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Missing Linkages

WP-T2: Deliverable 2-4

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December 2019

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1. INTRODUCTION

For the future competitiveness of the alpine bio-economy, eco-innovative business models (BM) based on new technological opportunities are believed to play a key role. According to the European Commission, the action plan to develop the bio-economy in Europe is likely to create one million new green jobs by 2030. The bio-economy is one of the EU's largest sectors of activity, comprising agriculture, forestry, fisheries, food, bioenergy and bioproducts, with an annual turnover of around €2 trillion and some 18 million employees.

However, companies do not innovate in isolation. Today, there is broad agreement that companies and entrepreneurs are embedded in social systems of innovation (Lundvall, 1992; Edquist, 1997; Nelson, 1993). This highlights the systemic nature of innovation processes, emphasizing that companies innovate in close collaboration and interdependence with other organisations (e.g. suppliers, customers, competitors, etc.), non-profit entities (e.g. universities, schools, government ministries), institutions (e.g. laws, rules, norms), and other social entities (e.g. local residents, local authorities, consumers). Moreover, firms intentionally may actively make use of their surrounding external sources in terms of collaboration (Dyer & Singh, 1998; Nooteboom, 2009), user-driven innovation (von Hippel, 2004), or "Open Innovation" (Chesbrough, 2003, 2007). In summary, the 21st-century innovation paradigm is characterized by networking collaborative systems of innovation with knowledge bases distributed all over the entire innovation system (Freeman & Soete, 2009).

Based on these considerations, one of the aims in work package T-2 of the AlpBioEco project was to identify and define missing linkages in the alpine bio-economy's innovation system that could hamper the emergence and diffusion of eco-innovative BM in the value chains of apples, walnuts, and herbs (Deliverable 2-4). The findings of this report are based on the performed cross-industry, Open Innovation workshops to develop eco-innovative BM blueprints for the alpine region (see Deliverable 2-1), the identification and analysis of several good and bad practice examples of eco-innovative business models (see Deliverable 2-2), as well as the derived success factors and needed competencies (see Deliverable 2-3).

2. INNOVATION SYSTEMS

The systems perspective on innovation is based on an evolutionary perspective. Thus, innovation is not assumed to be a homogeneous and linear process but exhibits technological and socio-cultural peculiarities on the regional, industry, national, and international level (Koschatzy, 2012).

Innovation systems can be approached from various perspectives. National or regional systems of innovation can be easily defined by governmental or geographical boundaries. More recently, the degree of stickiness and the kind of knowledge base and its relation to proximity are used as additional criteria (Asheim & Gertler, 2005). The definition of sectoral or industrial innovation systems depends on statistical delimitations, which can be applied on different levels of granularity (e.g. different levels of industrial branch classification or different levels of regional statistics). In contrast, technological systems of innovation are more difficult to define. Besides building partially on national, regional, and sectoral systems, they also include the dynamic dimensions of technological diffusion and technological change (Koschatzky, 2012).

Generally, the innovation system is composed of two kinds of constituting factors. Firstly, there are 'elements' or 'components'. Components refer to a bundle of organizational actors, actor groups and institutional rules that define the 'rules of the game'. Both actors and rules have a pertinent function for the performance of the innovation system. Secondly, there are relations (e.g. processes, activity flows) between the components (Edquist, 2005). The necessary condition to speak about an innovation system is that "…it must be possible to discriminate between the system and the rest of the world" (ibid., 2005, p. 187). This means that the system must be specific and identifiable in terms of a different 'quality' than its surroundings.

According to Nelson (1993) and Patel & Pavitt (1994), innovation systems are made up of four main elements:

1. The institutional structure: Private companies, universities, research and educational organisations, norms, routines, networks, financial organisations, and the policy of promoting and regulating technological change and innovation.
2. The incentive system: Incentive systems for innovation, technological transfer and knowledge spillovers, learning and qualification, business formation, and job mobility within and between the system's components.
3. The skills and creativity of innovation and economic actors: Diversity, quality, and novelty of products and services, as well as opportunities to forge new paths of development.
4. The cultural peculiarities: General openness to and acceptance of new technological solutions, entrepreneurial mindset, the willingness of taking risks and accepting uncertainty.

These central characteristics build the basis of different interpretations of innovation systems and are usually adapted according to specific application needs. Kuhlmann and Arnold (2001) have provided one of the most established heuristic models of an innovation system, its components and their interrelations, in their study for the Research Council of Norway (Figure 1).

