AHFES

A **QUADRUPLE HELIX** ATLANTIC AREA **HEALTHY FOOD** ECOSYSTEM FOR **GROWTH OF SMES**

D3.3 Recommendations for Strengthening the ecosystem for innovation

15.07.2022

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Abbreviations and Acronyms

CFPC	Cork Food Policy Council
FAO	Food and Agriculture Organization
HiAP	Health in all policies
HR	Human Resources
R&D	Research and Development
SME	Small and Medium Enterpresies
WHO	World Health Organization

Executive summary

Europe's regions are working to improve the competitiveness of regional industry by designing and implementing innovation cooperation policies and measures aimed at maintaining the health of the population.

The AHFES project focuses in particular on healthy food innovations and on exchanging experiences and learning from each other on how to formulate better cooperation policies and practices supporting innovation.

Built on the learnings from the analysis of current trends and policies for innovation growth (D3.2), and on the Analysis of current trends and best practices (D4.1), the aim of this report, in PART 1, is to propose a series of recommendations for increased cross-sector and cross-regional cooperation, both from a political point of view and from an operational point of view.

Small and medium-sized companies play a fundamental role in the country's economy, as they create jobs, promote innovation, maintain competition between Producers and generate economic wealth. However, it is necessary to consider that SMEs face some obstacles in the market, as they are sometimes less able to model and influence the external environment of the company (suppliers, customers, among others), in addition to having access to fewer resources.

In this way, this report aims, in PART 2, to analyze and identify the flaws in the innovation process of SMEs that lead to a low percentage of success in the market, specifically in the Atlantic area. In addition, this report will also present possible strategies to overcome obstacles and failures in the innovation process based on a four-helix structure.

To analyze the innovation processes of the SMEs the Atlantic area's countries and to identify the measures and strategies necessary for the increase of innovation, the results obtained in the D6.1 report "Catalogue" were analyzed, and these datas were complemented with bibliographic research in international and national sources.

After focusing on the ways to improve the cooperation policies and practices supporting innovation, the AHFES project observed, in D4.2, at each participating region level, how civil society and consumers were getting more and more involved in healthy food innovation projects.

The last decade has seen the 3 Helix innovating system, involving academics, institutions, and private companies, turning to a 4 Helix system giving voice to civil society actors who offer the perspective of improving the innovation process. This report, in PART 3, suggests a series of recommendations for involving health food and lifestyles consumers in innovation.

Following these three types of innovation recommendations on cross cooperation, support services and consumers involvement will allow Healthy food European businesses to be more competitive, more productive, and more sustainable, thereby improving European citizens' well-being.

1 Policy Recommendations for Increased Cross-sector and Cross-regional Cooperation for innovation

1.1 Context presentation

Europe's regions are working to improve the competitiveness of regional industry by designing and implementing innovation cooperation policies and measures aimed at maintaining the health of the population. The current project focuses in particular on healthy food innovations and on exchanging experiences and learning from each other on how to formulate better cooperation policies and practices supporting innovation.

The connection between the innovation system evolution and the food and healthy lifestyles of a community is increasingly perceived. For this reason, it is essential that the innovation system for the development of healthy foods is based on the cooperation of all sectors and that it considers health policies applied at a global and regional level. Therefore, it is crucial to be aware of the objectives to be achieved by the World Health Organization (WHO) and the European Commission[1]. In recent years, priority areas have been highlighted: prevention and control of non-communicable diseases in Europe, water quality and human health, and the Green Deal. In the area of prevention and control of non-communicable diseases, the document published by the WHO, "Action Plan for the prevention and control of Non-communicable Diseases in the European Region, stands out. The action plan highlights the importance of intervening in the industry, specifically in the reformulation of food products (amount of salt, sugar, fibre, and fats) to improve the nutritional level. In this way, WHO aims to reduce 25% of premature mortality from cardiovascular diseases, cancer, diabetes, or respiratory diseases[2].

Regarding water quality, WHO developed strategies to improve water quality, since it is used during the food production cycle, affecting the level of food security[3,4]. Finally, as for the "Green Deal" developed by the European Commission, it aims to boost the efficient use of resources by moving to a clean and circular economy with the purpose of restoring biodiversity and reducing pollution[5].

For the development of the recommendations, four case studies of innovative projects were selected in the priority areas mentioned above to obtain knowledge of the difficulties and gaps encountered during the project's development at the level cooperation. Also, it was made a literature review and information collected from WP4.1[6] and WP3.2[7] reports.

The selected projects are:

• "Rose4Pack" project[8]: aims to develop an active biodegradable packaging, allowing to conserve the quality of the food and increase its shelf life, while being a sustainable packaging;

[1] Anderson, C. A. M., Thorndike, A. N., Lichtenstein, A. H., Van Horn, L., Kris-Etherton, P. M., Foraker, R., & Spees, C. (2019). Innovation to Create a Healthy and Sustainable Food System: A Science Advisory From the American Heart Association. Circulation, 139(23), e1025–e1032
[2] https://www.euro.who.int/en/health-topics/noncommunicable-diseases/pages/policy/publications/action-plan-for-the-prevention-and-control-of-noncommunicable-diseases-in-the-who-european-region-20162025
[3] https://ec.europa.eu/info/food-farming-fisheries/sustainability/environmental-sustainability/natural-resources/water_en
[4] https://www.who.int/water_sanitation_health/publications/water_quality_strategy/en/
[5] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en
[6] AHFES, 2019. "D4.1 Analysis of current trends and best practices on 4H cooperation for innovation and growth in the AA".
[7] AHFES, 2020. "D3.2 Report on current strategies & policies for innovation growth in healthy food and lifestyles".
[8] http://www2.insa.pt/sites/INSA/Portugues/ID/Documents/Rose4pack_Folheto_PT.pdf

• "Terres de Sources" Project[9]: the purpose of the project is to reinforce the protection of water resources and support farmers committed to the protection of resources, thus reinforcing the quality of water throughout the food production chain;

•Project strengthening with "Less salt, same flavor"[10]: this project aims to reduce the salt content in bread at the level of national bakeries in Portugal;

•Project "MilaCel Functional Fibers"[11]: the objective project is to produce a functional dietary fibre from surplus apples and not used in the manufacture of food, juices and cider.

1.2 Why increase inter-regional and inter-sectoral cooperation?

Health is a very relevant topic in all countries in the Atlantic area. Case studies selected by the different European partners of the project (deliverable D4.1)[12] and covering the following countries: Northern Ireland, Ireland, Wales, France, Spain and Portugal, demonstrate that the AA area is facing the same issues: combating obesity through complex interventions in healthy eating and physical activity (5/8 case studies presented); protecting water resources and the production and distribution of high quality food products; recruiting and building the capacity of future innovators in healthy eating; and providing innovation support to small businesses to foster competitiveness in the agri-food sector.

It is particularly on the problems of combating obesity that AA countries have a strong interest in creating synergies and pooling their strengths and expertise to be more effective. It is considered that "a healthy population is fundamental to prosperity, security and stability, being a cornerstone of economic growth and social development"[13]. Thus, health promotion is a process that aims to increase the capacity of the individual and the respective community to control their health and thus improve it. To this end, health promotion should not be exclusive to the health sector but should be transversal to all sectors, since the well-being of an individual is linked to healthy lifestyles, considering social, personal, physical and social characteristics.

Policymaking has been changing, reflecting trends in globalization, multilevel policy networks and greater democratic participation[14]. Treaties and standards add new dimensions to existing standards at both national, regional, and local levels (figure 1)[15]. The Ottawa Charter made it possible to understand the importance of intersectoral and interregional collaboration for health and the reduction of inequalities. Intersectoral cooperation has two crucial aspects, horizontal and vertical. The horizontal aspect concerns collaboration between sectors in the health sector and,

[9] https://www.eaudubassinrennais-collectivite.fr/blog/terres-de-sources-laureat-de-lappel-a-projets-national-territoires-dinnovation-206-millions-deuros-a-la-cle/
[10] https://www.sns.gov.pt/wp-content/uploads/2018/04/selo_excelencia_pao_com_menos_sal_regulamento.pdf
[11] https://milacel.com/en/functional-fibre/
[12] AHFES, 2019. "D4.1 Analysis of current trends and best practices on 4H cooperation for innovation and growth in the AA".
[13] Understanding how and why health is integrated into foreign policy - a case study of health is global, a UK Government Strategy 2008–2013
[14] http://www.fao.org/3/y4653e/y4653e04.htm
[15] Neely, C., Bourne, M., Chesterman, I., Kouplevatskaya-Buttoud, D., Bojic, D., & Vallée, D. (2017). Accelerating Impact through Cross-Sectoral Coordination at the Country Level.

at the same time, between the health sector and other sectors. As for vertical cooperation, cooperation occurs through different levels of government and region.

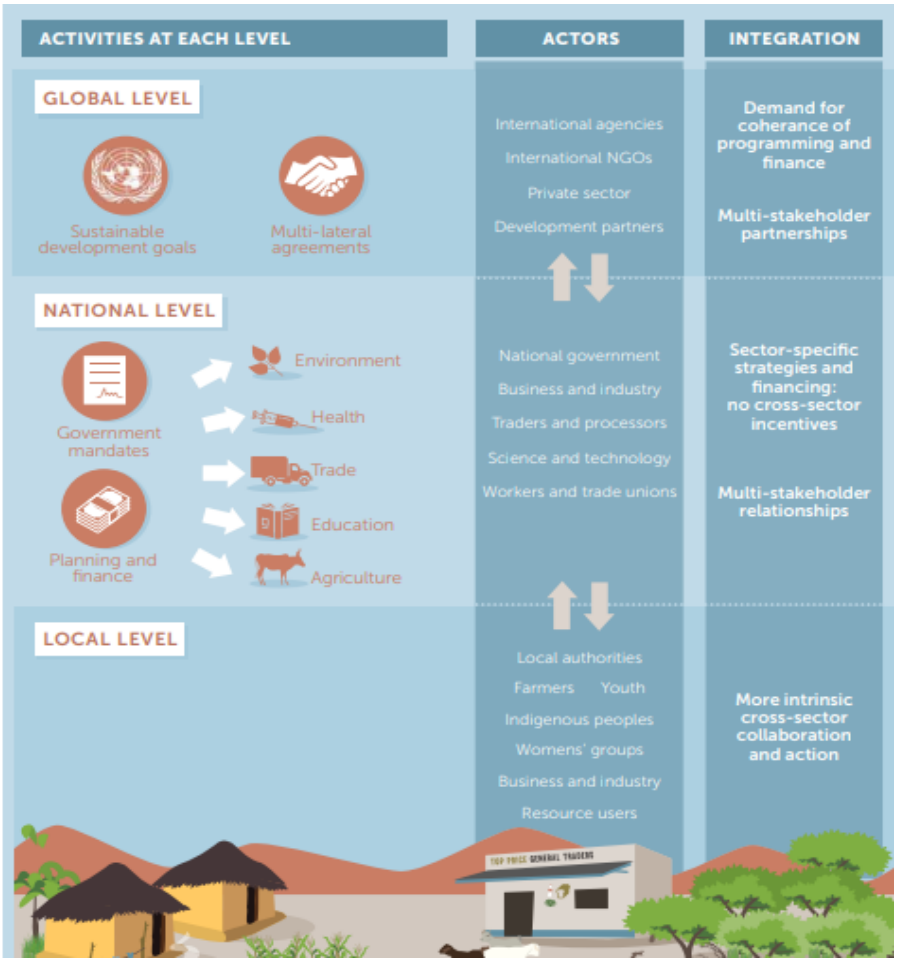

Figure 1. Cooperation Levels adopted by FAO[15]

In 2006, during the Finnish presidency of the European Union, emerged the concept of "Health in all policies (HiAP), that aim including collaboration of various sectors to achieve common goals. More recently, the tool "Health in all policies (HiAP) was applied and Food and Agriculture Organization (FAO) developed a document which provides countries with guidance on how to implement "Health in all policies"[16]. This concept recognizes the role of the health sector, but it also identifies the specific and synergistic impact of the actions of other government sectors on the health of a population. Therefore, the government of each country plays a central role in cooperating with other stakeholders to create an environment that enables and encourages behavioural changes in individuals, families, and communities. There has been greater effectiveness and acceptance of health and promotion policies when there are a wide intervention

[16] Ståhl T. Health in All Policies: From rhetoric to implementation and evaluation - the Finnish experience. Scand J Public Health. 2018 Feb;46(20_suppl):38-46. doi: 10.1177/1403494817743895. PMID: 29552965.

and involvement of the various sectors (industry, universities, governments, and the community) in the formulation of the respective measures.

