Bilbao Ekintza

Bizkaia beaz

CIRCLE ECONOMY

innobasque

CIRCULAR
BILBAO & BIZKAIA

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1 | Identifying the starting point

Moving towards a circular city is a complex journey that involves many different stakeholders, companies, technologies and resources. With such a wide range of stakeholders, numerous starting points must be created to successfully initiate the transition towards a circular economy. The political context is key to identifying and initiating change in areas where there is strong political and economic interest. The main challenge of this phase was, therefore, to identify sectors and industries that are present in the public debate, to find out where exactly there is motivation and political support to work towards circularity and where there might already be momentum of an ongoing transition. This is important to ensure that the circular economy will further strengthen the economy of Bilbao and Bizkaia.

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The first phase of this report is structured in the following way:

Sectors and themes: To get a grasp on how the territory is structured first an overview is provided on the most relevant sectors in Bilbao and Bizkaia.

Growth of Bilbao and Bizkaia: Exploration of key historical events, and important policy targets to highlight the political will and the strengths and weaknesses of the economy.

Employment analysis: Analysis of the employment distribution for the sectors in Bilbao and Bizkaia.

Economic analysis: Provides insights into the value that each sector generates for the economy.

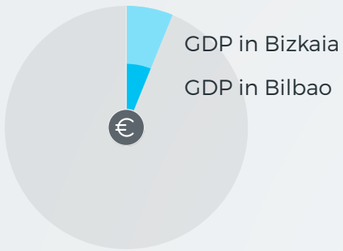
Resource use: To provide insights on which sectors have the largest potential to reduce resource use through the circular economy, an analysis of resource per sector is done.

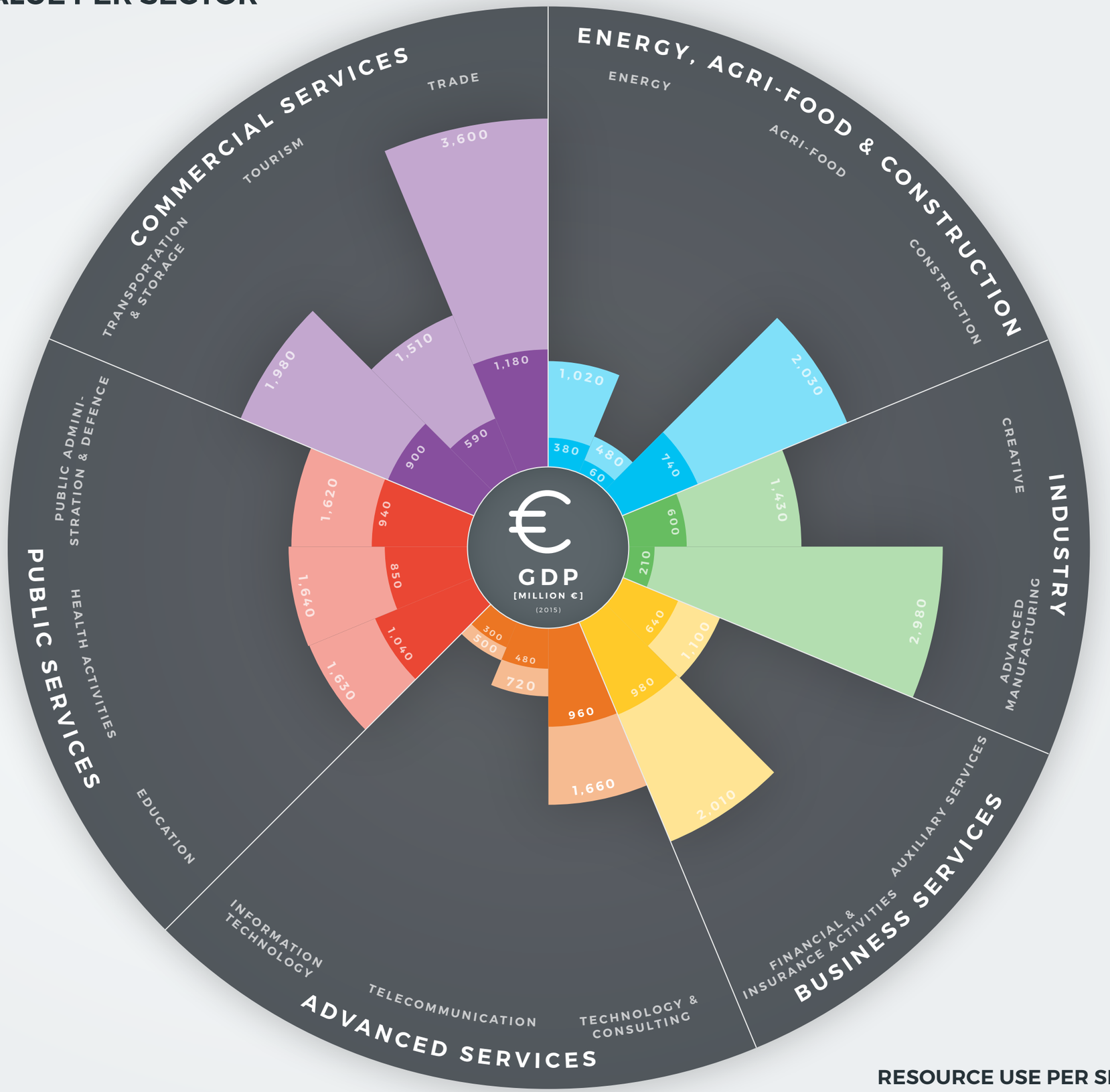
Top 10 sectors: Based on the political and economical analysis, the top 10 most important sectors are scored based on an economical and circular score.