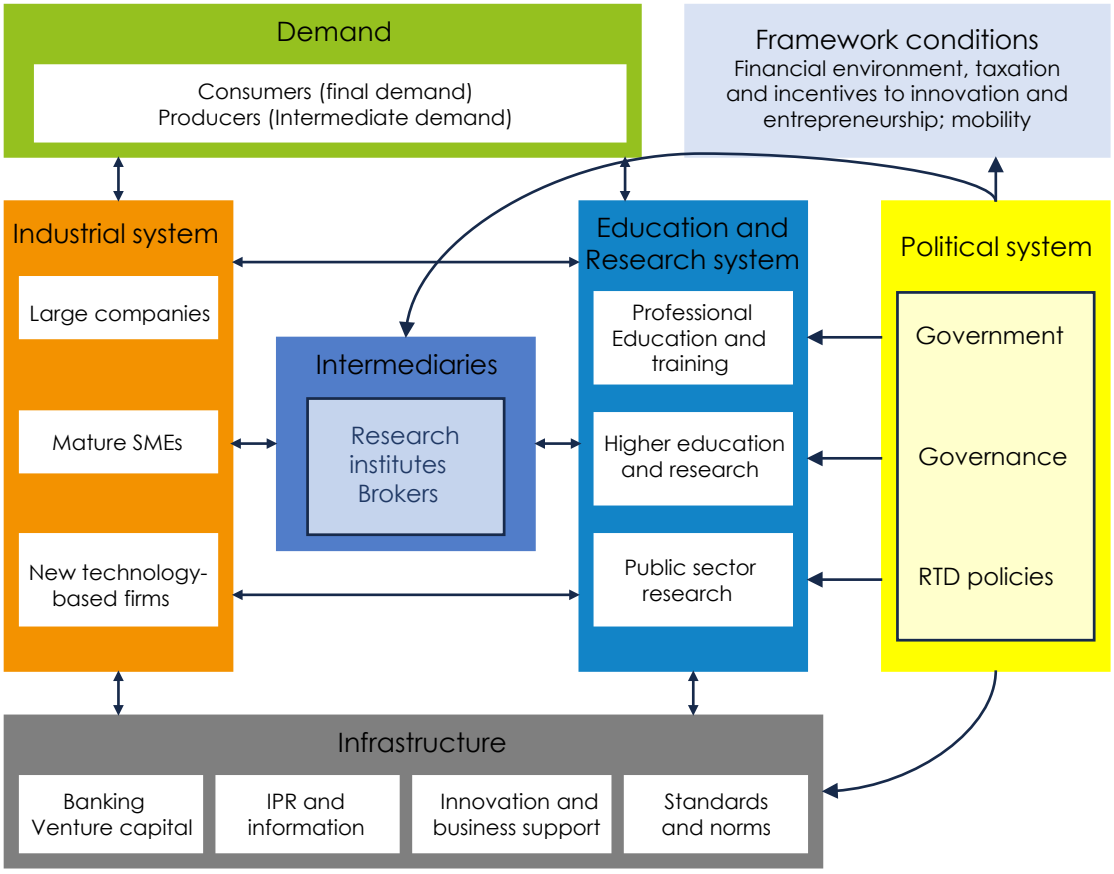

Figure 1: National Innovation System Model (Kuhlmann & Arnold, 2001; own modification)

The model focuses on the two main sub-systems 'industry' and 'education/research', and links them through the active role of intermediary organisations. These components (i.e. sub-systems) are influenced by and themselves influence the demand system (i.e. market), the framework conditions, as well as the prevalent infrastructure system, and are shaped in-turn by the political system.

Hekkert et al. (2007) formulated a set of functions that represent the key activities of an innovation system:

1. Stimulation and maintenance of entrepreneurial activities
2. Enabling the development of new knowledge in terms of different types of knowledge generation (e.g. research & development [R&D], learning-by-doing, learning-by-using)
3. Enabling knowledge diffusion through networks between the system's components

4. Guiding research and the search for new solutions (e.g. to exit a certain path of technology
5. Market formation (e.g. by setting tax incentives)
6. Mobilisation of resources (e.g. providing funding or subsidies, stimulating the mobility of researchers and employees
7. Creation of legitimacy / counteracting resistance to change

Hence, if barriers in the innovation system occur in terms of missing linkages between certain actors, it is likely that some of these functionalities are sub-optimally fulfilled. We use the concept of the innovation system and its functionalities like an integrated framework to identify missing linkages between actors in the alpine bio-economy, which might hamper the development, and diffusion of eco-innovative BM.