On the other hand, cooperation between countries can help to solve joint problems and share acquired knowledge and best practices at three levels (figure 2).

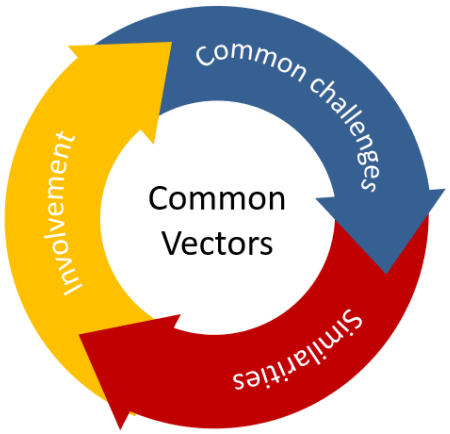

Figure 2. Common vectors between European Atlantic Area Countries

The first vector refers to the everyday challenges that countries have with each other regarding the state of health and the efforts and measures to be implemented to promote health, and in this way, they can help each other and learn from the results already achieved. Second, the existence of similarities in cultural, religious, and economic policies allows for rapid integration of measures and practices, thus strengthening cooperation between partner countries. Finally, the vector 3 concerns international involvement in regional and global processes. As seen in the WP3.2 report in the area of health, many countries face very similar challenges and concerns, with cooperation between countries and the application of benchmarking being practical tools that strengthen, share and accelerate the implementation of the solution and its result. An example of a joint action/cooperation is “CHRODIS PLUS” that aims to support European countries to improve the prevention and management of chronic diseases through the application of pilot projects and the implementation of innovative approaches that have had favourable and successful results in other countries and contexts[17]. In this action, they encourage and support cooperation between countries, with the main aim of improving outcomes, directly benefiting citizens' health. The benefit of collaboration between countries is the ability to support and strengthen national efforts to achieve health development while at the same time, enriching perspectives on practices and lessons learned in other countries.

[17] https://webgate.ec.europa.eu/chafea_pdb/health/projects/761307/summary

1.3 How can the innovation ecosystem in the European Atlantic Area be strengthened from a political point of view?

1.3.1 The crucial role of political actions in innovation

Innovation can be defined as a process of creating value through the application of new solutions to significant problems and the development of new products. This process is driven by the cooperation of 4 Helix, which includes science, education, industry, and society. The interactions between the actors and the flow of technology and information/know-how form an ecosystem of innovation (figure 3). In this way, an innovation ecosystem aims to solve a problem while allowing the diversification of the economy[18].

The variability of the actors involved in the process allows the enrichment of the ecosystem that must facilitate the formation of effective networks between the different actors. Besides, for generated innovative ideas, developed, and tested, coordinated and collaborative action with the use of the resources of the ecosystem actors is required.

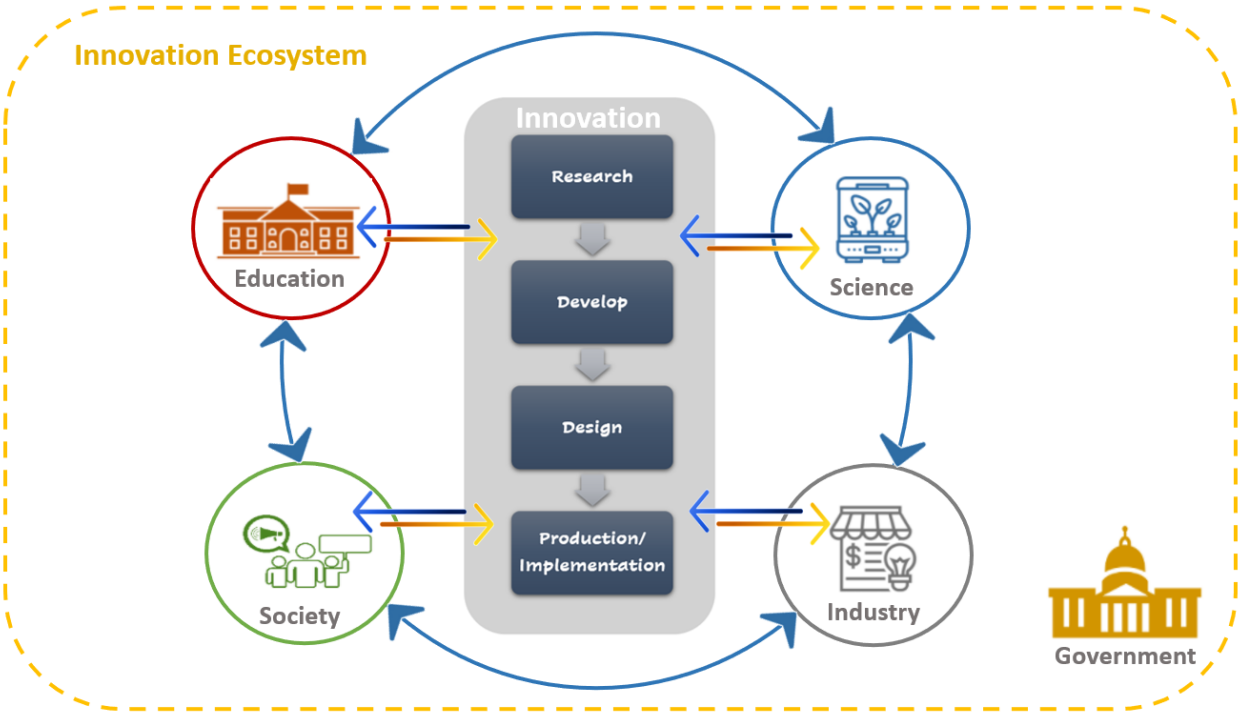

Figure 3. Innovation system applied in 4H

Based on the D3.2 report, it appears that **the political actions developed and implemented by the government play a crucial role in innovation.** The government's role in the ecosystem is related to the creation of supportive policies and a regulatory environment in which actors are encouraged and can thrive through fiscal incentives or partnerships that allow mutual growth. Also, the government is essential to ensure that actors have access to the technological infrastructure they need for the development of innovation. However, the application of extreme measures and policies may not be sufficient for the development of the ecosystem, and it is

[18] Corsaro, D., Cantù, C.,Tunisini, A. (2012). Actors' Heterogeneity in Innovation Networks. Industrial Marketing Management (5), 780–789.

necessary to find a balance in the government's participation in the ecosystem, not allowing the government to play the central role. On the other hand, it was observed that ecosystems at the local level need greater understanding, contribution, support, and to apply different strategies for better final results[19].

1.3.2 Two examples of political actions reinforcing the innovation ecosystem

Next, two examples in the area of healthy eating will be addressed to analyse the innovation ecosystems and therefore consider which strategies is better to enrich the innovation ecosystems to be implemented from the political point of view.

At the global level, we can consider a WHO example in healthy eating and physical activity the **"WHO Global Strategy on Diet, Physical Activity and Health"**, which includes various actors such as the governments of each country, WHO, international partners, the private sector and civil society. This strategy resulted in recommendations for guidance to countries on reformulating new policies and improving existing measures. Besides, specific tools have been developed for each region, so that each country can use the tool and implement the marketing recommendations. With the development of the proposals, they verified that new scientific information is essential to allow the adjustment of the political levers and the strategic processes to introduce changes. There are three critical elements for these processes: the range of policy principles, the prerequisites for the introduction of political strategies (need for leadership, effective communication of problems and functional alliances) and finally, strategic actions[20].

The second example is related to **salt and sugar reduction in food products by WHO recommendation**. The reformulation of food products is a strategy to improve the population's health status by improving the nutritional properties of foods. The reformulation of food is generally based on reducing salt, sugar, and fat, which is encouraged by health authorities, supported by the scientific community and implemented by the industry. However, this is a complex process for the food industry, and several steps are necessary for the reformulated product to respond to the implemented measures and simultaneously be successful in the market:

• Reformulation of the food (replacement or reduction of salt, sugar and fat);

• Nutritional analysis of the reformulated food;

• Creation of the reformulated food packaging (labelling, more sustainable);

• Analysis of the safety and shelf life of the reformulated food;

• Regulation at the country level where the reformulated food will be marketed;

• Creation of marketing companies for reformulated food;

• Consumer assessment of reformulated food.

In this way, the existence of a 4-helix innovation system is verified, requiring the actors' involvement: government, consumer, industry, and science. However, in this system it is necessary to continue investing in the promotion and stimulation of research and investigation in this area, enabling and considering the consumer's involvement so that the innovation system is successful. Besides, it is crucial that the government as an actor in this system provides support

[19] AHFES, 2020. "D3.2 – Report on current strategies & Policies for innovation growth in healthy food and lifestyles"
[20] WHO. (2004).Global strategy on diet, physical activity and health Report by the Secretariat

in terms of funding and that over time it removes the existing barriers between industry and science.

1.3.3 Acting on the strategy within the regions and between regions to strengthen the innovation ecosystem

1.3.3.1 Alignment of regional resources essential to work in common strategic directions

Innovation practices can vary across projects and regions and it was noted that fragmentation of systems can reduce the capacity for dynamic change that limits the optimal effectiveness of innovation systems. In this context, it is important to align regional resources to work in common strategic directions. Joint learning on innovation policies and practices and specific methods supporting innovation cooperation bring real added value in the context of budgetary constraints where local and regional authorities are looking for the best value for money. The identification of specific cases where cooperation practices have proved successful is instructive and limits the risks and costs of trial and error in future innovation projects.

1.3.3.2 A political commitment to be consolidated to build regional innovation systems

Across the AA region, it is clear that policy makers at the national level are encouraging and investing in innovation. If innovation failures are to be considered, policy makers need to be guided by impact and return on investment. However, the position of policymakers cannot be limited to investment and evaluation, they need to engage more directly in innovation testing and system-building measures. This is increasingly recognised, and policy makers have more open and engaged working relationships with other 4H partners. At the same time, all 4H innovation partnerships and the associated policy culture of cooperation for innovation are elements that require constant attention and active engagement within innovation regions.

1.3.3.3 Mentoring and sharing of strategic vision to be strengthened among regional innovation systems

It can never be taken for granted that an open culture of engagement will be maintained. Policymakers and innovation cluster leaders at the regional level should adopt a mentoring role with members of the innovation system. A broader vision focusing on the internationalisation and specialisation of regional innovation is also needed, as well as a continuous recognition and updating of mental models in relation to the broader context and local issues that influence innovation.

1.3.4 Sharing good practices within and between regions to reinforce the Atlantic Area innovation ecosystem

1.3.4.1 Transfer of good practice within and between regions is difficult to achieve

While the synthesis of key learning experiences and strategies for moving forward documented in the final product is valuable, the transfer of good practice within and between regions is difficult, even though many projects share similar objectives. According to Heydebreck, Gabrielsson and Dahlöf (2014)[21], factors that explain the difficulties encountered during transfer include the absorption capacity of regional policy makers, insufficient involvement of policy makers in projects and the potential conflict between the innovative character of a practice, its proven success and its transferability. They note that it is often the simplest and least innovative practices that are transferred between regions, while highly successful practices with proven impact often develop in a specific context over a long period of time with an associated infrastructure and set of capacities that make rapid transfer less feasible.

