Promotion of Industry and Internal Trade (DPIIT). Some of the most recent investments and developments in the automobile sector in India are as follows:

- In November 2020, **Mercedes Benz partnered with the State Bank of India** to provide attractive interest rates, while expanding customer base by reaching out to potential HNI customers of the bank.

- **Hyundai Motor India invested** ~Rs. 3,500 crore (US$ 500 million) in FY20, with an eye to gain the market share. This investment is a part of Rs. 7,000 crore (US$ 993 million) commitment made by the company to the Tamil Nadu government in 2019.
In October 2020, Kinetic Green, an electric vehicles manufacturer, announced plan to set up a manufacturing facility for electric golf carts besides a battery swapping unit in Andhra Pradesh. The two projects involving setting up a manufacturing facility for electric golf carts and a battery swapping unit will entail an investment of Rs. 1,750 crore (US$ 236.27 million).

In October 2020, Japan Bank for International Cooperation (JBIC) agreed to provide US$ 1 billion (Rs. 7,400 crore) to SBI (State Bank of India) for funding the manufacturing and sales business of suppliers and dealers of Japanese automobile manufacturers and providing auto loans for the purchase of Japanese automobiles in India.

In October 2020, MG Motors announced its interest in investing Rs. 1,000 crore (US$ 135.3 million) to launch new models and expand operations in spite of the anti-China sentiments.

In conclusion, here are the “Made In Europe Lightweight” ’s opportunities in India:

➢ Good chances to collaborate in know-how related areas – tech-transfer, joint ventures, joint R&D-projects
➢ Lightweight related knowledge and know-how as fields of cooperation
➢ Price- and cost sensitive region! Steel cheap – preference of metal lightweight materials, but expect lack of Mg, Al an other light metals
➢ One focus also on affordable and optimized manufacturing processes
➢ 2-wheelers and small commercial vehicles might be also relevant segments

6. Maritime sector

There have been difficulties to find information on the lightweight market for the maritime sector. Furthermore, lightweight materials and technologies have been completely overlooked in a document describing the different possible ways to make the Japan maritime sector greener in the foreseeable future.

The document is the “Roadmap to zero emission from international shipping” (https://www.mlit.go.jp/common/001354314.pdf), released by the Japanese Ministry of land, infrastructure, transport and tourism in collaboration with the Japan Ship Technology Research Association. The document focuses the strategy on encouraging the adoption of low-carbon or zero-carbon fuels and doesn’t make any specific reference to light weighting solutions.

This approach is also confirmed by the latest issue of “Future visions of maritime Japan Industries”, the magazine of the Shipbuilders' Association of Japan, in which the use of fuels
such as hydrogen, ammonia and CO2 capture solutions are identified as the most significative future technologies for achieving decarbonisation targets.

Yet, the Japan Maritime Self-Defense Force is one of the worldwide most prominent navy force in the world and one the most relevant shipbuilding country: in 2020 Japan’s world order book was still higher than Europe’s one (1.799 gross tonnage of orders against 1.499: https://www.sajn.or.jp/files/view/articles_doc/src/8e791e1f4502e1d216149f7087e1a843.pdf ). If such a mature market does not show any sign of explicit interest in the lightweight materials and technologies, there is a strong possibility that this mobility sector has not much profit in innovating in such materials and technologies.

To confirm this hypothesis, contacts have been established with a Swedish institution that is coordinating E-Lass, the European network for lightweight application at sea. we will ask them to support us on these conclusions both on Japanese market and on other target countries or in identifying possible other opportunities for the lightweighting market in the maritime sector.

7. Conclusion

The completion of this task has confirmed that all the markets that had been identified in the project proposal where relevant. Specific regions of interest have been selected for the broad Latin American market and new particularly attractive for a “Made In Europe Lightweight” initiative regions have been identified for the different sector.

Thanks to a better understanding of the local context for each of them, we have been able to identify the general threats and opportunities of these destinations for our project. The task 1.2 is then designed to allow us to identify the strength and weakness of the ELCA consortium.
WP1 - Task 1.2
Analysis of partnership competences

Project title: European Lightweight Cluster Alliance
Acronym: ELCA

Task 1.2. Analysis of partnership competences
WP1 – Intelligence, collaboration and joint actions planning.
Grant Agreement No 951158
Duration of the project: 1.09.2020 – 31.08.2022
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1. Task Description

Task 1.2. Analysis of partnership competences

Leader: MAV

Participants: POL, BIC, MAV, MECH

Duration: M1-M6

Description: MAV will coordinate this task and connect to WP3 on monitoring and cross-fertilisation activities. The aim of the task is to evaluate the relative positioning on innovation and research trends and opportunities that the partnership is able to tackle according to the outputs of T1.1.

