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Executive Summary

The work carried by Vertigo Lab is multifaceted as it undertook to connect entrepreneurial endeavors in new fields with regional socioeconomic impacts and global environmental impacts evaluation. The first part of the work was to connect the existing activity classification with the new Blue Economy fields defined by the European Union. These fields studied remain part of other industries and were difficult to truly identify. This was the case of biotechnologies and seabed mining. There are not yet developed enough to be fully integrated in the NACE classifications.

Furthermore, the work conducted allowed the regionalization at the NUTS3 administrative scale in France and to expand the NACE 64 sectors to NACE 615 sectors in France. Other countries did not have sufficient open data to carry similar work. The sub sectorial granularity was only available for aquaculture practices, albeit only at the national level. Vertigo Lab used the development work and the database knowledge to estimate four companies across three countries in the Atlantic Area. Vertigo Lab worked with coaches to help them understand and transmit the results to the beneficiaries. The results were provided with the visuals developed for the project in addition to an explanatory note.

1. Introduction

This research program is interested in the blue economy in the sense of the European Commission's definition (presented below) and not in the conceptual sense developed by the economist Gunter Pauli. The latter considers the blue economy in opposition to the red economy of the industrial era and the green economy of sustainable development, through a vision quite close to biomimicry. He defines the blue economy as an economy that meets the basic needs of everyone, not just human beings. It aims to stop producing waste and pollutants by drawing inspiration from what nature does.

Within the framework of FANBEST program, we consider the blue economy as defined in 2018 by the European Commission, as "all economic activities related to the oceans, sea and coasts, including the direct and indirect support activities necessary for its functioning". However, this definition remains rather vague because it does not allow for a clear definition of the contours. Activities that take place at sea (e.g., fishing, shipping) or on the coast (e.g., port activities) fit perfectly into the definition of the blue economy. However, it would be too simplistic to approach it solely through these activities. Indeed, land-based activities can also have strong economic links with purely maritime activities. This is the case, for example, of a company specialized in the ship painting business. This activity is not directly in contact with the maritime environment but is closely linked to it. In order to have an exhaustive vision, we add to this definition the transversal and support activities (activities aimed at increasing knowledge of the marine environment, training, public administration and associations for the protection of the sea and the coast). In FANBEST, the contour issue remains as tourism and biotechnologies can be associated in several activity categories.

This difficulty in defining the contours of the blue economy hinders its development. Without a precise definition, it is difficult to: conduct studies and analysis of the potential of the blue economy; bring together actors around a common vision; and carry and finance projects that do not fit into any box. In 2014, a report by the Regional Economic, Social and Environmental Council (CESER) of Brittany thus pointed to the two major difficulties of conducting studies on the blue economy: the definition of the contour and the measurement, both closely related. Firstly, the definition of the scope, as there is no universally accepted list of the activities concerned; secondly, the measurement, as the nomenclatures used to classify economic activities have not been designed to study the blue economy in a specific manner (e.g. it is not possible to isolate companies specializing in the painting of boats and ships in the painting sector). Socio-economic studies are thus confronted with methodological difficulties in constructing robust socio-economic indicators. This dimension is specifically addressed in this study on socio-economic impacts.

At the European level, it was only in 2007 that the European Commission initiated work to address maritime issues in a more coherent way and to strengthen coordination between different policy areas. It was not until 2014 that the European Union adopted legislation to create a common framework for maritime spatial planning (MSP) in Europe. Indeed, the competition related to maritime space has highlighted the need for effective management, designed to avoid conflicts and create synergies between different activities. The objective of this legislation is to reduce conflicts between sectors, encourage investment, increase cross-border cooperation between EU countries, but also to protect the environment. Finally, in 2017, the European Commission published a document "Blue Economy in the EU - What is the Blue

Economy?" Only published in English, this document presents a very succinct definition "the blue economy covers all economic activities with a direct or indirect link to the ocean", a list of non-detailed sectors and a few figures at the European level. This discrete framework, only in English, considerably limits its appropriation at national and territorial levels, and by the actors of the blue economy. Since 2018, a report presents an annual analysis of the scope and size of the blue economy in the European Union. Regarding the integration of environmental issues, our research on the subject has shown that they were not the subject of specific reflection or recommendations. The notion of sustainability appears regularly but without specifying the approaches and themes to be explored. The approach, opted by Vertigo Lab in FANBEST then, was look at the sustainability aspect through economic flows.

Various regulatory and non-regulatory measures announced by the EU Communication on the Green Deal (COM (2019) 640 of 11 December 2019) aim at transforming the EU into a resource-efficient, climate-friendly, and competitive economy. There are several tools currently available to carry out socio-economic analysis of the maritime economy: Material flow cost accounting (Le Gouvello 2019; Nguyen 2018), life cycle costing (Ruiz-Salmón et al. 2021; Utne 2009), input–output model (Cai et al. 2005; Garcia-de-la-Fuente, Fernandez-Vazquez, and Ramos-Carvajal 2016; M.-K. Lee and Yoo 2014; Leung and Pooley 2001) and cost benefit analysis (Vestergaard, Stoyanova, and Wagner 2011). The IOM is a linear modeling approach associating the flow of production inputs with the resultant flow of produced outputs in an economy.

The IOM has been applied at national or regional scale to analyze the economic and social effects of maritime sectors (Garza-Gil, Surís-Regueiro, and Varela-Lafuente 2017; Grealis et al. 2017; Cai et al. 2019; Bagoulla and Guillotreau 2020) or to inform the introduction of new measures or regulations (e.g. a study by (Cai et al. 2005) on longline fishing regulations). This model highlights the knock-on effects of the studied economic sectors through the integration of upstream impacts while providing a territorial approach. Based on socio-economic accounting, IOM interest consists in evaluating impacts at sectors or subsectors levels. Indeed, the national input-output tables provided by EUROSTAT only aggregated sectors without their subsectors. For instance, NACE 03 Fishery and aquaculture can be disaggregated between Marine fishing and marine aquaculture but only the aggregated sector’s intermediate sales are provided. Developing an IOM adapted to maritime sectors builds on oceans’ national accounts. National accounts adapted to maritime sectors usually face difficulties in adopting a common definition, classification standard, and scope of the ocean economy (Park and Kildow 2015).

The following report demonstrates how Vertigo Lab computed the socioeconomic impacts of projects along the Atlantic Arc. FANBEST aims at developing a network of innovative projects in new maritime fields through a mix of funding mechanisms exploration and coaching efforts. As projects mature and seek further funding, investors may require both regional and sectorial specific impact assessments. We present the method we used to provide this service.

2. The FANBEST Project

One key aspect of the development of Blue Economy in the Atlantic Area (Figure 1) should be based on innovative activities (European Commission, 2012), but business environment faces some problems to reach this goal. In this sense, this business environment is composed mainly of SMEs, hindering this innovative process. Follow this main idea, another two factors appear:

a) Disconnection between the business environment and the innovation system and lack of knowledge from both sides: market agents regarding the lines of research and its results and research centers about the market and business potential.
b) Difficulty for the Atlantic Area companies linked to the maritime economy to access external financing to undertake innovative projects and developing value products.

This situation can block their possibilities of growing, to move forward to the "scaling up phase" and to become more competitive on a global market. Under these circumstances FANBEST is aimed to foster the technology transfer to SMEs in blue biotechnology and exploitation of marine resources by creating a network of public and private entities focused on the fund raising that make possible the start and scale-up phase. Funds such venture, business angels, participatory loan or crowdfunding will be offered by tools and services, so that the technologies and innovations "made in Atlantic regions" can reach the market turned into successful business projects.

The Interreg Atlantic Programme is financed by the European Regional Development Fund (ERDF) under the European Territorial Cooperation objective of the European Union Cohesion Policy for the programming period 2014-2020.

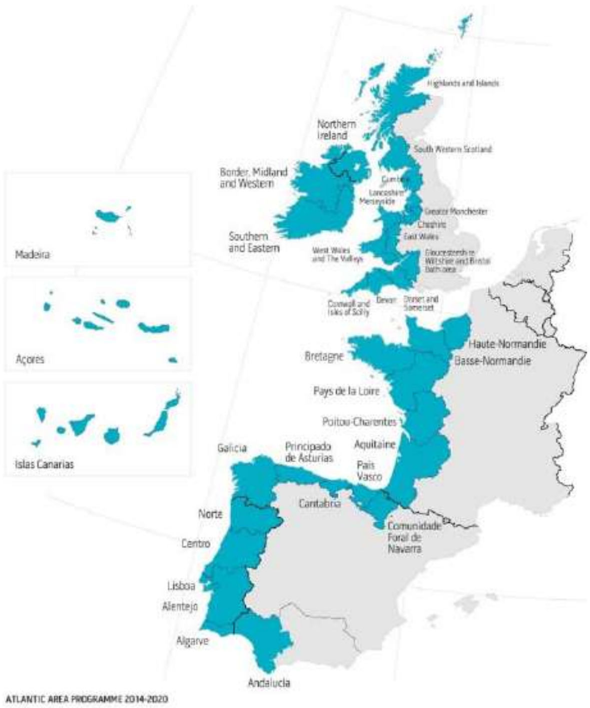

Figure 1. Atlantic Area covered by FANBEST project.

2.1. Objectives of the Project

Improving the information about the financing needs and the potential of technology transfer, with special attention to projects led by women.

Taking advantage of the knowledge and opportunities that represent business angels and other not banking financing agents like crowdfunding platforms for SMEs of the maritime economy that do not have the necessary size to access to R+D projects investment.

Improvement of skills and abilities of the support services for entrepreneurs and spin-offs so that they can facilitate the fund raising for innovative projects and positioning the universities as agents that become agents connected with the necessary funds and financing support for innovation.

Exploration and exploitation of university R+D in all their potential. This network will facilitate and coach that the research outputs reach the market in the form of new commercial products or innovative services, provided by SMEs located in Atlantic regions.

Increasing the funds and financial instruments available for innovation and scaling up in SMEs linked with marine resources sustainable exploitation.

2.2. FANBEST Services

a) **Training Programme**. This programme is based on the idea of enhancing the capacity of advisers and support services in fundraising for technology transfer. The programme mainly targets two types of beneficiaries located in the European Atlantic Area: consultants/trainers of incubators and accelerators, development agencies, knowledge transfer department of universities, etc; any entrepreneur, researcher, and manager with an interest in the Blue Economy. This task corresponds to an online training programme aimed at improving knowledge on financial support and good practices applicable to start-ups (including spin-offs) and larger-scale enterprises in the blue economy.

b) **Stock Market**. A website for the transfer of innovations and technologies of the Blue Economy in the Atlantic Area. The purpose of this portal is to know about technologies and innovations close to market originated from marine and maritime resources and with a great potential for industrial use. Also, with a directory of investors potentially interested in investing on these technologies and innovations. In short, it is a meeting point between R+D+i entities, technology centers, companies and startups related to the Blue Economy and investment entities potentially interested in making the BE an Atlantic Area competitiveness pole.

c) **Virtual Business Missions**. The project will organize some webinars to enhance the knowledge across key stakeholders on the opportunities offered by the blue sector and facilitate "virtual" platform for innovative projects promoters and investors or mentors, as well as for companies to exchange best practices and develop commercial links.

d) **Investment coaching**. This activity aims to coach selected projects on Blue biotechnology and/or marine resources, particularly SMEs which are trying to scale up or new projects which are going to be launched. At the same time, the project will also check the success of the financial instruments set and the funded innovation projects during the first year.

e) **Stakeholders Map**. Since Blue Economy is not a sector itself it creates a major challenge to identify correctly agents taking part of BE activities. In this sense, FANBEST Project aims to create a map to solve this situation, also accompanied by a set of conclusions and recommendations about this stakeholder landscape.

2.3. Activity integration in the project

Vertigo Lab activity inscribed its activities with the investment coaching. As part of their coaching, companies were allowed to get their company's socioeconomic and environmental impacts assessments. The resulting data could be used to secure further funding if they decide to go through the impact investor route.

3. Blue Economy & FANBEST

3.1. Defining the blue economy

Vertigo Lab conducted work on the definition of the blue economy was continued in order to better define its contours and facilitate its measurement. We had previously hypothesized that a clear definition shared by all would facilitate the deployment and ownership of the blue economy. Thus, an analysis of the national ocean accounts was conducted in order to understand their structure and therefore the activities concerned within the framework of the FANBEST project detailed in the previous section. The study of the development of these national ocean accounts first allowed us to understand the approaches implemented to define the perimeter of the blue economy. The U.S. Bureau of Economic Analysis (BEA), using research conducted by (Colgan 2013), analyzed the ocean economy according to three fields. The first field consists of everything related to activities on the water such as transportation, offshore extraction or fishing. The second field represents the activities that are conducted on the seashore such as recreational activities like boating and diving. Finally, the third field is concerned with land-based activities that have a link with the ocean, such as shipbuilding and repair or the production of technical clothing specific to the sea. There are thus three types of activities the first "in" the ocean (fishing, extraction, etc.), "from" the ocean (beach tourism, processing of fishery products, etc.) and "to" the ocean (shipbuilding, R&D, etc.) (Park & Kildow, 2015). In these three fields, the idea is to see the ocean economy with its "inputs" and "outputs" (Figure 2). Finally, the BEA focuses on considering maritime activities on a coastal strip in relation to the ocean.

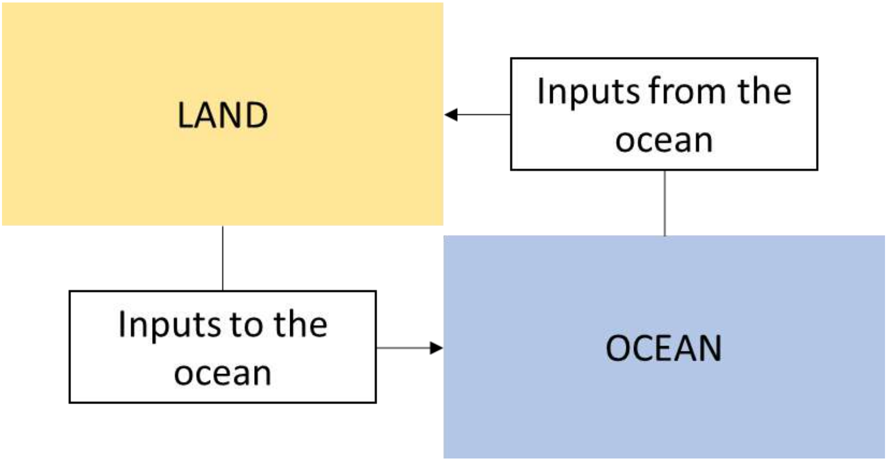

Figure 2. Relationship between the ocean and the blue economy (from (Park and Kildow 2015))

The perimeter of maritime activities, as already mentioned, remains difficult to determine. That is why, in order to further refine our definition, we took into account the degree of "maritimity" of the sectors of the blue economy, we have distinguished three levels (Figure 3). The first level corresponds to direct maritime activities, i.e. where the sea (disregarding other water bodies such as rivers and lakes) is directly linked to the activities. For example, fishing, aquaculture, certain sports activities are at the first level because **the sea is the vector of work**. The second level is indirect because it concerns companies with activities indirectly linked to the sea. For example, fishmongers and fish shops are part of this level because these companies are **sea dependent** on the sea, but they have only an indirect link. Finally, the third level concerns activities where the sea adds value to the activity, but the maritime part is not mandatory for the development of the activity. The accommodation and catering sector, thanks to tourism, is concerned because the **sea is a catalysis to the activity.**

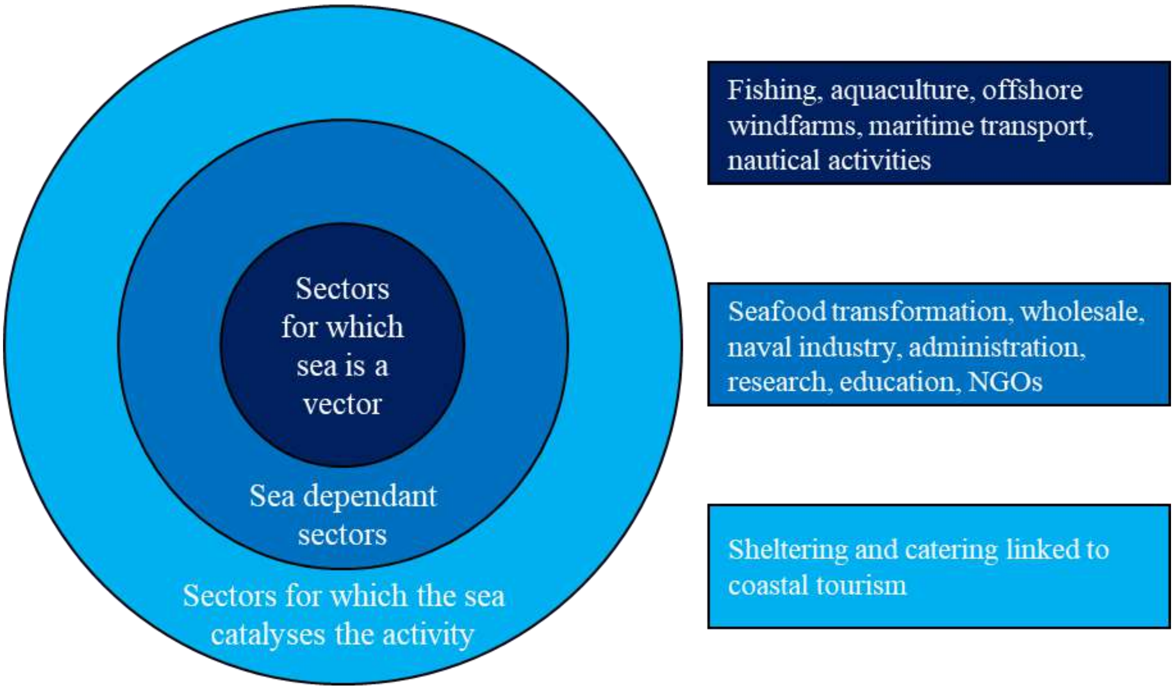

Figure 3. Perimeter of the blue economy according to the degree of maritimity method

3.2. Approach by NACE code

3.2.1. General framework

In order to derive national accounts, it is necessary to extract specific data on production, value added and employment from the input-output tables produced by the countries. This is where the previous classification comes into its own, as it provides information on the importance of the ocean in the economy. For example, the sectoral definition allowed the BEA to determine that the ocean contributed 1.5% to the US economy, more than agriculture and just below the real estate sector (Kildow et al. 2014).