1.3.4.2 The conditions for better transferability of successful cooperation practices between regions

The adoption of new innovation cooperation practices that are transferred from one case or region to another requires : a clear definition of the practice; capacity building of key stakeholders who need to be involved in the process; sufficient funding and anticipation of key resource needs; commitment to the new practice among all 4H cooperation partners; sufficient political stability in the overall context of the 4H partners and a sufficiently favourable regulatory situation to support the new practice; prior analysis to determine whether businesses will welcome the new practice, and a judgement as to whether the new practice fits in with the local habits and routines of businesses and public bodies.

While interregional learning and cooperation are valuable, effective transfer involves a thorough understanding of the local context and characteristics of the region, including the barriers to the adoption of specific cooperation practices and the essential "enabling" conditions, in terms of stakeholder characteristics and capacities and organisational arrangements. Policy flexibility and stakeholder flexibility are key factors for successful policy implementation. Dynamic and flexible organisational arrangements and processes that facilitate the dissemination of knowledge throughout the learning system are essential for successful innovation. Networked mutual learning and close interaction are important, but to maintain dynamic flexibility and be sustainable without collapsing capacity or overloading the system, cooperative innovation systems need to have substantial resources and critical mass and well-developed links with external systems from which they can access complementary know-how and competences. It is clear from working with AHFES partners that capacity constraints are a system-wide problem. This suggests responses that aim at both increasing resources and critical mass and strategic efforts to focus on quality rather than quantity in the whole innovation ecosystem.

In addition, the consequent mobility of human resources creates **the mobility of knowledge** between partners and between regions. Thus, it is essential to increase the graduation of experience at a scientific and technical level in the innovation system, allowing the work

[21] Heydebreck, P. Gabrielsson, N., & Dahlöf, C.A. (2014). Innovation Systems. INTERREG IVC Analysis report, INNO.

developed in the innovation system to reach the objectives provided and sometimes to exceed the expected level. However, sometimes the increase in knowledge is not enough to transfer knowledge between the actors, so it is necessary to create measures that enable the mobility of qualified personnel between the actors to contact other environments and modify ideas according to the “environment".

That being said, many innovations are doomed to failure and it is therefore important to focus on quantity to allow for the necessary variety and failure in the overall innovation learning system, as much learning takes place through variety and failure in the innovation process.

1.3.4.3 A necessary encouragement for openness and interaction between the 4Hs

In addition, research institutes and universities should continue to focus on innovation in the healthy food sector, interact with enterprises and provide incentive mechanisms, including financial, intellectual, methodological, and practical support to SMEs in their region. SMEs have a unique opportunity in the context of the new cooperative learning networks in the AA region. In order to take advantage of these opportunities, they need both to open up to and provide feedback to policy makers and scientists, clearly informing them of their main needs and understanding of consumer needs and perceived market opportunities. Policymakers, academics and SMEs need to establish a positive and open culture of exchange and support, recognising the unique contributions of each. All partners need to provide feedback and communicate openly, and welcome the challenges associated with successful innovation. In this context, no partner can impose its culture exclusively on other partners; rather, they must remain open to change and learn from each other.

1.3.4.4 The importance of reinforcing the science - politics - industry interface, through programs to balance innovation with health

Among these 4 Helix concepts, the importance of science and industry in innovation systems is increasingly observed. It is essential that all the processes carried out are transparent and that it allows the involvement of both actors, allowing the definition of priorities and the needs to be met for a given community. On the other hand, it is crucial to strengthen the links between industry and science, as this involvement allows the absorption and commercialization of the science results obtained by industry. One way to enhance this link is to guarantee intellectual property regimes, on the one hand encouraging investment in innovation and on the other, providing the dissemination of scientific and technical knowledge.

1.3.4.5 An indispensable contribution of citizens as co-actors of healthier food

The inclusion of citizens and consumers in the 4H partnership also implies that consumers should be considered first and foremost as citizens and not as consumers or customers. In this way, their needs are seen as part of the collective needs of society and they can be included with good intentions and maximum creativity throughout the design, evaluation and implementation phases of innovation projects. Ultimately, all partners in 4H innovation systems must see themselves as co-actors and co-creators and act as equals in the movement towards better health and well-being and sustainability for all.

As community involvement is crucial for the innovation system actors to have access to a more social perspective, the government must enable community participation in the innovation system. However, there is a risk associated with greater community involvement: perspective variability.

Therefore, the government must create networks of approaches at different levels and **develop incentive strategies to encourage participation by community.**

1.4 How to facilitate cooperation in the framework of innovation projects?

1.4.1 Cooperation challenges identified in the European Atlantic area

Collectively, across all case studies chosen to be analysed in the framework of AHFES project, it is clear that innovation cooperation can be challenging. Figure 4 illustrates key themes emerging across case studies in the types of challenges faced by partners as they seek to work collaboratively on their innovation projects.

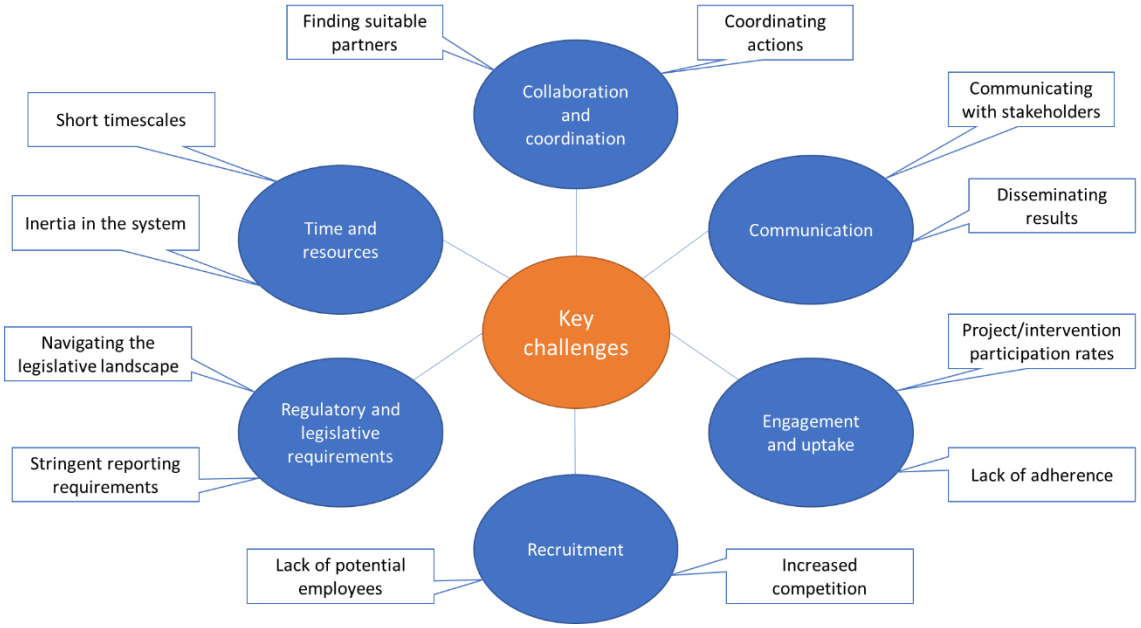

Figure 4. Challenges to Efficient and Effective Innovation Cooperation

The largest set of challenges identified across case studies relates to issues of **collaboration and coordination**. Included in this category are challenges in finding suitable collaborators (e.g. manufacturers), securing the engagement of organisations to participate in research and innovation projects, and coordinating activities with actors across multiple domains across regional differences. In TERRE DE SOURCES French project, the collaboration with numerous farmers is key to ensure that there will be a real impact of using less pesticides on the quality of water. In the same project, engaging consumers to understand the Terre de sources label, and the efforts that have been made to produce more environmental-friendly food products, is crucial to secure market opportunities and to change mentalities and the perception of local agriculture.

In the Active packaging project, the multisectoral collaboration (food industry, raw material product, packaging industry, research and consumer) allowed the developed product to be successful in the market, being the final product more sustainable, with better nutritional properties in terms of food and a label that allows the consumer to have all the necessary information.

In the salt reduction project, intersectoral collaboration was also implemented, including ministries of health, industry, research centres and consumers. Consumers' involvement allowed the whole product developed to be accepted in the general market and not just in the healthy market niche.

Communication emerged as a distinct category of challenges across case studies. Communication challenges, such as a lack of effective communication between stakeholders, was identified as a factor that can limit the impact of innovation projects. In MilaCel Functional Fibres Welsh project, the goal was of course to develop healthier products for children, but it was also to communicate on fibres so that citizens would be more aware of their nutritional interest to lower the sugar and fat content.

The salt reduction project on bread aims to reformulate a bakery product to reduce the salt content. In this case, the target population is a population in general with no specific groups. In this case, the information provided to consumers must be transparent and concise. However, it is not just access to information that will influence the consumer's choice. Consumer participation in these projects allows the developed product to be based on the consumer's environment, from environmental to social factors.

Challenges linked to **time and resources** were also identified across case studies. In some cases, these related to delays caused by external bodies (e.g. HR departments in collaborating organisation), or more global systemic inertia (e.g., in regional change dynamics). In other cases, the timescale between innovation, production, and delivery were considered to be extremely demanding, and posed significant challenges to smaller companies. Innovation can take time and a variety of process, organisational, and systemic delays need to be factored into any design and implementation process. As well as time pressures, resources such as the availability and competency in the use of complex equipment and machinery were highlighted as a considerable challenge to innovation. For instance, a sstructured planning approach and robust monitoring of progress were used to create the project plan of the MilaCel Functional Fibres project to meet the deadlines imposed by the SBRI competition it took part to. In the projects of active packaging and salt reduction, the concept of “product development time” is different among the actors involved. This difference is more evident between the industry and the science and knowledge centres. In these cases, the industry wants the product to be developed in the shortest possible time, contrary to science centres that tend to prolong the project's timeline. Thus, the actors must find a time balance between themselves.

Another category of challenges relates to issues of **engagement and uptake**, which are central to food research and innovation projects, but the challenges associated with engineering high levels of engagement and uptake are not always effectively planned for. In salt reduction and active packaging projects, there is low consumer involvement in developing the final product. Sometimes it is complex to create a community group that allows an overview of the population, with no direct gains for the group that participates. The same is sometimes true for the industry group, as seen in the salt reduction project. In this project, there was a low level of involvement in the industry, with no concrete national representation.

Innovation cooperation challenges associated with navigating and meeting **regulatory and legislative requirements** were also highlighted among the case studies, for example creating products that meet key **regulatory and legislative** requirements as regards the kinds of nutritional claims which can and cannot be made when marketing products. Sometimes, the project itself needs the creation of a legal innovation; it was the case for TERRE DE SOURCES project that led to the creation of a legal innovation to allocate the public market to local school catering, sinequanone condition to make to project possible. Sometimes, regulations and legislation make it challenging to develop projects, making it essential for one of the actors to be a member of scientific and legislative knowledge. This was seen in the active packaging design,

since, although it is still a current and developing theme, the legislation is continually being updated. In the case of the salt project, given WHO legislation for all countries, it does not consider the differences in sensory factors on the part of the consumer, which highlights the importance of consumer involvement in the project. Thus, it is necessary to consider during the product development the existing legislation and regulations from the regulations for the implementation of the project in general to the regulations and legislation for the product in question (constitution, place of sale, national or international, among others)

Finally, challenges in the category of **recruitment** relate to the difficulties of promoting the food innovation industry as a career path. Challenges include an insufficient pool of potential employees for companies innovating in this sector, as well as competition from other sectors which may draw potential employees from this already limited pool into other areas of work.

