INNOVATION ECOSYSTEMS IN EUROPE:

First outline of an innovation ecosystem index

Author
MARLEN KOMOROWSKI
RESEARCHER
Marlen.Komorowski@vub.be

imec - SMIT - VUB
Pleinlaan 9, 1050 Brussel
BELGIUM

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INTRODUCTION

This short and introductory study was conducted by imec – SMIT – VUB[1] on behalf of the Digital Transition Partnership[2], which brings cities, EU countries and the European Commission together to provide more efficient public services and a better knowledge exchange.

The Action Plan of the Digital Transition Partnership within the Urban Agenda for the EU foresees the development of practical frameworks and actions regarding legislation, ethics and technologies for cities to promote digital transformation. This involves a set of tools on how to accelerate the development and how to turn cities into innovation ecosystems for digitalisation. In order to do so, it is necessary to beforehand understand innovative ecosystems of cities in Europe better.

The goal of the here presented research study is to develop a typology, which gives a better understanding of what kind of archetypes of European innovation ecosystems exist. Additionally, the study develops a set of flexible and fixed criteria for the archetypes, which can be used by cities to classify themselves and develop the best strategies to develop innovation ecosystems. The findings are to be understood as the starting point to create a first outline of an innovation ecosystem index, which can be used to create a concrete tool set that supports cities in Europe.

The study applied four research steps:
1. **Framework development and desk research**
   (more information on the literature study and framework developed including a literature list can be found in ANNEX 1)
2. **Survey development based on framework**
   (the full survey can be found in ANNEX 2)
3. **Compiling of expert list through data scraping for survey distribution and data gathering**
4. **Data gathering and analysis**
   (more information about the data scraping methods, sources and software applied can be found in ANNEX 3)

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[1] See ANNEX 4 for more information about the author and imec – SMIT – VUB.
[2] See https://ec.europa.eu/futurium/en/digital-transition for more information.

ANALYSING INNOVATION ECOSYSTEMS IN EUROPE

The findings of this study are based on two main sources of information:

1. Desk research / literature study

A literature study was conducted to explore insights from academic articles and other relevant reports and research. These insights were used to create a first delineation of the typology and criteria of innovation ecosystems (see ANNEX 1 for more information).