These national ocean accounts, currently being developed in the USA (Fenichel, Addicott, et al. 2020), Ireland (Morrissey and O'Donoghue 2013), China (Song, He, and McIlgorm 2013) and South Korea (Jeong-In et al. 2019), are based on the same principles as other accounts, bringing together environmental, social and economic data from national agencies, institutions and the private sector, and are regularly updated and organized according to a standardized framework. The goal of Vertigo Lab in this project was not to measure the blue economy but to address how the blue economy was measured to understand what falls within the umbrella of blue economy, economically and environmentally speaking and what does not.

Vertigo's approach has been to draw on the extraction of activities in the economy from the input-output tables of other countries' national accounts. This work was done in part by Kalaydjian and Girard 2017 in the French Economic Data (DEMF). However, these data are not linked to NAF (Nomenclature des Activités Françaises) activity codes, the French equivalent of European NACE codes. Thus, Vertigo, using maritime accounts from other countries and already available data, has endeavored to extract the maritime part of the NAF codes. The extraction contributes to a more precise definition of the perimeter of the blue economy in France while facilitating the measurement of these activities. Thus, a table of equivalence between maritime activities and the associated NACE codes has been developed (Table 1).

Table 1. NACE code being either entirely in the blue economy, partially in the blue economy or indirectly in the blue economy

NACE	LABEL
03.11	Marine fishing
03.21	Marine aquaculture
06.10	Extraction of crude petroleum
06.20	Extraction of natural gas
08.12	Operation of gravel and sand pits; mining of clays and kaolin
08.93	Extraction of salt
09.10	Support activities for petroleum and natural gas extraction
09.90	Support activities for other mining and quarrying
10.20	Processing and preserving of fish, crustaceans and mollusks
21.20	Manufacture of pharmaceutical preparations
28.11	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines
30.11	Building of ships and floating structures
30.12	Building of pleasure and sporting boats
32.30	Manufacture of sports goods
33.15	Repair and maintenance of ships and boats
38.11	Treatment and disposal of non-hazardous waste
38.12	Treatment and disposal of hazardous waste
38.31	Dismantling of wrecks
42.22	Construction of utility projects for electricity and telecommunications
42.91	Construction of water projects
42.99	Construction of other civil engineering projects n.e.c.
46.38	Wholesale of other food, including fish, crustaceans and mollusks
47.78	Other retail sale of new goods in specialised stores
50.10	Sea and coastal passenger water transport
52.10	Warehousing and storage
52.22	Service activities incidental to water transportation
52.24	Cargo handling
52.29	Other transportation support activities
55.10	Hotels and similar accommodation
55.20	Holiday and other short-stay accommodation
55.30	Camping grounds, recreational vehicle parks and trailer parks
56.10	Restaurants and mobile food service activities
56.30	Beverage serving activities
65.12	Non-life insurance

65.20	Reinsurance
72.11	Research and experimental development on biotechnology
72.19	Other research and experimental development on natural sciences and engineering
79.90	Other reservation service and related activities
84.12	Regulation of the activities of providing health care, education, cultural services and other social services, excluding social security
84.13	Regulation of and contribution to more efficient operation of businesses
84.22	Defense activities
85.32	Technical and vocational secondary education
91.02	Museums activities
93.29	Other amusement and recreation activities

3.2.2. Definition of perimeter with French databases

The classification of maritime economic activities that we propose here is inspired by that used by Eurostat for the elaboration of the annual economic report on the blue economy in the European Union. However, our classification is based primarily on the codes of the Nomenclatures of French Activities (NAF). The estimation of the degree of "maritimity" was carried out in two steps. The first step consists of determining, at the level of NAF 732, i.e. the 732 sub-classes of the NAF classification, the sectors that can be related to a maritime activity. Some are easily identifiable, such as sector 03 (in NAF88 for the 88 sectors defined by the NAF classification) for fishing, aquaculture, and fisheries management, with subclasses 03.11Z (marine fishing) and 03.21Z (marine aquaculture). Others are less obvious, such as 46.38A (Wholesale of fish, crustaceans, and mollusks or "Seafood processing") in division 46 (Wholesale trade). For others, finally, the maritime part is included in the subclass. For example, boat schools are in subclass (72.11Z - Research and experimental development on biotechnology) which is mixed with other research on biotechnology. This first step is essential to determine the range of all activities related to the blue economy in FANBEST. Table 2 presents the result of this first step in identifying maritime activities within the FANBEST project contours. Five sectors are broken down into 10 distinct activities and 21 sub-classes. The databases associated with them helped us identify the companies associated with them in order to get a sense of the socioeconomic impacts through available data. In France, corporate data are widely available to anyone through the INPI API[1]. Thus, we were able to collect data on companies similar to project to help estimate the socioeconomic impacts (see section on project assessment method). Other countries in the Atlantic Arc do not provide similar data so that we were not able to have such access on company's impacts. Because of the lack of data, we were not able to assess as accurately companies outside of France.

Table 2. Industry perimeter and data sources for FANBEST sectors

Sector	Activity (maritimity typology)	NACE Code (NAF732)	Sectorial perimeter	Data source
Seafood	Aquaculture (Vector)	03.21Z – Marine aquaculture	Companies whose legal entities are based in the	Statista ; IFREMER (Activité des

[1] https://data.inpi.fr/swagger

			territory even though some activity is conducted outside the territory	navires de pêche Quartier Maritime) ; SIRENE ; Societe.com ; INSEE (Recensement de la population, Compte de la nation, FLORES, ESANE), ACOSS Stats ; EUROSTAT
Seabed mining	Nodule mining (Vector)	08.12 - Operation of gravel and sand pits; mining of clays and kaolin	Companies whose legal entities are based in the territory	SIRENE ; Societe.com ; INSEE – Recensement de la population ; INSEE (Recensement de la population, Compte de la nation, FLORES, ESANE) ; ACOSS Stats ; EUROSTAT
Marine energy & offshore wind energy	Research & engineering (Dependent) *Concerns all sectors as well*	72.19 - Other research and experimental development on natural sciences and engineering 71.12B - Engineering, technical studies	Companies whose legal entities are based in the territory	CCI ; SIRENE ; Societe.com ; INSEE – Recensement de la population ; INSEE (Recensement de la population, Compte de la nation, FLORES, ESANE) ; ACOSS Stats ; EUROSTAT
	Electricity production (Vector)	35.11 - Production of electricity		
Coastal tourism	Shelter (Catalysis)	55.10Z - Hotels and similar accommodation	Companies whose legal entities are based in the	SIRENE ; Societe.com ; INSEE

		55.20Z - Holiday and other short-stay accommodation	territory. As it could be difficult to address which is provided to local residents and which is provided to tourist. Only establishments in the costal area are taken into account. Plus, the ratio tourists / locals is used to ponder the revenue generated by tourists for a given period.	(Recensement de la population, Compte de la nation, FLORES, ESANE) ; ACOSS Stats ; EUROSTAT
		55.30Z - Camping grounds, recreational vehicle parks and trailer parks		
	Catering (Catalysis)	56.10A - Traditional catering		
		56.10B - Cafeterias and other self-service catering		
		56.10C - Fast food restaurants		
		56.30Z - Beverage serving activities		
	Renting and leasing of recreational and sports goods linked to maritime activities (Dependent)	77.21A – Renting and leasing of recreational and sports goods	Companies whose legal entities are based in the territory linked to maritime activities	SIRENE ; Societe.com ; AGRESTE ; INSEE – Recensement de la population ; INSEE (Recensement de la population, Compte de la nation, FLORES, ESANE ; ACOSS Stats ; EUROSTAT
		77.34Z - Renting and leasing of water transport equipment		
	Sports and recreation linked to maritime activities (Dependent)	85.51Z - Sports and recreation education		
		93.12Z - Activities of sport clubs		
		93.19Z - Other sports activities		
		93.29Z - Other amusement and recreation activities		
Biotechnologies	Research (Dependent)	72.11Z - Research and experimental development on biotechnology	Companies whose legal entities are based in the territory linked to maritime activities	SIRENE ; Societe.com ; INSEE (Recensement de la population,

		72.19Z - Other research and experimental development on natural sciences and engineering		Compte de la nation, FLORES, ESANE) ; ACOSS Stats ; EUROSTAT
	Pharmacy (Dependent)	21.20Z - Manufacture of pharmaceutical preparations		
	Food and feedstock processing (Dependent)	10.9 - Manufacture of prepared animal feeds		
	Cosmetics (Dependent)	20.42Z - Manufacture of perfumes and toilet preparations		

As mentioned above, there are four possible scenarios for estimating the socio-economic weight of a maritime activity:

a) The NACE code of the company is covered almost entirely in the NACE code of a sector, and no disaggregation is necessary to estimate their socio-economic impacts. This is the case for fishing and aquaculture (NAF code 03Z).
b) Maritime activities are categorized in a sub-class of a sector of activity, and the intermediate consumption is different from the rest of the sector, so they require disaggregation. It is not relevant in the case of FANBEST sectors.
c) Activities are categorized in a subclass, but their intermediate consumption is not different from other subclasses of the same sector. In this case, the intermediate consumptions of the sector should be taken. For example, renting and leasing of recreational and sports goods linked to maritime activities sectors have similar intermediate sales as other renting equipment sectors (since merchandises going through are not considered in the sectorial accounting method)
d) The sector is taken in its entirety (accommodation and catering) but production is adjusted in relation to the maritime share of the sector. Only the fraction of accommodation and food services output associated with coastal tourism is counted. It is considered that the attractiveness of the maritime area explains all the tourist activity in this sector.

3.3. Assessment of the direct impacts of the blue economy

The evaluation of direct impacts requires the calculation of the production, the added value and the number of jobs of maritime activities. In order to evaluate the production and the added value, it is necessary to evaluate the salaried and non-salaried jobs per sector of the blue economy, based on INSEE (the French national statistics agency) data. It was then necessary to extract from the publicly available data ASSEDIC, ENIM and MSA databases the number of salaried jobs by NAF732 code and by commune. These data were then cross-referenced with population census data, data from localized files on salaries and salaried employment (FLORES

- INSEE) and SIRENE data indicating the number of employees in companies as well as their legal status. It was necessary to evaluate the job aspects of sectors in order to compare the projects with established companies. This allowed the development estimation to be tailored to similar projects.

The legal status is an important data point because it allows us to assess the number of non-salaried workers by referencing the self-employed and non-salaried managers (of limited liability companies, for example). Production and value added could be calculated thanks to this estimation work and refined with an analysis using field data of salaried and non-salaried employment (converted into FTE). The conversion from FTE to production was done using the employment intensity which determines the number of FTE needed to achieve a turnover of €1M. The conversion between output and value added was done through the value-added rate. These two measures of employment intensity and the value-added rate are taken from the EUROSTAT's input-output table (symmetrical employment-resource balance tables) and the blue economy input-output table.

These tables provide a sector's purchases from suppliers for a given output. These two sources have also made it possible to estimate the remuneration of employees and non-salaried workers for the blue economy sectors. Thanks to the construction of this table of direct impacts (production, added value, employment, remuneration of employees), intermediate consumption could be estimated in order to evaluate the indirect and induced impacts of the blue economy project. Thus, a tool has been developed to specifically evaluate the socio-economic impacts of the blue economy sectors.

4. Input-output Model

4.1. Use of IO models in maritime sectors

The input-output model is widely used in socio-economic impact studies. It was developed by the economist Wassily Leontief (Leontief 1986). Its interest lies in that it considers the economic activity interactions with other economic activities via industrial trade within a territory. The latter is usually geographically and administratively defined.

The input-output model evaluates three types of impacts: direct impacts, indirect impacts, and induced impacts. Therefore, in a socioeconomic assessment, the direct impacts focus only on the studied activity; indirect impacts include the impacts generated by purchases from suppliers of said activity, taking into account the entire value chain. Finally, the induced impacts correspond to the socio-economic impacts generated by the consumption of employees working either in the activity or in the chain of suppliers. The integration of direct, indirect, and induced impacts allows to know the total contribution of the studied activity onto the territory economy.

By evaluating the three types of impacts, the model assesses the knock-on effects (or ricochet effect) of an activity onto other activities in the territory. By mobilizing this model, it is possible to know the activity's socio-economic impacts generated by one monetary unit of production onto the activity itself, as well as onto all the economic activities of the territory of interest. The results of the model are generally of interest to policy makers as they allow the identification of strategic sectors for the economy of a territory, i.e. the sectors that generate the strongest *spillover* effects onto other sectors of the economy of the territory. Jacobsen, Lester, and Halpern (2014) have shown the interest of using input-output models to study the different socio-economic consequences of management within the different sectors of the blue economy. By performing a meta-analysis on multiplier data from 808 studies from 180 countries, the authors found an average multiplier of 1.82. These results show that blue economy sectors generate a significant *spillover* effect into the rest of the economy. More importantly, among the 8 blue economy sectors considered, the four sectors associated with the fisheries and aquaculture sector are among the 4 of the 8 sectors with the highest multipliers. The authors conclude that the failure to take these *spillovers* effects into account has implications for policy-making effectiveness.

The input-output model is based on the symmetrical input-output tables that are assembled annually by the national statistical institutes. However, the activities' detail is highly dependent on the nomenclature of activities used by Eurostat. For example, whilst Eurostat publishes input-output tables according to 65 sectors of activity, fishing and aquaculture activities are aggregated. Thus, the use of an input-output model poses the problem of disaggregating the input-output table to show the different activities within the blue economy.

The input-output model has already been used in studies related to marine resources and the blue economy. For example, Morrissey and O'Donoghue (2013) mobilized an input-output model to assess the total socio-economic contribution of the blue economy sectors. The authors disaggregated the Irish input-output table to show the 10 sectors of the blue economy. The authors showed that the blue economy sectors had stronger upstream impacts (among the 10 sectors with the strongest upstream effects, there are 3 blue economy sectors) than downstream (among the 10 sectors with the strongest downstream effects, there is only one blue economy sector). Grealis et al. (2015) mobilised an input-output model to assess the expected socio-economic impacts of aquaculture development in the framework of the National Strategic Plan for Sustainable Aquaculture Development. The authors showed that a €71m increase in aquaculture production would generate a total increase in production in Ireland of €243m and create 1,565 jobs. Garcia-de-la-Fuente, Fernandez-Vazquez, and Ramos-Carvajal (2016) disaggregated the IOT of Asturias (Spain) to assess the socio-economic impact of small-scale fisheries on the Asturian economy. Results showed that the multipliers of added value and employment were higher for small-scale fishing than for other fishing and aquaculture activities.

Nevertheless, while studies exist on socio-economic impact evaluation of maritime activities associated with FANBEST blue economy activities (see previous section), no studies have looked into biotechnologies or coastal tourism through an IO model standpoint. As mentioned before, the reasons lie within the difficulties to disaggregate the sectors mostly because of the lack of data pertaining to each sector so it renders the disaggregation laborious. Only France, through its open data initiative[2], has presented enough granularity to achieve fine disaggregation. Alas, other countries of the Atlantic Arc remain opaque in public data so that little can be done to further refine the IO tables provided.

Furthermore, no study has yet been carried to evaluate the environmental impacts of maritime activities of one country onto other countries using the environmentally extended multi-regional input-output model. In fact, the phenomenon of globalization and the free movement of goods and services within the European Union has led to a fragmentation of the value chain within the different EU countries (Tukker and Dietzenbacher 2013). Multi-regional models aim to quantify these economic interdependencies between countries, given the fragmentation of the value chain. For instance, databases such as Exiobase (Stadler et al. 2018), Eora (Lenzen et al. 2013), WIOD (Timmer et al. 2015) were created for this purpose. As these databases also incorporate environmental data, they are widely used to conduct ecological footprint studies (Wood et al. 2014). As more than half of all trade (61%) takes place between EU countries, leading to high interdependencies, the necessity to compute the environmental model at the European and wider scales seem necessary. It would prevent miscounting errors since we would take into account all that is produced in the value chain (see section on budget vs footprint)

4.2. Input output model framework

At first, the general operation of the input-output model will be described. In order to assess the socio-economic impact of the activities of the fisheries and aquaculture sectors, a multi-regional input-output model was used although the industries in the input-output table were disaggregated in order to show the industries and products associated with the fisheries and aquaculture sector. The methodologies associated with the multi-regional input-output model and the disaggregation of the input-output table are presented below.

4.2.1. Ordinary input-output model

Input-output models are based on the product supply use equilibrium published in the input-output tables.

$$\mathbf{x} = \mathbf{Zi} + \mathbf{Y} \tag{1}$$

Where **x** is a column vector of output composed of *n* rows - that corresponds to industries - **Z** is the (n*n) matrix of intermediate consumption and Y is the column vector (*n* rows) of final demand.

[2] https://www.data.gouv.fr/fr/pages/about/a-propos_data-gouv/

The model then defines the matrix of technical coefficients **A**, which corresponds to the share of goods and services purchases that are necessary for the production activity.

$$\mathbf{A} = a_{ij} = \frac{z_{\boldsymbol{ij}}}{x_{\boldsymbol{j}}} \qquad (2)$$

Where z_{ij} represents the amount of intermediate consumption in products i from industry j and x_j the amount of production j. The model considers that the matrix of technical coefficients is constant (assumption of model linearity). This assumption also implies that returns to scale are constant and that production processes remain stable. Empirical studies have shown that this matrix is relatively stable, especially in the short and medium term (Bon 1986). These technical coefficients change over time with technological change. (3) is the result of the integration of (2) into (1) and factorization.

$$\mathbf{x} = (\mathbf{I} - \mathbf{A})^{-1}\, \mathbf{Y} = \mathbf{B}\, \mathbf{Y} \qquad (3)$$

Où $\mathbf{B} = (\mathbf{I} - \mathbf{A})^{-1}$ is called the Leontief inverse matrix. The elements b_{ij} indicate the direct and indirect impacts on the output of industry j following a change in final demand for product i. From the inverse Leontief matrix, the model calculates the multipliers, i.e. the total direct and indirect impacts following a monetary unit change in final demand for product i. This model can only apply to dynamics within a constraint territory.