The evaluation plan will be designed by MAV, which will consist of a questionnaire that will give the possibility to identify the core competences of each cluster and the already existing partnerships on an international level. Each participant will be responsible for delivering the inputs of their own cluster to MAV, who will make sure that they are aligned with the objectives of the task. The activities per partner include interviews with their members, personal contacts and dedicated meetings and events (at regional/national level: at least one per country). The real involvement of SMEs from clusters will be sought, beyond Letters of Intend e.g., by participating in meetings in which the action will be explained besides of some strategic key factors to land to selected countries. This work has been already performed by AMZ, who will then not participate in the task but will deliver its inputs.

The analysis of the consortium competences will also consider the possibility of adding new partners from the EU. The consultation of specialised documents, e.g., foresight studies, is considered in order to make sure that the outcome of T1.2 is aligned with the forecast of the market(s). During the interregional workshop of T1.1, the information gathered from all partners will be discussed. The main outcome of T1.2 will be the composition of the complete partnership (matrix of competences: value chain stages vs. sectors) and its aligning with the opportunities identified in T1.1.
2. The questionnaire

To identify the core competences of each of the five clusters participating on the project and to know the already existing partnerships on an international level a questionnaire has been elaborated.

The questionnaire is structured in two main parts:

- The first one is about lightweight materials and industries. This part will allow the consortium to identify what are the main capacities on lightweight materials for each segment: mobility (aeronautic, automotive, rail and maritime), health care, energy, industry, and building.

- The second one is about lightweight materials and technologies. This part will allow the consortium to detect what are the main competences and the main challenges or difficulties to implement the lightweight materials for each step of the value chain: materials (availability of raw materials, price, materials, functionalization), industrial manufacturing (scale up, assembly & joining parts, materials functionalization, separation, recycling and revalorization) investment, formation and skills, policies or / and legal restrictions.

The questionnaire template can be found on the Annex.

To avoid issues with the privacy policy conditions, the original surveys answered by each member have not been distributed among the different partners. To write this document, there has only been used the aggregated data of each cluster.

Each of the five clusters participating in the project fill the questionnaire considering 104 SMEs:

- For Bydgoszcz Industrial Cluster (BIC), they think that 20 BIC members are important in the ELCA scope and 15 of them are SMEs.
- Regarding The Advanced Materials Cluster of Catalonia (MAV), the relevant SMEs for the project are 10.
- Polymeris (POLYM) has 12 members which are relevant in the ELCA scope and 7 of them are SMEs.
- There are 42 important SMEs in the ELCA scope for Automotive Supplier Network Saxony (AMZ)
- 38 members are considered for Emilia-Romagna Mechatronic and Motoristic Cluster (Clust-ER MECH) and 30 of them are SMEs.
3. General Information of the Associates

On this section, there is briefly explained the general information for each cluster, including the members that produce lightweight materials and what type of lightweight they currently produce.

3.1. AMZ (Automotive Supplier Network Saxony)

The automotive industry in Saxony started more than 110 years ago, and nowadays is one of the most important economic activity not only in the region but also in Germany. The automotive production in Saxony employs about 95,000 people, involve 780 suppliers and 5 OEMs and produce about 720,000 cars every year. This has driven the development of innovative projects by top R&D institutions in the fields of electric mobility, lightweight construction, battery technology and automatization. The AMZ was founded in 1999 with the aim of centralising and coordinating the innovation activities of automotive suppliers in Saxony.

Formed by a staff of experienced engineers, the AMZ has realised more than 300 projects, over 315 presentations to OEMs/Tiers1 and 70 supplier workshops. Its network is integrated by more than 140 members, including R&D, suppliers, mechanical engineering & production equipment, and industrial services.

3.2. Clust-ER MECH (Emilia-Romagna Mechatronic and Motoristic Cluster)

The mechanical sector in the Emilia-Romagna region employs over 350,000 people and is the most important in terms of revenues and exports. Clust-ER MECH (Emilia-Romagna Mechatronic and Motoristic Cluster) is an association of 112 public and private bodies (start-ups, small, medium and large and companies, research centres and training institutions) that operates with the aim to share skills, ideas and resources to support the competitiveness of the sector.

More than 20 years both in industrial research and scaling up in modelling, processing and material replacement for aluminium alloys and other lightweight metals.

An industrial group having one of the biggest machine park in Europe in the field of additive manufacturing is part of the network and is certified for all the sectors. Thanks to industrial partnerships they have available competences for special powders and non-commercial ones.

More than 20 years also in industrial research and scaling up in continuous and discontinuous fibres products (PMC), with a specific expertise in crashworthiness, hybrid Joining, nano-
functionalization by means of nano fibres. Cluster-ER MECH has available a pilot plant for separation, recycling and revalorization of polymer metric composites.

