



Harvest Atlantic Project - Sectorial Analysis of Marine Biotechnology in the Atlantic Area

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ABSTRACT

Marine Biotechnology involves utilising "marine bio resources either as the source or the target of biotechnology applications" (Irish Marine Institute, 2014).

This component of the HARVEST Atlantic Project focused on analysing different subsectors of the maritime economy including marine biotechnology in Atlantic territories, specifically- Ireland, Portugal, Scotland and Spain. Using an online survey and structured interviews with relevant companies in the industry, this subsector was examined to gauge a more in depth understanding of its strengths and weaknesses in order to highlight recommendations enabling innovation and competitiveness in this sector. The key recommendations from the analyses conducted were; the need for a reduction in associated bureaucracy, the need to simplify sector legislation, the need to promote awareness and involvement in all sector activities, and the need to put in place a support channel for SME's, (HARVEST Atlantic Project, 2014).

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1. Introduction

The HARVEST Atlantic Project (Harnessing All Resources Valuable to Economies of Seaside Territories of the Atlantic) was a collaborative project between four EU partners including Cork Institute of Technology in the Republic of Ireland.

This article focuses on the sub sector investigated by Cork Institute of Technology that of Marine Biotechnology. This article highlights results derived from an analysis of the sector which have been compiled into the HARVEST Atlantic Project Report document.

"The marine environment constitutes two-thirds of our planet and offers huge potential for citizens' well-being, with extensive resources that form the basis for many economic activities", (HARVEST Atlantic Project, 2014). The maritime re-

gions in the EU are responsible for approximately, "40% of its GDP and the maritime economy for 3 to 5%" (ec.europa.eu).

Cork Institute of Technology was tasked with the Sectorial Analysis of Marine Biotechnology activity in the HARVEST regions. Marine Biotechnology can be defined as, "those efforts that involve marine bio resources, either as the source or the target of biotechnology applications" (Irish Marine Institute, 2014).

The marine biotechnology sector employs the use of bio-resources derived from the sea for the production of services and products (Marinebiotech.eu). Current estimations indicate that this sector will experience an annual growth rate of 10 to 12% in the coming years. This statement emphasises the, "huge potential and high expectations", for added advances in the sector globally (Marinebiotech.eu).

The overall aim of the project was to, "identify the best practices and sustainable solutions in the maritime economy in order to improve the Atlantic territories socioeconomic situation", (HARVEST Atlantic Report, 2014) The project strived to, "strengthen the sector through increased productivity, competitiveness and job creation", (HARVEST Atlantic Report, 2014). This was undertaken by development of an online survey to-

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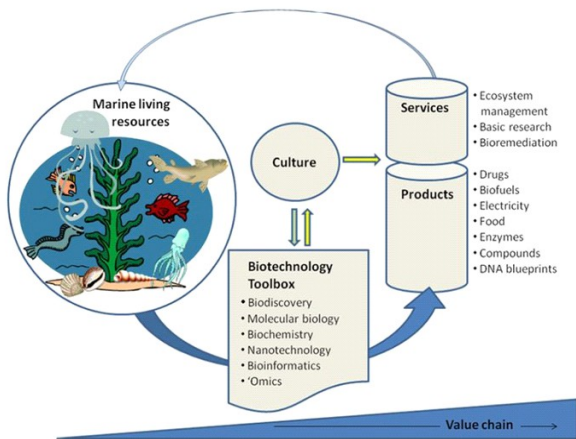
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Figure 1: Products and Services developed from Marine Biotechnology



Source: Marinebiotech.eu

gether with indepth structured interviews delivered to key enterprises in the sector. Information was gathered, analyses undertaken and key recommendations were formulated.

2. General Description

2.1. Value Chain of Marine Biotechnology

The value chain of marine biotechnology begins with research and development. At this stage the concept and viability of a product are assessed. Some of the companies featured in the HARVEST report dealt with seaweed and its derivatives and in these cases the proposed health benefits associated with the products need to be scientifically proven to give the product credibility and the potential of any detrimental effects on the consumer analysed and reported.