1.4.2 Key lessons to facilitate cooperation and better innovate together

A thematic analysis of key learning experiences reported across case studies revealed a number of related clusters of ideas, which are illustrated in Figure 5.

Among these key learnings are quoted more specific ideas to make it easier to cooperate in innovation:

Consumer engagement: need to involve the consumer in innovation processes to ensure that the innovation developed is in line with expectations. Within the framework of MilaCel Functional Fibres project, any products made with the new functional fibers should be of a texture, flavor and appearance that would appeal to the intended target market of school aged children. That's why questionnaires were designed, using psychologically robust methodology, to interview children and their parents to get sure that the products would fit the children target. In the salt reduction project, consumer involvement is a crucial factor for the success of the product developed. The development of sensory study panels with consumers' participation was essential to be aware of the limit that could be reached. Besides, it is necessary to carry out multicentric adhesion studies to select groups with few confounding variables.

Taking into account organisational and individual capacities:

- o Smaller companies collaborating on projects have fewer resources, time and even a variety of skills than larger companies.
- o Multi-sectoral collaboration between companies of very different sizes and from very different sectors of activity brings great richness and is essential to the success of a project.

Well aware of the richness of mixing profiles, Innovate UK created SBRI which provides solutions to government public sector challenges by engaging with small businesses who may provide innovative solutions. It was a real asset for the MilaCel Functional Fibres project because the Welsh Government staff were able to facilitate connections with schools and to ensure feedback from potential consumers.

Coordination and management:

- Good coordination of the group made up of the different actors in the project is key to its success.
- Projects with a territorial dimension would be more effective than isolated innovation actions, especially if the problem being addressed is identical.

The action of TERRE DE SOURCES promotes for example a territorial, partnering and open-ended approach of innovation, engaging 5 different types of actors (farmers, local authorities, SMEs, citizens and academics) in a same common goal: improving the quality of water in Rennes watershed.

Business and finance strategies:

- Economic reasons are the best way to motivate actors to work together

Cost is a crucial factor in building customer loyalty.

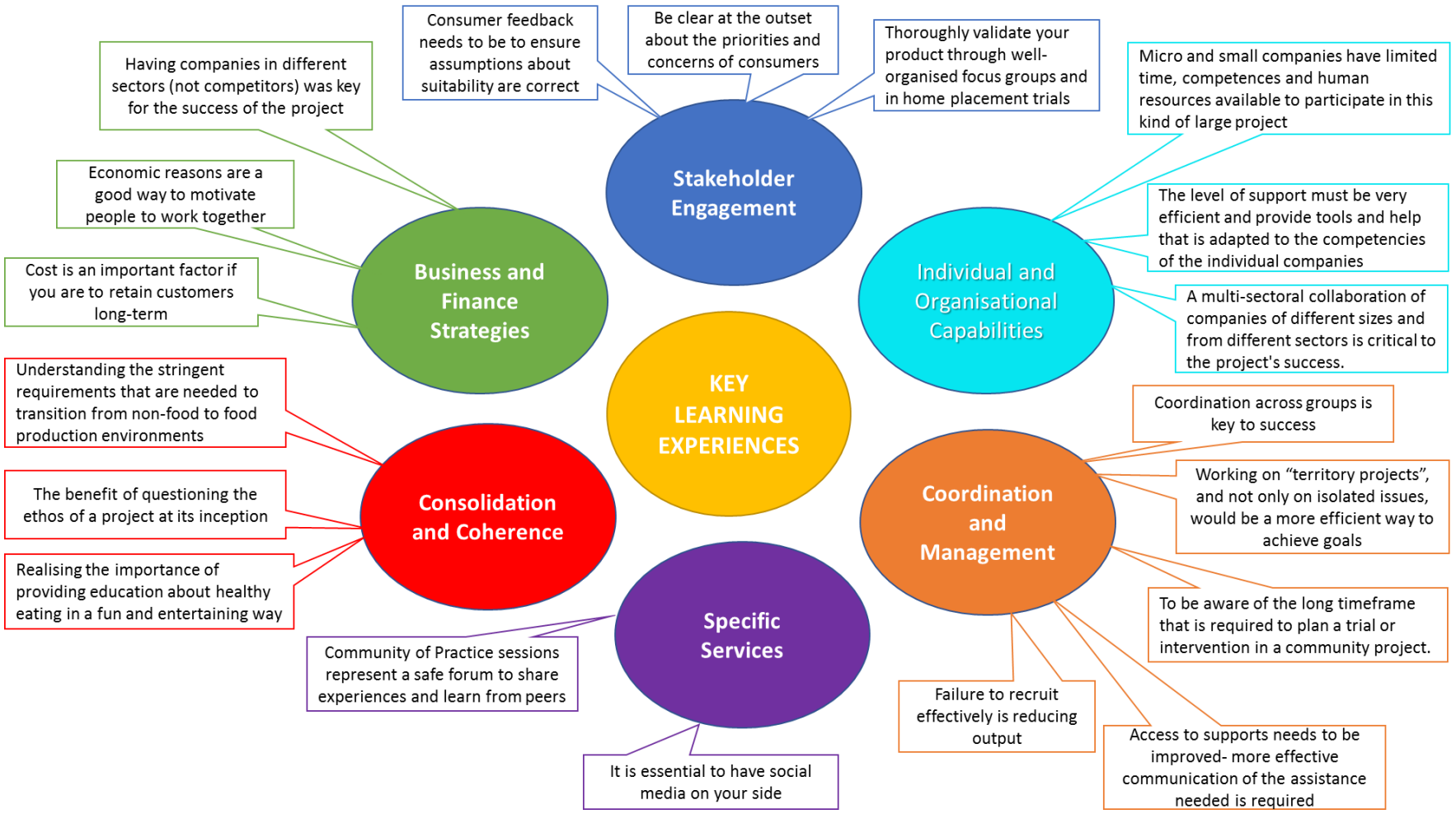

Figure 5. Key Learning Experiences arising from Innovation Cooperation

1.4.3 Tools and methods that can facilitate cooperation in order to better innovate together

A thematic analysis of methods, tools, and strategies of cooperation reported across case studies revealed a number of related clusters of ideas, which are illustrated in Figure 6.

The **engagement and awareness** category are comprised of methods, tools, and strategies for engaging with the public and/or stakeholders and raising awareness about products and services. This includes, for example, recruitment of ambassadors to represent the industry in school outreach events, sending promotional information directly to industry journalists and bloggers, as well as hosting outreach events in the local community to engage with citizens as regards their interests, and any feedback they can provide. It was the case in Milacel functional fibres project in which a number of outreach events, speaking to local community groups in order to engage citizen interest in the project and to gain feedback was used. The salt reduction and active packaging projects applied the methodologies to increase the population's involvement through awareness-raising actions and consumer-oriented workshops at both the local and regional levels.

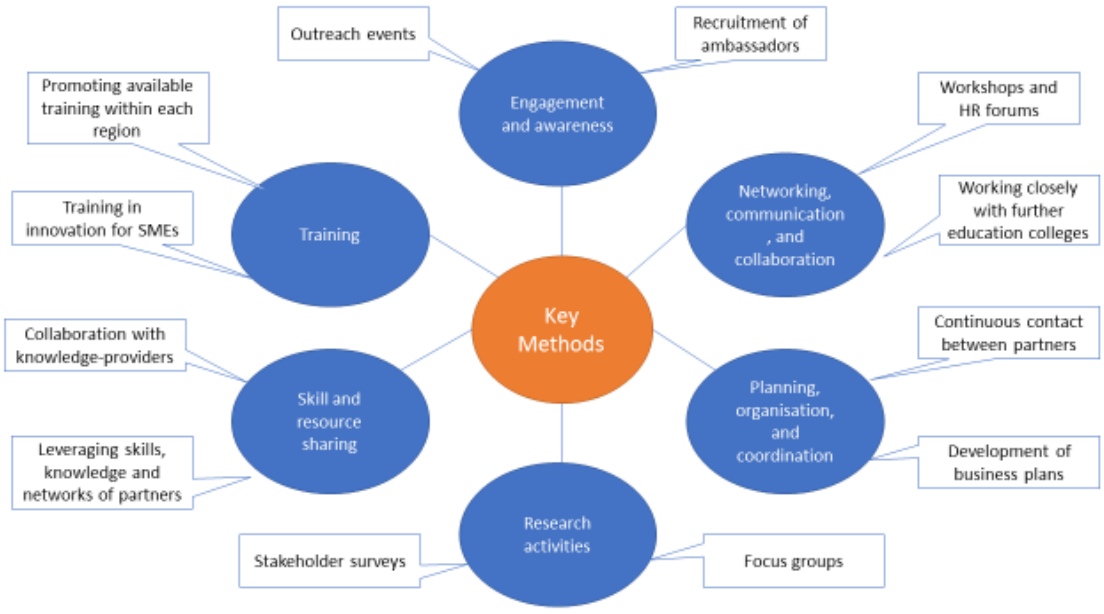

Figure 6. Methods, Tools, and Strategies of Cooperation

The **networking, communication, and collaboration** category relates to ways in which SMEs maintain, grow, and utilise networks to advance their goals. This includes, for example, forming a cooperative company to bring together various groups of stakeholders (e.g. employees, funders, producers, industries, institutional bodies, and consumers); in France for example, a cooperative company “SCIC Terres de sources” succeeded in gathering various producer’s networks and environmental and consumers associations to make them work together.

Another way is to facilitate meetings between different parties in the network; hosting idea generation workshops for companies to co-deliberate over new products or services; and

facilitating fora which provide opportunities for companies to share information and address common issues.

The **planning, organisation, and cooperation** category consists of various tools, methods, and strategies used by SMEs in planning, organising, and coordinating their efforts. This includes a diverse set of strategies ranging from the development of research collaboration agreements, legal innovation methods, and business plans, to the use of file-sharing services such as Dropbox for easy co-working and coordination of resources.

The category of **research activities** addresses the diverse approaches to collaborative research utilised by SMEs. These include surveys of all stakeholders (e.g. bakeries) at a national level, focus groups with target market consumers for market validation, analysis of school curricula to establish levels of industry representation, and interviews with children and their parents as part of market analysis and consumer testing, as for the Milacel Functional fibres project.

The **skill and resource sharing** category are comprised of various ways in which SMEs advanced their goals by sharing various skills, knowledge, and resources. For example, utilising the existing supply chains, experimentation capabilities and production facilities of organisations in each SME's network. Other examples of skill and resource sharing relate to collaborating with a knowledge-provider to develop a nutritional profile of key ingredients (e.g. quinoa), and the creation of a cross-city purchasing group to facilitate a more integrated service delivery.

The analysis of the case studies also revealed a focus on **training** as a way of embedding tools, methods, and strategies of cooperation. This category includes SMEs in the network providing training, for example, on export strategy, research, and business planning and implementation -- including upskilling support and apprenticeships, organising training and campaigns at cross-national, national and regional levels to promote products, and raising awareness of training opportunities available in each region.

2 Recommendations on innovation support services to SMEs

2.1 Context presentation

Small and medium-sized companies play a fundamental role in the country's economy, as they create jobs, promote innovation, maintain competition between Producers and generate economic wealth. However, it is necessary to consider that SMEs face some obstacles in the market, as they are sometimes less able to model and influence the external environment of the company (suppliers, customers, among others), in addition to having access to fewer resources.

In this way, taking into account the constant challenges currently being faced by the food industry, innovation has become increasingly crucial for the survival of SMEs and, simultaneously, for establishing a competitive advantage over competitors.