A master course has also been activated in the field of polymeric composites materials, in partnership with several industrial sponsors.

In the field of plastics processing Emilia-Romagna region is one of the most advanced districts in Italy and has been active for more than 40 years, focused mainly on technical and mechanical parts, also with metal replacement projects, components for medical devices and food & beverage packaging.

Some examples of lightweight applications:

- Carbon fibre wheel
- Master in composite materials
- Aircraft parts and Zephir Helicopter
- Carbon fibre recover
- 3D printing process for titanium alloy Titanium Alloy Ti6242
- Metal replacement

3.3. Bydgoszcz Industrial Cluster (BIC)

The BIC was established in 2006 with the aim of creating optimal development conditions, stimulating cooperation, and integrating plastics processors and tool manufacturers of the plastics sector. The cluster offers to the customers of its members competences in the whole value chain, with the participation of different types of stakeholders.

BIC is formed by 139 members including:

- 99 enterprises (13 large companies, 86 SMEs)
- 9 business-related institutions
- 6 R&D units
- 25 natural members.

The members of Bydgoszcz Industrial Cluster constitute a chain of suppliers – they offer both polymers and additives: masterbatches, fillers, modifying agents. They manufacture a complete
range of tools for plastics processing: moulds, blow moulds, extrusion heads, rubber injection moulds, along with machining tools: blanking dies, stamping dies and forging dies. The tools are made of steel and often based on standard parts provided by local suppliers. The processors manufacture a variety of products by means of injection moulding, extrusion and blow moulding.

The enterprises of the Cluster offer high-quality moulds and other processing tools (e.g., made from high strength steel) and also deal with the manufacturing of plastic products (e.g. polyamide for technical details or polypropylene with additives; in composites, both glass fibres and carbon fibres or WPC are used as additives) for various industries, i.e. household appliances, food, medical, pharmaceutical, automotive, aero, rail, cosmetic and packaging or building industries.

3.4. POLYM (Polymeris)

POLYM is the only competitive cluster dedicated to Rubbers, Plastics and Composites. The main missions of POLYM are to foster more innovation and to encourage the emergence of new R&D projects; to promote innovation in the service of Rubbers, Plastics and Composites; and to open up business development to other industrial sectors and to the international cooperation. POLYM becomes a reference in matters of Rubbers, Plastics & Composites Innovation on the territory, with the aim to allow France, its regions and companies to achieve excellence in the technologies and application areas of tomorrow while being part of a stronger European ambition.

POLYM has over 300 members including:

- 200 companies, 90% of SMEs
- 50 centers of R&D and training
- 30 institutions
- 20 public authorities

Among their members, there are the ones that work with lightweight materials, mainly foamed polymers, engineering polymers and polymer matrix composites: Raigi, Interep, SAITEC, Mecelec, Hexcel Composites, Noma Composites, Plastic Omnium, SkinPack, IPC, Colmant Coated Fabricks.

POLYM has several industrials in the cluster who works on foamed polymers for mobility. Particularly in automobile and aeronautic sector. These societies work also for industry and building. In mobility, foamed polymers are used for insulation and sealing.

In terms of lightweight technologies, they can highlight their competences in formulation, processing, scale up, joining parts and functionalization thanks to design office inside industrials.
For example, they have competences in formulation of two-component system of polyurethane to design foam gaskets. Processing of phenolic foams, polyurethane, closed cell foams.

POLYM has also competences in recycling and revalorization of polymers with the collect and recycling of mattresses with cores manufactured from polyurethane foam or latex foam.

In the field of engineered polymers and polymer matric composites, POLYM is well established in the east of France which is recognized for its high concentration of plastics processing industrials.

Some examples of success composites products:

- **Formulation of foam silicone functional**
- **Development hydrogen container**

### 3.5. The Advanced Materials Cluster of Catalonia (MAV)

The Advanced Materials Cluster of Catalonia (MAV) was created in 2015 through the promotion of ACCIÓ, the Agency for the Competitiveness of Catalan Business of the Generalitat de Catalunya. MAV is based in Barcelona comprises an ecosystem of 62 members, aiming to become a solver of reference in materials and their technologies. Its mission is to boost the competitiveness of Catalan industry by a close collaboration between companies and research partners. The cluster facilitates joint innovations between stakeholders by minimizing the gap between fundamental/applied research and private economy and favouring open innovation leading to a win-win situation. The main objectives addressed are promoting business opportunities, providing a fertile environment for collaborative projects, bringing strategic and technological information, and innovating in materials and/or manufacturing processes for an industrial context.

The development and use of new materials are key to product and process innovations in multiple sectors, including mobility, healthcare, energy and environment, construction, or cities smart. Therefore, MAV is a completely transversal cluster with a scope of application to multiple verticals, which require innovation in materials, as well as in their processes and / or products. MAV and its members operate in those verticals to respond to technological challenges and reduce barriers collected through collaborative projects, thus creating a space for commercial and research networks to share.