Raw materials are sourced from the sea. In the case of seaweed containing products, the species of seaweed required will have been chosen previously and the harvest site identified. The services of a seaweed harvester are also be required, (a seaweed harvester is someone who extracts the seaweed from its source). Both traditional and modern artificial means of seaweed drying are put to use, (HARVEST Atlantic Report, 2014).

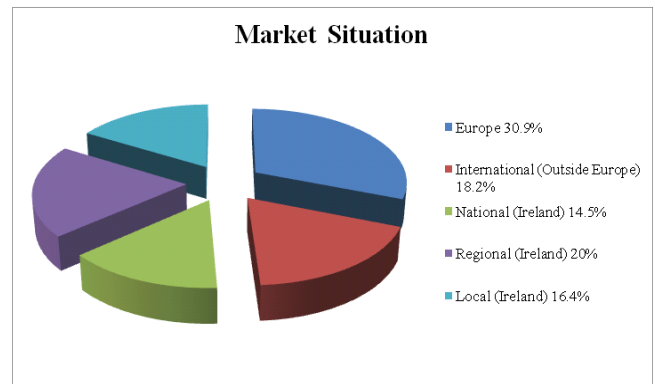
The production stage requires sufficient amounts of raw materials that meet strict quality standards. At this stage, human capital skills and knowledge are combined with the goal of producing a product that is both novel and innovative, (HARVEST Atlantic Report, 2014).

Moving to the marketing and sales stage, the key factors centred on the marketing of the product in such a manner as to ensure that all customers are fully aware of the availability and existence of the product. Equally important is obtaining appropriate sales locations and effective distribution channels and networks to ensure the product reaches the consumers, (HARVEST Atlantic Report, 2014).

2.2. Market Situation

While the marine biotechnology sector has a widespread international distribution, it is also apparent that this sector is

Figure 3: Pie chart of the Largest Markets for the Irish Marine Biotechnology Sector



Source: HARVEST Atlantic Report (2014)

much more prevalent and has a greater presence in some countries when compared to others. For example, in Ireland over recent years several companies have emerged working towards advances in marine biotechnology in order to develop products that are both novel and innovative.

Certain marine biotechnology companies were found to have customers based in China, America and The Middle East. As well as these strong market, the market in Ireland has proven itself to be much stronger than was first anticipated which has been an unexpected bonus to these companies, (HARVEST Atlantic Report, 2014).

2.3. General Description of Sector

Marine Biotechnology is a relatively young sector with much exploration yet to be done and much data to be extracted. For the purpose of defining and describing this sector in the HARVEST project, relevant NACE codes were chosen to identify what types of marine biotechnology activities existed and what types of companies were involved.

The codes chosen covered areas of aquaculture, manufacture of prepared animal feeds, research and experimental development on natural sciences and engineering, research and experimental development on biotechnology and manufacture of pharmaceutical products and preparations, (HARVEST Atlantic Report, 2014).

The table below was compiled from survey results during the HARVEST project, from the five different activities that were included in the marine biotechnology label. The most prominent activity in all EU areas examined was found to be aquaculture.

2.4. Strategic Framework

When considering the strategic frameworks in place for the marine biotechnology sector in Ireland and Europe, two such strategies dominate:

"Sea Change - A Marine Knowledge, Research & Innovation Strategy for Ireland 2007-2013".

Figure 2: Illustration of the Value Chain of the Marine Biotechnology Sector



Source: HARVEST Atlantic Report (2014)

Table 1: Summary of Marine Biotechnology Figures at a European Level. Percentages of Companies in EU countries involved in the following sub-sectors

	Aquaculture %	Manufacture of Animal Feed %	Natural Sciences and Engineering R&D %	Biotechnology R&D %	Manufacture of Pharmaceutical Products%
Ireland	38.3	6.2	14.8	12.3	6.2
Portugal	5.1	2.6	5.1	3.8	0
Scotland	11.4	0	0	5.6	2.8
Spain	27.1	20.8	0	12.5	0

Source: HARVEST Survey, HARVEST Atlantic Report (2014)

This strategy was adopted by the Irish Government in 2007. This strategy aims to encourage the development of marine resources to enable them to add to the knowledge economy. It was hoped that areas such as competitiveness, sustainability, economic stimulation and diversification would be directly impacted upon as a consequence (www.marine.ie). Sea Change, "targets sub-sectors", with the aim of increasing competitiveness through emerging research and new technologies alongside the development of, "innovative competitive production systems and service models to target niche, high-value and high growth markets", (www.marine.ie), (HARVEST Atlantic Project, 2014).