With the increase in the level of competitiveness among SMEs, innovation becomes a crucial activity for all companies to increase profitability and, consequently, the company's survival in the market. The concept of innovation is comprehensive, constituting a multidimensional phenomenon at various levels and resulting from several functionally different processes. Still, at the same time, they are integral and interdependent processes[22].

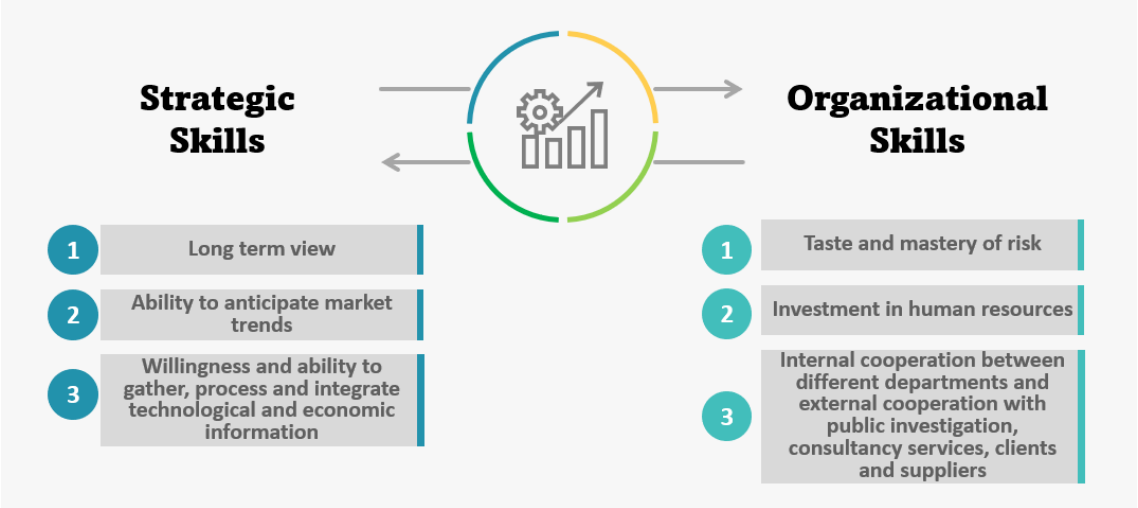

Figure 7. Competences for innovation SME

Despite differences between regional and international organizations, certain common factors can make the innovation process more or less favourable. Several studies conclude that for the innovation process success, there are some determining factors, like the structure of the SME, the training and development of the team, the degree of involvement of the team and also how the SME itself learns and shares knowledge with members, should they be internal and external to the organization (figure 7).

[22] OCDE. ENHANCING THE COMPETITIVENESS OF SMEs THROUGH INNOVATIO

According to the European Innovation Scoreboard 2021, Europe lags behind countries like China and Canada in terms of innovation (Figure 8A). Comparing the countries of the Atlantic area with the European Union, it is observed that Portugal and Spain and Italy are considered "Moderate Innovator" (Figure 8B).

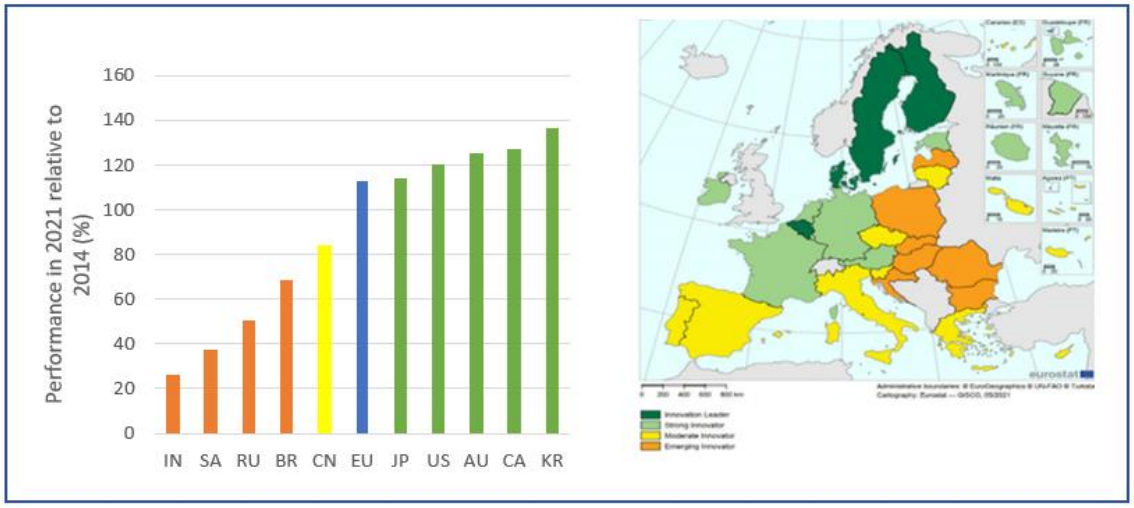

Figure 8. PERFORMANCE IN 2021

(A – EU PERFORMANCE RELATED TO OTHER COUNTRIES. B- EUROPEAN COUNTRIES INNOVATOR CATEGORY)[23]

Concluding, the success rates of innovation processes in the food and healthy lifestyles sector are still minimal, so it is essential to address and identify existing failures and develop responses to increase the success of innovations and, in turn, increase the company's growth and competitiveness between them.

In this way, this report aims to analyze and identify the **flaws in the innovation process** of SMEs that lead to a low percentage of success in the market, specifically in the Atlantic area. In addition, this report will also present **possible strategies to overcome obstacles and failures in the innovation process based on a four-helix structure.**

To analyze the innovation processes of the SMEs the Atlantic area's countries and to identify the measures and strategies necessary for the increase of innovation, the results obtained in the D6.1 report "Catalogue" were analyzed, and these datas were complemented with bibliographic research in international and national sources.

[23] https://www.weforum.org/agenda/2022/10/european-union-top-innovative-countries/

2.2 SME needs for innovation

According to the study, there is a need to find strategies in the area of innovation to be applied in SMEs. To understand the most considerable difficulties and obstacles that SMEs face in this sector, a survey was carried out aimed at SMEs in the Atlantic area in the Healthy Food and Beverages sector (WP6 of this project)[24].

Based on the results obtained, it can be said that there are currently two primary needs, which are interconnected: efficient technology transfer (knowledge transfer) and available financial resources (figure 1).

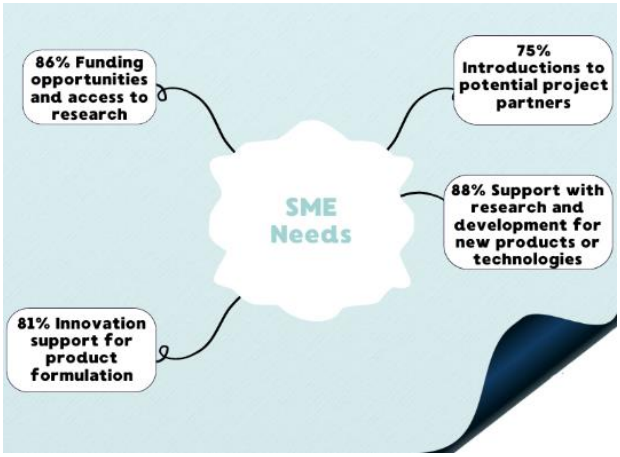

Figure 9. Some results from WP6 survey

According to studies carried out by the scientific community, it is already common knowledge that innovation occurs based on a multidisciplinary team and when all the processes are “open”. It was found that many of the innovation processes that SMEs carry out sometimes fail because of a lack of input from other actors, which leads to the important name “communication of science and transfer of knowledge”. We are thus entering the field of collaboration between actors and “open science”[25].

On the other hand, we have the issue of financial support for SMEs, which, for obvious reasons, cannot have the monetary funds required to innovate on their products. There are several government initiatives for companies to apply, but sometimes the criteria and the time settings are not enough, and sometimes there is too much paperwork that companies end up, not even participating. It is crucial to understand that investment in innovation is not a short-medium-term scenario but a medium-long-term one, which is sometimes necessary to go back to the beginning. Therefore, all the knowledge of the innovation process and what it entails is essential for “head and foot” financing to be carried out.

Both factors are crucial for SMEs to increasingly “embrace” innovation and launch new products in healthy eating nationally and internationally. It is essential that there is the creation of more

[24] AHFES, 2021. D6.1 Catalogue of Innovation Services
[25] Anand, A., Muskat, B., Creed, A., Zutshi, A., & Csepregi, A. (2020). Knowledge sharing, knowledge transfer and SMEs: evolution, antecedents, outcomes and directions. In Personnel Review (Vol. 50, Issue 9, pp. 1873–1893). Emerald Group Holdings Ltd.

strategies to support companies at a financial level and that, at the same time, the transfer of knowledge is increasingly encouraged, showing its importance for the success of the company and its future creations.

2.3 Barriers to Innovation for SMEs

The innovation of SMEs in the food sector has been increasingly important for the final product to be successful in the market. However, although it is an already very advanced topic, there are still many barriers to developing food products.

Several factors inhibit the innovation dynamics of companies. Generally speaking, they are internal and external to the organization. Still, the impact is felt either by preventing the innovation process from starting or delaying it or causing inefficiencies[26].

External factors are linked to difficulties in accessing technological information, difficulty accessing external financing, problems in recruiting qualified personnel and even the market. On the other hand, internal factors refer to a lack of funds or the perception that the risks and costs of the innovation process are too high.

Internal Factors

Each company has an internal structure, a management style and a culture that can influence innovation. The internal factors that may constitute barriers to innovation are listed and explained below.

- Age and size of the company: Avermaete et al. 2003 emphasize a relationship between age, size and the regional market in which companies operate. Thus, there is a relationship between the age of the company and its innovative capacity. In addition, several studies confirm that the company's size influences innovation, with a larger company having greater availability of financial resources, greater access to financing, greater capacity to attract and retain qualified staff, more quickly for management and R&D.

- Agility: an aspect to be taken into account is the company's agility, that is, the company's ability to respond to requests and problems that arise.

- Human and Technological Resources: Everything that a company does involves some technology, which supports the activity and allows the production of goods or services that are adequate and adjusted to the needs of the market. In this way, companies will be able to differentiate themselves with technology, creating a competitive advantage in the business environment. In this way, technology acts as the main driving force for technological and socio-economic development. On the other hand, human resources are considered one of the significant barriers that exist. The qualified human resources weakness is recognized both at the

[26] Mugogo, Salau, A. (2020). Barriers to SME innovation for performance: evidence from Zimbabwe. International Journal of Education and Research. (Vol. 8, Issue 11)

level of governments and the group of companies, with a mismatch between the training given in schools and the economy's needs.

- Finance: Several studies refer to the scarcity of financial resources as one of the main barriers to innovation. Its importance depends on the type of innovation, the company's economic-financial capacity, and its economic structure.

External Factors

SMEs are highly dependent on their surroundings, from customers, suppliers, external institutions and the market in general, from which they receive various influences that condition the innovation process. Next, the external factors that can constitute barriers to innovation are analysed.

- **Research and Development:** considering that innovation is the application of the invention and that this, in turn, is the result of research, barriers can often arise in the initial phase of innovation, which corresponds to research and development (figure 10). In general, SMEs do not formally develop R&D.