MAV is formed by 62 members including:

- 37 SME’s, 60%
- 13 Large Companies
- 12 Universities and Research Centres

This project was funded by the European Union's COSME Programme.
Among their members, there are some which are producing and developing lightweight materials and technologies:

- SME and large companies: AMES Group, COMPOSITES ATE, REFISA., COMPOXI, LUBRIZOL, MENZOLIT, ALSTOM, B-Circular and ISOVOLTA

- Universities and Research Centers: UPC, EURECAT and CAMPUS COMPÒSITS GIRONA

In terms of lightweight materials for the mobility sector, MAV members mainly work for automotive, railway and aeronautics. They are currently focused on developing and manufacturing:

- High alloy steels
- Foamed polymers
- Engineering polymers
- Polymer matrix composites

Some success examples of lightweight materials applications:

- **BounCell-X™ TPU Foam - Lubrizol**
- **Glass Reinforced - Lubrizol**
- **Refisa composites for railway**
- **Carbon SMC - Menzolit**
- **Cupra carbon fiber – Composites ATE**
4. ELCA Consortium Core Competences

After compelling the data from the five partners of the consortium related to lightweight materials competences of their own members, the core capacities of the ELCA consortium has been extracted and analysed.

4.1. Lightweight Materials & Industries

Table 1 shows the raw data gathered in terms of lightweight materials for each industry in order to identify the main competences among the partners of the consortium. The expertise is graded from 1 to 5 (being 1 the lowest).

<table>
<thead>
<tr>
<th>Lightweight Materials</th>
<th>Industry</th>
<th>Mobility</th>
<th>Health care</th>
<th>Energy</th>
<th>Industry</th>
<th>Building</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Aero</td>
<td>Auto</td>
<td>Rail</td>
<td>Maritime</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metallic alloys</td>
<td>High strength steel</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Aluminium alloys</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Magnesium alloys</td>
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<td>Titanium alloys</td>
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<td></td>
<td>Titanium aluminide alloys</td>
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<td>4</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>4</td>
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<td>Engineering Polymers</td>
<td>Metallic alloys</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Foamed Polymers</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Advanced ceramics (e.g., porous ceramics)</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Polymer matrix composites</td>
<td>Discontinuous fibres</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Continuous fibres</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Metal Matrix Composites</td>
<td>Discontinuous fibres</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Continuous fibres</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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</tr>
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<td></td>
<td>Cermets</td>
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<td>2</td>
<td>1</td>
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<td>1</td>
</tr>
<tr>
<td></td>
<td>Continuous fibres</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>1</td>
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<td>56</td>
<td>48</td>
<td>40</td>
<td>37</td>
<td>50</td>
</tr>
</tbody>
</table>

Table 1. Lightweight Materials & Industries Competences
To identify what are the main lightweight materials competences for each sector, there have been elaborated five separated graphs according to the different sectors: mobility, healthcare, energy, industry, and building (see Figure 1, 2, 3, 4 and 5, respectively).

With a general view in terms of lightweight materials, the consortium develops and manufactures more intensively polymers (including engineering polymers and foamed polymers), polymer matrix composites (including continuous and discontinuous fibres) and metal alloys (mainly aluminium alloys, titanium alloys and high strength steel). Regarding the sectors, the consortium has more incidence on mobility, industry, and energy.

Mobility

As observed from Table 1, the consortium lightweight materials capacities on the different mobility sectors are quite similar. However, a higher degree of expertise is detected for the aeronautic and automotive industries.

The consortium integrates several organizations (including enterprises, research centers and universities) working on lightweight materials for the mobility sector. Lightweight vehicles and aircrafts have a critical role for the improvement of power efficiency and reduce CO₂ emissions in mobility.

According to the results of the questionnaire conducted and represented in Figure 1, the most manufactured lightweight materials for mobility applications are polymers and polymer matrix composites. The potential of metallic alloys is also relevant. Particularly, there is a high usage of high strength steel, aluminium alloys, titanium alloys and titanium aluminate alloys. On the contrary, there is room for improvement among the consortium in the case of ceramic and metallic composites.

---

Figure 1. Lightweight Materials competences in mobility industry

This project was funded by the European Union’s COSME Programme.
Health Care

On the health care market, polymers, advanced ceramics and polymer matrix composites are the lightweight materials with most potential among the consortia.

It is important to highlight that on the metallic alloy’s family, titanium alloys are the most produced, at the same level as there are the engineering polymers. (See Figure 2).