The second strategy is from the **"European Science Foundation Marine Board: Marine Biotechnology a new vision and Strategy for Europe"**.

The Marine Board is a European platform consisting of member organisations wishing to act on and develop common goals and priorities, "to advance marine research, and to bridge the gap between science and policy in order to meet future marine science challenges and opportunities", (www.marine.ie).

The Marine Biotechnology sector is quickly being realised to be a crucial component of the worldwide biotechnology sector, (HARVEST Atlantic Report, 2014). "The global market for Marine Biotechnology products and processes is currently estimated at €2.8 billion (2010) with a cumulative annual growth rate of 4-5%", (www.marine.ie).

This strategy offers a unified vision of the sector across Europe. It is envisaged that by the year 2020, the sector will be both organised and globally competitive, (www.marine.ie).

3. The Marine Biotechnology Sector Within Harvest Regions

3.1. Description of the Sector in the Harvest Regions

The companies surveyed in Ireland involved in marine biotechnology were predominantly concerned with seaweed, sea minerals, and fish. The companies involved ranged from having an involvement in sea derived cosmetics, to companies dealing with novel ingredients for food derived from seaweed extracts, to those using marine raw materials to produce animal feeds", (HARVEST Atlantic Report, 2014).

The results of the HARVEST online survey determined that aquaculture was the most prevalent marine biotechnology activity in Ireland, followed by research and experimental development. Research and development in the biotechnology sector and the manufacture of pharmaceutical products and preparations were activities in which companies engaged with the least, (HARVEST Atlantic Report, 2014).

When analysing the survey results for Scotland, once again aquaculture was found to be the most popular marine biotechnology activity, followed on by research and experimental development. However, the scope of the Marine Biotechnology sector in Scotland was much more limited than elsewhere in the HARVEST regions, as Scottish companies were not found to engage in the areas of prepared animal feed and research and experimental development on natural sciences and engineering. The least prevalent activity in the sector for Scottish companies was the manufacture of pharmaceutical products and preparations, (HARVEST Atlantic Report, 2014).

The Marine Biotechnology sector in Portugal was mainly linked to the use of seaweed (macro algae and microalgae) as sources of industrial products, and to a lesser extent some aspects of fishing and processing of fish.). The activities that were

most prevalent were aquaculture and research and experimental development which is in keeping with the results from both Ireland and Scotland, (HARVEST Atlantic Report, 2014).

In Spain, there are more than 32 research groups that are integrated with biotechnology, however, there was not a specific consolidated line of research in marine biotechnology at present. However, a small number of biomedical companies are now looking into incorporating aspects of marine biotechnology in to their activities. An example of this type was PharmaMar which is, "dedicated to exploring the marine world in search of innovative treatments", (HARVEST Atlantic Report, 2014). Spain differed slightly to the other regions of the HARVEST project with the manufacture of prepared animal feed being much more prevalent than elsewhere, (HARVEST Atlantic Report, 2014).

3.2. Location

The criteria of location was incorporated into the HARVEST online survey by incorporating questions such as, "What reason(s) best justify the location of your company?" and, "Do you think the position or market image of your company benefits from being located in the Atlantic Area or from using Atlantic products or resources?", (HARVEST Atlantic Report, 2014).

Companies cited: "family reasons", "proximity to raw materials", and "regional or local incentives" as determining factors on their location choice. All of the companies investigated found it beneficial to be located in the Atlantic area and where permissible, chose to locate themselves in close proximity to the natural resources which they utilise, (HARVEST Atlantic Project, 2014).

The majority of companies reported that their products were exported internationally to both Europe and further afield. The company's largest markets tended not to be situated locally.

3.3. Innovation

The majority of companies surveyed engaged in innovation activities in 2012 (period in which survey undertaken). Companies considered innovation to be an activity worthy of investing time and energy, (HARVEST Atlantic Report, 2014).