4.2.2. Multi regional input-output (MRIO) model

Assessing the impacts of an activity located in one country on several countries requires the development of a multi-regional input-output model. Considering two countries identified by exponents r and s. The multi-regional model version equation (3) is rearranged to become equation (4).

$$\begin{bmatrix}\mathbf{x}^r \\ \mathbf{x}^s\end{bmatrix} = \begin{bmatrix}\mathbf{A}^{rr} & \mathbf{A}^{rs} \\ \mathbf{A}^{sr} & \mathbf{A}^{ss}\end{bmatrix}\begin{bmatrix}\mathbf{x}^r \\ \mathbf{x}^s\end{bmatrix} + \begin{bmatrix}\mathbf{Y}^r \\ \mathbf{Y}^s\end{bmatrix} \qquad (4)$$

Where $\mathbf{x}^r$ is output in region *r*, $\mathbf{x}^s$ is output in region *s*, $\mathbf{A}^{rr}$ is the purchases share of goods and services produced in region *r* destined for the production of industries in region *r*, $\mathbf{A}^{rs}$ is the share of goods and services produced in region *r* destined for the production of industries in region s, $\mathbf{A}^{sr}$ the share of purchases of goods and services produced in region *r* destined for the production of the industries in region *s*, $\mathbf{A}^{ss}$ the purchase share of goods and services produced in region *s* destined for the production of the industries in region *s*, $\mathbf{Y}^r$ the region *r* final demand, and $\mathbf{Y}^s$ the region *s* final demand.
Similarly, the inverse Leontief matrix can be calculated to assess direct and indirect impacts in an input-output model (5).

$$\begin{bmatrix}\mathbf{x}^r \\ \mathbf{x}^s\end{bmatrix} = \begin{bmatrix}\mathbf{B}^{rr} & \mathbf{B}^{rs} \\ \mathbf{B}^{sr} & \mathbf{B}^{ss}\end{bmatrix}\begin{bmatrix}\mathbf{Y}^r \\ \mathbf{Y}^s\end{bmatrix} \qquad (5)$$

Where $\mathbf{B}^{rr} = b_{ij}^{rr}$ denotes the amount of industry *j* output in region *r* as a result of one monetary unit of final demand for product *i* in region *r*, $\mathbf{B}^{rs} = b_{ij}^{rs}$ the amount of industry *j* in region r as a result of one monetary unit of final demand for product *i* in region *s*, $\mathbf{B}^{sr} = b_{ij}^{sr}$ the amount of industry *j* in region *s* following one monetary unit of final demand of product *i* in region *r*, $\mathbf{B}^{ss} = b_{ij}^{ss}$ indicates the amount of output of industry *j* in region *s* following a monetary unit of final demand of product *i* in region *s*.
Using the multi-regional model, it is possible to calculate spillover effects, i.e. the socio-economic spillover effects of one country on the economy of another country. These spillover effects are identified through the matrices $\mathbf{B}^{rs}$ and $\mathbf{B}^{sr}$. Similarly, the multi-regional models allow for feedback effects calculations, i.e. the impacts of purchases made abroad but which

return to the country because the production abroad required products that were produced in the country.

4.2.3. Regionalization with location quotient

Regional models are the application of the IO framework at the regional level (i.e., sub-national level). Most IO accounts are set nationally. They demonstrate the sectorial division within the economy and usually the exchanges with the rest of the world, or sometimes with other countries (in the EU account for instance). Nonetheless, regional accounts, taking account to smaller geographical area are less ubiquitous and few countries release IO accounts at the regional level (Japan is one). France releases every year its national accounts (INSEE) but they are not segregated by region or smaller entities (*départements*). While a bottom-up approach could be used to determine all the exchanges in a geographical entity, its breadth and difficulty makes it costly and lengthy. Therefore, a top-down approach is mostly always used by IO specialists. Early studies used regional supply percentage (eq. 6) that is the expression of the regional proportion of goods where x is the output of good, e the export of good and m in the import of good.

$$\boldsymbol{p_i^r} = \frac{(\boldsymbol{x_i^r} - \boldsymbol{e_i^r})}{(\boldsymbol{x_i^r} - \boldsymbol{e_i^r} + \boldsymbol{m_i^r})} \qquad (6)$$

Using these percentages, the production of good in a region r can be symbolized by the following equation:

$$\boldsymbol{x^r} = (\boldsymbol{I} - \boldsymbol{p^r A})^{-1} \boldsymbol{f^r} = (\boldsymbol{I} - \boldsymbol{A^{rr}})^{-1} \boldsymbol{f^r} \qquad (7)$$

Nonetheless, these proportion assume that regions produce the same goods in one sector, using similar technologies, just at different amounts, which is not true. It Brittany (FR) produce electricity with its dam system and Normandy nuclear, then the inputs will vary. The integration of regional specificities in input production requires the adoption of surveying techniques. However, these techniques are very costly and very intensive in human resources. That is why the economists prefer to adopt the non-surveying techniques, by employing the location quotient method.
Location quotients are used for non-survey methods, also called *top-down* approach in which the regionalization of nation IO tables is operated using the **location quotients (LQ)** instead of the survey methods with an exhaustive list of industries in the region (Miller and Blair 2009). There are four LQ used in practice: Simple Location Quotient (SLQ), Cross Industry Location Quotient (CILQ), Round's Location Quotient (RLQ), and Flegg's Location Quotient (FLQ) (Klijs 2016).

Simple Location Quotient (SLQ)

SLQ is based on the principal of maximal intraregional trade and minimal interregional trade and assumes that cross-hauling is inexistent. The SLQ method assumes that the region does not need to import a product if the region is already specialized in the production of this product.
Therefore, the SLQ does not integrate the relative regional economic weight of the purchasing sector i compared to the relative regional economic weight of the selling sectors j (that would be CILQ below). The SLQ_i equation is the following:

$$\boldsymbol{SLQ_i} = \frac{\frac{\boldsymbol{x_i^R}}{\boldsymbol{x_i^N}}}{\frac{\boldsymbol{x^R}}{\boldsymbol{x^N}}} = \frac{\boldsymbol{I}}{\boldsymbol{S}} \qquad (8)$$

Where I is the output of supplying industry I on an industry I on the reginal level relative to the output of industry I on the national level. Similarly, S is the regional total output relative the total national output. The regionalised technical coefficient for the industry i can be calculated as such:

$$a_{ij}^R = \begin{cases} a_{ij}^N \; if \; SLQ_i \geq 1 \\ SLQ_i \cdot a_{ij}^N \; if \; SLQ_i < 1 \end{cases} \tag{9}$$

Cross Industry Location Quotient (CILQ)

Apart from the similar assumptions made in SLQ, CILQ does not take into account the size of the region as the factor S is cancelled out.

$$CILQ_{ij} = \frac{SLQ_i}{SLQ_j} = \frac{\frac{x_i^R}{x_i^N}}{\frac{x_j^R}{x_j^N}} = \frac{I}{J} \tag{10}$$

Where I is the output of supplying industry I on an industry I on the regional level relative to the output of industry I on the national level. Similarly, J is the regional output of purchasing industry j relative the national output of industry j. The regionalised technical coefficient for the industry i can be calculated as such:

$$a_{ij}^R = \begin{cases} a_{ij}^N \; if \; CILQ_{ij} \geq 1 \\ CILQ_{ij} \cdot a_{ij}^N \; if \; CILQ_{ij} < 1 \end{cases} \tag{11}$$

Round's Location Quotient (RLQ)

According to (Round 1978), the LQ should take into account both the size of supplying and demanding industries as well as the regional size. RLQ was developed as an in between SLQ and CILQ.

$$RLQ_{ij} = \frac{SLQ_i}{\ln(1 + SLQ_j)} = \frac{\frac{x_i^R / x_i^N}{x^R / x^N}}{\ln(1 + \frac{x_j^R / x_j^N}{x^R / x^N})} = \frac{I/S}{\ln(1 + J/S)} \tag{12}$$

$$a_{ij}^R = \begin{cases} a_{ij}^N \; if \; RLQ_{ij} \geq 1 \\ RLQ_{ij} \cdot a_{ij}^N \; if \; RLQ_{ij} < 1 \end{cases} \tag{13}$$

Flegg's Location Quotient (FLQ)

Even though CILQ allow for croos-hauling, the phenomenon is underestimated by CILQ and does not take into account the regional size. The final 'tweak' allows for estimating the cross-hauling by modifying the RLQ formula (eq. 14) with a regional scalar λ^*.

$$FLQ_{ij} = CILQ_{ij} \cdot \; \lambda^* = \frac{SLQ_i}{SLQ_j} \cdot \; \lambda^* = \frac{\frac{x_i^R}{x_i^N}}{\frac{x_j^R}{x_j^N}} \cdot \left[\ln(1 + \frac{x^R}{x^N}\right)]^\delta = \frac{I}{J} \cdot [\ln(1 + S)]^\delta \tag{14}$$

Where $0 \leq \delta < 1$ and is the weighing parameter for the size of the region (0.3 by default) The FLQ is the preferred method for regionalization.

4.3. Disaggregation

Disaggregating the input output tables means to “separate” activities within each other in order to gain in accuracy. For instance, the NACE A03 - Fishing and aquaculture can be disaggregated between A3.1 – Fishing and A3.2 Aquaculture. These activities can be furthered disaggregated if the data is available. As such, in order to measure accurately the companies’ socioeconomic impacts, a furthered disaggregated IO table is necessary.

4.3.1. Framework

There are two methods for assessing the socio-economic impacts associated with a disaggregated industry in an input-output table (Miller and Blair 2009).

The first method, considered the most robust, aims to disaggregate the input-output table by row and column to show the sub-industry. This would result in n+1 rows and n+1 columns. However, this method is difficult to implement, as it requires data collection on both the amount of input purchases for the disaggregated industry production (this is the n+1 column of the input-output table), as well as the products of the disaggregated industry sale between the different industries (this is the n+1 row of the input-output table). From official survey data, the data generally available are for the inputs associated with the disaggregated industry. However, very little information is available on the sales structure.

The second method, known as the final demand approach, consists of assessing the socio-economic impact of an industry by knowing only its technical coefficients. Let x_j denote the output of the disaggregated industry J, and $\mathbf{A_j}=a_{iJ}$ the column vector indicating the share of purchases of product i from the disaggregated industry J. The economic impacts of industry J are calculated based on (eq. 15).

$$\mathbf{x} = \mathbf{B}.\mathbf{A}_{\boldsymbol{J}}.\,\mathrm{x}_J \qquad (15)$$

Where the matrix **B** indicates the inverse Leontief matrix of n rows and n columns. The second method will be used to disaggregate the IOTs to show the different sectors associated with fishing, aquaculture, and Seafood transformation.

4.3.2. Benchmark of IO table proxies

Much work focusing on disaggregating national IOTs into economy IOTs has been attempted to determine the weight of the maritime economy on the national territory as well as the socio-economic impacts. Notably, the Research Centre for the Maritime Economy in Ireland has disaggregated the national input-output tables in Ireland to create the IOT of the bioeconomy with the maritime in the middle with notably, a focus on aquaculture (Morrissey and O’Donoghue 2013; O’Donoghue et al. 2019; Park and Kildow 2015; Grealis et al. 2017). Although, the research is not directly available, the method provided by (Executive Agency for Small and Medium sized Enterprises. et al. 2017) has allowed us to reconstruct an IOT specific to the desired sector. Table 3 shows the benchmark organized to decide from which table to choose the proxy from in order to disaggregate the sector.

Galicia for its part has also developed regional IOTs and especially disaggregated to obtain specificity for processed products, aquaculture (focus on mussel farming (Rodríguez 2009)) and fisheries (Garza-Gil, Surís-Regueiro, and Varela-Lafuente 2017). The Scottish government, meanwhile, has also disaggregated the IOT to highlight several sectors of the economy, including fishing and aquaculture (‘Input-Output Multiplier Study of the UK and Scottish Fish Catching and Fish Processing Sectors’ 2002).

In the USA, detailed data from the BEA have been used to set up an ocean satellite account to determine the weight of the ocean in the national economy. This work has highlighted blue economy sectors contained in NAF/NAICS/NACE codes (Colgan 2016; Park and Kildow 2015; Colgan 2013; Fenichel, Addicott, et al. 2020; Fenichel, Milligan, et al. 2020; Kildow et al. 2014; Nicolls et al. 2020). The IOT from the BEA is by far the most complete one.

Nevertheless, in order to properly disaggregate, the author have been careful to choose the country from which the country of interest is the closest. For instance, in order to disaggregate aquaculture in France, two regions were available Scotland and Galicia. Scotland is focused on salmon farming while Galicia on mussel farming. France has an important oyster farming sector. Therefore, Galicia seems to be more appropriate to be used in order to disaggregate French aquaculture sector. This method was used for all maritime sectors of interest.

Table 3. Input-Output Tables in the world that could present maritime specificities.

Country	Number of sectors represented	Blue economy specificities	Source
Scotland	82	Disaggregation fishing and aquaculture. Aquaculture specific to salmon farming	(Chief Economist Directorate 2020)
Ireland	58	Aggregated	(Manto, Kilduff, and Sheridan 2018)
UK	105	Ship repair and maintenance disaggregate / sea food transformation present	(Meyrick 2020)
France	38	Very aggregated	(INSEE 2020)
Spain	65	No specific blue economy sector	(INE 2019)
Pays Basque	85	Fishing and aquaculture aggregated in NACE 03	(EUSTAT 2015)
Cantabria	52	Seafood transformation disaggregated	(ICANE 2021)
Asturias	66	Multiregional approach with origin provided	(SADEIS 2018)
Galicia	110	Disaggregation between fishing and aquaculture. The latter focuses on mussel farming. Further disaggregation for seafood transformation, naval construction and maintenance	(IGE 2019)
Andalusia	82	disaggregation for seafood transformation, naval construction, and transport	(Instituto de Estadistica y Cartograpfia de Andalucia 2020)
Portugal	99	Very aggregated	(INE 2018)
USA	403	Very disaggregated but no specificities to blue economy	(BEA 2021)

Denmark	117	Disaggregated with seafood transformation	(Statistics Denmark 2019)

4.3.3. Applied method

Based on the national account input-output table, Vertigo Lab has extracted the sub- categories in the activity sectors considered. The maritime sectors being present sometime in subcategories (such as 30.11Z & 30.12Z for naval construction), it is necessary to “extract” them from the main categories (for instance NACE 30 for other transport material manufacturing based on the previous example). In order to disaggregate national accounts, it is necessary to extract specific data on production, value added and employment from the input-output tables produced by the countries. This is where the previous classification comes into its own fruition, as it allows us to know the importance of the ocean in the economy. We were also able to get the value-added ratio as well as the employment intensity of the sector and derive the intermediate consumption. We performed the Iterative proportional fitting (IPF) method in order to adjust the value-added to the national account tables.

We used an advanced software to disaggregate the table in France by coding the pathway in KNIME. As a result of IPF method and complex algorithms, we were able to get the sector specific to the Ocean economy and in particular to FANBEST sectors. For the aquaculture sector, we were able to derive even deeper by having details on each type of aquaculture (mussel farming, oyster farming, salmon farming, etc.) using data available at the European level. This work developed over the span of the year will help us assess the beneficiaries with accuracy.

The disaggregation was processed in two steps. The first one is to generate the intermediate consumption ratio for the proxy table (*proxy*) in fishing and aquaculture and multiply it by the respective intermediate consumption of the national (*nat*) fishing and aquaculture sectors (eq.16). The latter can be found thanks to the STECF table and are generally comprised of the energy costs as well as supply (feedstock and livestock) in accordance with the STECF reports (European Commission. Joint Research Centre. and Scientific, Technical and Economic Committee for Fisheries (STECF). 2018; European Commission. Joint Research Centre. and European Commission. Scientific, Technical and Economic Committee for Fisheries. 2020a; 2020b).

$$\boldsymbol{CI_{i,nat}} = \sum \boldsymbol{CI_{i,nat}} * \frac{\boldsymbol{CI_{i,proxy}}}{\sum \boldsymbol{CI_{i,proxy}}} \tag{16}$$

Whilst this method will provide the correct ratio for each intermediate consumption such that the consumption intermediate sum will reflect the entered total intermediate consumptions (the column sum) for each subsector. However, the line sum between, for instance, fishing and aquaculture, will be different from the aggregated sector from the ESA IO table. This difference is mainly explained by the differences in concepts between the various database involved in the computation (not always consistent with national accounting concepts). Therefore, there is a need to harmonize disaggregated economic data in consistent way with the national input-output table. To do that, we use for the iterative proportional fitting (IPF) algorithm to get the appropriate column and line sums. Experimentally, there was the need of 25 iterations to obtain a correct fitting. This served as the first round of disaggregation.

4.4. Socioeconomic computation

4.4.1. Socioeconomic indicators

The methodology we have developed aims to quantify the socio-economic impact (in terms of production, added value and number of jobs) of maritime activities on a territory, through the knock-on effects that this sector generates on other sectors of the economy.

The operating impacts concern all the impacts associated with the company's activity, namely its sales and operating expenses. The operating expenses taken into account in our model include the purchase of goods, the purchase of raw materials, external expenses, staff remuneration (wages and social security contributions) and the net amount of taxes on production. The operating expenses include the expenses for car rental by the rental companies. Unlike the purchase of new vehicles, the use of leased cars does not require depreciation. In addition, leasing requires a regular expense (called rent) from the company that owns the vehicle.

The investment impacts relate to the impacts associated with vehicle purchases. Leasers become the owners of the vehicles purchased. Unlike operating expenses, purchased vehicles require depreciation. They are accounted for in a separate account within the company's accounting system (recorded as fixed assets), as well as in the national accounts. They are characterized by a life of more than one year. In addition, the investments amount is generally more volatile from one year to the next, compared to the amount of operating expenses.