![Figure 2. Lightweight Materials competences in the Health Care industry.](image)

Energy

As depicted in Figure 3, the ELCA consortium has more capacities on polymers and polymer matrix composites for energy industries. Advanced ceramics and metallic alloys (in particular, aluminium and titanium alloys) have also a remarkable potential on this sector.


![Figure 3. Lightweight Materials competences in the Energy industry.](image)
Industry

The capacities on the industry sector are like the ones on the energy sector. The ELCA consortium has higher capacities on polymers and polymer matrix composites. Advanced ceramics and metallic alloys (in particular, high strength steel, aluminium, and titanium alloys) have also a good potential on industry. (See Figure 4).

![Figure 4. Lightweight Materials competences in Industry.](Image)

**Building**

To finalise with the different sectors studied, the clusters' competences in terms of lightweight materials on the building and construction industry are polymers on the first place, followed by polymers matrix composites. (See Figure 5).

![Figure 5. Lightweight Materials competences in building sector.](Image)

This project was funded by the European Union's COSME Programme.
4.2. Lightweight Materials & Technologies

On the following table (Table 2) there are gathered main competences in terms of lightweight materials in the value chain. The competences are graded from 1 to 5 (being 1 the lowest).

<table>
<thead>
<tr>
<th>Lightweight Materials</th>
<th>Materials</th>
<th>Industrial Manufacturing</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Availability of raw materials</td>
<td>Price</td>
<td>Functionalization</td>
</tr>
<tr>
<td>Metallic alloys</td>
<td>High strength steel</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Aluminium alloys</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Magnesium alloys</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Beryllium alloys</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Titanium alloys</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Titanium aluminide alloys</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Engineering Polymers</td>
<td>Discontinuous fibres</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Continuous fibres</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Foamed Polymers</td>
<td>Advanced ceramics (e.g., porous ceramics)</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Polymer matrix composites</td>
<td>Discontinuous fibre</td>
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<td></td>
<td>Continuous fibre</td>
<td>4</td>
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<tr>
<td>Metal Matrix Composites</td>
<td>Discontinuous fibre</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Continuous fibre</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Cerments</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Advanced Ceramic-matrix composites</td>
<td>Discontinuous fibre</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Continuous fibre</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
<td>47</td>
<td>55</td>
</tr>
</tbody>
</table>

Table 2. Lightweight Materials & Technologies Competences

In general terms, the ELCA consortium have advanced competences on industrial manufacturing, particularly for scaling up and joining parts, assembly and functionalization of materials. This is especially relevant for high strength steel and aluminium alloys, engineering and foamed polymers and polymer matrix composites (continuous and discontinuous fibres) lightweight materials.

Aiming to detect the top level consortium competencies depending on the type of lightweight materials (i.e. ceramic, metal alloys, polymer composites, etc.), different graphs (Figure 6, 7, 8, 9 and 10) have been elaborated.
**Metallic Alloys**

In the case of metal alloys, the consortium has higher competences in functionalizing them (See Figure 6). On the contrary, the main challenges are the availability of raw materials and the policies and legal restrictions.

Among the different metallic alloys, the consortium has better capacities on high strength steels and aluminium. It is important to highlight that beryllium alloys have the lowest punctuation, being the price the main gap to implement this kind of alloys.

![Figure 6. Lightweight Materials & Technologies Competences – Metallic Alloys](image)

**Polymers**

In relation to polymers, including engineering polymers and foamed polymers, the consortium has excellent competences on the industrial manufacturing stage: scale up, functionalization, assembly and joining parts, separation, and recycling. (See Figure 7). For this family of lightweight materials, the main challenges among the consortium are formation and skills capabilities and the access of investment.
Advanced Ceramics

The main competences on advanced ceramics are functionalization, scale up, formation and skills, and investment. (See Figure 8). Like the rest of lightweight categories, the legal restrictions are not a core competence among the consortia.

Figure 8. Lightweight Materials & Technologies Competences – Advanced Ceramics
Polymer Matrix Composites

The consortium has excellent competences for the polymer matrix composites (including continuous and discontinuous fibres). The main capacities rely on the industrial manufacturing phase, but also on formation and skills, price and legal restrictions. (See Figure 9).

Figure 9. Lightweight Materials & Technologies Competences – Polymer Matrix Composites

Metal Matrix Composites

The metal matrix composites (including continuous, discontinuous fibres, and cermets) have the lowest punctuation pointing out that this family of materials is less developed and manufactured by the members of the consortium. Nevertheless, among metal matrix composites, the highest expertise is in the case of cermet materials; particularly, highlighting the capacities of scale up, assembling and formation and skills. (See Figure 10).

Figure 10. Lightweight Materials & Technologies Competences – Metal Matrix Composites

This project was funded by the European Union's COSME Programme.
Ceramic Matrix Composites

On the ceramic matrix composites (including continuous, discontinuous fibres), the consortium has higher competences in terms scale up and investment. (See Figure 11). Similarly to the rest of composites families, separation, recycling and revalorization and policies and legal restrictions are the main challenges.