Enterprises were involved with internal or external marketing activities aimed at the introduction of their innovations. These activities highlighted the innovative aspects within the companies. Undertaking such innovative activities companies resulted in an increased range of goods and services along with increased capacity and improvement of the quality of products, (HARVEST Atlantic, 2014).

In order to drive innovative processes, companies engaged consultants, universities and higher education institutes. Companies were willing to cooperate with these different stakeholders and actively sought their assistance, (HARVEST Atlantic, 2014). Constraints to innovation included: "Uncertainty in demand / market for new products or services", "Market dominated by established enterprises" and the "Impact of regulations or standards".

3.4. Human Capital

Employees within the marine biotechnology sector are generally educated to university level. The vast majority possessed a Bachelors degree (BSc or equivalent), and to a lesser extent employees were educated to Doctorate (PhD) OR masters qualifications (MSc). The shortage of suitably qualified individuals was cited by a number of companies, mostly notably the absence of PhD and MSc qualifications. This was seen to be a barrier to innovation within these companies, (HARVEST Atlantic Report, 2014). 50% of the respondents reported that they had skills shortages that the local/regional third level institutions would be capable of meeting. The most prevalent skill shortages were in market and business development skills, product or service innovation and development skills, (HARVEST Atlantic Report, 2014).

3.5. Policy Making

One of the key outcomes of the HARVEST project was the production of a policy toolkit for use by local authorities to assist in the creation of policies that will enable job creation and remove barriers to innovation.

Participating enterprises highlighted supports and mechanisms that would assist in the stimulation of a more productive, favourable environment that would ultimately benefit businesses across the maritime economy, (HARVEST Atlantic Report, 2014).

This highlighted key topics that companies felt should be addressed, these included:

- Reduction in the level of bureaucracy when undertaking their economic activities.
- Simplification of the legislation when undertaking economic activities.
- Promotion of sector-relevant clusters and networks.
- Creation of an effective channel of information and support to SME's.
- Promotion of skills and training development for employees, and the promotion of linkages between industry and third-level institutions.
- Promotion of entrepreneurship and incubation along with maritime education policy.
- Improved access to finance supports and increased productivity supports.

4. Conclusions

4.1. Summary

The Marine Biotechnology sector is concerned with the utilisation of, "marine bio resources either as the source or the target of biotechnology applications", (Irish Marine Institute, 2014). Marine biotechnology encompasses many different types of activities which for the purpose of the HARVEST project

consisted of aquaculture, the manufacture of pharmaceutical products and preparations, research and development of natural sciences, engineering and biotechnology and the manufacture of prepared animal feed, (HARVEST Atlantic, 2014).

Companies investigated in this study were mostly involved with marine organisms (fish), sea minerals and seaweed for use as raw materials. Aquaculture was found to be the most prevalent marine biotech activity in the sector. This activity was followed by research and experimental development. The majority of these enterprises sold their products internationally with 30.9% of their largest markets being in Europe. The main location determinants were being close to family, regional and local incentives and proximity to raw materials. Marine biotechnology companies were actively involved in innovation, it being considered worthwhile and of value to them. Innovation was seen to take the form of new product development and marketing activities. As a result of their innovation efforts, companies experienced a marked increase in their range of goods/services, together with an increase in capacity and improved quality.

4.2. Policy Implications

Companies felt excessive bureaucracy created a barrier to the undertaking of their economic activities. The industry deemed that policy makers must be made aware that this issue.

Companies expressed a desire to have the legislation surrounding the undertaking of economic activities be simplified. Legislation, whilst serving the purpose of protection towards both the consumers and the company is necessary. However, many companies determined that in its present form it was more of a hindrance to them. Companies voiced their desire for the creation and promotion of sector related clusters to benefit their economic activities. Individuals and enterprises of relevance in the marine biotechnology sector were found to be unaware of the existence of any such clusters or networks currently in place.

Finally, it was highlighted from the survey that companies were not satisfied with the levels of support and information currently being made available to SMEs. There was a need for the creation of effective channels of information and support to allow creation of clusters and sharing of best practices within the industry.

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