Socio-economic impacts are evaluated according to three socio-economic indicators:

- **Production:** this corresponds to the monetary value of goods and services sold by a company or establishment. It is calculated from the amount of sales, corrected for inventory variations.
- **Value added:** this corresponds to the economic wealth created by a company or establishment. It is equal to the difference between production and intermediate consumption (i.e. purchases of non-durable goods and services destroyed or transformed during the production process: raw materials, energy products, services, etc.). The value added contributes to the creation of economic wealth within a (national) territorial, evaluated from the Gross Domestic Product (or GDP).
- **Jobs**: it corresponds to the number of jobs (salaried and non-salaried) in full-time equivalent (FTE) that are mobilized for the participation in the production activity of a company or an establishment.

The operating impact of maritime activities on the economy of a territory is evaluated according to three levels of impact using the ImpacTer model adapted to the blue economy (Figure 3 and see the socio-economic impact file for more details):

- **Direct impact:** corresponds to the amounts of production, added value and number of jobs of the maritime activity (see section 3.3).
- **Indirect impact:** corresponds to the amounts of production, value added and the number of jobs in the supplier sectors upstream of the fisheries value chain. This includes direct suppliers, but also suppliers of suppliers, etc.
- **Induced impact:** corresponds to the amounts of production, added value and the number of jobs in the sectors of activity (excluding the blue economy) that benefit from the consumption of employees working in the fisheries value chain, i.e. the employees of the European fishing activities as well as the employees of the suppliers.

4.4.2. Indirect and induced impact computation

The construction of the ImpacTer model (see box below) could require the construction of regional input-output tables. These tables make it possible to simulate the interactions (purchases/sales of goods and services) between the different sectors of activity within the administrative entity (county, *département*, or the region). The construction of this model was carried out on the basis of data published by the statistical institutes Eurostat and INSEE (for France) using techniques developed by researchers at the University of the West of England (Flegg's location coefficients) (Flegg, Webber, and Elliott 1995).

The maritime activities are linked to the other economic activities of the country, the county and the region, through the ImpacTer model, based on the estimation of the structure of intermediate consumption necessary for production. The financial data allow the classification of intermediate consumption according to their NAF code (and the NAF code of the supplier). The data can then be integrated into the input-output tables previously constructed.

These multipliers are first used for socio-economic diagnostic purposes. They make it possible to identify, for a given year (for this study, the year 2019), the sectors that have generated the most socio-economic impacts, taking into account both their expenditure structure (evaluated from the share of production destined for the purchase of goods and services and the remuneration of employees) and the geographical origin of the goods and services purchased (share of goods and services purchased). A sector will have a greater impact on the local economy if the producers of this sector spend a large part of their production on goods and services produced locally (indirect impacts), and if a large part of the production is destined for the remuneration of employees and consumed locally (induced impacts).

Presentation of the ImpacTer model for maritime activities

Socio-economic impacts are evaluated using the ImpacTer model developed by Vertigo Lab. This model is used to calculate the socio-economic impacts of an activity or of spending on goods and services in a given territory. ImpacTer is based on an economic model called "input-output model". This model was developed by Wassily Leontief, winner of the Nobel Prize in Economics in 1973. It is a robust model recognized in the academic world. It is currently widely used in socio-economic impact studies. The input-output model is based on the input-output tables published annually by the statistical institutes (INSEE and EUROSTAT). These tables record in a coherent accounting framework the flows of goods and services between the various activities within the territory, as well as data on the production process of these activities.

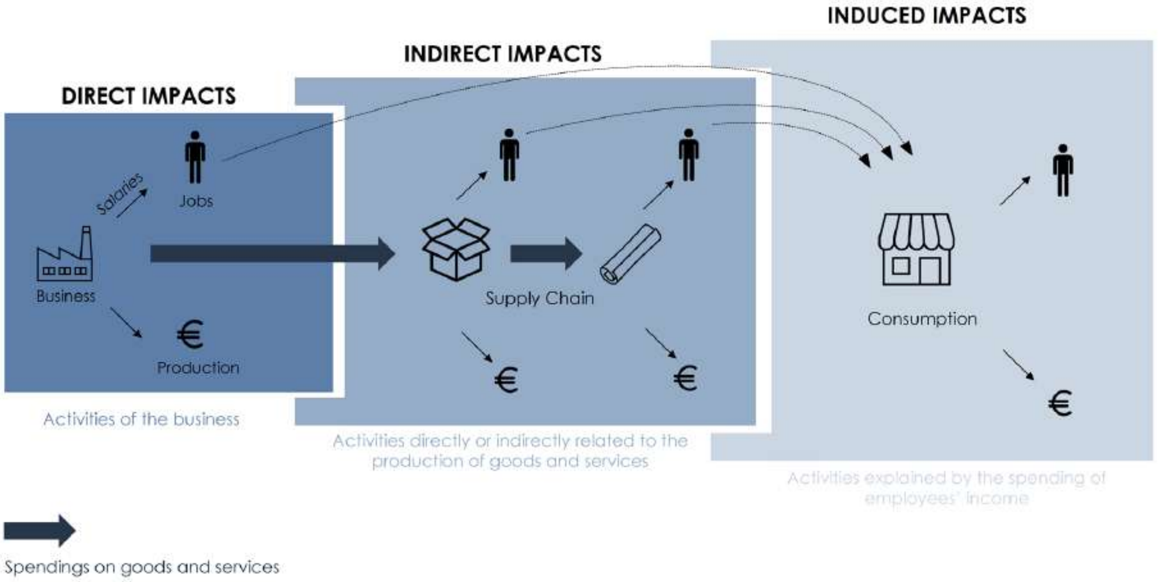

Figure 4. Scheme showing what the three levels (direct, indirect, and induced) of impacts represent after evaluation by ImpacTer

4.4.3. Main hypotheses and limitations

The input-output model, like any economic model, is based on a number of assumptions:

- Returns to scale are constant: a doubling of output requires doubling all purchases of goods and services and doubling the number of workers. In other words, the production process is assumed to be stable.
- The model is linear: the multiplier effect is assumed to be constant. Each additional euro consumed in a good or service generates the same additional impact (no threshold effects). The model does not take into account the scarcity of resources (natural resources, human resources, etc.), which limits the socio-economic impact of an increase in economic activity in a territory.
- The results depend on the level of disaggregation of economic activities (aggregation bias). The results are more accurate for input-output tables that adopt a disaggregated nomenclature of activities.

These assumptions are widely accepted by the scientific community. They are verified at least until the medium term.

5. Environmentally Extended Input-output Model

5.1. Database benchmark

If socioeconomic assessments are geographically driven since we may want to know the impact of an activity onto a territory, environmental assessments want to encompass a larger geographical scope. It is because, in terms of environmental damages, we are interested in the impacts all across the value chain since processes can be delocalized easily and so are the environmental damages. Unlike socioeconomic impacts, delocalization benefits the company since pollution intensive processes are conducted outside the country of interest. Below are the main databases and the references related to the construction of an input-output table integrating environmental data (Table 4):

Table 4. Benchmark table of most well-known database for environmental extended input output tables (non-exhaustive list)

Database	Website	Reference	Comments
Eora	https://worldmrio.com/	(Lenzen et al. 2013)	The Eora global supply chain database consists of a multi-region input-output table (MRIO) model that provides a time series of high-resolution IO tables with matching environmental and social satellite accounts for 190 countries. The database requires licensing to be used for commercial purposes such as project environmental assessments.
World Input-Output Database (Wiod)	https://www.rug.nl/ggdc/valuechain/wiod/?lang=en	(Timmer et al. 2015)	The WIOD provides annual time series of world input-output tables from 1995 onwards. They are based on officially published national IOTs and merged with national accounts data and international trade statistics. It has been used to describe trends in global supply chain trade and in research on the formation of regional production clusters in the world economy. On the other hand, some sectoral estimates are based on homogeneous factors (e.g. when disaggregating Ireland's IOT) leading to inaccuracies in national and international trade.
Exiobase	https://www.exiobase.eu/	(Tukker and Dietzenbacher 2013; Stadler et al. 2018;	EXIOBASE is a global, detailed Multi-Regional Environmentally Extended Supply-Use Table (MR-SUT) and Input-Output Table (MR-IOT). It was developed by LCA Consultant 2.0 with a

		Wood et al. 2014)	European centric approach. Therefore, the intersectoral flows are well detailed for the European Union and major economies. The environmental based nomenclature of products differs from the standard NACE code, which makes equivalency difficult. The open license makes it free for commercial usage.
US Environmentally extended Input-output model	https://www.epa.gov/land-research/us-environmentally-extended-input-output-useeio-technical-content	(Yang et al. 2017)	The USEEIO serves as a benchmark for the industry disaggregation and is based on the robust Input Output tables developed by the Bureau of Economic Analysis. It is widely used in North America. Nevertheless, the US centric approach makes it difficult to be used in a European framework.
GTAP	https://www.gtap.agecon.purdue.edu/	(Aguiar et al. 2019)	The Global Trade Analysis Project has developed a method for sectorial exchanges in dynamic modelling. It is widely used for computable general equilibrium model (CGE), which is more resource intensive than IO modelling. The European Calculator (Costa et al. 2021) project crossed the two method (GTAP + material IO) but the process is not relevant for innovative projects.
FABIO (Food and Agriculture Biomass Input-Output model)	https://pubs.acs.org/doi/10.1021/acs.est.9b03554	(Bruckner et al. 2019)	FABIO covers 191 countries and 130 agriculture, food and forestry products from 1986 to 2013. The focus on agricultural products makes it inapplicable in the blue economy context
GLORIA	https://ielab.info/analyse/GLORIA	(University of Sydney 2021)	GLORIA is widely recognized as the most complete IO database. It covers the supply and use tables for 190 countries. The license nevertheless, makes it only available for noncommercial purposes. The environmental extension needs to be realized and is not readily available.

OECD	https://www.oecd.org/sti/ind/input-outputtables.htm	No founding article	Comprehensive database but the sectorial aggregation makes it less accurate

5.2. Framework

These environmental extended multiregional input-output databases are employed to calculate the environmental footprints of consumers (Hardadi, Buchholz, and Pauliuk 2021; Beylot et al. 2019) or environmental impacts of public policies (Behrens et al. 2017). Markandya et al. (2016) employed a multiregional model (WIOD database) to calculate the employment effects of the implementation of low-carbon technologies in the European Union.

Multi-regional IO databases covering extensions to waste generation, time series, at national level such as the EXIOBASE database, a multi-unit or multilayered Supply and Use Table inventoried in 965 mass, monetary and energy units, at multi-regional level (Merciai and Schmidt 2018; Stadler et al. 2018), represents great opportunities for the development of assessment tools of CE practices.

Exiobase is the preferred choice to compute the environmental impacts of the projects. The reason is because Exiobase was developed as a European project (part of FP7) and so all European countries are represented. Other countries (non-European countries) are also represented such as China, the United States but only the main EU trading partners are represented. It seems fitting for the exercise since the main trading partners of the countries along the Atlantic Arc are other European countries.

Exiobase presents these monetary exchanges for 200 products and for 44 countries + five supranational entities including Rest of the World (RoW). The Leontif Matrix (B) can be connected to socioeconomic and environmental pressures (designated in Pressure unit/M€). This means that for each product it is possible to measure its impacts from its means of production (direct) and from its value chain both in the country and other countries. This model allows then the computation of delocalized environmental pressures. There are 1090 environmental pressures (CO2, Methane, Domestic Extraction Used - Metal Ores - Iron ores, Blue Water, Cropland - Wheat, etc.) and 23 socioeconomic impacts (female employment, value added, taxes, compensation, etc.). The environmental impacts have been regrouped in midpoint indicators such as Water, GHG emissions, Land use, Materials, ecotoxicity, etc. There are 128 midpoint indicators (Steinmann et al. 2018).

Doing similar work that for the maritime economy comparing the NACE sectors and the maritime activities, we compared the products with the products available in Exiobase (Table 5).

Table 5. Exiobase conversion for maritime products.

Sector	Activity	Exiobase product
Seafood	Aquaculture	Fish and other fishing products; services incidental of fishing (05)
Seabed mining	Nodule mining	Sand and clay
Marine energy & offshore wind energy	Research & engineering	Research and development services (73)
		Other business services (74)
	Electricity production	Electricity by wind
		Electricity by tide, wave, ocean
Coastal tourism	Shelter	Hotel and restaurant services (55)

	Catering	serving activities
	Renting and leasing of recreational and sports goods linked to maritime activities	Renting services of machinery and equipment without operator and of personal and household goods (71)
	Sports and recreation linked to maritime activities	Education services (80)
		Recreational, cultural, and sporting services (92)
Biotechnologies	Research	Research and development services (73)
	Pharmacy	Chemicals nec.

For each product, we obtain the intermediate sales in the country of production, plus, in all the countries in which an item can have been added. For instance, if company X makes an algae-based molecule, we can obtain what the processes need from the country of production (for instance France), in addition to what is imported from each country. Knowing where inputs are from helps us get the environmental impacts more accurately. Electricity production in France emits less GHG than electricity production in Germany. If half the inputs come from France and half the inputs from Germany, we can obtain an accurate estimation of the GHG emission associated with producing a certain product.

Mathematically speaking, in a two-region model (**r** & **s**), the multiregional equation (eq. 5) can be adapted to provide the pressure impacts (Ə) (eq. 17) in order to obtain the direct impact of a production (Ɛ)

$$\begin{bmatrix} Ɛ^r \\ Ɛ^s \end{bmatrix} = \begin{bmatrix} Ə^r \\ Ə^s \end{bmatrix} \begin{bmatrix} \mathbf{B}^{rr} & \mathbf{B}^{rs} \\ \mathbf{B}^{sr} & \mathbf{B}^{ss} \end{bmatrix} \begin{bmatrix} \mathbf{Y}^r \\ \mathbf{Y}^s \end{bmatrix} \qquad (17)$$

The computation is therefore simple, by having the intermediate sales breakdown by product and region, we can obtain the impacts linked to the intermediate sales and therefore ponder where the impacts are the greatest. For the FANBEST project, we have only used the environmental impacts in terms of GHG emissions which can be broken down between impact indicators and the composed midpoint indicators (Table 6)

Table 6. Composition example of an environmental midpoint indicator based on Exiobase (Stadler et al. 2018)

Midpoint indicator	Impact indicator
GHG emissions (GWP100) | Problem oriented approach: baseline (CML, 2001) | GWP100 (IPCC, 2007)	CO2 - combustion - air
	CH4 - combustion - air
	N2O - combustion - air
	CH4 - non-combustion - Extraction/production of (natural) gas - air
	CH4 - non-combustion - Extraction/production of crude oil - air
	CH4 - non-combustion - Mining of antracite - air
	CH4 - non-combustion - Mining of bituminous coal - air

	CH4 - non-combustion - Mining of coking coal - air
	CH4 - non-combustion - Mining of lignite (brown coal) - air
	CH4 - non-combustion - Mining of sub-bituminous coal - air
	CH4 - non-combustion - Oil refinery - air
	CO2 - non-combustion - Cement production - air
	CO2 - non-combustion - Lime production - air
	SF6 - air
	HFC - air
	PFC - air
	CH4 - agriculture - air
	CO2 - agriculture - peat decay - air
	N2O - agriculture - air
	CH4 - waste - air
	CO2 - waste - biogenic - air
	CO2 - waste - fossil - air

5.3. Exiobase robustness

5.3.1. Exiobase extrapolation validity

Exiobase benchmark was realized in 2011, which means that the original data, gotten from the literature is based in 2011. Nevertheless, each year, the consortium updates the tables based on extrapolations. In order to evaluate the impacts of extrapolation, we compared the estimated data of CO_2 emissions from Exiobase with measured emissions in France taken from Eurostat[3] (Figure 5). The data seem to be convergent between 2011 and 2019. Afterward, the shock produced by COVID 19 is not shown in the Exiobase extrapolation. This indicated that the extrapolation can be used up until 2019 in order to produce the environmental assessment since the ratio between economic activities and environmental pressure remains convergent. One can ponder whether the convergence can reappear if economic activities regain their momentum in 2022.

[3] Eurostat, Air emissions accounts by NACE Rev. 2 activity (env_ac_ainah_r2)

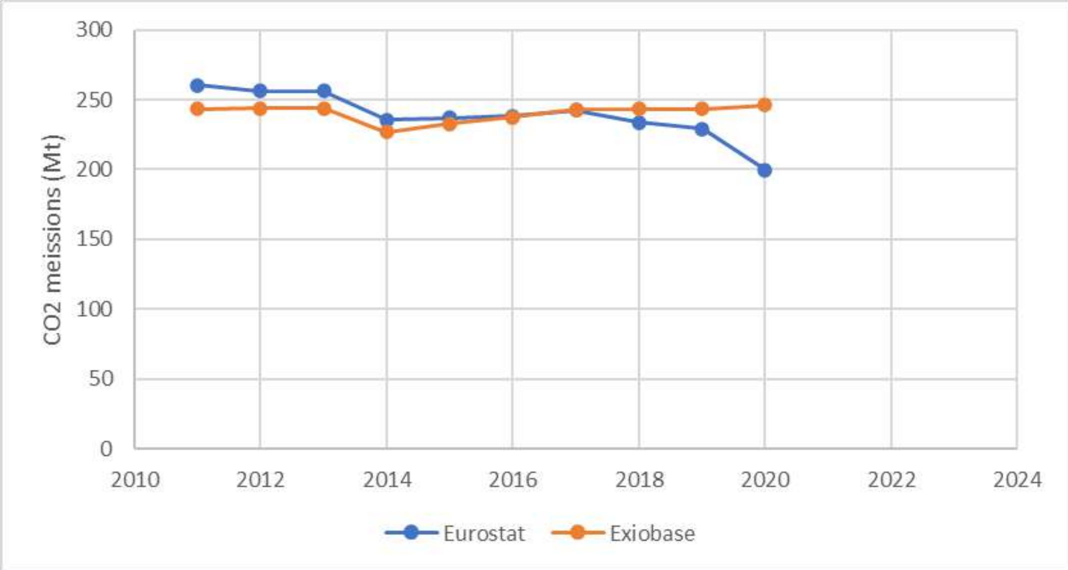

Figure 5. Comparison between Exiobase extrapolation and Eurostat data for France's carbon emissions from economic activities

5.3.2. Inventory vs footprint approach

What should we measure? There are two ways to measure either as an inventory or as a footprint (INSEE 2021). The former is the total emissions produced by a country in a year t. It is as though we put a sensor above the country (c) and after a year, we look at the results. Therefore, we can look at emissions as the total carbon emissions of the population by adding the emissions from productive activities (**X**) for domestic usage (steel production, services, etc.) and household (**F**) emissions (gas combustion, etc.). Moreover, GHG emissions do not incorporate imported goods and services but consider exportation (eq. 18).

$$\boldsymbol{GHG_c = GHG_{X_{domestic\ use}} + GHG_{X_{export}} + GHG_F} \tag{18}$$

Through this viewpoint, we can look at which country emits the most per capita (Figure 6). France with its decarbonized electricity production system (70% nuclear) appears to be one of the lowest emitters in carbon dioxide at 6.6 tons of carbon per capita. Other European countries such as Spain or Germany, which have a more carbon intensive electricity production have higher emissions per capita.