2. Survey

A survey was conducted that complemented the findings of the literature study. The survey has been distributed to 2.514 identified experts of European innovation ecosystems. These experts include managers of ecosystems, cluster organisation representatives and participants in innovation ecosystems from Europe, which have been identified through desk research and data scraping methods. In total 325 responses were collected (response rate of 13%). After cleaning the collected responses for duplicates (i.e. responses about the same ecosystem) and invalid responses (e.g. responses about ecosystems outside of Europe), information on a total of 247 innovation ecosystems could be collected and analysed. Data was collected from 35 countries and 163 cities covering almost all of Europe. The majority of ecosystems are located in Southern Europe. All regions in Europe are represented in the survey (see Figure 1) (see ANNEX 2 and 3 for more information about the survey).
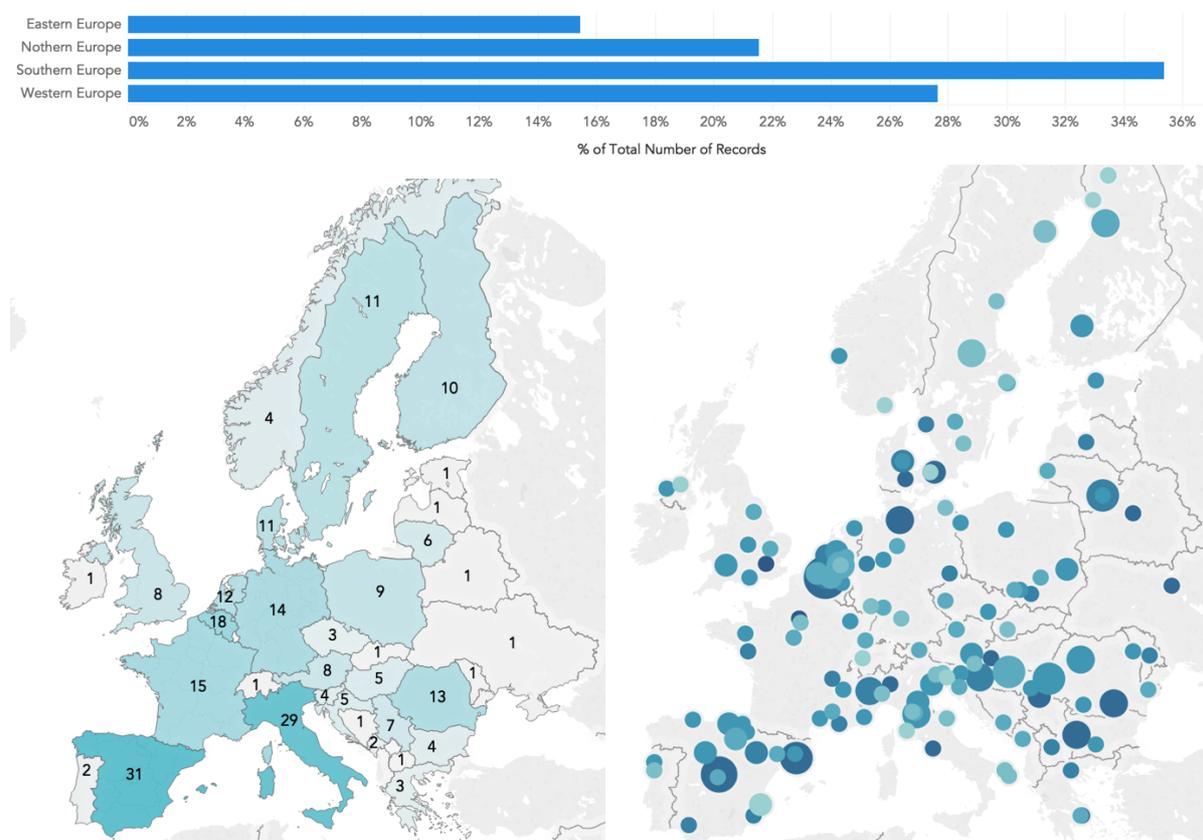

Figure 1 – The distribution of data gathered from innovation ecosystems in Europe.

DEFINING AN INNOVATION ECOSYSTEM TYPOLOGY

Based on the literature study, the following definition for innovation ecosystems has been developed:

> *Innovation ecosystems are here defined as the structures that are formed between actors that pursue technology development and innovation as one of their objectives.*

This can include any kind of organised or unorganised connected group of individuals, firms, governmental and academic organisations. The definition is intentionally kept broad as innovation ecosystems are dynamic structures with multiple and changing actors and actions meaning they are highly complex systems. This also makes the development of a typology explicitly tricky. To overcome this problem, we will (A) first present a conceptual typology model that highlights defining criteria of innovation ecosystems and develop a model that visualises possible a possible index of innovation ecosystems. The findings are based on the literature study and are complemented by additional insights derived from the survey. Second, (B) we will present the most prevalent archetypes that exist in Europe. The archetypes are derived by interpreting the survey data through cluster analysis.

A. THE CONCEPTUAL DELINEATION OF INNOVATION ECOSYSTEM TYPES

Nine main criteria have been identified to create innovation ecosystem types. These criteria are not exhaustive. The focus is on creating a list of criteria that represent the most influential criteria that have an impact on the functioning and management of the innovation ecosystem. At the same time, the criteria represent overarching concepts, which enable the criteria to fit and be relevant for all kind of different ecosystem types. This creates a model that can be used to create a future tool set and index for innovation ecosystem creation and future research in this area.