3. PROCEEDING

The empirical basis for identifying the missing linkages in the alpine bio-economy innovation system were the 22 Open Innovation workshops conducted between May and November 2019 (see Deliverable 2-1). In these workshops, the participating stakeholders (mainly farmers, manufacturing companies, intermediaries, and universities/R&D) developed BM blueprints for eco-innovative products/solutions in the value chains of apples, walnuts, and herbs. Missing linkages were identified by personal notes taken during the BM workshops by the facilitation team based on the discussions in the teams. Additionally, one dedicated working step of this exercise was to identify the needed competencies and resources outside the start-up/company as well as to define critical success factors for their BM idea. Besides the workshops, we conducted 11 expert interviews with successful and less successful founders of bio-economy start-ups as well as with professionals in the start-up ecosystem in the alpine region (Deliverable 2-3). One part of the interview also raised the question about their perceptions of missing linkages.

The findings and statements retrieved from these two activities are condensed and synthesized into four major missing linkages, which are discussed in the following chapter.

4. MISSING LINKAGES

In total, we identified four missing linkages in the alpine bio-economy innovation system during the workshops and in the conducted expert interviews. These are summarized in the figure below (Figure 2).

The *first missing linkage* can be found between apple, walnut or herbs farmers and *research partners like universities* (of applied science) and/or *R&D organisations* (e.g. Fraunhofer, R&D service providers). This had not been an issue in the past when farmers were mere producers of animal feed or raw materials for food manufacturers being positioned at the very bottom end of the value chain. However, when farmers increasingly turn into entrepreneurs with bio-economy start-ups and climb-up the value chain to achieve higher valorisation of their products, they need to become product, service and/or process innovators themselves including the development of marketing strategies and finding a suitable IPR strategy to protect their assets. While a few farmers already have some experiences in these fields, most of them lack the know-how, competencies as well as the necessary personnel and financial resources to initiate product, service or process development activities.

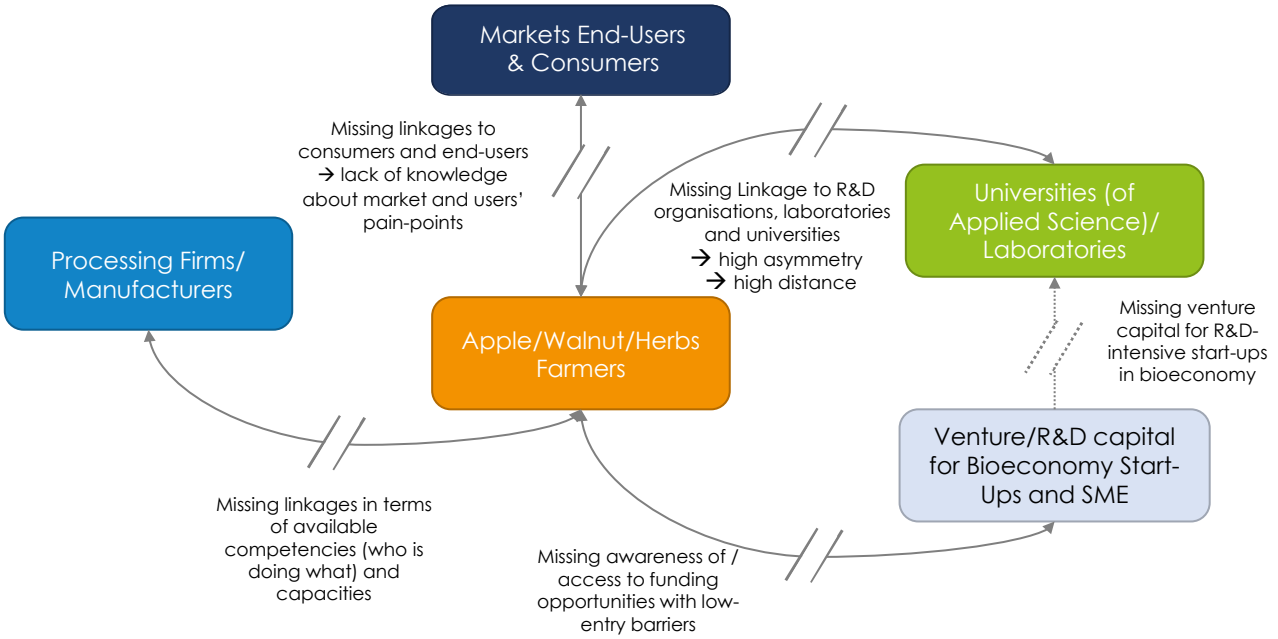

Figure 2: Missing linkages for the development of eco-innovative business models in the alpine bio-economy (own illustration)