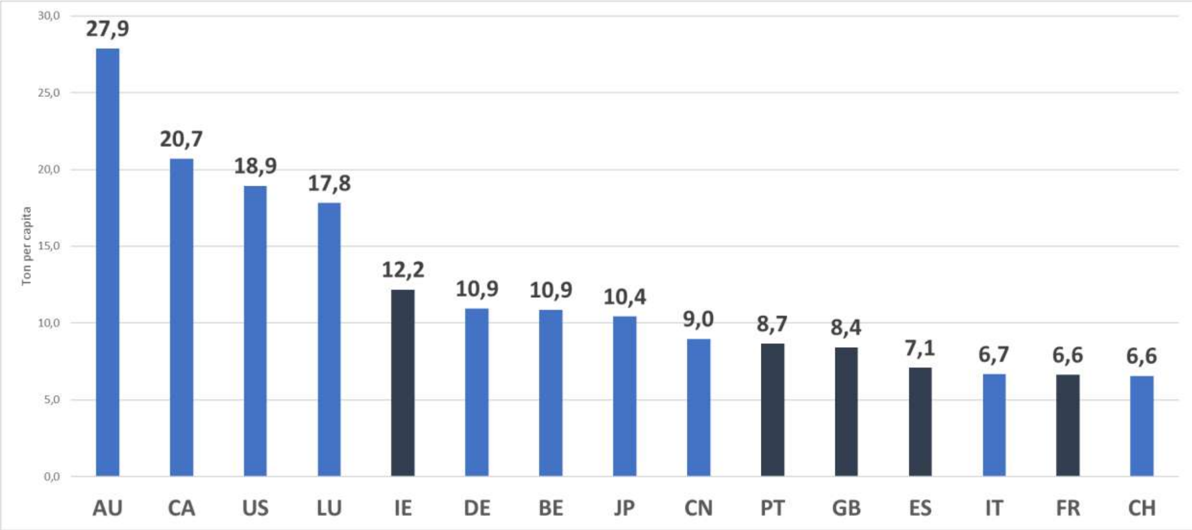

Figure 6. Emissions per capita based on the inventory approach, year 2019. The FANBEST countries are in dark blue and are compared to their neighbors (Germany, Belgium, Switzerland, Italy, and Luxembourg) as well as World large economies (Australia, Japan, Canada, the USA, and China) (Stadler et al. 2018)

Through the inventory method, it is easy to imagine that one country would outsource its emissions. The footprint approach would look at emissions from a supply chain logic. For instance, when a consumer purchases an electric car, even if the car has been assembled in France, its component come from all over the world. Therefore, in addition to emission associated with assembling the car and running the car (electricity from nuclear), there is a need to add the carbon emissions linked to producing the battery, the steel, etc. that are produced outside of the French borders. The footprint method takes into consideration the entirety of the production and usage process in order to measure the carbon footprint (eq. 19). That means that all imported goods are taken into accounts although the exported goods and services are not measured.

$$\boldsymbol{GHG_c = GHG_{X_{domestic\ use}} + GHG_{X_{imported}} + GHG_F} \quad (19)$$

Through this measure, the Exiobase country ranking change dramatically as many countries, which have more of a service economy (France for instance) import their emissions from industrial economies like China. China has productive means that are mostly based on coal, which emits more than nuclear. Therefore, the impacts of imported goods and services increase the carbon footprint of French people (Figure 7). Based on this measure, France's inhabitants have a carbon footprint of about 9.5 tons of CO_2 per capita, which is in line with the ADEME's number (ADEME 2020) of average carbon footprint per inhabitant. The computation are also convergent with France's statistical institute's measurements (INSEE 2021).

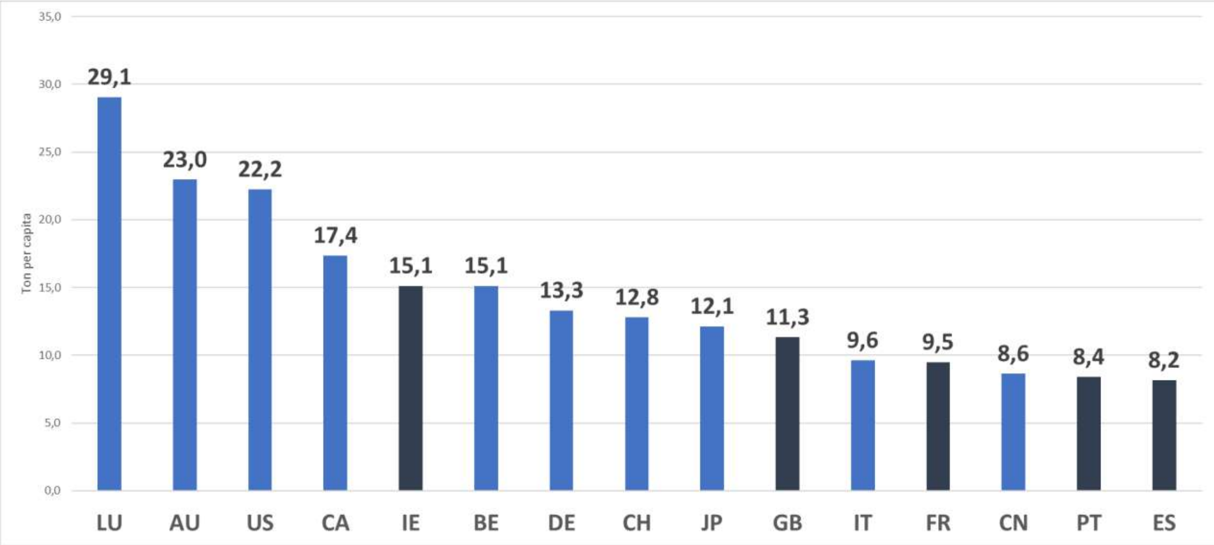

Figure 7. Emissions per capita based on the footprint approach, year 2019. The FANBEST countries are in dark blue and are compared to their neighbors (Germany, Belgium, Switzerland, Italy, and Luxembourg) as well as World large economies (Australia, Japan, Canada, the USA, and China) (Stadler et al. 2018)

The difference between these two measures is presented in Figure 8. As we can see, most traditional western nations show a positive difference between inventory and footprint. This indicates that the wealthiest nations delocalized most of their emissions.

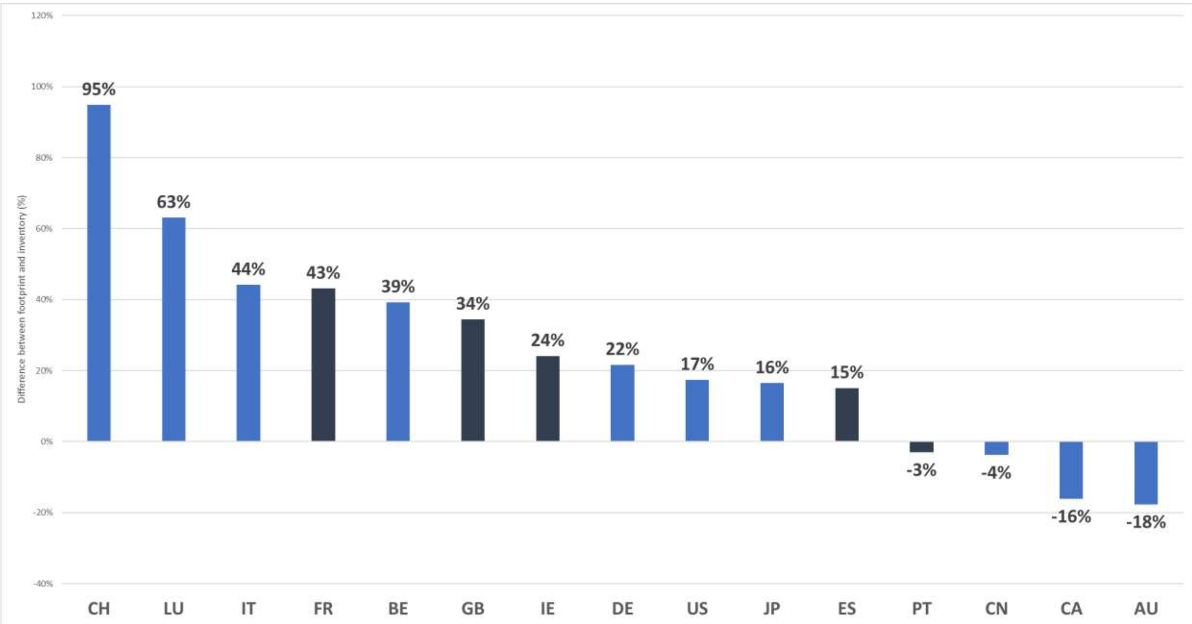

Figure 8. Differences between footprint and inventory. The FANBEST countries are in dark blue and are compared to their neighbors (Germany, Belgium, Switzerland, Italy, and Luxembourg) as well as World large economies (Australia, Japan, Canada, the USA, and China) (Stadler et al. 2018)

5.4. Carbon footprint methodology

5.4.1. Carbon footprint GHG protocol methodology

The classical carbon footprint methodology is based on the GHG protocol and integrates three scopes (Figure 9).

Scope 1 is the direct emissions linked to the productive activity. If a company burns X amount of fuel to produce steel for instance. Then, the direct GHG impacts will be linked to fuel burning.

Scope 2 refers to the emissions linked to electricity, heat, steam, and cold consumption for production. Therefore, if the same company need electricity to run, then it should be accounted in the scope 2.

Scope 3 is everything else along the entire value chain of the company. Transport and usage downstream are considered. This means that the entire lifecycle of the product is attributed to the company. Upstream, purchase of goods and services is used for the computation as well as the associated energy and transportation demand. In addition, commute or professional trips are added to the equation. Finally, the elements of the "purchase of goods" category correspond to "cradle-to-gate" LCI (Life Cycle Inventory) emission factors. They therefore include all the emissions generated during the manufacturing process, from the extraction of the raw material to the exit of the factory (ADEME 2022).

While the scopes 1 and 2 can be measured by asking the company of their needs in terms of fuel, electricity, land, etc. the scope 3 required more research for suppliers GHG emissions. Therefore, impact factors from databases (e.g., ecoinvent) are used in order to estimate the carbon footprint of transport or purchases. For instance, if a French car manufacturer purchases steel from Germany, then there is a impact factor associated with steel production in Germany that takes into account the electricity production mix and current industry standards for production. The European Investment Bank has provided a detailed report to help assess the carbon impact of projects with the aforementioned factors (European Investment Bank 2022).

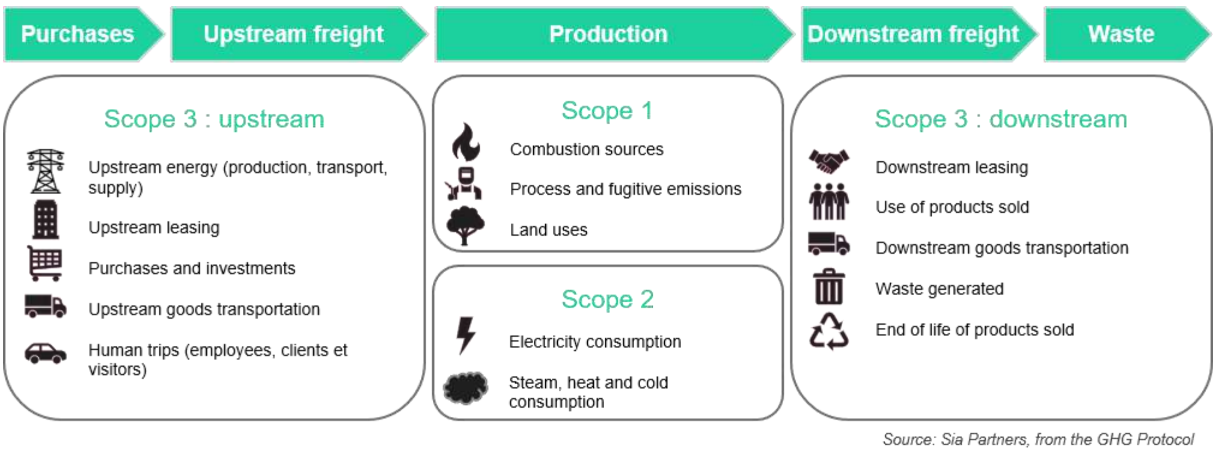

Figure 9. Diagram showing the boundaries of the GHG protocol

5.4.2. Methodology with Exiobase

The results from Exiobase differ from the standard GHG method, mostly in the scope 3. Exiobase provides for each product associated emissions per one-million-euro unit. Therefore, the direct emissions consist of using the product emission coefficient average (Ɛ) times the company's production (**X**) (eq. 20). Sometimes, companies have done their own carbon footprint assessments. Then, we use the direct impact directly given by the company.

$$\boldsymbol{GHG_{Scope1}} = \mathcal{E}_{\text{product}} * X_{product} \quad (20)$$

The scope 2 was also straightforward as we simply needed to investigate the intermediate sales associated with electricity, steam, heat, and cold production, which are shown in Table 7. Equation 21 shows how we derived the Scope 2 for each country and each product (for instance the scope 2 for wheat production in Austria). In the equation A is the technical coefficient matrix and Ɛ is impact factor.

$$\mathbf{GHG_{Scope2}} = \sum \mathcal{E}_{\text{product Scope 2}} * \mathrm{A}_{\text{product Scope2}} \quad (21)$$

Table 7. Products considered for the Scope 2 in Exiobase

Sectors for Scope 2
Electricity by coal
Electricity by gas
Electricity by nuclear
Electricity by hydro
Electricity by wind
Electricity by petroleum and other oil derivatives
Electricity by biomass and waste
Electricity by solar photovoltaic
Electricity by solar thermal
Electricity by tide, wave, ocean
Electricity by Geothermal
Electricity nec
Transmission services of electricity
Distribution and trade services of electricity
Steam and hot water supply services

Finally, the Scope 3 is vastly different from the GHG method as we do not consider the downstream aspect. For instance, the usage impacts of a products are not added to the method. The footprint comes from all the suppliers upstream which means that even the suppliers of the suppliers and their respective emissions are considered. Similarly, the commute and professional trips are not considered in this method. Only, the impacts of the supply chain (without electricity production) are computed. B is the Leontief matrix (eq. 22).

$$\mathbf{GHG_{Scope3}} = \sum (\boldsymbol{\mathcal{E}_{product}} * \mathbf{B_{product}}) - \mathbf{GHG_{Scope1}} - \mathbf{GHG_{Scope2}} \quad (22)$$

6. PowerBi canvas

PowerBi was developed to provide the user with a flexible and automated framework to visualize data. The software is ideal to show the results of the socioeconomic and environmental assessments carried for the projects. It is generally composed of three pages and a glossary. The canvas is extracted as a PDF and sent to companies. A canvas was developed for the FANBEST project. It is also accompanied by an explanatory note. The latter can be found in the appendices (Appendix I – Explanatory note and Appendix II – Individual legend cards).

6.1. Introductory page

The introductory page (Figure 10) serves as mean to see the main results of the socioeconomic assessment. As such, the first results seen are the contribution multiplier of the company in terms of value added and jobs. Value added is important because it shows the contribution of the company into the territory's GDP. The higher the multiplier, the higher the contribution. It secures a mean to demonstrate the investment impacts onto a company, specifically for public agency. For jobs, it serves as a mean to demonstrate the jobs that will be supported by the company's operation through the supply chain and consumption. The next line provides an overview of the rank compared with other industry in the NACE 64 (more in 6.3).

The donut charts provide an overview of the ratio between direct, indirect, induced (except for environmental impacts) and investment impacts. This demonstrates the structure of the multipliers and the impacts. The total below comprises of the four (or three for environmental) impacts.

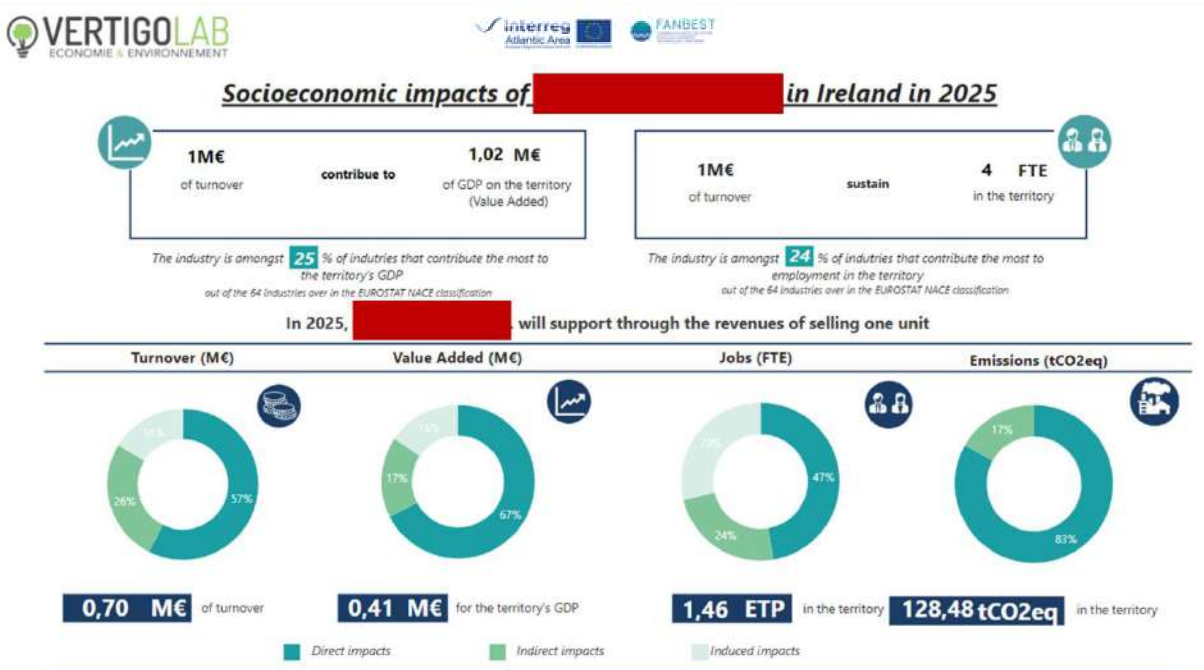

Figure 10. Introductory page overview

6.2. Raw data page

The raw data page (Figure 11) is comprised of two tables and the geographical parameter. The first table demonstrates the raw data between direct, indirect, induced and potentially the investment impacts of the company. It shows for the turnover (or production), the value added, employment and the GHG emissions. The units are indicated in the legend.