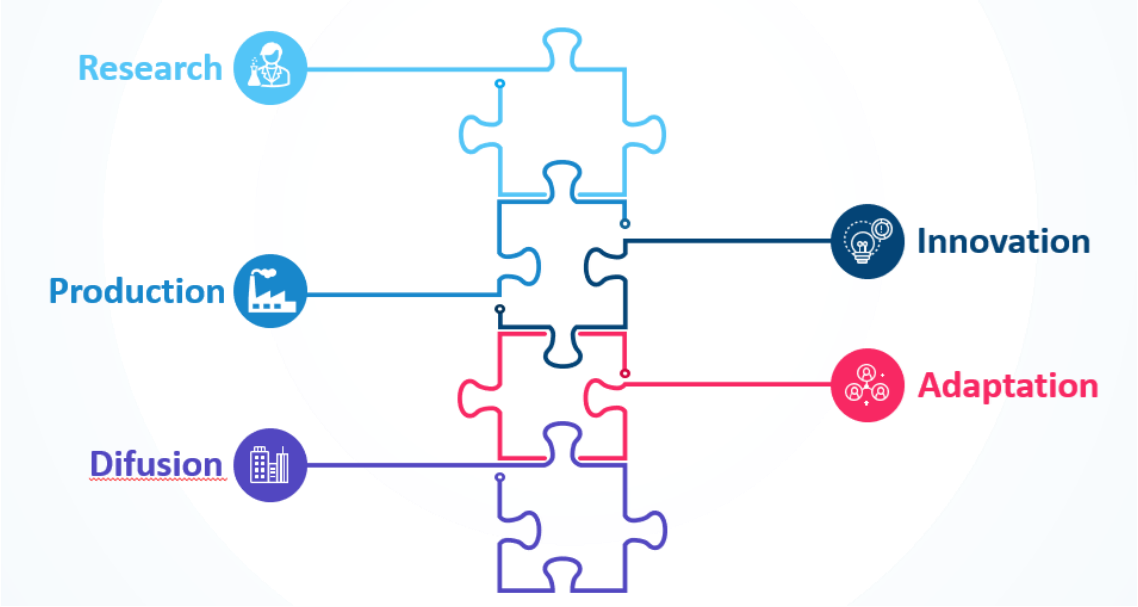

Figure 10. Innovation process phases

- Institutional, technological and political environment: There are variations in the external environment that can constrain innovation, such as regulations and fees applied by governments that may not be the most appropriate for SMEs, changes in the world economy, deviations or insufficiencies in management, change in social and cultural values in which the SME is inserted.

- Market: The adoption of innovation by consumers often requires changes in their habits, which can lead to resistance to innovation. This resistance suggests the existence of functional and psychological barriers to the adoption of innovations.

2.4 Synthesis of the main recommendations for innovation support services to SMEs

Taking into account the needs of SMEs observed through the applied questionnaires and the obstacles described in the previous chapter, some recommendations (figure 11) are related to improving the innovation process of companies and, therefore, their success in the world of the food industry and healthy drinks.

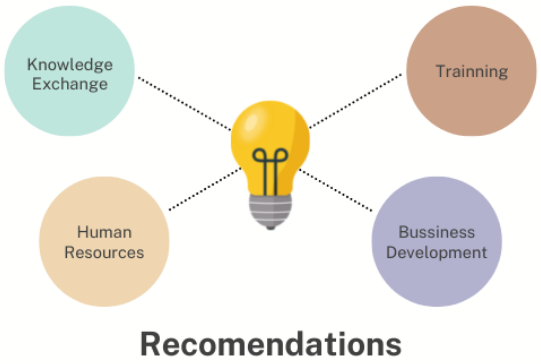

Figure 11. Recommendations

- **Knowledge Exchange:**

The exchange of knowledge is one of the different essential points for the innovation of SMEs, and it must be increasingly encouraged learning among the actors. One of the strategies to increase links between operators is through collaborative research and development programs. For this, it is vital to promote among the construction companies, or companies, that they will act as expected of the two actors. On the other hand, in the case of universities, it is possible to increase the involvement with the industry through the student's participation in the companies during the master's thesis, graduation, and PhD. This way, the company can access work from both sides and exchange knowledge. In this way, universities must increase the exposure of their students. At the same time, they are developing skills and a more significant opportunity for effort and employment.

As far as research centres are concerned, it is, therefore, that the government increasingly organizes essential strategies so that "open science" is increasingly a common term among the scientific community. However, it is crucial to understand that it is not only the science side that needs to open its horizons but also companies need to be open so that a download of knowledge is not only on one side. This is one of the significant obstacles. For this, it is necessary that an agreement is reached between both producers involved and that it is during and that is during the process of concluding all this knowledge and after the conclusion of the innovative process.

Finally, consumers are an increasingly important factor in the success of products on the market. It appears that more and more companies are aware of their importance in the innovative process. It will be necessary for SMEs to understand that consumers are also knowledge transfer actors. They are evaluated on how successful the product is, and who is responsible for its success, and who are assessed on how it will work so that they can give their input not. As possible, consumer groups, sensory tests or even consumer involvement during the process will be necessary. Sometimes, having this actor at the beginning of the process can ensure that the entire innovative approach does not take so long.

- **Human Resources:**

For innovation, companies must have a multidisciplinary team. This team should be composed of members with individual skills and knowledge that can be used collectively in the company. In this way, it is essential that when creating the innovation team, take into account that the work of this team must be based on shared principles, with the members learning from their peers and complementing each other with different knowledge throughout the process. and know-how.

- **Training:**

Having a specialized and multidisciplinary team is vital for the innovative process. However, the importance of having trained for the team is increasingly observed. There is a positive relationship between increased employee training and product innovation capabilities in the context of SMEs. This point is essential since new technologies emerge every day, new knowledge in terms of science, technology and even in terms of consumer demands. With the team's training, the company will always have specialized employees who, at the same time, have the latest news. All this training, in addition to being an added value for the employee and being able to motivate the entire team, also allows the possibility of improving the innovation process in certain phases, such as the food production process, or of being able to apply a specific formulation to improve a product already on the market or to stand out for its novelty. For all this to be possible, the company must regularly give access to conferences, internships and courses so that they can constantly be updated.

- **Business development:**

For the company to succeed and survive, it is essential to know about financing and, at the same time, access to all the possible investments it may have. In this way, SMEs, taking into account the previous recommendations, will be able to opt for research projects between different actors, being able to increase, on the one hand, the transfer of knowledge and current technology and, on the other hand, it allows them to have funding for their innovative processes. It is, therefore, crucial that companies are aware of all funding competitions but that they can, on the other hand, be advised to know which one best suit their objective.

3 Recommendations for involving healthy food and lifestyles consumers in innovation

3.1 Context presentation

After focusing on the ways to improve the cooperation policies and practices supporting innovation, the AHFES project observed, at each participating region level, how civil society and consumers were getting more and more involved in healthy food innovation projects.

The last decade has seen the 3 Helix innovating system, involving academics, institutions and private companies, turning to a 4 Helix system giving voice to civil society actors who offer the perspective of improving the innovation process.

To better understand this phenomenon, each partner had first to list the most important 4 Helix actors operating at region level. Among the 1125 healthy food actors identified in the European Atlantic Area, private companies largely dominate efforts to address healthy food and represent the most numerous helices. The partners findings also pointed out that civil society is the least represented helix in each participating European Atlantic Area region. Despite this fact, the consortium research on the issue reveals the extraordinary potential of collaboration between the civil society helix and the other ones to contribute to a healthier way of eating in the area.

Then, a consolidated analysis of the partners led to notice the different ways consumers can get involved in the European Atlantic Area healthy food and lifestyles innovation. Interesting examples of innovation case studies illustrated how the consumer was asked by academics, institutions or private companies to contribute successfully to a healthy food innovation project. The partners' researches also revealed remarkable cases where the consumer himself takes action towards another helix to impulse changes towards Healthy Food and lifestyles.

The fact that the 4 Helix model of cooperation is still not the preponderant model used in innovation is hiding reasons explaining the difficulties to implement such projects as for example: distinct ways of approaching the innovation process, different language/terms used, the level of bureaucracy, or even the lack of feedback on what happens to all the ideas transmitted after the civil society's participation.

To overcome these obstacles, improve and make better use of civil society involvement, each actor has developed strategies and possible drivers to make things change: creation of cooperation models really involving civil society and consumers, increase of listening and observation initiatives of the consumer to better understand their expectations, or make better use of social networks which offer real opportunities to interact with consumers.

Good practices are also in favour of engaging consumers in innovation; it can be physical meetings such as industrial tourism, pop-up blinds, gastronomic competitions, sports sponsorship or promotional actions in points of sale. digital meetings for e-reputation can also bridge the gap between consumers dans the other helixes: brand website, online recipe sites, social networks, blogs, fans pages, games and competitions, crowdsourcing platform and connected packaging to favour users' experience. Internships is another way to involve the civil society during the research process. Living labs are another opportunity to place citizens at the centre of innovation. Research and innovation projects with a goal of developing a product are another good practise for civil society to get involved in the product acceptance phase.

Consumers are more and more asked to take part to innovating food products development and are even sometimes taking themselves action towards other actors to contribute, but there are

still important barriers that prevent the 4H approach to spread out: cultural aspects and openness are key success factors and cooperation models really involving civil society and consumers are to be created.

3.2 State of consumer involvement in healthy food and lifestyles innovations

In recent years, there has been a wave of new practices that are changing civil society's role in innovation in the area of food and healthy lifestyles. The 4 Helix (4H) system is seen as an extension of 3 Helix (3H), in which a four civil society actor has been included (figure 1). In this way, 4H adds new "voices" and "thoughts" to the innovation process that will allow to open horizons and better perceive how it will be received when the product is launched on the market[27].

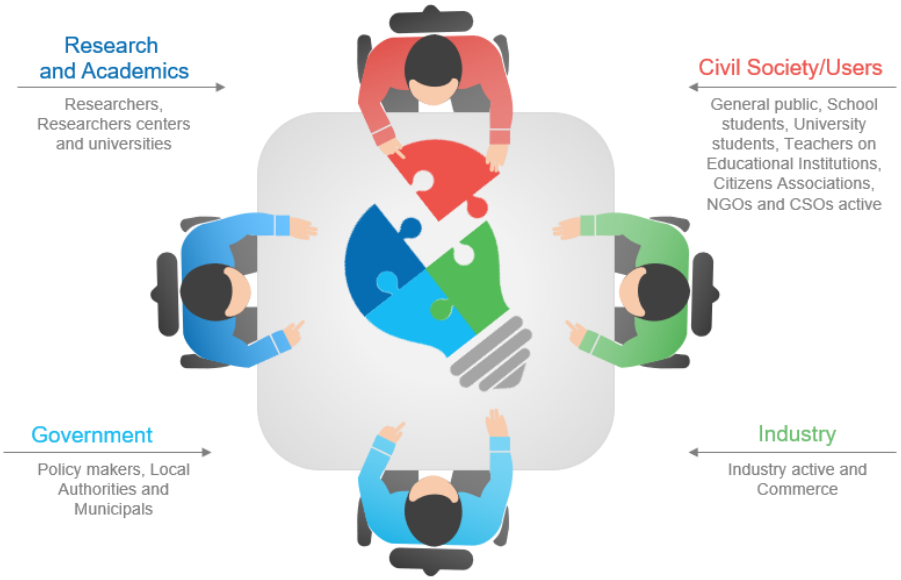

Figure 12. 4 Helix Model

The AHFES work (Deliverable 4.3 - Mapping of the innovation ecosystem) has shown that the European Atlantic Area region is well provided with actors from the four different helixes in the field of healthy food and lifestyles, nevertheless the civil society is less represented[28]. This can happen because this actor can be less concerned by healthy food, or less used to work with the predominant industry helix.

Some regional initiatives show encouraging cases of the consumers involvement, but at a time when 90% of all innovations fail, in ¾ of cases because of marketing failure, the proposed offer

[27] Grundel, I., Dahlström, M. A Quadruple and Quintuple Helix Approach to Regional Innovation Systems in the Transformation to a Forestry-Based Bioeconomy. J Knowl Econ 7, 963–983 (2016). https://doi.org/10.1007/s13132-016-0411-7
[28] https://www.ahfesproject.com/app/uploads/2020/07/D4.3_MIE_v1.0.pdf

has to be better aligned with the consumer's real needs[29] and the relations between consumers and the other helixes have to be intensified.