Hence, it has been frequently mentioned by farmers that they do not know where they can get help in developing a new product or a new processing solution. In many cases, they are not even aware of which R&D organisations or universities of applied science in their region work on which research topics in the field of bio-economy and food technology (missing awareness). And even if they know, they are very reluctant to get in touch and initiate an innovation collaboration. The following quotation underlines this quite well:

> *"I am not an academic and I am afraid that I do neither understand what they are talking about, nor that they would be willing to deal with my question as I am a simple farmer"* (farmer, workshop taking place in Waldburg, Germany).

Statements like this reveal a greatly perceived distance between farmers and R&D organisations/ universities. It can be reasoned that the asymmetry of such interrelations between farmers and R&D/ universities, for instance in terms of size (big vs. small), culture (formally academic vs. informal family-like), nature of knowledge and expertise (formal vs. implicit) or planning horizons (mid-to-long-term vs. short-term/seasonal) plays a crucial role. However, as many eco-innovative BM involve new technological solutions (e.g. 3D-printing of apple pomace, new extraction methods), new supply chain designs (e.g. regional producer collaboratives) as well as new profit models (e.g. pay-per-use), most farmers have to get access to the respective knowledge and know-how. Hence, knowledge transfer from research to farmers will be a crucial factor for success.

The *second major missing linkage* that showed-up during the workshops and the interviews is about the *downstream perspective of the value chain*. It turned out in the BM developing workshops that many of the apple, walnut, or herb farmers are not used to thinking in terms of market-related characteristics or consumers' demands and pain points. This could be again due to their traditionally static BM of being a supplier of raw material, fruits or animal feed for business clients. Hence, the farmers in many cases neither do have direct interlinkages to their end users/consumers of the products made from their input materials nor are they used to think in terms of BM innovation, market positioning or target group marketing. Interestingly, those farmers who already have started selling their organic fruits and herbs in their own farm shops showed a set of basic know-how in this field.

Nevertheless, if alpine farmers want to achieve higher levels of valorisation by venturing new eco-innovative BM, they will need to establish and maintain direct interfaces and linkages with their end-customers and require some basic competencies in market strategy, BM design, and marketing.

The *third missing linkage* that has been revealed during the workshops as well as during the interviews is to be found between apple, walnut, or herb farmers and their *regional manufacturing environment*. For instance, if walnut farmers want to valorise walnut components like walnut press-cake or use extracts from green walnuts, they need to collaborate with neighbouring oil mills. Similarly, apple farmers who want to develop new products out of apple pomace need to know which regional apple processors can offer which volumes. On the other side, also processors like oil-mills lack knowledge about how

many walnuts are harvested in their region to optimise their capacity planning. As we found it during the research conducted in work package T2, this kind of information and linkage is missing in all the alpine regions involved in the project.

Finally, the *fourth missing linkage* refers to infrastructure in terms of a *missing access/ availability to venture and R&D capital* for start-ups and SME in the alpine bio-economy. This missing linkage has two aspects. On the one hand, if existing farmers want to achieve higher levels of valorisation by means of developing new eco-innovative products and services, they need to be aware and get access to innovation funding schemes (e.g. like 'innovation checks' in Baden-Württemberg and Austria). But many farmers are not aware of such opportunities, also because they were not in need in the past. Additionally, even support schemes with comparably low entry barriers frequently use wordings that discourage farmers to participate (e.g. "entry into continuous R&D" in the Austrian 'Innoscheck' provided by the FFG). Given the fact, that such innovation funding schemes have been mainly designed for manufacturing firms, this is not surprising. Additionally, the administrative hurdles (e.g. filling-in the application form, share of own financial contribution) appear not to be manageable for many farmers.

On the other hand, there is a perceived lack of R&D risk capital for R&D-intensive bio-economy start-ups like, for example, the development and testing of pesticides based on natural agents of walnuts and certain herbs. Likewise, the industrial scaling of 3D-printing solutions for apple pomace or walnut press-cake require R&D-intensive development of new process solutions. This issue has also been recently addressed by the public debate in Austria. As reported by the Wiener Zeitung (27.11.19), the Austrian Council for Research and Technology Development suggests providing a governmentally secured 'fund of funds' to improve the availability of venture capital for biotech and high-tech start-ups.