SECTORS AND THEMES

ECONOMIC VALUE PER SECTOR

The second part of the economic analysis is an exploration of Gross Domestic Product (GDP) per sector. This provides insight into the value that each of the sectors provide to the local economy. In the graph the dark color represents the GDP in the city of Bilbao whereas the light color represents the GDP in the province of Bizkaia. The larger the surface, the larger the GDP.





RESOURCE USE PER SECTOR

TOP 10 SECTORS

The top 10 sectors is based on sectors that were politically most relevant in combination with the best performing sectors in GVA, employment and resource use. For each of the sectors, the economic score (left part of the indicator) and circular score (right part of the indicator) is shown. These scores are visually represented for Bizkaia (top part of the indicator) and Bilbao (lower part of the indicator). The economic scoring is based on GVA and employment, where the sector with the most jobs or GVA receives a score of 10, and the smallest sector a score of 0. The circular score is based on resource use and waste production, and the sector with the highest resource use receives a score of 10, and the smallest sector a 0. In the graph the dark color represents the score for Bilbao whereas the light color represents the score for Bizkaia. Based on their accumulated score the sectors are ranked from having the lowest to the highest potential for a circular Bilbao and Bizkaia.

CONCLUSION PHASE 1

2 Material flow analysis

Mapping resource flows through the city and region

In Phase 2, the most important environmental pressures, and those value chains with a high dependency on virgin materials, are pinpointed. For this, the physical resource flows through Bilbao and Bizkaia's trade, advanced manufacturing and tourism sector are mapped. Developing one clear overview of resource flows in Bilbao and Bizkaia gave a powerful understanding of the main sustainability impacts, consumers, and producers of waste. This is the basis for evaluating opportunities and priorities for a more circular and inclusive Bilbao and Bizkaia.

Identifying leverage points within the system

The material flows analysis shows how biomass, energy, metals, minerals and chemicals are flowing through the city, and how they are consumed and processed by the various sectors. Secondly, the way in which those streams are treated at the end of life was also analysed; are they landfilled, incinerated, recycled or remanufactured? From this, a refined state of the sector was developed, and it became apparent where the greatest leaks in the systems are and where the leverage points for a transition towards a circular economy are placed. Based on these leverage points, circular strategies will be identified in the next phase.

Understanding hotspots of resource flows

To broaden the understanding of where key economic activities, business and resource flows are located within Bilbao and Bizkaia, a geographical analysis was conducted. This helped identify clusters of key players within each sector and their locations within the city and region. This has given a clearer understanding of where potential hotspots of resource flows are positioned. Additionally, it has helped to identify the best locations for the implementation of circular innovations and the potential for scaling up pilot projects in the future.

The second phase of this report is structured in the following way:

- **Methodology material flow analysis**: A brief overview of the methodology and definitions used.
- **Material flow and geographical analysis tourism sector**: An analysis of the tourism sector, where the subsectors restaurants and hotels will be explored in more detail.
- **Material flow and geographical analysis trade sector**: An analysis of the trade sector, where the subsectors wholesale, retail and sale and repair of vehicles will be explored in more detail.
- **Material flow and geographical analysis advanced manufacturing sector**: An analysis of the trade sector, where the subsectors wholesale, retail and sale and repair of vehicles will be explored in more detail.
- **Prioritisation of sectors**: For each of the sectors, a prioritisation graph has been created that shows the economic relevance, circularity potential and greenhouse gas emissions.

Within the Advanced manufacturing sector, the Transport equipment, Metallurgy & metal products, and the Electrical equipment subsectors are displayed.

Metals constitute the most important resource inputs, and the Metallurgy & metal products consumes the majority of all resources. Whereas the majority of waste is recycled, there is no significant amount that is reused, and almost 40% is still sent to landfill.