The second table is about the operating multiplier so concerns only the direct, indirect, and induced impacts for each of the four aforementioned elements. Finally, the geographical perimeter is important because it gives the boundaries in which the study was conducted.

Figure 11. Raw data page overview

6.3. Industrial rank page

The industrial rank page (Figure 12) shows the rank of the company compared with the other industries following the NACE 64 classifications. A lower rank indicates that the multiplier is good compared with other sectors in the territory. For non-mature projects, the rank in value added and employment are the most important to consider.

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What is the multiplier effect of [redacted] ***compared with other sectors of the Irish economy ?***

	Production		Valeur ajoutée		Emploi
1	Education services	1	Education services	1	Wholesale and retail trade and repair services of motor vehicles and motorcycles
⋮		⋮		⋮	
48	Computer programming; consultancy and related services;Information services	30	Rubber and plastic products	46	Scientific research and development services
49	[redacted]	31	[redacted]	47	[redacted]
50	Natural water; water treatment and supply services	32	Other non-metallic mineral products	48	Wholesale trade services, except of motor vehicles and motorcycles
⋮		⋮		⋮	
65	Basic pharmaceutical products and pharmaceutical preparations	65	Basic pharmaceutical products and pharmaceutical preparations	65	Chemicals and chemical products

The tables above allow you to visualize your position in the Irish economy among the 64 industries.

Figure 12. Industrial rank page overview

6.4. Glossary page

The glossary page (Figure 13) presents the important definition of the canvas.

VERTIGOLAB ECONOMIE & ENVIRONNEMENT

Definitions

Industry: All businesses that share the same main activity (e.g., the agricultural sector includes all businesses that are involved in farming).
Turnover: Total amount of goods and services sold by establishments.
Value added: This represents the wealth created by companies. It is calculated by the difference between the amount of production (value of goods and services produced) and the purchases of goods and services necessary for its production activity (intermediate consumption). The value added evaluates the company's contribution to the GDP of the territory.
Full-time equivalent employment (FTE): This is the equivalent number of jobs that would be working full-time in the production of goods and services. The number of FTE jobs is an indicator used to assess labor intensity, as it takes into account the specific working time of seasonal and part-time contracts.
Direct impacts: This is the company's direct contribution to the national economy. It is the amount of its turnover and the number (in FTE) of employees it employs.
Indirect impacts: These are the amounts of turnover and the number of jobs that are explained by the purchases of goods and services made by the company. Indirect impacts take into account the entire value chain (suppliers, suppliers of suppliers, and so on up the value chain).
Induced impacts: These are the amounts of turnover and the number of jobs explained by the remuneration of workers (salaried and non-salaried) who work in the company and in its value chain.

Operating impacts: These are the impacts related to the operation of the company, excluding investments. For this study, only the direct, indirect and induced impacts linked to the operation are shown.
Investment impacts: These are the impacts related to the company's investments
Turnover multiplier: This is the total amount of turnover (in millions of euros) in the region generated by one million euros of turnover of the cooperative. The turnover multiplier makes it possible to analyze the knock-on effects (domino effects) on other sectors up the value chain.
Employment multiplier: This is the total number of jobs (in FTE) generated by one million euros of sales in France. The employment multiplier makes it possible to analyze the impact of employment on the national economy.
Value added multiplier: This is the value added produced per million euros of sales in France. The value-added multiplier makes it possible to analyze the company's contribution to national GDP. In addition, the type I multiplier makes it possible to measure the percentage of "made in France" in purchases (close to 1).
Gross Domestic Product (GDP): It is calculated as the sum of the added values of the companies located in a territory (State, region, etc.). It indicates the creation of economic wealth in this territory.

Figure 13. Glossary page overview

7. Project socioeconomic and environmental assessments

7.1. Assessment types

There are three types of assessments (Figure 14) based on the company's maturity.

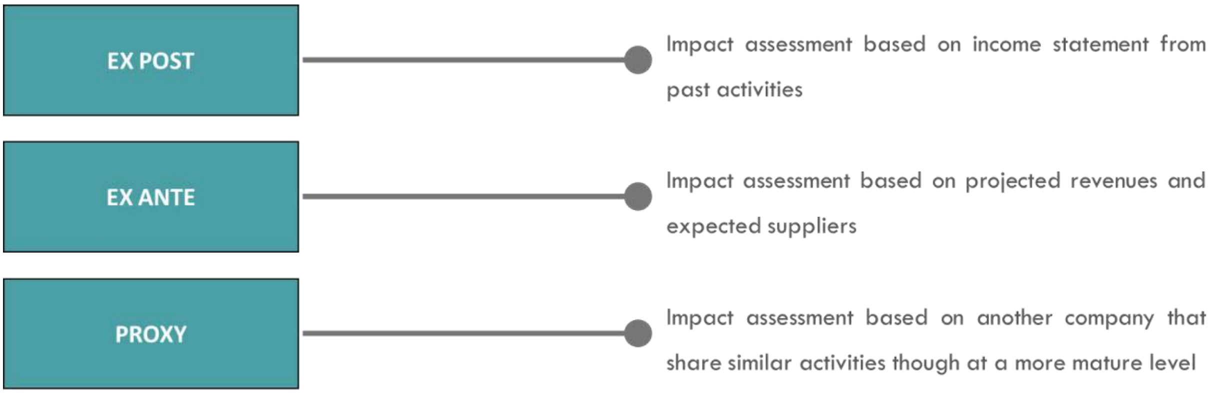


Figure 14. Assessment types for companies and/or projects

7.1.1. The ex-post assessment

The first one, the ex-post assessment is for companies that existed for a while and generated revenues that can be shown in income statements. In the income statements, Vertigo Lab is able to look at the total revenue generated by the company, the amount (in €) of goods and services purchased to run the company, the subsidies, and the taxes paid to the state. In France, the *Institut national de la propriété industrielle* (INPI) provides freely all companies account statements. Nevertheless, some companies decide to keep it confidential so that an socioeconomic assessment is not possible based on the given information. Even with the account statements, more information is required in order to provide an accurate assessment. Information such as suppliers, suppliers' amount (in €), and suppliers' location can sharpen the evaluation.

This is because either the suppliers are estimated thanks to the input-output tables provided by national accounts, or they are provided. The national accounts provide averages for an entire sector from which a company might differ. For instance, a cement company has innovated to make a carbon neutral cement through different processes. Without the provided suppliers, one might not see the positive impacts a change of practices has done socioeconomically and environmentally speaking. With the provided suppliers, one can estimate more accurately the impacts of the new processes. Furthermore, the company may be able to locate its purchases and look at the impacts it has on the territory. By locating specifically, the suppliers we may have a better view of the amount of "Made in Country" of an activity. This could also show the potential amount of environmental delocalization, which is an important aspect of the environmental footprints of companies. Again, a new process may increase the "made in country" ratio as well as reduce the environmental footprint as less of the process is delocalized. The general method is shown in Figure 15.

Figure 15. Scheme showing the inputs and the outputs of an ex-post analysis

7.1.2. The ex-ante assessment

The ex-ante assessment is similar to the ex-post assessment except that the data is based on projections. It follows the similar methods as the suppliers may be addressed and expected. The revenues, added value, and purchases are also projected in a scenario imagined by the company (Figure 16). Similarly, the more the company decides to invest in realistically projecting the supply amounts (in €) and origin, the more the assessment will be accurate.

This assessment is powerful when companies imagine growth in sales and scale up their companies. Furthermore, this could be useful for relocation purposes. An ex-ante impact assessment can be useful for a company that decides to relocate onto a territory and wants to estimate the impacts of such move. Finally, local administration may want to know the impacts that a company could have if it implants an establishment onto their territory.

Figure 16. Scheme showing the inputs and the outputs of an ex-ante analysis

7.1.3. The assessment based on a proxy

If there are data available, the company's assessment can use proxy data. For instance, for a company with a project in an innovating sector can look at revenues and other account indicators from other companies to evaluate their growth perspective. That means that it would look at the value added of a company with few employees, then one with a bit more employee and one with a larger employee base. By looking at the different indicators and their averages, one can estimate the trajectory and the impacts of the company throughout its growth (Figure 17).

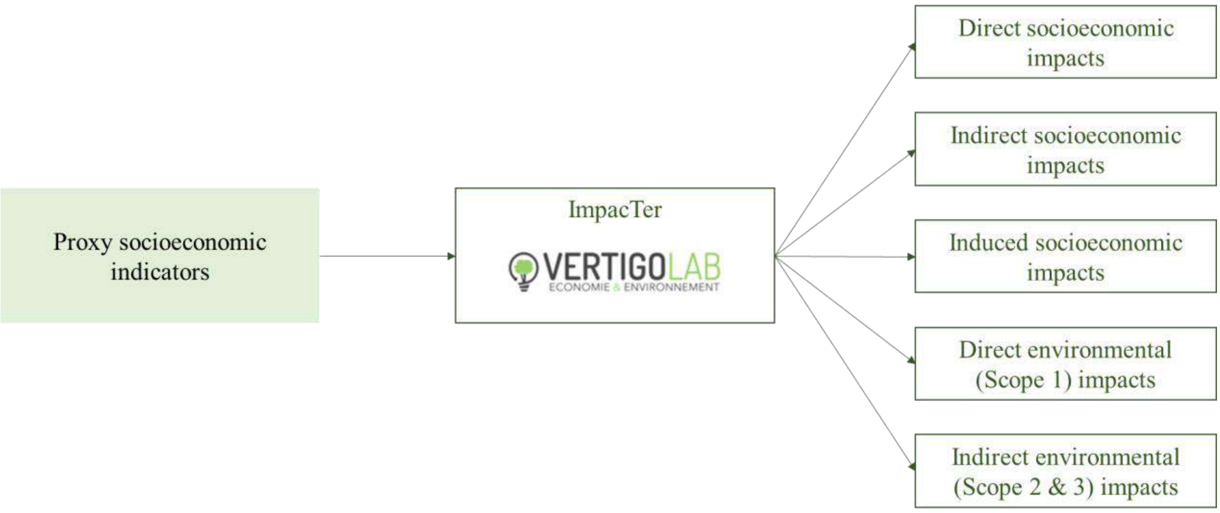


Figure 17. Scheme showing the inputs and the outputs for an assessment based on proxy data.

7.2. Company's assessments

As part of the FANBEST project, we evaluated four companies with different profiles (Table below). The companies were first coached by a partner and part of the coaching involved a socioeconomic assessment. Not all coaching partners were willing to engage in the assessment and not all companies were willing to take the time to help us perform one. Four companies in total agreed to do it. There were two in France, one in Spain, and one in Ireland. The process was about the same. We first approached the coaching partner to present the assessment who put us in contact with the company. Then, we contacted the company and had a one-hour discussion about their project and how this could fit the assessment. We then sent them a canvas to fill out based on the discussion. We produce a first draft of the assessment and had a second discussion with the company and the coach to explain what the number entails. If the draft was validated, we sent them the final version. We were also able to run some iterations for some projects based on new information.

The environmental assessment was accomplished as well although the project aspect of the companies did not allow for accurate inputs for direct impacts (Scope 1). As such, the environmental assessment was conducted using Exiobase. The direct GHG impacts (Scope 1) of companies used the product means, while the indirect impacts (Scope 2 & 3) used the environmental multipliers. The environmental assessments remain experimental and provide a first, though incomplete, environmental picture of the projects.

Table 8. List of companies that agree to partake in the socioeconomic and environmental assessment

COMPANY	COUNTRY	STATUS	ASSESSMENT TYPE
DENV-R	France	Publishable	Ex ante
FARWIND	France	Confidential	Ex ante
OTERO SOLAR FARMS	Spain	Publishable	Ex ante
LIMERICK WAVE	Ireland	Publishable	Ex ante

7.2.1. Denv-R

Denv-R is a company that was coached by Atlantpole b based in the West Coast of France, near Nantes. The company aims at making water cooled servers. The concept is to set up a floating barge along a river or in the ocean and to set up cloud servers within. The cooling liquid to cool down the heating servers will be the cool water from the river or the ocean. The barge would host the servers so that they would need to be connected to the Internet as well as to the electricity network. This would be an electricity efficient method to cool down the servers comparing to the current method.

For a turnover of 1 M€ with a GVA of 600 k€ and 10 FTE, DENV-R contributes to 210 k€ of wealth creation in the Pays de la Loire region and supports 1.8 FTE in indirect and induced impacts.

As far as the added value multiplier is concerned, DENV-R is part of the 22% of the 65 sectors of the Pays de la Loire economy that generate the most economic wealth for 1 M€ of turnover. DENV-R is one of the 20% of the 65 sectors of the economy of Pays de la Loire which supports the greatest number of jobs for 1 M€ of turnover.

The €500k investment for the floating barge, the installation of electrical, climatic and computer equipment and the feasibility studies have contributed €810k to the French GDP and supported 7.1 FTEs in socio-economic impacts.

By 2025, the DENV-R project will have created 23.3 FTEs in France and contributed €2.2M to French GDP.

The following results are shown at two different regional scales. The first set of figures is at the national level (Figure 18, Table 9, Figure 19). The second set (Figure 20, Table 10, Figure 21) is at the NUT2 regional level in France (Pays de Loire).

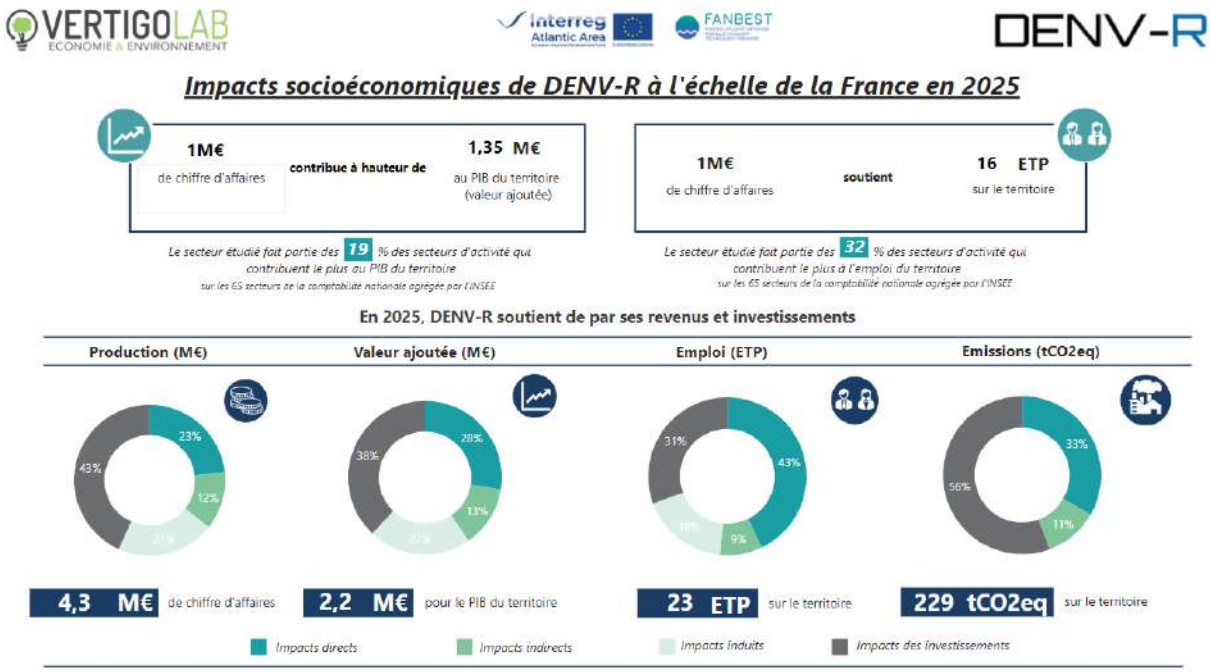
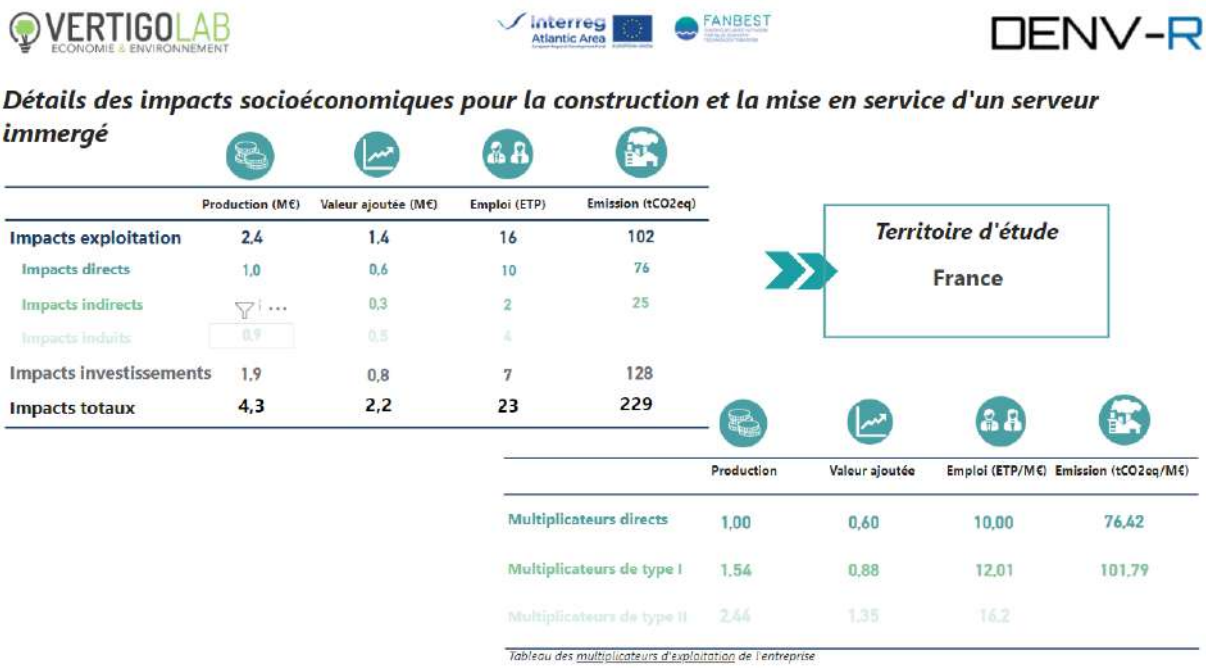


Figure 18. Denv-R's impacts in FRANCE) projected in 2025 through investments and operation

Table 9. Denv-R's gross values and operating impact multipliers in ***France*** *projected in 2025*



Détails des impacts socioéconomiques pour la construction et la mise en service d'un serveur immergé

	Production (M€)	Valeur ajoutée (M€)	Emploi (ETP)	Emission (tCO2eq)
Impacts exploitation	2,4	1,4	16	102
Impacts directs	1,0	0,6	10	76
Impacts indirects		0,3	2	25
Impacts induits	0,9	0,5	4	
Impacts investissements	1,9	0,8	7	128
Impacts totaux	4,3	2,2	23	229

Territoire d'étude

France

	Production	Valeur ajoutée	Emploi (ETP/M€)	Emission (tCO2eq/M€)
Multiplicateurs directs	1,00	0,60	10,00	76,42
Multiplicateurs de type I	1,54	0,88	12,01	101,79
Multiplicateurs de type II	2,44	1,35	16,2	

Tableau des multiplicateurs d'exploitation de l'entreprise

Quel effet d'entraînement pour la construction et la mise en service d'un serveur immergé par rapport aux autres secteurs de l'économie française ?