![Figure 11. Lightweight Materials & Technologies Competences – Ceramic Matrix Composites](image-url)
Table 3 presents the results obtained for the main bottlenecks, challenges or gaps that exist among the consortium to implement the lightweight materials. The challenges are graded from 1 to 5 (being 1 the lowest).

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Lightweight Materials</th>
<th>Materials</th>
<th>Industrial Manufacturing</th>
<th>Investment</th>
<th>Formation / skills</th>
<th>Policies or / and Legal restrictions</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Availability of raw materials</td>
<td>Price</td>
<td>Functionalization</td>
<td>Scale up</td>
<td>Assembly &amp; joining parts</td>
<td>Materials Functionalization</td>
<td>Separation, recycling, and revalorization</td>
</tr>
<tr>
<td>Metallic alloys</td>
<td>High strength steel</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Aluminium alloys</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
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<td>1</td>
</tr>
<tr>
<td></td>
<td>Magnesium alloys</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Beryllium alloys</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Titanium alloys</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Titanium aluminide alloys</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Engineering Polymers</td>
<td></td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Foamed Polymers</td>
<td></td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Advanced ceramics (e.g., porous ceramics)</td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
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<tr>
<td>Polymer matrix composites</td>
<td>Discontinuous fibres</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>4</td>
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<tr>
<td></td>
<td>Continuous fibres</td>
<td>3</td>
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<td>5</td>
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<tr>
<td>Metal Matrix Composites</td>
<td>Discontinuous fibres</td>
<td>3</td>
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<tr>
<td></td>
<td>Continuous fibres</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Cermets</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Advanced Ceramic-matrix composites</td>
<td>Discontinuous fibres</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Continuous fibres</td>
<td>3</td>
<td>3</td>
<td>3</td>
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<tr>
<td>Total</td>
<td>49</td>
<td>54</td>
<td>53</td>
<td>47</td>
<td>42</td>
<td>47</td>
<td>55</td>
</tr>
</tbody>
</table>

Table 3. Lightweight Materials & Technologies Challenges

Four main challenges have been identified: i) the recyclability, separation, and revalorization of lightweight materials, ii) the price, iii) the investment capabilities, and iv) the functionalization of lightweight materials.
5. Annex

5.1. The questionnaire template

Contents:

The questionnaire aims to identify the core competences of each of the five participating clusters and to identify the already existing partnerships on an international level.

Privacy policy:

Responsible: Cluster members of COSME Grant Agreement No 951158. Purpose: Collection of data for identification of the core competences of each cluster and partnership Legitimation: Consent of the interested party. Recipients: No data transfers to third parties are foreseen, the results will be made public in an aggregated and anonymous way. Rights: Access, rectify and delete data as well as other rights as explained in the additional information.

Questions:

GENERAL DATA

1) Name of the organization

2) Cluster membership: (Yes / No)

3) Business or academia (University / Research Centre / KT Centre / etc.)

3.1) If you are a business (Start-up, Small, Medium, or Large Company)

4) Name of the contact/s of the organization related to the questionnaire.
CORE COMPETENCES AMONG THE CONSORTIUM

PART I. Lightweight materials & Industries

I.1) What are your main competences in terms of lightweight materials for each industry?

(Please grade your potential from 1 to 5, being 1 the lowest)

<table>
<thead>
<tr>
<th>Lightweight Materials</th>
<th>Industry</th>
<th>Mobility</th>
<th>Health care</th>
<th>Energy</th>
<th>Industry</th>
<th>Building</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Aero</td>
<td>Auto</td>
<td>Rail</td>
<td>Maritime</td>
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<tr>
<td>Metallic alloys</td>
<td>High strength steel</td>
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<td></td>
<td>Aluminium alloys</td>
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<td>Magnesium alloys</td>
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<td>Beryllium alloys</td>
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<td>Titanium alloys</td>
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<td></td>
<td>Titanium aluminide alloys</td>
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<tr>
<td>Engineering Polymers</td>
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<tr>
<td>Foamed Polymers</td>
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<tr>
<td>Advanced ceramics (e.g., porous ceramics)</td>
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<tr>
<td>Polymer matrix composites</td>
<td>Discontinuous fibres</td>
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<tr>
<td></td>
<td>Continuous fibres</td>
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<tr>
<td>Metal Matrix Composites</td>
<td>Discontinuous fibres</td>
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<td></td>
<td>Continuous fibres</td>
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<td></td>
<td>Cermets</td>
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<tr>
<td>Ceramic-matrix composites</td>
<td>Discontinuous fibres</td>
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<tr>
<td></td>
<td>Continuous fibres</td>
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</tr>
</tbody>
</table>
## PART II. Lightweight materials & Technologies