TOP 3 PRODUCTS

Energy products
- Blast furnace gas [7.000 TJ]
- Electricity by nuclear [5.000 TJ]
- Electricity by gas [5.000 TJ]]

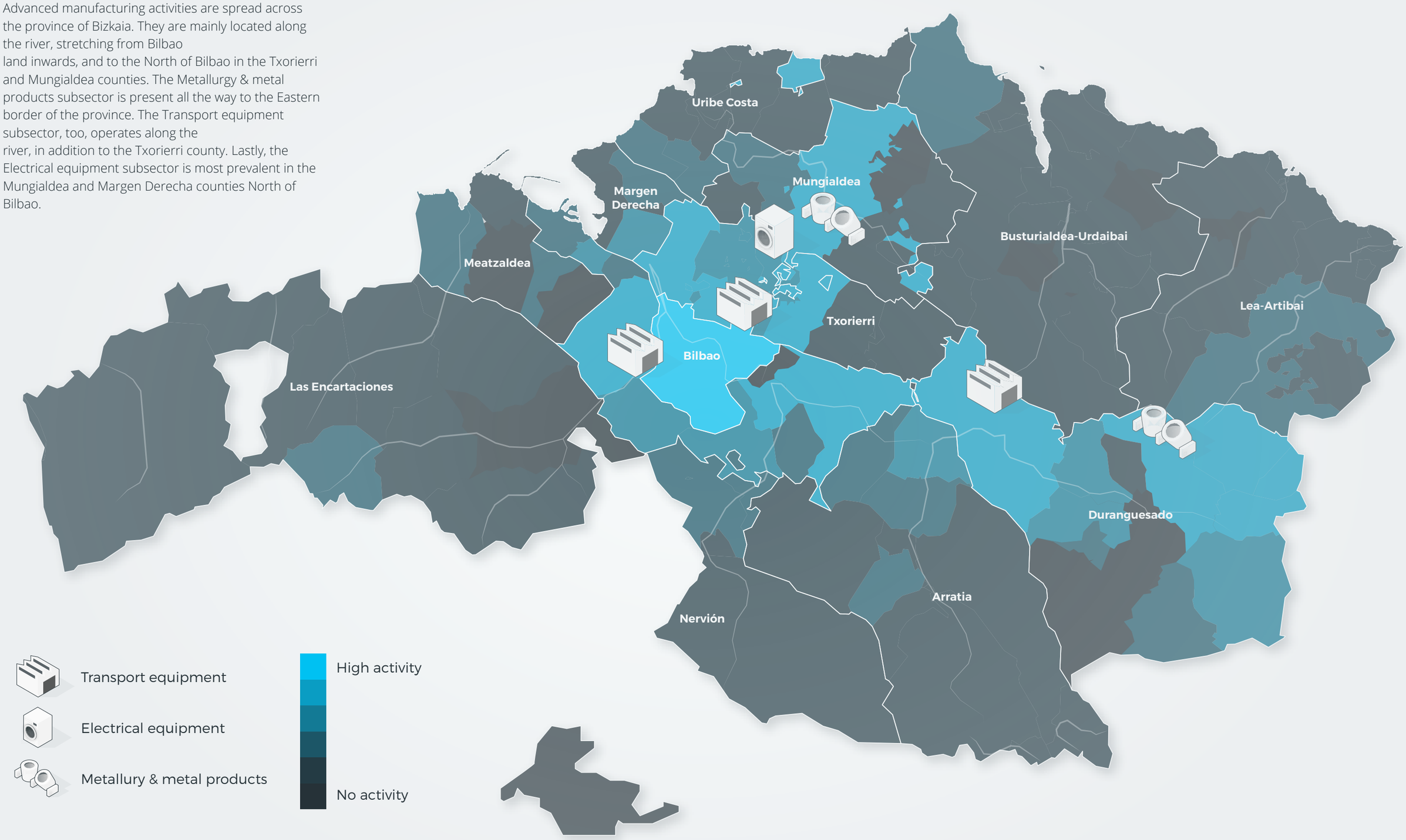
Metal products
- Basic iron and steel products [1.077.000 tonnes]
- Iron ores [320.000 tonnes]
- Lead; zinc and tin ores [71.000 tonnes]

Minerals & chemicals products
- Glass and glass products [105.000 tonnes]
- Non-metallic mineral products [79.000 tonnes]
- Chemicals [49.000 tonnes]

Biomass products
- Wood and products of wood and cork [34.000 tonnes]
- Forestry products [20.000 tonnes]
- Paper and paper products [4000 tonnes]

GEOGRAPHICAL ANALYSIS ADVANCED MANUFACTURING

Advanced manufacturing activities are spread across the province of Bizkaia. They are mainly located along the river, stretching from Bilbao land inwards, and to the North of Bilbao in the Txorierri and Mungialdea counties. The Metallurgy & metal products subsector is present all the way to the Eastern border of the province. The Transport equipment subsector, too, operates along the river, in addition to the Txorierri county. Lastly, the Electrical equipment subsector is most prevalent in the Mungialdea and Margen Derecha counties North of Bilbao.



The prioritisation chart provides insights regarding the circularity potential and economic relevance of the discussed subsectors. The final aim of the bubble chart is to provide support for the decision-making process regarding which subsector the analysis will be focusing on in the next phases.