In the present report we will see a state of consumer involvement in Healthy food and lifestyles. Then, we will analyse the different ways the consumer contributes to healthy food innovation, being asked for contribution by another helix or asking himself another helix to contribute. Finally, we will try to understand the reasons why the involvement is not adequate and sufficient, and we will study the drivers, the good tools and practices to strengthen consumers involvement.

Among the 1125 healthy food actors identified in the European Atlantic Area, **private companies largely dominate efforts to address healthy food** and represent the most numerous helix with 707 European actors, before institutional actors (with 183 actors), educational ones (with 147 actors), and finally civil society actors (with 88 actors)[2].

Civil society is the least represented helix in each participating European Atlantic Area region, that is to say in Northern Ireland, Ireland, Wales, France, Spain and Portugal. This scarce number may be due to the fact that clusters and academic AHFES partners rarely collaborate with Civil society actors, and as a consequence, lack knowledge of part of them. As observed in regions like Galicia, civil society movements can be scarce, and this cultural aspect may be a barrier for the implementation of user co-creation and living lab methodologies, as consumers may be reluctant to take an active role in innovation processes. Another reason is that the triple helix approach is still the preferred way to innovate even if the 4H approach is emerging. As a consequence, the rare observed collaboration between all the 4 helixes explains a poorer knowledge of this helix in comparison with the three other helices in the Atlantic Area.

Among the 88 identified European actors are different main kinds of civil actors: charity or charitable organisation (26), producer's networks (18), support and awareness-raising organisation (13) and consumers associations (10).

Northern Ireland Chest Heart is an example of **local charity organisation**: it has been working to prevent chest, heart and stroke illnesses in Northern Ireland, encouraging people to use healthy options in their diet with the objective of replacing food products for the "healthy option".

In Ireland, the Cork Food Policy Council (CFPC), a **support and awareness-raising organisation**, is committed to working towards building a healthier, more sustainable, more equitable food system for the people of Cork Ireland.

In Western France, the number of civil society actors implicated in healthy food has been growing progressively during the last decade because of the consumers raising awareness on healthy food, with among others the development of **food local direct purchasing networks** (AMAP, La Ruche qui dit oui), **organic producers associations** (GAB), and **consumers associations** helping citizens to adopt healthier lifestyles and eating habits (La Bonne Assiette, La Clé des champs).

In Galicia, a number of **consumer cooperatives**, formed by citizens worried about healthy feed and environmental aspects are showing active in the ecosystem.

The media are one sector of civic society that enable the voice of consumers to be heard in the United Kingdom. Indeed, there is a specialist food and drink media sector, in the form of printed magazines and online websites, blogs, videos and other social media presence.

[29] https://www.umi.us/fr/blog/raisons-echecs-innovation/

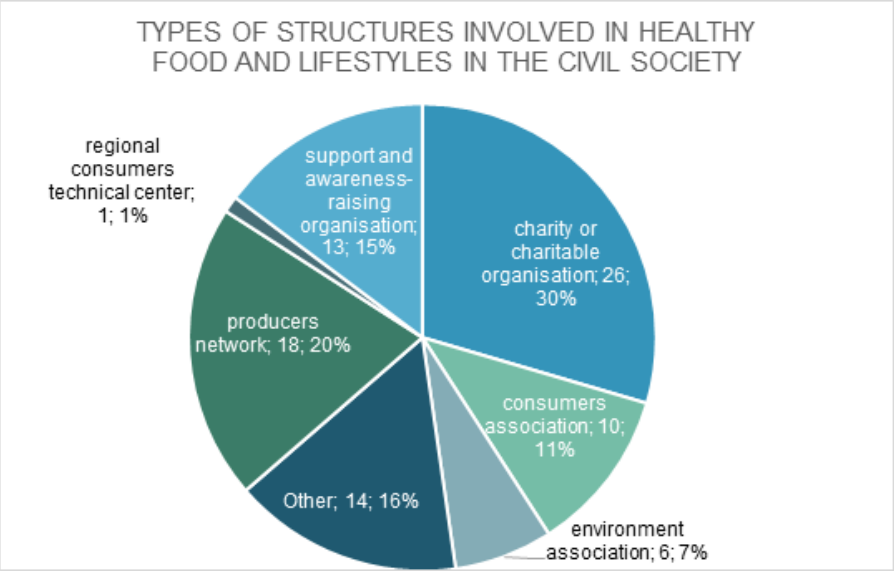

Figure 13. Types of civil society structures involved in healthy food and lifestyles in the European Atlantic Area

To conclude, **civil society is the least represented helix in each participating European Atlantic Area region.** However, **the consortium research on the issue reveals the extraordinary potential of collaboration between the civil society helix and the other ones to contribute to a healthier way of eating in the area.**

3.3 How consumers can get involved in the European Atlantic Area healthy food and lifestyles innovation

Through analysing the European Atlantic area initiatives in favour of Healthy food and lifestyles, the consortium proved the significant potential of collaboration between the civil society helix and the other ones to contribute to a healthier way of eating in the area.

3.3.1 When consumers are asked by another helix to contribute to a healthy food innovation project

The AHFES research led to the observation that few types of collaborations succeed in gathering all the 4 helixes. However, interesting examples of innovation case studies illustrated how the consumer was asked by another helix to contribute successfully to a healthy food innovation project [2]:

- Institutions asking for consumers participation:
    - Public-led initiatives were developed through the European Atlantic area to **encourage children and families and to provide information and advice about a healthier life and diet** (Ireland, Wales)
    - Associations can sometimes **invite consumers to join their governance** (France) to work together with all the other helixes for greater transparency and quality in industrial food.
    - In some European regions, **regional calls for proposal invite civil society representatives to apply** (France) if they respond to the objective of improving healthy food and lifestyles.

- Industries inviting consumers to collaborate:
    - Small and Medium-sized Enterprises (SMEs) invited consumers to **taste or even co-create new healthy products in the framework of technical centres, nursing homes, or on fairs or farmers' markets** (Portugal, Northern Ireland) to ensure the suitability of their innovation.

- Academics inviting consumers to collaborate:
    - Partnerships between universities and social campaigns **allow a contribution and dissemination of scientific knowledge** between the two actors.
    - **"Citizen Science"** is a more active collaboration and centred on a "science of all and for all", being a process that involves the public in scientific research **acting as contributors, collaborators, and leaders of the process**.

    - **Open science** is a collaboration in which the scientific community interacts with each other and civil society. In this collaboration, the imperative is **to allow access to the research results carried out and create open data repositories so that it is at the level of any indication**. Thus, in addition to disseminating knowledge, there is the possibility of creating value in the market.

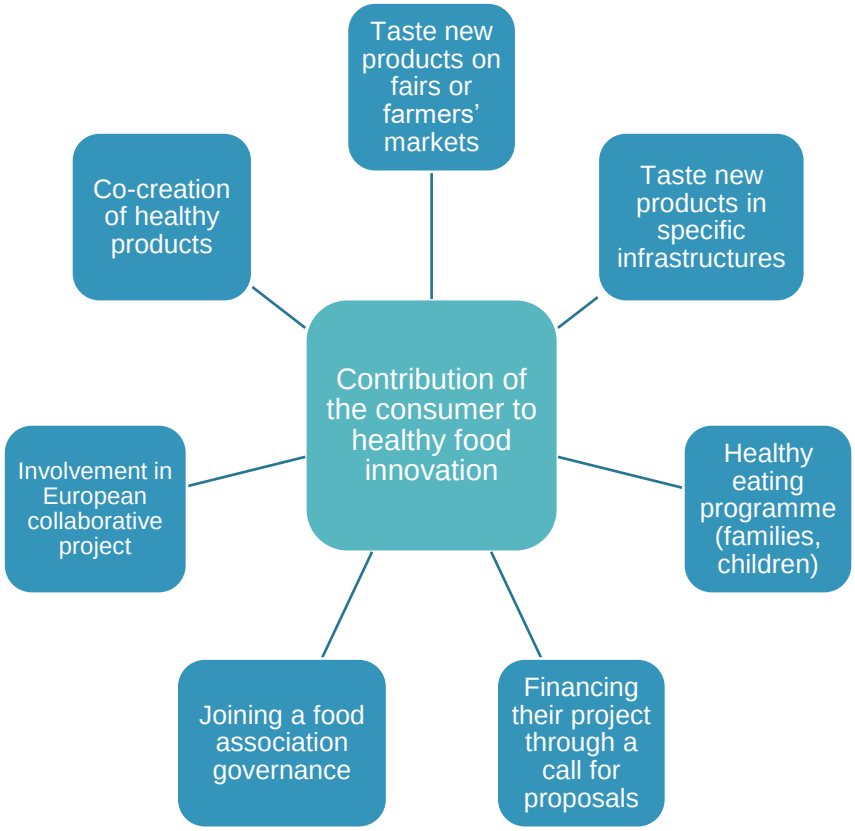

Figure 14. The different ways the consumer contributes to healthy food innovation

3.3.2 When consumers take themselves action towards another helix to impulse changes towards Healthy Food and lifestyles

In addition to these consumers contributions to already existing cooperation projects, we have noticed remarkable practices of collaboration that favour Healthy eating at the instigation of the consumers themselves. Here are the pragmatic cases that were observed in the European Atlantic area:

- Consumers actions towards food producers and industries:
  - **Cooperative stores** (France) which come from a fundamental will to eat healthier, local food, with fair prices for producers, as for consumers. The co-operators own altogether the supermarket, and they contribute monthly to the management of the store. The food producers, in exchange of guaranteeing healthy and equitable products to consumers, benefit from higher selling prices than in traditional distribution networks.
  - The **progressive change in consumption patterns**, for example consumer appeal for organic food (Spain, Portugal, France), has had impacts in the food industry that has fostered the production of healthier or more "healthy-appealing" products. Industries have shortened their ingredients lists of products (clean label), they have considered the geographical proximity as a marketing strategy, and there has been an increase in the launch of organic products.

- Consumers' will to change their diet thanks to the participation of private food companies and retailers:
    - In Ireland, a **TV programme** follows the life of selected leaders who adhere to a strict diet and exercise regime over the course of two months. Consumers who choose to follow the food programme can easily purchase the ingredients and cook the meals at home for themselves and their families. Private food retailer operators provide consumers with ingredients conveniently flagged as those ingredients pertaining to the food plans.

Even if the 4H collaboration model is not the most commonly used in the Atlantic area, the types of collaboration previously mentioned above, on a 2 Helix (2H) or 3H models base, show the will to involve more the consumers in the food innovation process, and have proven to be successful.

3.4 Possible drivers of influence to improve the consumers involvement in the Healthy food and lifestyles innovation process

To improve the collaboration of the 4H actors in the healthy food innovation process, it's important to analyse the reasons why consumers are less involved than the other actors. This analysis can lead to determine the possible drivers that could help things change. In general, the different actors have distinct ways of approaching the innovation process; the language/terms used are different o which hinders efficient communication and the level of bureaucracy. In the case of civil society interaction with other actors, it is observed that the biggest obstacle is in the applied language, which makes it challenging to participate in the innovation process or in the way civil society presents its perspective or suggestion. Besides, this new actor's participation in these processes is minor and is justified by the lack of feedback on what happens to all the ideas transmitted or what happened to the product after civil society's participation[1, 30].

To overcome these obstacles and improve and make better use of civil society involvement, each actor has developed strategies and possible drivers to make things change.