	Production		Valeur ajoutée		Emploi
1	Services d'assurance: de réassurance et de caisses de retraite, à l'exclusion de la sécurité sociale obligatoire	1	Services liés à l'emploi	1	Services liés à l'emploi
⋮		⋮		⋮	
43	Produits des industries extractives	11	Constructions et travaux de construction	20	Services d'hébergement et de restauration
44	DENV-R	12	DENV-R	21	DENV-R
45	Meubles et autres produits manufacturés	13	Services de santé humaine	22	Services d'architecture et d'ingénierie, services de contrôle et analyses techniques
⋮		⋮		⋮	
65	Services immobilier	65	Produits de la cokéfaction et du raffinage	65	Produits de la cokéfaction et du raffinage

Les tableaux ci-dessus permettent de visualiser votre positionnement au sein de l'économie française parmi les 64 secteurs d'activités.

Figure 19. Denv-R rank compared with the other ***French*** *industries (NACE 64)*

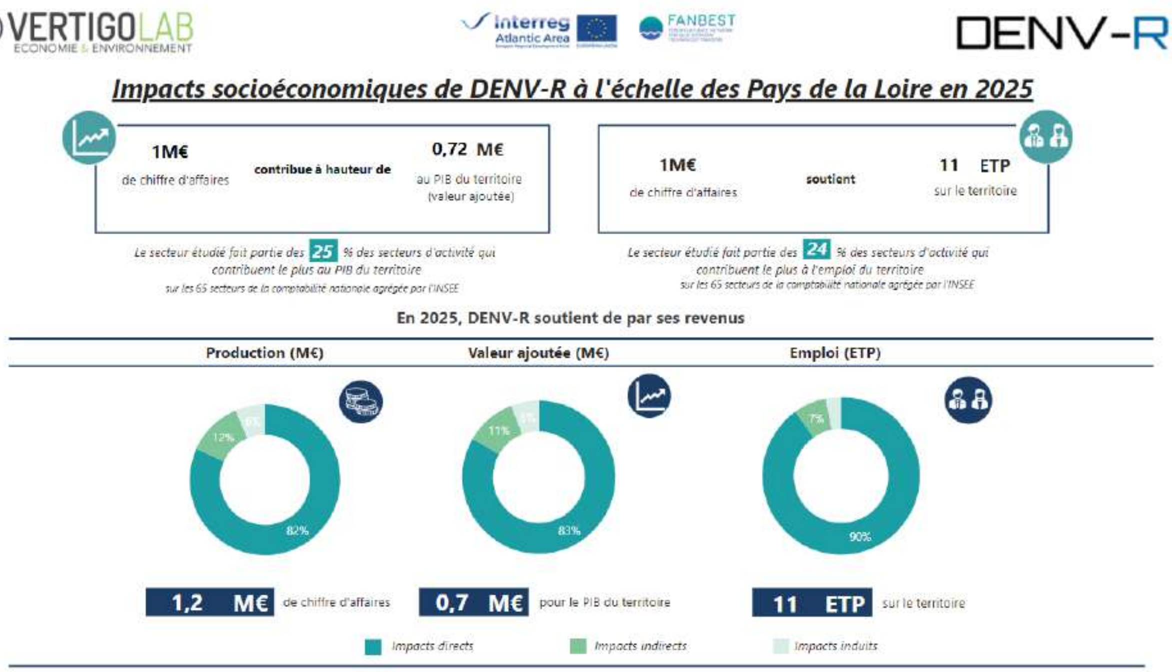


Figure 20. Denv-R's impacts ***in Pays de la Loire*** *projected in 2025 its operation*

Table 10. Denv-R's gross values and operating impact multipliers in Pays de la Loire projected in 2025

VERTIGOLAB ECONOMIE & ENVIRONNEMENT — Interreg Atlantic Area — FANBEST — DENV-R

Détails des impacts socioéconomiques pour la construction et la mise en service d'un serveur immergé en Pays de la Loire

	Production (M€)	Valeur ajoutée (M€)	Emploi (ETP)
Impacts exploitation	1,2	0,7	11
Impacts directs	1,0	0,6	10
Impacts indirects	0,1	0,1	1
Impacts induits	0,1	0,0	0
Impacts totaux	**1,2**	**0,7**	**11**

Territoire d'étude

Pays de la Loire

	Production	Valeur ajoutée	Emploi (ETP/M€)
Multiplicateurs directs	1,00	0,60	10,00
Multiplicateurs de type I	1,15	0,68	10,74
Multiplicateurs de type II	1,22	0,72	11,1

Tableau des multiplicateurs d'exploitation de l'entreprise

VERTIGOLAB ECONOMIE & ENVIRONNEMENT — Interreg Atlantic Area — FANBEST — DENV-R

Quel effet d'entraînement pour la construction et la mise en service d'un serveur immergé par rapport aux autres secteurs de l'économie des Pays de la Loire ?

	Production		Valeur ajoutée		Emploi
1	Production de films cinématographiques: de vidéos et de programmes de télévision: enregistremen...	1	Services liés à l'emploi	1	Services liés à l'emploi
⋮		⋮		⋮	
51	Meubles et autres produits manufacturés	16	Services de réparation d'ordinateurs et de biens personnels et domestiques	15	Services de poste et de courrier
52	DENV-R	17	DENV-R	16	DENV-R
53	Eau naturelle: traitement et distribution d'eau	18	Services sportifs: récréatifs et de loisirs	17	Transports terrestres et transports par conduites
⋮		⋮		⋮	
64	Produits de la cokéfaction et du raffinage	64	Produits de la cokéfaction et du raffinage	64	Produits de la cokéfaction et du raffinage

Les tableaux ci-dessus permettent de visualiser votre positionnement au sein de l'économie française parmi les 64 secteurs d'activités.

Figure 21. Denv-R rank compared with the other ***Pays de la Loire's*** *industries (NACE 64)*

7.2.2. Francisco Otero solar farms

Francisco Otero is an engineer, entrepreneur from Galicia who saw the *bateas*, Galician rafts onto which mussel farmers grow mussels, potential. The idea would be to set up solar panels over them that would produce electricity in addition to producing mussels. The assessments was conducted in two phases. The first one was the estimation of a pilot project following an investment of 300k€ to pay for equipment and human resources involving one *batea*. The second one was for a three-year installation project onto a polygon of *bateas* i.e., 180 *bateas*. The latter would require a 22-million-euro investment.

For the pilot, the investment is about 300 k€. This investment generates socioeconomic impacts in Spain from employee spendings and suppliers' activities. It is estimated that investments in the pilot project will lead to 200k€ in value added contributing to Spain GDP. It will also sustain 3,8 FTE in Spain accounting those employed for the project (Figure 22 & Table 11).

For the installation, the investment is about 22,5 M€. This investment generates socioeconomic impacts in Spain from employee spendings and suppliers' activities. It is estimated that investments in the installation of solar panels in 350 bateas will lead to 25 M€ in value added contributing to Spain GDP. It will also sustain 399 FTE in Spain accounting those employed for the project (Figure 23 & Table 12).

The value created exceeds the investment showing positive socioeconomic impacts of the project in Spain. Further studies will be required to probe the socioeconomic impacts of the created company.

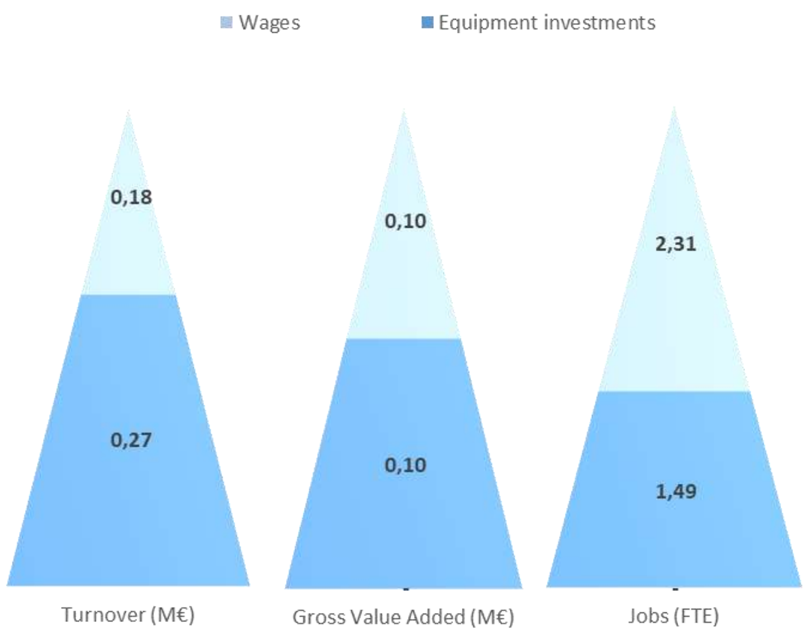


Figure 22. Solar farms socioeconomic impacts for a pilot project for three months

Table 11. Investment impacts onto the Spanish territory disaggregated between the impacts of the salaries and the impacts of the equipment for a three-month pilot project involving one "bateas"

Total Impacts	Turnover (M€)	Gross Value Added (M€)	Jobs (FTE)
Wage	0,18	0,10	2,31
Equipment Investments	0,27	0,10	1,49

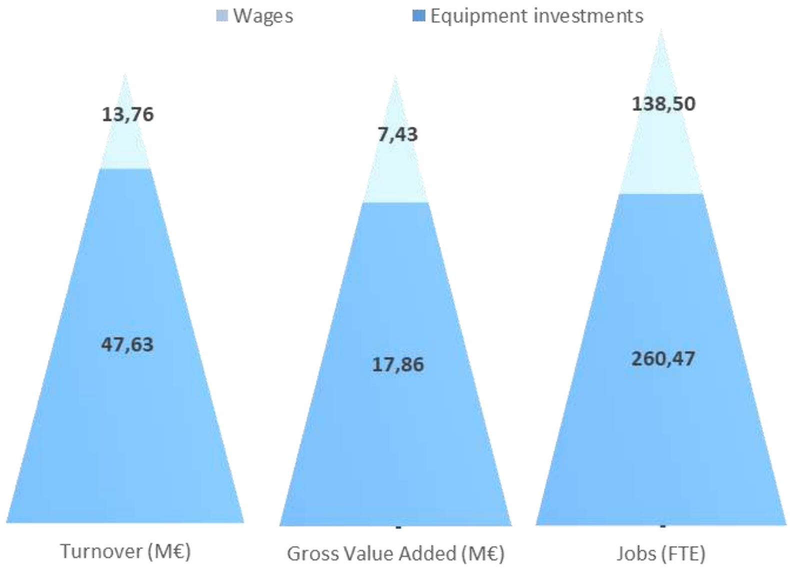


Figure 23. Solar farms socioeconomic impacts for an installation project for three years

Table 12. Investment impacts onto the Spanish territory disaggregated between the impacts of the salaries and the impacts of the equipment for a three-year installation project involving one polygon of "bateas"

Impacts	Turnover (M€)	Gross Value Added (M€)	Jobs (FTE)
Wage	13,76	7,43	138,5
Equipment Investments	47,63	17,86	260,5

Because the work done for Francisco regarded solely investments, it was not possible to use the PowerBi canvas created for the project.

7.2.3. Limerick Wave Ltd.

Limerick Wave Ltd. is a company based in Ireland that develop a power take off innovative mechanism that could be added to wave energy converters. The product designed is planned to be sold to energy technology developers for a unit price of 400k€.

For the production of 1 unit of Limerick Wave product (innovation in PTO technology), the socioeconomic impacts are as followed:

- For selling one unit, Limerick wave would contribute of about 400k€ to the Irish GDP, with about 120k€ in indirect and induced impacts
- In addition, selling one unit would lead to the creation of 0.71 full time job

Comparing with other sectors (the 64 NACE sectors from Eurostat), Limerick Wave Ltd. contributes more than 50% of other sectors to the Irish GDP.

Nonetheless, because of the capitalistic nature of the project – i.e. the value added is used to reimburse the investments in machinery – Limerick Wave supports more jobs than 23% of other sectors in total impacts (direct, indirect and induced impacts) (Figure 24 & Table 13).

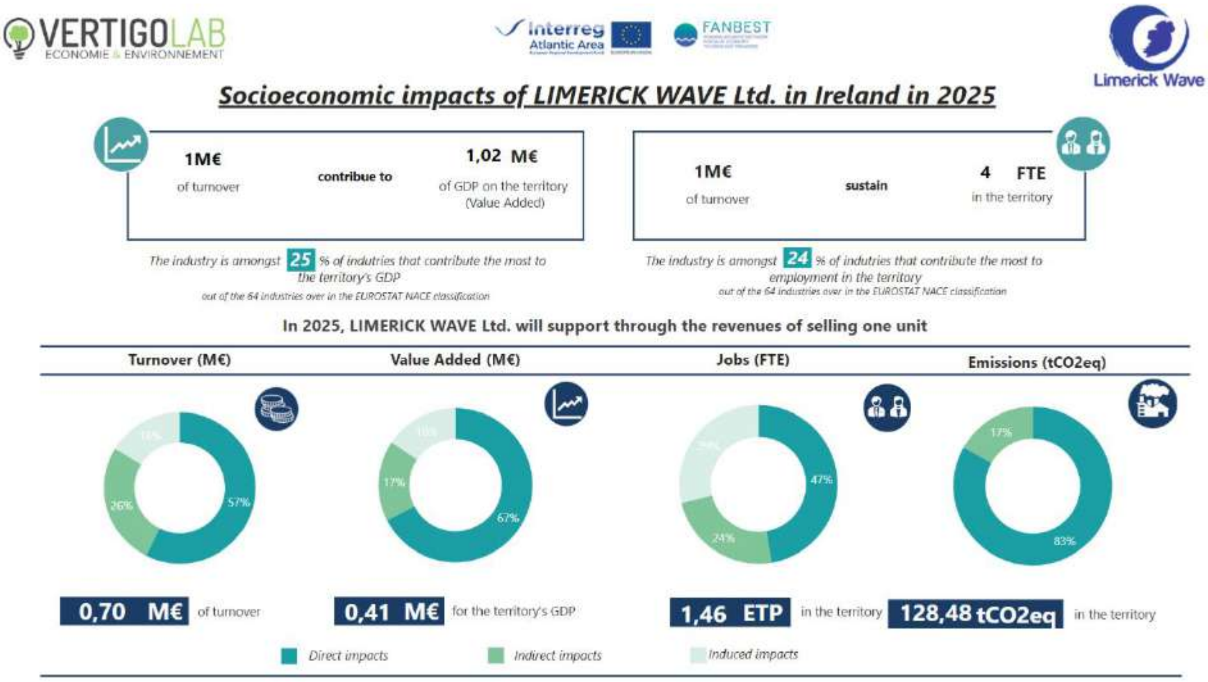


Figure 24. Limerick wave's impacts to produce one unit of energy converter which would generate 400 K€ revenue.

Table 13. Tables with the detailed socioeconomic impacts of a unit sold by Limerick Wave Ltd.

VERTIGOLAB ECONOMIE & ENVIRONNEMENT — Interreg Atlantic Area — FANBEST — Limerick Wave

Socioeconomic impact details of Limerick Wave for the production of one unit

	Turnover (M€)	Value Added (M€)	Jobs (FTE)	Emission (tCO2eq)
Operating impacts	0,70	0,41	1,46	0
Direct impacts	0,40	0,28	0,69	107
Indirect impacts	0,18	0,07	0,35	22
Induced impacts	0,11	0,06	0,42	
Total impacts	**0,70**	**0,41**	**1,46**	**128**

Geographical perimetre
Ireland

	Turnover	Value Added	Jobs (FTE/M€)	Emission (tCO2eq/M€)
Direct multiplier	1,00	0,69	1,73	267,04
Type I multiplier	1,46	0,86	2,59	321,19
Type II multiplier	1,74	1,02	3,6	

Operating multiplier table

What is the multiplier effect of Limerick Wave Ltd. compared with other sectors of the Irish economy ?