II.1) What are your main competences in terms of lightweight technologies for each type of material? (Grade from 1 to 5, being 1 the lowest)

<table>
<thead>
<tr>
<th>Lightweight Materials</th>
<th>Materials</th>
<th>Industrial Manufacturing</th>
<th>Investment</th>
<th>Formation / skills</th>
<th>Policies or / and Legal restrictions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Availability of raw materials</td>
<td>Price</td>
<td>Functionalization</td>
<td>Scale up</td>
<td>Assembly &amp; joining parts</td>
</tr>
<tr>
<td><strong>Metallic alloys</strong></td>
<td>High strength steel</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aluminium alloys</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Magnesium alloys</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Beryllium alloys</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Titanium alloys</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Titanium aluminide alloys</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Engineering Polymers</strong></td>
<td><strong>Foamed Polymers</strong></td>
<td><strong>Advanced ceramics</strong> (e.g., porous ceramics)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Polymer matrix composites</strong></td>
<td>Discontinuous fibres</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Continuous fibres</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Metal Matrix Composites</strong></td>
<td>Discontinuous fibres</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Continuous fibres</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cermets</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Advanced Ceramic-matrix composites</strong></td>
<td>Discontinuous fibres</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Continuous fibres</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
II.2) What are the main bottlenecks, challenges, or gaps to implement these new lightweight materials? (Grade from 1 to 5, being 1 the lowest)

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Materials</th>
<th>Industrial Manufacturing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lightweight Materials</td>
<td>Availability of raw materials</td>
<td>Price</td>
</tr>
<tr>
<td>Metallic alloys</td>
<td>High strength steel</td>
<td>Aluminium alloys</td>
</tr>
<tr>
<td>Engineering Polymers</td>
<td>Foamed Polymers</td>
<td>Advanced ceramics (e.g., porous ceramics)</td>
</tr>
</tbody>
</table>
PART III. Additional information

III.1) For your top competences (graded in 5) identified in the part I and II, could you describe in 2-3 lines more details about each of them.

III.2) Could you present some achievements/examples? Note: a link containing the info or a scheme in the form of picture would be enough.

III.3) Other relevant information in context with the questionnaire you would like to add.
Work Package 1 Conclusions

The main objective of this Work Package was to identify the lightweight opportunities in different targeted markets, as well as the first contacts for engaging with the corresponding regional and local policy.

To do so, the ELCA partnership has realised an exhaustive study to identify the specific expertise of each partner across the value chains for the targeted sectors. A questionnaire has been conducted to the members of the five clusters. The results of this study allowed the consortium to verify that the outcome of the WP is aligned with future market opportunities and to building a joint marketing strategy and common brand of “Lightweight made in Europe”.
<table>
<thead>
<tr>
<th>Partners</th>
<th>Strategies &amp; management</th>
<th>Expertise for technologies &amp; materials</th>
<th>Business development &amp; innovation management expertise</th>
<th>Targeted regions with existing contacts</th>
<th>Companies, cluster members interested in ELCA</th>
<th>Projects &amp; success cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saxony automotive industry</td>
<td>Metal Composites Ceramics</td>
<td>Innovation support for SMEs / quality assurance or publicly funded SME support Cluster development Policy support</td>
<td>U.S. - office Detroit Japan - office Tokyo Cluster members with branches in Brazil</td>
<td>Karl Mayer Technische Textilien GmbH</td>
<td>Carbon Fibre Wheel Aircraft parts Carbon Fibre recover 3D printed Titanium Alloy</td>
<td></td>
</tr>
<tr>
<td>Emilia-Romagna automotive &amp; mechanical cluster</td>
<td>polymeric composites plastics metal</td>
<td>Share skills, ideas and resources to support the competitiveness of the sector. Developed a pilot plant for recycling polymer matrix composites.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Established in 2006 Silver level since 2019 140 members Create optimal development conditions for plastics processors and tool manufacturers of the plastics sector</td>
<td>Plastics Tooling and plastics processing Plastics recycling</td>
<td>The integration of processing and tool experts, representing their interests outside the industry and also establishing a network of business connections facilitating the operations of companies, access to human resources, technological development and an increase of innovation in production.</td>
<td>International offices of Polish Investment&amp;Trade Agency</td>
<td>Aplex Sp. z o.o. Graform Sp. z o.o. KAPlast Sp. z o.o. Siropol Sp. z o.o. ZELAN Sp. z o.o.</td>
<td>Amulet – H2020 Better Factory – H2020 InterEBKP 3.0 – Expansion of Bydgoszcz Industrial Cluster to International Markets TIREC – development of a technology for new polymeric compositions with recycled tires rubber and new products designing INforM - Innovation Framework for Challenge Oriented Intelligent Manufacturing INMOLDNET</td>
<td></td>
</tr>
<tr>
<td>Gold level since 2013</td>
<td>Plastics Rubber Composites</td>
<td>Promote the expertise of French plastics engineering,</td>
<td>Fonden Plast Center Danmark, Raig, Interep, SAITEC, Mecelec,</td>
<td>PERCY (COSME PROGRAM) -</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This project was funded by the European Union's COSME Programme.
ELCA Consortium Core Competences