The Metallurgy & metal products subsector and the Restaurants subsector have the highest potential, respectively due to mainly circularity potential and economic relevance. In a second belt, Retail trade, Wholesale trade, and Transport equipment can be found. The outer bound, representing the lowest rating subsectors, includes Sale and repair of motor vehicles & sales of automotive fuels, Electrical equipment, and Hotels.

The chart on the right displays a ranking of the eight subsectors based on circularity potential (y-axis) and economic relevance (x-axis). These scores are based on the following indicators:

Circularity potential:

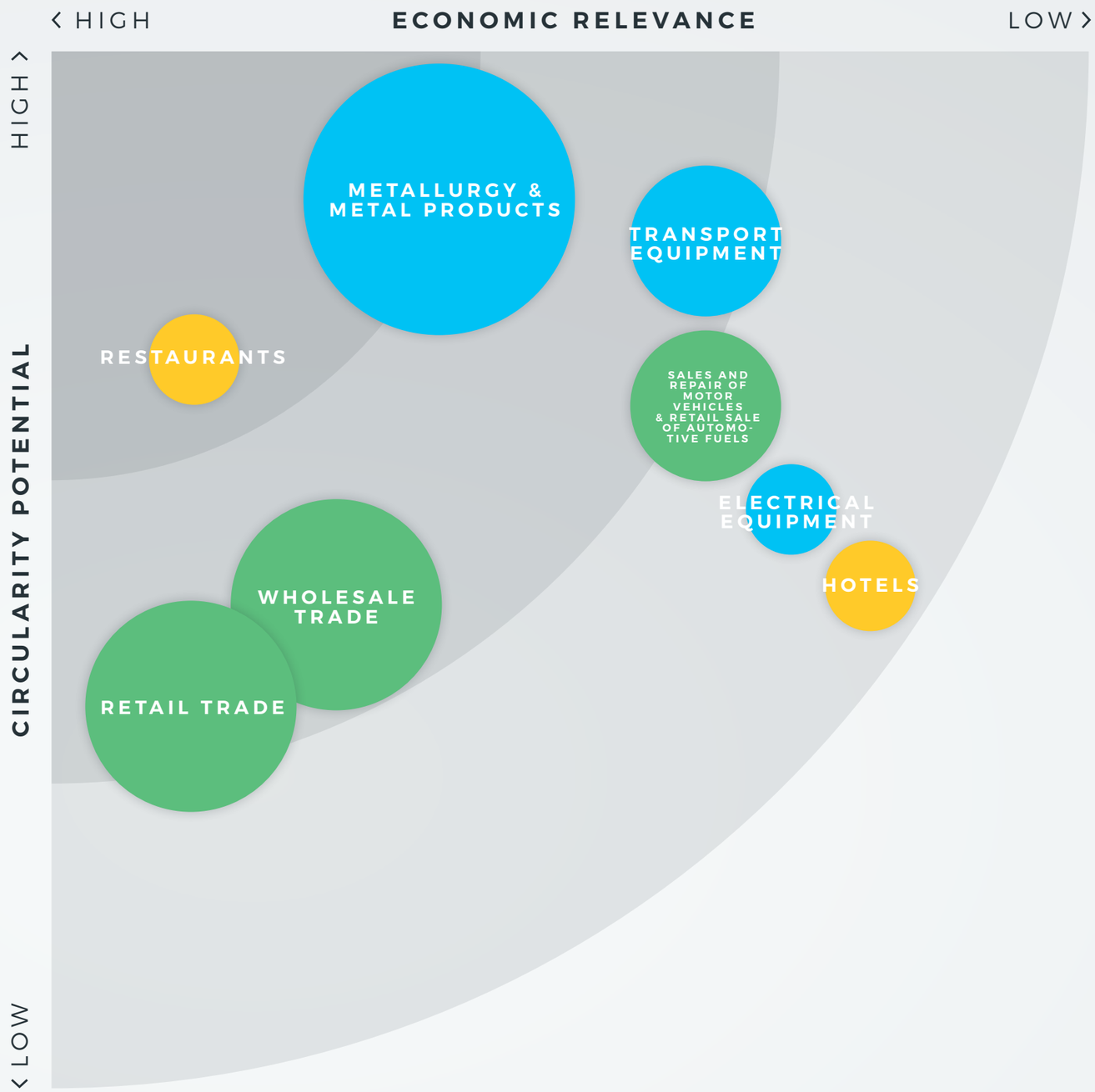
- Waste generation [tonnes]: total amount of solid waste generated by the subsector over the year
- Material intensity [kg/€]: amount of resources needed for the production of a monetary unit of that product
- Waste value recovery [%]: share of solid waste which undergoes value recovery treatments

Economic relevance:

- Jobs: total number of employees per sub-sector
- Establishments: total number of establishments per sub-sector
- Gross value added: economic value generated by the sub-sector
- Strategic dimension: political relevance of the sub-sector for Bizkaia

Emissions:

The size of the circle is a measure for the greenhouse gases emitted by the subsector.