	Production		Valeur ajoutée		Emploi
1	Education services	1	Education services	1	Wholesale and retail trade and repair services of motor vehicles and motorcycles
⋮		⋮		⋮	
48	Computer programming; consultancy and related services;Information services	30	Rubber and plastic products	46	Scientific research and development services
49	LIMERICK WAVE Ltd.	31	LIMERICK WAVE Ltd.	47	LIMERICK WAVE Ltd.
50	Natural water; water treatment and supply services	32	Other non-metallic mineral products	48	Wholesale trade services; except of motor vehicles and motorcycles
⋮		⋮		⋮	
65	Basic pharmaceutical products and pharmaceutical preparations	65	Basic pharmaceutical products and pharmaceutical preparations	65	Chemicals and chemical products

The tables above allow you to visualize your position in the Irish economy among the 64 industries.

Figure 25. Limerick Wave Ltd. rank compared with the other Irish industries

7.3. Assessment examination and perspective

ImpacTer is normally used by Vertigo Lab for mature companies with several years of account statements. The work realized as part of FANBEST had us develop a more agile method that allows for the evaluation of projects and companies' projections. The perimeter work conducted as well as the articulation with several assessment methodology offers a wide potential of usage for impact assessment in the blue economy sectors. They allow the company to estimate its impacts long term in order to secure investments. By estimating the future supplier, it helped the company projects themselves in their business model and accounting projected flows. This is different than a mature companies with analytics that can easily provide a suppliers' list and the respective amounts purchase. Companies should use this exercise to project their costs and therefore assess their potential impacts. It is a win-win strategy for the company.

The comparison with existing sectoral indicators allows policy makers or investors to assess whether the activity contributes to economic development, and whether it helps achieve territorial socio-economic and environmental objectives. The companies assessed were particularly well ranked across all indicators and sectors, almost consistently in the higher half. This demonstrates that innovation in the blue economy has high impacts at either the sub-national or the national scales. This analysis is more difficult to provide for the environmental impacts as the process is more experimental. The companies therefore can use these results to demonstrate their impacts on a specific territory. Our economies value growth and job potentials, which is what the model provides. The results can be widely used to secure funding, for marketing purposes, etc.

While the results provide estimations, they are estimations based on national account tables and do not address specific value chain in innovative fields. As such, "green" supply chains are not represented and would require additional work and references to be implemented. Future work could be realized to integrate the effect of "decarbonized" supply chains in the model and their effects on socioeconomic and environmental impacts.

8. Conclusion and recommendations

The coached projects allowed us to develop a method to estimate the socioeconomic and environmental impacts of projects. This will help them secure funding as they can demonstrate impacts, which is increasingly relevant for investors. The investors are looking into projects that are relevant for the territory, especially for employment. Through FANBEST, in addition to helping companies develop, Vertigo Lab has provided this service, which can be reemployed for future endeavors. One can regret that few companies accepted to work with Vertigo Lab in order to conduct the socioeconomic and environmental assessment. Further work should be done to convince entrepreneurial coaches of the value of the evaluation.

Work can be done to improve the model and therefore the assessments. First, the granularity in the industries assessed is important in France because it was possible to access several databases such as INPI, INSEE, etc. This allowed the model to be more accurate at the regional level on one hand and at the industrial level on the other. It is necessary that other countries in the Atlantic Area open their database to get the necessary data. In order to get to similar levels of granularity, it would be necessary to have at least the employment by NACE 615 sectors as well as the value added and the production for all these sectors. It seems also important to have the employment by the 64 NACE sectors and by administrative regions in order to regionalize the national input output tables. With this work, companies along the Atlantic Arc and not only in France will obtain further finesses in their assessments.

In terms of environmental assessment, the step is steeper. The national granularity is important, but 200 products do not coincide with the industries of the NACE classifications. Further work needs to be done to have them match. Second, whilst the multi-regional aspect of the model provides insights onto where the environmental impacts come from, the lack of data at the regional level makes it impossible to develop a model with regional impacts. Further work is necessary to regionalize the Exiobase dataset and have it match with the NACE classification.

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Appendix I – Explanatory note

What are the socio-economic and environmental impacts of a company and how are they taken into account in the study?

By supporting jobs and creating wealth in the area where it is located, each company (or any type of organization, project, financing, etc.) generates socio-economic impacts (or spinoffs) that benefit the local economy. These spinoffs are not limited to the perimeter of the company (salaried jobs, added value of the company) and are essentially explained by

- Purchases made from its suppliers (throughout its supply chain).
- Wages paid by the company and its suppliers, which in turn generate spending by households.
- Fiscal spillovers, taxes and duties paid by the company and its suppliers.

The socio-economic benefits estimated in this work include **the value added generated in France, the number of jobs supported in the region (in full-time equivalent) and the associated CO_2 emissions**. They are defined according to several types of impacts:

- **Direct impacts:** these impacts are explained by **the company's activity alone**. They include the value added, the number of FTE jobs and the tax benefits generated by the company (or group of companies studied)
- **Indirect impacts:** these are explained by **purchases of intermediate consumption of goods and services** made outside the group. They include the value added, the number of FTE jobs and the tax benefits generated throughout the company's supply chain (the company's suppliers, suppliers of suppliers, etc.)
- **Induced impacts:** these are explained by the expenditures made by (i) **the employees of the company** studied and (ii) **employees located upstream in the value chain**.

These impacts are then grouped according to the following nomenclature:

- **Type I impacts** include **direct** and **indirect impacts**.
- **Type II impacts** include **direct**, **indirect**, and **induced** spillovers. They account for the total spillovers of each company.

How is it possible to estimate the impact of a company along its supply chain?

A company's direct impacts are estimated from its income statements. On the other hand, **its indirect and induced impacts must be simulated using national accounting data** (which provides a schematic representation of a country's economic activity). For France, input-output tables modeling economic activity are produced by the National Institute for Statistics and

Economic Studies (INSEE) and collected by Eurostat (the European Commission's Directorate General for Statistical Information at the Community level).
These tables break down the expenditures of each sector (or branch) of activity and are thus able to illustrate the inter-branch relationships within an economy.

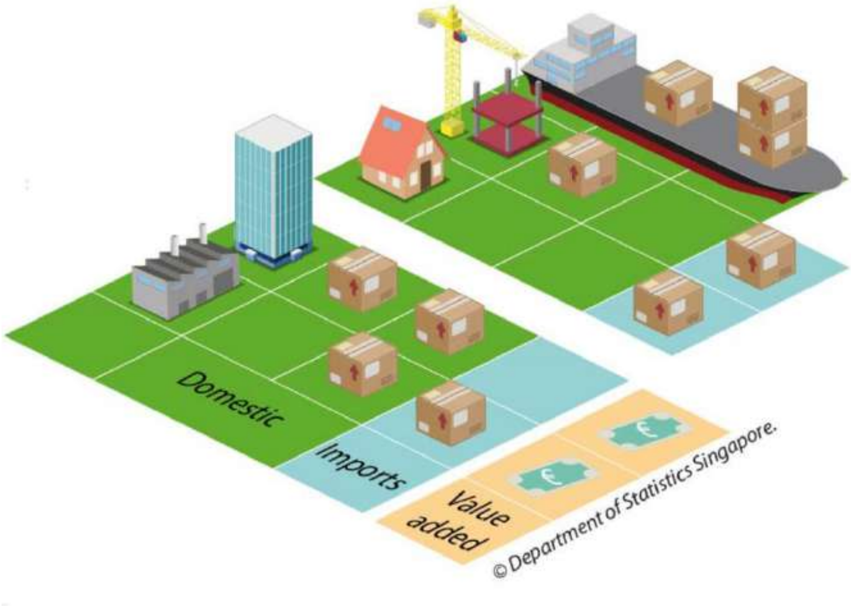


Figure 1: Scheme representing an Input output table

What does "multiplier effect" mean and what is the link between the multiplier effect and the impact of an enterprise?

In order to compare companies with each other, their Type I and Type II impacts can be analyzed in relation to their revenues. The calculation of these multiplier effects is as follows: Type I or II impact divided by the consolidated turnover of the company in question. This allows us to estimate the impact of each company for one million euros of sales. For all the companies (or groups of companies) studied, the type I and type II multiplier effects are therefore estimated for each of the indicators evaluated (value added, FTE jobs and tax benefits). By referring to the same benchmark (i.e., €1 million in sales), it is easier to compare the socio-economic impact of each group.
Example: If Vertigo Lab's type I value-added multiplier is estimated at 0.85, this means that it generated €850,000 in value-added (its contribution to French GDP) for €1 million in sales. In other words, if it generates €2M, it will generate €1.7M of added value.

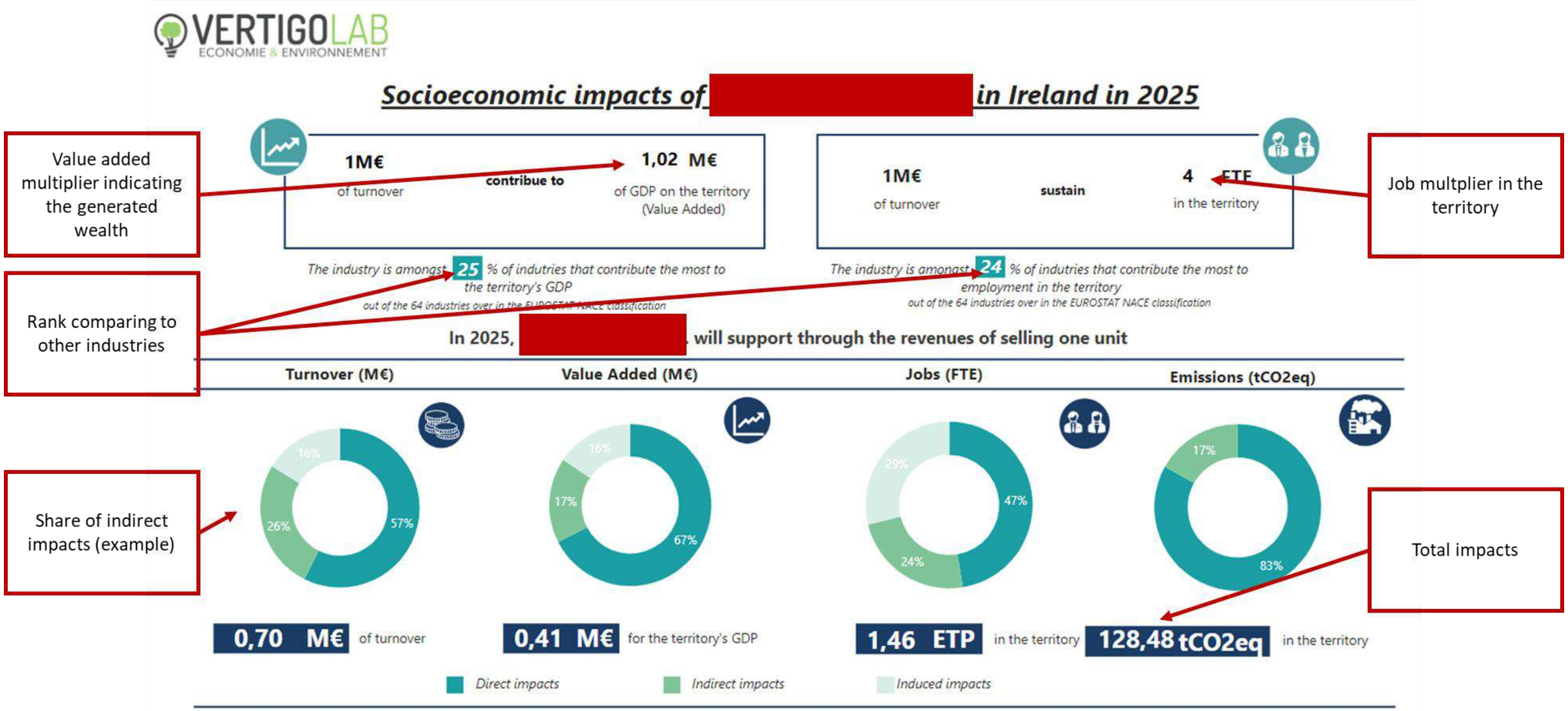
What is the difference between operational and investment impacts using a car rental company as an example?

The operating impacts concern all the impacts associated with the company's activity, namely its sales and operating expenses. The operating expenses taken into account in our model include the purchase of goods, the purchase of raw materials, external expenses, staff remuneration (wages and social security contributions) and the net amount of taxes on production. The operating expenses include the expenses for car rental by the rental companies. Unlike the purchase of new vehicles, the use of leased cars does not require depreciation. In addition, leasing requires a regular expense (called rent) from the company that owns the vehicle.

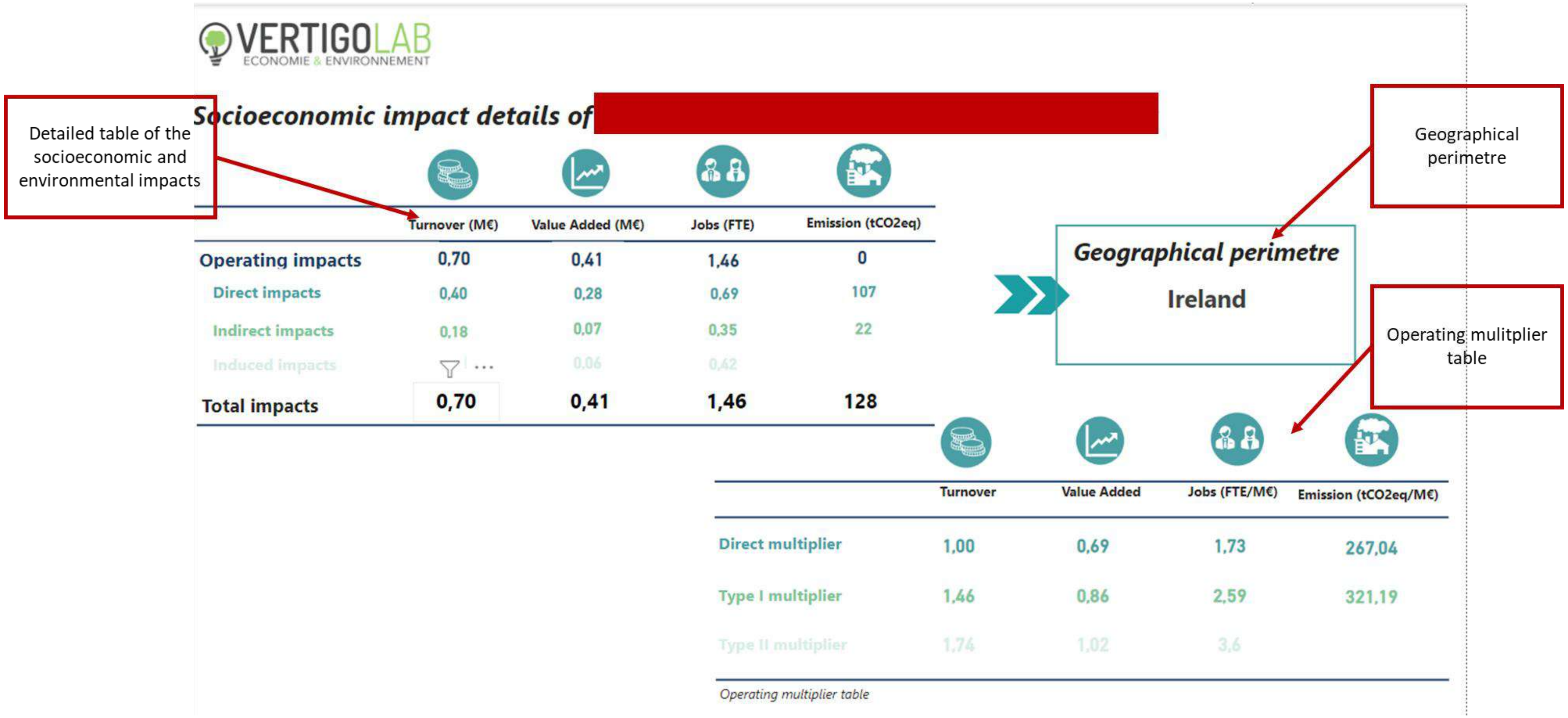
The investment impacts relate to the impacts associated with vehicle purchases. Leasers become the owners of the vehicles purchased. Unlike operating expenses, purchased vehicles require depreciation. They are accounted for in a separate account within the company's accounting system (recorded as fixed assets), as well as in the national accounts. They are characterized by a life of more than one year. In addition, the investments amount is generally more volatile from one year to the next, compared to the amount of operating expenses.

Appendix II – Individual legend cards

What does the first card mean?



What does the second card mean?



	Turnover (M€)	Value Added (M€)	Jobs (FTE)	Emission (tCO2eq)
Operating impacts	0,70	0,41	1,46	0
Direct impacts	0,40	0,28	0,69	107
Indirect impacts	0,18	0,07	0,35	22
Induced impacts		0,06	0,42	
Total impacts	0,70	0,41	1,46	128

	Turnover	Value Added	Jobs (FTE/M€)	Emission (tCO2eq/M€)
Direct multiplier	1,00	0,69	1,73	267,04
Type I multiplier	1,46	0,86	2,59	321,19
Type II multiplier	1,74	1,02	3,6	

What does the third card mean?

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What is the multiplier effect of [redacted] compared with other sectors of the Irish economy ?

Production		Valeur ajoutée		Emploi	
1	Education services	1	Education services	1	Wholesale and retail trade and repair services of motor vehicles and motorcycles
⋮		⋮		⋮	
48	Computer programming; consultancy and related services;Information services	30	Rubber and plastic products	46	Scientific research and development services
49	[redacted]	31	[redacted]	47	[redacted]
50	Natural water; water treatment and supply services	32	Other non-metallic mineral products	48	Wholesale trade services; except of motor vehicles and motorcycles
⋮		⋮		⋮	
65	Basic pharmaceutical products and pharmaceutical preparations	65	Basic pharmaceutical products and pharmaceutical preparations	65	Chemicals and chemical products

The tables above allow you to visualize your position in the Irish economy among the 64 industries.

Rank of the company compared with EUROSTAT industries

Industries with similar multipliers than the company