<table>
<thead>
<tr>
<th>Core Competences</th>
<th>Lightweight Materials &amp; Technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Targeted Industries</strong></td>
<td>With a general view in terms of lightweight materials, the consortium develops and manufactures more intensively polymers (including engineering polymers and foamed polymers), polymer matrix composites (including continuous and discontinuous fibres) and metal alloys (mainly aluminium alloys, titanium alloys and high strength steel). Regarding the sectors, the consortium has more incidence on mobility, industry, and energy. On the mobility sector, the main expertise is focused on aeronautics and automotive and rail.</td>
</tr>
<tr>
<td>Value Chain Competences</td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>The ELCA consortium have advanced competences on industrial manufacturing, particularly for scaling up and joining parts, assembly and functionalization of materials. This is especially relevant for high strength steel and aluminium alloys, engineering and foamed polymers and polymer matrix composites (continuous and discontinuous fibres) lightweight materials. The consortium has less expertise and capacities on policies and legal restrictions.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Value Chain Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Four main challenges have been identified:</td>
</tr>
<tr>
<td>• the recyclability, separation, and revalorization of lightweight materials</td>
</tr>
<tr>
<td>• the price</td>
</tr>
<tr>
<td>• the investment capabilities</td>
</tr>
<tr>
<td>• the functionalization of lightweight materials.</td>
</tr>
</tbody>
</table>
## ELCA Consortium Opportunities

<table>
<thead>
<tr>
<th>Market</th>
<th>Aero</th>
<th>Rail</th>
<th>Automotive</th>
<th>Conclusion-possible actions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Japan</strong></td>
<td>High mature market especially in carbon fibres and carbon fibres composite</td>
<td>High mature market especially in carbon fibres and carbon fibres composite</td>
<td>High mature market especially in carbon fibres and carbon fibres composite</td>
<td>➢ consolidated contacts needed &lt;br&gt; ➢ time-consuming due to cultural issues</td>
</tr>
<tr>
<td><strong>USA</strong></td>
<td>High mature market oligopole – limited numbers of global players</td>
<td>High mature market oligopole – limited numbers of global players</td>
<td>High mature market oligopole – limited numbers of global players</td>
<td>➢ promoting our expertise and creating useful local contacts &lt;br&gt; ➢ High demand in very innovative technology</td>
</tr>
<tr>
<td><strong>India</strong></td>
<td>The Indian aerospace composites market is expected to see <strong>significant growth opportunities</strong> in both local and export market developing in the years to come</td>
<td>more mature than we expected</td>
<td>Fastly growing market-less mature than Japan and USA-motivated by innovation-price sensitive</td>
<td>➢ <strong>Auto:</strong> Targeting low-cost technologies and materials +recycling solutions &lt;br&gt; ➢ <strong>Rail + Auto + Aero:</strong> developing local materials supply chain &lt;br&gt; ➢ <strong>Rail:</strong> consolidated contacts needed</td>
</tr>
<tr>
<td><strong>Latin America</strong></td>
<td>Not highly developed aerospace market but organizing the largest aerospace fair in Latin America-well positioned + foundation promoting this industry already exist</td>
<td>NA</td>
<td>NA</td>
<td>➢ gain of visibility through the aerospace fair &lt;br&gt; ➢ using local initiative for creating contact</td>
</tr>
<tr>
<td>✓ <strong>Chile</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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This project was funded by the European Union's COSME Programme.
<table>
<thead>
<tr>
<th>Region</th>
<th>Country</th>
<th>Description</th>
<th>Strategies</th>
</tr>
</thead>
</table>
| Latin America| Brazil  | Brazil is supposedly the best positioned region but we lack informations of development. The Brazilian rail sector is developing right now. Though the US companies are already well-established. | ➢ Competing or partnering with already established US companies  
➢ Promoting our expertise and creating useful local contacts and knowledge  
➢ Positioning on smart materials                                                                 |
| Middle East  | UAE     | Development strategy targeting advanced technologies from all over the world—real willingness and related wealth—focusing on new sustainable solutions (Qatar for rail, Dubai for Auto + aero, RAK for aero etc.) | ➢ Promoting the most green and innovative solution to the wealthy investors                   |