CONCLUSION PHASE 2 >

3 Circular strategies

A longlist of innovations that can create a long-lasting effect on key material flows

In Phase 3, circular innovations were developed that tackle the most pressing environmental issues identified for the metal, restaurant and wholesale sectors. In order to do so, a long list of innovations that would render the focus sectors more circular and have an impact on the key material flows was created. The longlist is developed by looking at the impact area from the material flow analysis, global trends and local activities, thereby making sure that the most impactful strategies are selected that capitalize on global trends and use the local strengths of Bilbao and Bizkaia.

Establishing a future vision

A future vision was developed to identify the practical and scalable strategies that could spark a transition towards a circular economy in Bilbao and Bizkaia. They show how various businesses and government stakeholders can work together towards a common goal of a circular economy. Special attention has been given to cross-sector benefits, collaborative working and the potential for a significant impact.

12 circular strategies

Based on the future vision, 12 practical and scalable circular strategies were developed that have the potential to create systemic change. For each of the strategies, the inputs, processes and outputs that are required for each specific case, as well as the impact on key material flows, what the potential to create jobs and economic value is, and the feasibility, are indicated.

The third phase of this report is structured in the following way:

- **Framework to identify circular strategies**: An introduction to the framework that will be used to identify the most impactful strategies.
- **Circular vision**: A circular vision was developed to analyse how the three sectors would operate ideally in a circular economy.
- **Circular strategies**: For the metal, restaurant and wholesale sectors 12 strategies were developed which detail how they would transform the city and region.
- **Prioritisation of circular strategies**: For each of the 12 strategies a heatmap was developed, which will be used to prioritize the circular strategies that are further being developed in phase 4 of Circular Bizkaia and Bilbao.
- **Conclusion**: Conclusion from phase three and prioritisation meeting from the consortium.

IMPACTS

3.656.000 tonnes
Metals

1.145.000 tonnes
Emissions

766.000 tonnes
Waste

231.000 tonnes
Minerals & chemicals

52.000 tonnes
Biomass

39.000 TJ
Energy

BEST PRACTICES

Prioritise regenerative resources

Decarbonisation: In a low-carbon society, carbon dioxide is seen as a useful material, and capture the value of the emitted CO2. The heavy industry sector can be a pioneer of carbon capture and utilization solutions since they are one of the major polluting actors in society.

Waste as a resource

Urban mining: As a response to the current concern of resource depletion, a growing trend for urban mining is to perceive urban environments as mining sites. Many research institutions are already working on mapping out material stocks and flows in cities to understand the potential of recovering resources from urban environments.

Residual products: The metal industry produces vast amounts of residual streams that can be captured and processed into new goods. New companies are looking into technologies that capture slag from the metal industry and that can be re-used into new products.

Design for the future

Additive metal (re)manufacturing: 3D printers revolutionize the way goods can be manufactured, with significant benefits from an environmental as well as economic point of view. 3D printing can be especially efficient in replacing damaged components in remanufacturing of products.

Rethink the business model

Dematerialisation: Sustainability will not only come from improving the efficiency of manufacturing processes, but also from reducing our material consumption. In the foreseeable future, increasing attention will be put on designing products with less materials.

Material substitution: Known reserves of metal ores are depleting, leading to an increase of material prices. More companies are looking into material that can substitute the use of metals, to reduce dependency on scarce materials.

LOCAL ACTIVITIES

Prioritise Regenerative resources

Reduction of carbon emission is one of the key goals of the Basque country. Through the climate change strategy policy of the basque country local efforts are linked to European efforts of carbon emission storage.

Waste as a resource

The Metal sector in Bizkaia has a significant interest and a good understanding in terms of **value recovery** from metal waste streams. For instance, up to 80% of slag is already recycled, and several projects are investigating the potential use of slag in road construction.

Design for the future

High interest and well understanding of the **3D printing** technology can be seen in Bizkaia. Several firms and R&D institutions in the Basque country are working closely with technical companies and led for instance to the collaborationa 3D metal printer that can allow for he manufacturing of very complex and also big metal pieces.