3.4.1 New cooperation patterns to improve knowledge of the consumers helix

The four helixes, including the civil society one, are not used to work together because of the Triple helix tradition that has established habits of cooperation between academics, industries and institutions, supported by mechanisms of cooperation developed at regional, national and even European levels. In addition, the project team noticed that mechanisms of collaboration and funds promoting collaboration between the 4H, with a main consumer contribution, appears to be almost inexistent.

This situation leading to few collaborations with consumers logically explains a real lack of knowledge of the different types of actors among themselves, and more specifically a lack a knowledge of the consumer from the other innovation actors.

[30] Florian Schütz, Marie Lena Heidingsfelder, Martina Schraudner, Co-shaping the Future in Quadruple Helix Innovation Systems: Uncovering Public Preferences toward Participatory Research and Innovation, She Ji: The Journal of Design, Economics, and Innovation, Volume 5, Issue 2, 2019, Pages 128-146, ISSN 2405-8726, https://doi.org/10.1016/j.sheji.2019.04.002.

The **creation of cooperation models really involving civil society and consumers**, inviting them to take part to the healthy eating innovation from the very beginning of the process (test products are not enough) and providing means and funds to engage them can be a driver and should be considered at regional, national, but also European level.

As cooperation models are to be created by Regional, National and European institutions, these ones have to be convinced of the **necessary cooperation with the 4th helix of civil society that has to be an aspiration for them**.

On the consumer's side, **cultural aspects and openness are key success factors** to succeed in more engaging consumers in the food innovation process: their will to contribute to a healthier food development, as well as proofs of the efficiency of collaborating with the other helixes would facilitate their broader involvement.

The development of successful collaborations through new cooperation models should bring economic dynamics and more serenity between various types of actors, each of them realising that they are both looking for improving their own conditions related to healthy food and lifestyles.

3.4.2 Bridging the gap between what consumers say and do

Many studies have demonstrated the **gap between what consumers say about their consumption**, and what they really buy. This state of affairs actually leads to a deep misunderstanding of consumers, which makes the industry reluctant to collaborate with them.

In addition to this, there are **many problems facing food business operators**, not least the question of climate change, biodiversity, sustainability and more currently food packaging waste, **which does not give them time left to deal with trying to better understand their consumers.**

Another point that doesn't facilitate bringing industries and consumers closer together is that there are often **not enough competencies and human resource in agrofood industries** to tackle this issue of consumers. However, consumers are difficult to understand and this task requires to fully manage the technical used to analyse the consumer's thoughts and advices (for example, the focus group technical). Once having a the adequate (internal or external) competencies, new products opportunities for industries and retailers should be developed in relation with the consumers aspirations and needs.

At a time when **90% of all innovations fail, in ¾ of cases because of marketing failure**, the proposed offer has to be better aligned with the consumer's real needs and the relations between consumers and the other helixes have to be intensified [1, 31]. That's why **raising awareness of the reasons for innovation failure should be a priority in private companies**, that would then take measures to improve the consumer understanding.

Creating more links with consumers should lead to better understand their satisfaction and expectations, through two major means:

- **Initiate or increase listening and observation initiatives of the consumer** to better understand their expectations, its current and future uses and thus better innovate. One solution could be to demonstrate the interest of cooperating between consumers and the other helixes during festivals or food events where the consumers would begin to contribute with testing products on site and making comments about them. Another good indicator to be taken into

[31] https://www.umi.us/fr/blog/raisons-echecs-innovation/

account is the consumers purchase power: indeed, the analysis of sold products is a first track to understand consumers.

- **Make better use of social networks which offer real opportunities to interact with consumers**. Few pioneering agrofood companies have already created a consumers' community to create links with their brand and make people react and contribute to the development of new healthy food products.

In conclusion, there are cultural and expectations gaps between the different helices, especially between consumers and industries, but developing exchanges between them should make them realise what they have in common to better innovate in healthy food.

3.5 Good tools and practices to more engage consumers in innovation:

However, this general finding conceals really interesting examples of good tools and practices that should be more experienced and widespread within the Atlantic Area to more engage consumers in innovation.

3.5.1 Good tools to more engage consumers in innovation

We can first find tools to facilitate interactions with consumers all along the innovation process:

GENERATION OF IDEAS

At the first stage of the innovation process, ideas can be generated in relation with consumers' aspirations thanks to market and trends' studies, but also through the good or bad sales experienced by the agrofood companies.

CHOICE OF CONCEPTS

Confronting the concept to consumers is a good way to validate its relevance, and its development. For that, different means and techniques can be used by researchers and private companies' innovation teams: sensory tests, platforms evaluation of the online concept, focus group and round tables where consumers are invited, exhibition stands, food-trucks, tests of uses, pop-up stores, lead users, blogs, and even social networks. This phasis of the innovation process is one of the most appropriate to collaborate with consumers.

DEVELOPMENT & MANUFACTURING

Lean development and lean manufacturing methods: in a "Lean" approach, it is important to realise only what is of value to the customer and to eliminate the rest as much as possible. In this way, interact with customers in the stage development to ensure that the product corresponds best to his expectations is a practice that can be used.

MARKET LAUNCH

The good tools identified to create more links with the consumer are implemented both to optimise the marketing and to encourage the emergence of ideas and the choice of concepts: the monitoring of complaints, the experimental shops, satisfaction surveys, quality barometers (Customer panel to follow product quality), pop-up stores, crowdsourcing platforms, shop factories, food trucks, focus group, restoration concepts, and community management are all effective tools to help consumers, academics and industries to collaborate.

3.5.2 Good practices to more engage consumers in innovation

Good practices are also in favour of engaging consumers in innovation; they strengthen the actions promotion of the brand and its values that lead to meeting the consumer, whether physically or digitally.

- **PHYSICAL MEETINGS**

Many ways can help to meet physically the consumers: industrial tourism (objective of transparency), pop-up blinds (also called ephemeral shops), exhibitions (that favours exchanges, dialogue and proximity), gastronomic competitions (to enhance the know-how), sports sponsorship (for commitment purpose), and promotional actions in points of sale.

- "DIGITAL MEETINGS" FOR E-REPUTATION

Other practices can even allow to meet consumers digitally: brand website, online recipe sites, social networks, blogs, fans pages, games and competitions, crowdsourcing platform (with innovation purpose) and connected packaging to favour user's experience.

- **INTERNSHIPS**

There are several teaching and research establishments that allow civil society to be involved during the research process, either in the laboratory or at an earlier stage of evaluating the innovation proposal. This participation makes it possible to consider innovative and sometimes "out of the shell" ideas that could give rise to new projects with academia and science centres.

- **LIVING LABS**

The living labs are defined as open innovation ecosystems and bridge the gap between academia and the "real world" practice. In practice, living labs place citizens at the centre of innovation and in which the ability to shape better the opportunities offered by the new concepts and solutions introduced by the lair society is demonstrated.

- **RESEARCH AND INNOVATION PROJECTS**

When developing a product, civil society is generally involved in the product acceptance phase before known to the general public. In this phase, sensory tests are carried out in which the consumer is asked to evaluate the product concerning its sensory properties (smell, taste, appearance, among others).

4 Conclusion

In the first part of the report, the AHFES work results confirm that innovation is a process that is driven by cooperation between different actors in a 4H innovation system. This system allows the transfer of know-how between the actors and results in a diversification of the economy. However, there is still a need to work at two different levels: on the one side, the innovation ecosystem has to be strengthened through policy, and on the other side, efforts need to be made in cooperation and innovation practices.

Three main obstacles linked to policy were identified when applying an innovation system:

- the first is related to a given innovation system's applicability in another region, with only small and short-lived innovation systems successfully transferring it to another area.

- another critical point is the connection between all the actors, which remains very restricted and closed in terms of the process of innovation and knowledge transfer.

- and finally, in a new food product innovation system, the consumer is usually seen only as a consumer and not as an individual belonging to a community not participating in the innovation system's entire process.

To counter these barriers and to improve the innovation system, we have identified the following successful factors:

All actors in the system must have a co-actor and co-creator role, all considered at the same level. Thus, the government within an innovation system should have an equal connection between all the actors, allowing an overview. Within an innovation system, the government is responsible for creating supportive policies and an adapted regulatory environment to encourage all actors to take part to the innovation ecosystem.

In line with the obstacles mentioned earlier, it appears that at the level of policymakers, it is crucial that they systematically analyse and re-evaluate systems to improve their innovation policies.

In this way, the government must encourage the mobility of qualified personnel between the different actors and regions so that everyone views other environments allowing the modification and evolution of ideas taking into account "a certain environment".

Linked to mobility is the existence of a positive and open culture among the actors. To promote and encourage this culture, the government must strengthen, improve and guarantee intellectual property regimes.

Finally, the government should create networks at different levels and develop incentive strategies to encourage society's participation.

Moving forward, building on both the success and the lessons learned from their case studies, AHFES partners were asked to consider what changes to cooperation and innovation practice might be made in future, for similar projects.

After the thematic analysis of ideas focusing on future cooperation and innovation, it can be concluded that there are several gaps and obstacles.

One conclusion was that developing, maintaining and coordinating collaborative relationships is key to improving the innovation process. However, it was observed that there is a need to build and maintain relationships with collaborators, stakeholders and the public. It was concluded that it is necessary to create a large communication channel between all parties.

The promotion of awareness about support and improved communication strategies was also considered to be valued and enhanced. In this case, we suggested a new approach to recruitment with more engagement with the academic sector. Also, marketing and social media outlets can be the key to engaging with the public and potential employees about jobs opportunities. On the other hand, it is concluded that the recruitment process, the conditions for career progression, the benefits and support are key points to foster a culture of support among the entities.

The design project should contain a robust strategic plan. Results demonstrated that a change in the financing approach is crucial, allowing it to be "more SME-friendly" approach, such as accessible and less bureaucratic.

In this way, the momentum for cooperation on innovation in food and healthy lifestyles will flourish within a sustainable, hopeful, productive and vigorous learning culture that aims to promote greater well-being and prosperity for society. This will make European businesses more competitive, more productive and more sustainable, thereby improving European citizens' well-being.

Nowadays, for new companies and even those that already exist, the innovation process is essential to stand out in the target market. However, there are still many obstacles that SMEs face today to carry out the entire innovation process and even more to succeed in the market as a final product.

In the 2nd part of this report, it was shown that there is still a gap in knowledge sharing between the different actors of the four-helix. All this “secret” and “closed science” not only by companies but also by the scientific community needs to be resolved so that in the end, the innovative product developed is successful and can “give something new” to the consumer. On the other hand, there is still the issue of financing these processes, which is sometimes insufficient due to a lack of investment or even a lack of financial knowledge on the part of the innovative process, which ends up being insufficient. Innovation teams, their knowledge, and the actors involved are increasingly crucial for the innovation process. Therefore, it is essential to enhance partnerships and team knowledge and keep teams up to date. The SME must improve these factors so that the environment and internal and external possibilities improve.

Consumers are more and more asked to take part to innovating food products development and are even sometimes taking themselves action towards other actors to contribute, but there are still important barriers that prevent the 4H approach to spread out: cultural aspects and openness are key success factors and cooperation models really involving civil society and consumers are to be created. Ways have to be found to bridge the gap between consumers and the other helixes, through for example the improvement of competencies and human resources in agrofood industries to tackle this issue of consumers, and also raising awareness of the reasons for innovation failure and the necessary closer contact with consumers.

In the 3rd part of this report, the AHFES consortium research about consumers involvement led to different learning lessons: first, the civil society is the least active helix in the healthy food innovation development process. However, some observed initiatives all across the European Atlantic area have shown signs of inflection of the consumer involvement, with a real will to contribute to a healthier food for the human and planet health.

Quite a lot of tools and practices exist to develop this closer relationship with consumers, and it’s now up to the 4 helixes to make this reconciliation.