5. CONCLUSION

To summarise the project findings of missing linkages in the innovation system of the alpine bio-economy, four major linkages turned out to be in critical condition or even missing:

1. Insufficient linkages and networks between apple, walnut or herbs farmers and (regional) universities, laboratories, and R&D organisations resulting in missing knowledge who and how to test and develop new eco-innovative products and manufacturing processes.
2. Insufficient linkages between farmers and consumers/end-users resulting in missing knowledge about target group characteristics and future demands as well as missing competencies in market strategy, BM development, and product/service marketing.
3. Insufficient linkages between apple, walnut or herbs farmers and regional processing firms and manufacturing industries resulting in missing knowledge about existing capacities to provide the required amount and quality of pre-processed raw material for eco-innovative products.
4. Missing awareness of, and access to R&D risk capital and venture capital resulting in missing financial resources at both, the level of existing farmers as well as the level of high-tech start-ups that aim at developing and implementing eco-innovative products and services.

Based on these identified missing linkages the following recommendations for innovation policy can be derived in order to address these linkages and support the functioning of the alpine bio-economy innovation system:

- Lowering of entry barriers for farmers to participate in R&D funding schemes that encourage innovation collaborations between farmers and (regional) universities, laboratories, and R&D organisations. Because of the high asymmetries of such collaborations, such incentive programmes should be flanked by supportive coaching, skill-development, and coordinative services for farmers. Furthermore, universities and R&D organisations should be encouraged to adapt their transfer activities according to the needs and specific characteristics of farmers.

- Support the development of tailor-made vocational training/qualification for farmers in the fields of basic business administration, market strategy, BM design, and marketing to enhance their ability to think and plan from the perspective of the market.

- Establishment of closer linkages to other value-creating manufacturers and processing firms (e.g. oil mills, distilleries, producers of cosmetics) in terms of leveraging synergies and better exploit available capacities. This could be achieved, for instance, by incentivizing R&D project consortia, which involve manufacturers and farmers in interdisciplinary project teams to accelerate knowledge spillovers and information exchange between them.

- Considering whether and under which circumstances existing innovation funding schemes in bio-economy can be extended and adapted to better address farmers' needs. According to our findings, such adaptions should include a holistic understanding of innovation (i.e. including product, service, process, and marketing innovation) to enable the development of eco-innovative solutions. This also includes efforts to increase the awareness and knowledge of farmers about the existence of such supporting schemes. One possible solution could be to delegate this task to the already existing intermediary players like agricultural associations, chambers of commerce (e.g. ITKAM), non-profit organisations (e.g. BUND) or technology transfer centres (e.g. NOI, biz-up). Finally, it would be recommendable to provide support for farmers when applying for such funding programmes for the first time and for mastering the administrative requirements. Again, intermediary actors could provide such support.

- Finally, it is highlighted that another possible solution to address many of these missing linkages was identified. In many workshops conducted in this work package, the participants discussed and developed BM for a (regional) digital service platform which aims at linking suppliers, producers, consumers, non-profit organisations, R&D partner and universities as well as other relevant stakeholders (e.g. public authorities, intermediaries). One major goal of such a virtual marketplace would be to improve information flows, enhance knowledge spillovers and bringing together supply and demand to leverage synergies and reduce transaction cost of collaborative business activities between all partner in the value-creation network. The corresponding BM blueprint that has been designed for such a platform is included and described in Deliverable 2-1.

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This report was produced as part of the AlpBioEco project, which is co-financed by the European Regional Development Fund through the Interreg Alpine Space programme.

IMPRINT

Published by:
AlpBioEco project
InnoCamp Sigmaringen
Marie-Curie-Str. 20 · D-72488 Sigmaringen
www.alpine-space.eu/projects/alpbioeco

Where to order the publication:
Tel: +49 75 71 / 9 27 92 72
Email: alpbioeco@sigmaringen.de

Date: April 2020

Design: Rainer Görsch | Visual Communication

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PROJECT FUNDERS

EUROPEAN UNION

This project is co-financed by the European Regional Development Fund (ERDF) through the Interreg Alpine Space programme.
Support from the European Union: 1.820.666 €

Federal Ministry of the Interior, Building and Community

This project is funded by the "Federal Transnational Cooperation Programme" of the German Federal Ministry of the Interior, Building and Community