STRATEGIES

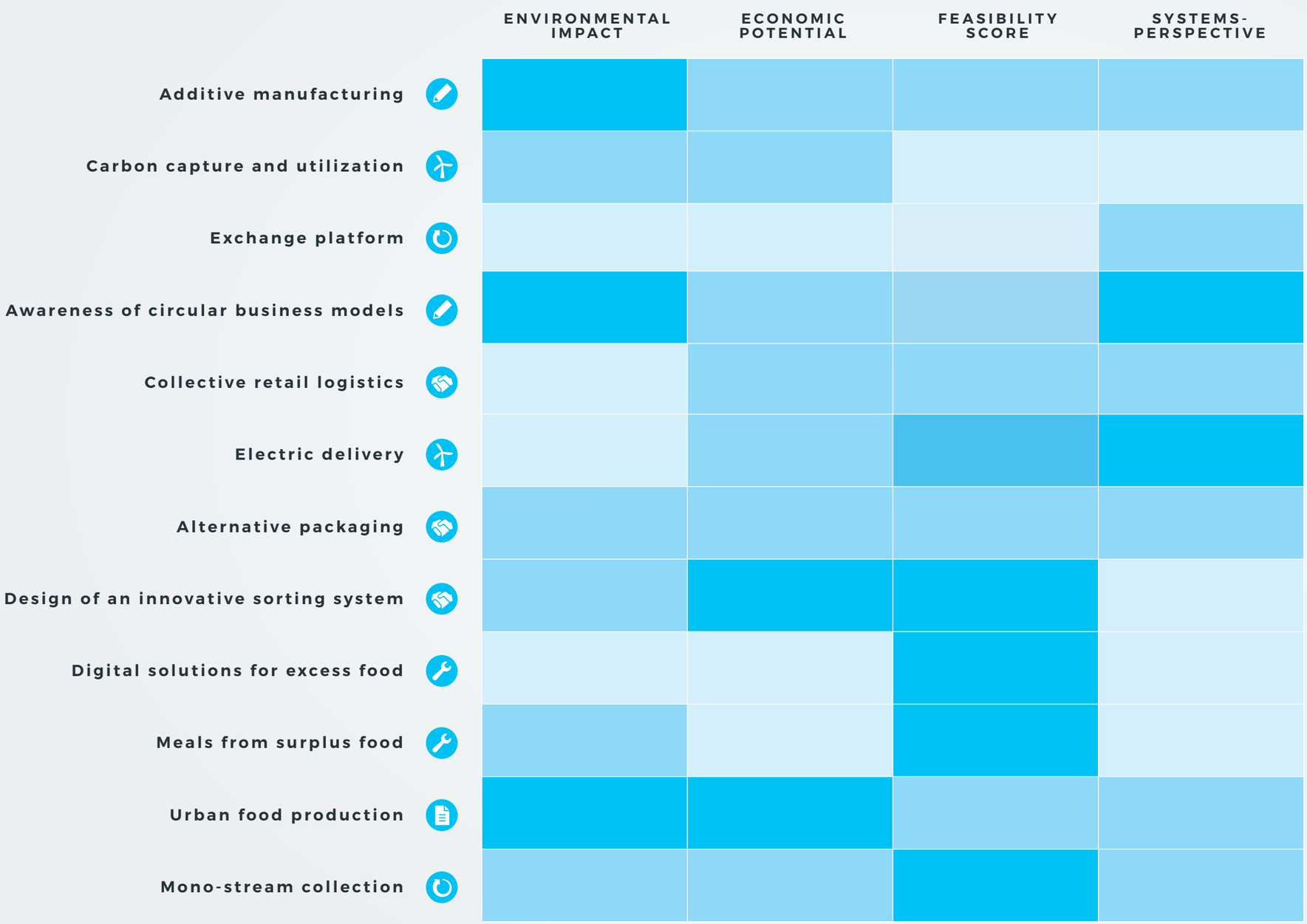
Carbon capture and utilization

Awareness of circular business models

Exchange platform

Additive manufacturing

CIRCULAR VISION



Based on the twelve strategies that are identified in the previous step, a heatmap will be used to prioritize the circular strategies that are further being developed in the phase four of circular Bizkaia and Bilbao. For this we will use four indicators.

Environmental impact
The positive impact on the environment based on the impact indicators summarized in low, medium and high.

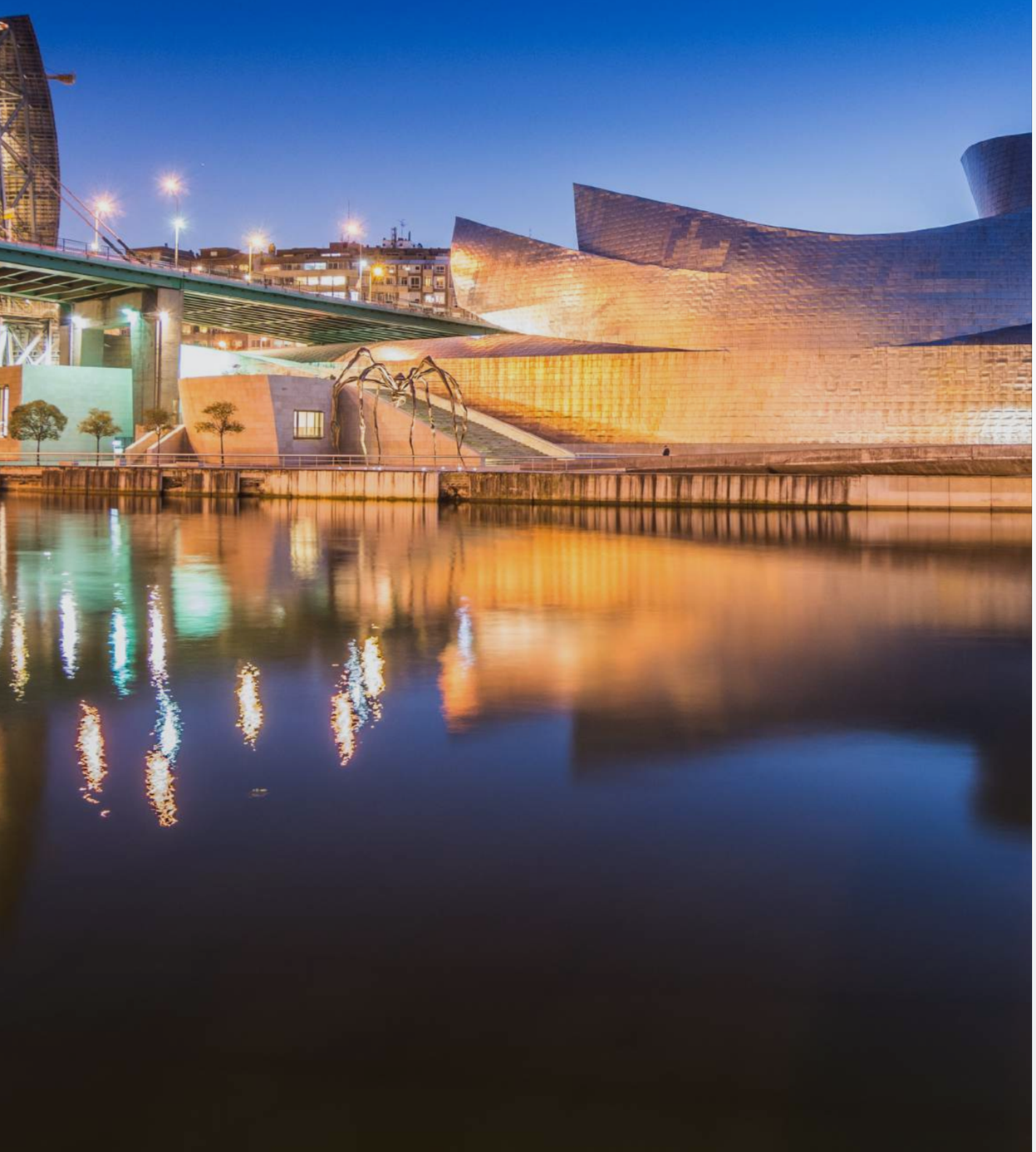
Economic potential
The potential to generate a positive impact on the economy or job creation.

Feasibility
The feasibility to realize a pilot formulated in low, medium high. Based on an analysis of cultural, institutional, financial and regulatory barriers.

Systems-perspective
The strategies have different territorial scales at which they intervene with the system. The following three are being differentiated: Micro, Meso and macro scale.

Priority: LOW | MEDIUM | HIGH

4 | Action plan



Action plan for six circular strategies in Bilbao and Bizkaia

Phase 4 provides a detailed action plan, building upon the prioritised strategies in phase 3. This report contains six different strategies organised by sector: the circular envisioning for the restaurant sector is covered by the strategies “meals from excess food” and “digital solutions for excess food”; the wholesale trade sector includes the strategies “design of an innovative sorting system” and “collective retail logistics”; finally, the metal sector is envisioned in a circular way through the strategies of “additive manufacturing” and “awareness on circular business models”.

A clear roadmap for implementation

Each of the strategies includes an introduction to the opportunity being addressed, an explanation of the strategy and an example of a successful business case already implemented based on the same approach. Then, the business model section explains how the actual implementation of the strategy could be carried out in Bilbao and Bizkaia. This section includes a map of local stakeholders involved in the functioning of the system, including an estimation of the benefits and investments related to each actor. Finally, a timeline and an actionable plan conclude each of the strategies.

The fourth phase of this report is structured in the following way:

- **Overview of strategies**: Introduction to circular strategies and future vision for the city.
- **Meals from surplus food:** Action plan and roadmap for the restaurant sector
- **Digital solutions for excess food:** Action plan and roadmap for the restaurant sector
- **Design of an innovative sorting system**: Action plan and roadmap for the wholesale sector
- **Collective retail logistics**: Action plan and roadmap for the wholesale sector
- **Additive manufacturing**: Action plan and roadmap for the metal sector
- **Awareness of circular business models**: Action plan and roadmap for the metal sector
- **Conclusion**: Main conclusion for phase 4

Restaurants sector

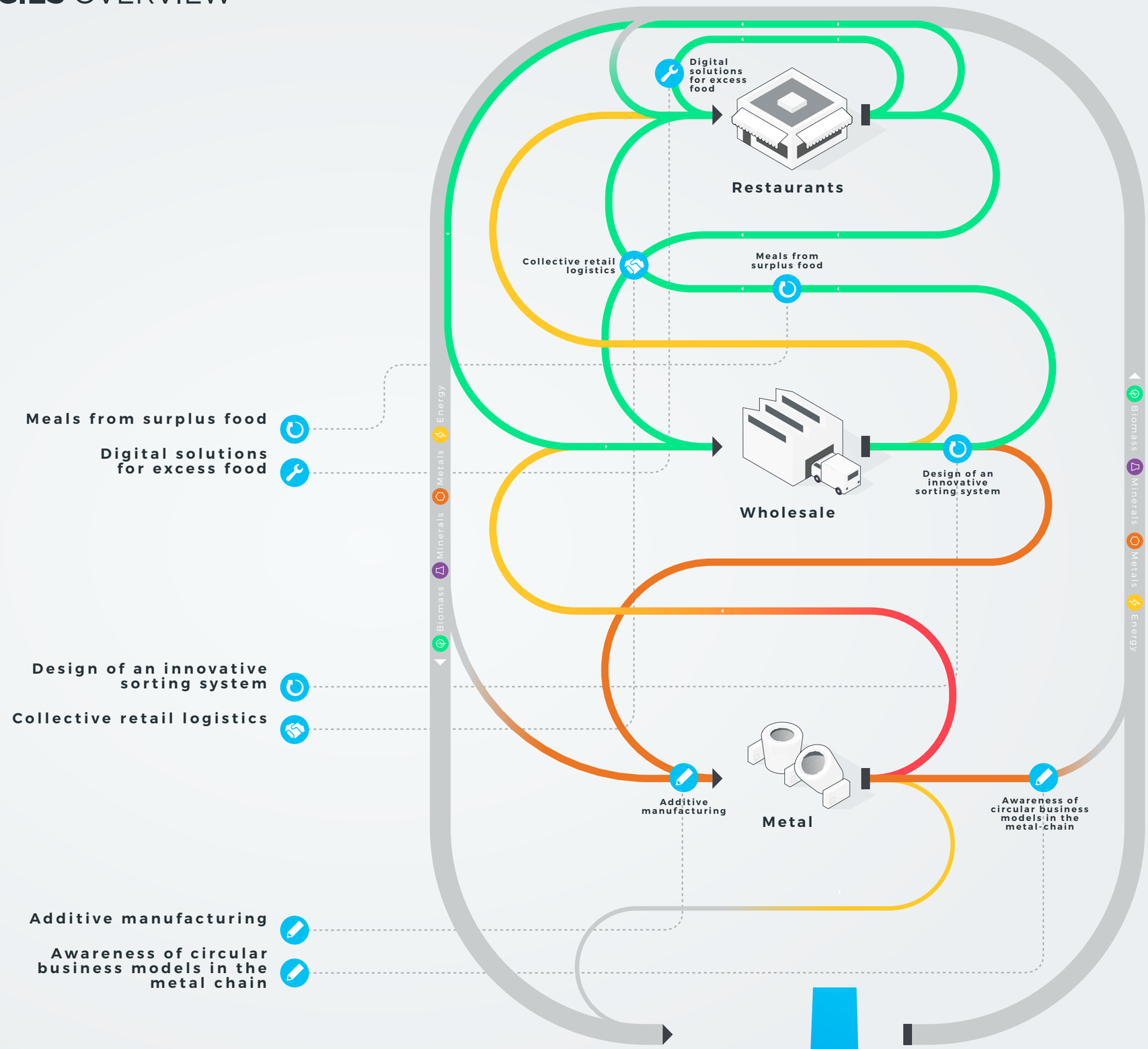
The circularity of the restaurant sector is proposed to be improved by means of the adaptation of the restaurants' meals towards a more sustainable offer including edible food which is discarded. A digital platform would also connect the consumers with surplus food that can be purchased at the end of the day at reduced prices. These two strategies complement each other by addressing the pre- and post-consumption phases.

Wholesale sector

The wholesale sector strategies address the functioning of the trading and distribution facilities by organising a more efficient waste separation system within the installations including a system of incentives to engage its users. The environmental impact of the wholesale activities is also considered through the design of a more efficient logistics system including a digital platform connecting the retailers, sustainable vehicles and a reverse logistics approach.

Metal sector

The metal sector can implement circular strategies based on additive manufacturing, which holds potential to foster collaboration across industrial actors and lead to a less resource-intensive activities through the manufacturing of metal parts. The shift to a circular mindset needs to also be reinforced through awareness projects in which circular business strategies are materialised into more cost-effective products' prototypes.



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Project Team

Circle Economy
Annerieke Douma, Jurn de Winter, Kay van 't Hof,
Matthew Fraser, Anna Diaz, Max Russell

Innobasque
Lola Elejalde, Oihana Blanco

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