1) City size

Based on the OECD[3], cities can be distinguished into seven different categories based on urban centre sizes measured in number of inhabitants, which can be scaled along: (1) XS (less than 50.000 inhabitants); (2) S (50.000 – 100.000), (3) M (100.000 - 250.000), (4) L (250.000 – 500.000), (5) XL (500.000 – 1.000.000), (6) XXL (1.000.000 – 5.000.000, and (7) Global (more than 5.000.000). In Europe, there are a total of 828 cities with more than 50.000 inhabitants. In the survey about 20% of these European cities are represented. The results of the survey show, that innovation ecosystems can be found and have their core located in all kind of different cities in terms of size. In industry cluster research, it has been highlighted, that urbanisation economies play an important role for attracting companies and for the creation of innovation dynamics. Urbanisation economies highlight, that the bigger the city, the better infrastructure is available, a larger pool of collaborators and other external economies of scale are created. However, this study found that functioning innovation ecosystems cannot only be found in large cities but also very small cities in Europe. One in four innovation ecosystems in Europe are located in medium sized cities (see Figure 2). The city size has a huge impact

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[3] See https://ec.europa.eu/regional_policy/sources/docgener/focus/2012_01_city.pdf.

on the functioning of the innovation ecosystem and should be highlighted as a criterion to define the type of innovation ecosystem.
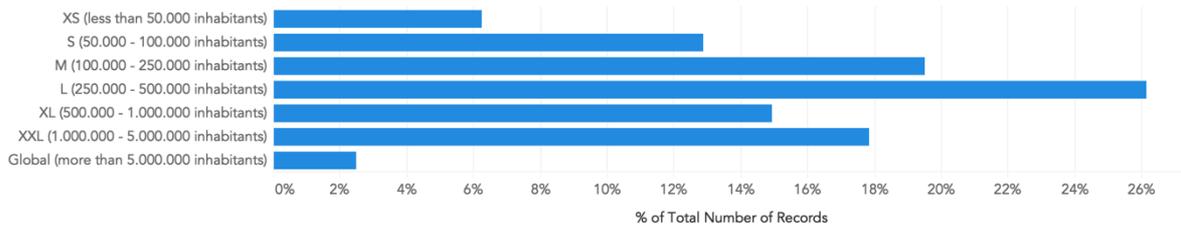

Figure 2 – The number of ecosystems identified in the survey per city size.

2) Number of innovation ecosystem actors

The type of innovation ecosystem and therefore the functioning of the ecosystem is highly dependent on the number of actors involved. An innovation ecosystem can take all different kinds of sizes and based on the definition (see above) already a group of two actors can create an ecosystem. The responses of the experts in the survey show, that innovation ecosystems can include a very small number of actors (six ecosystems identified and analysed via the survey report to include less than ten actors) or a very large number (five are reported to involve more than 10.000 actors). The most common size in terms of number of actors of an innovation ecosystem based on the survey responses ranks from 100-500 actors (see Figure 3).
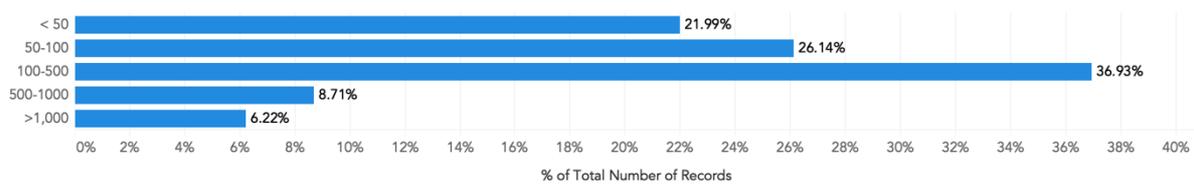

Figure 3 – The number of ecosystems identified in the survey per number of actors involved.

3) Types of actors involved

The actors involved in an innovation ecosystem represent different kind of organisations fulfilling different roles in the innovation ecosystem and therefore defining the type of innovation ecosystem. Von Leipzig and Dimitrov (2015) identified four main types of actors: (1) industry actors (companies, large enterprises, freelancers, etc.), (2) academia (universities, colleges, tech transfer offices, labs, technology parks, etc.), (3) public bodies (municipalities, regional authorities, public agencies, etc.), (4) finance (banks, venture capital, business angels, etc.), and (5) other actors (media, formal and informal networks, trade organisations, cluster organisations, etc.).

Based on the survey, we additionally identified actors like associations, chamber of commerce, research and technology organisations (RTOs), accelerators, incubators, and more to be involved in innovation ecosystems. 90% of ecosystems surveyed involve universities, SMEs and companies. Cluster organisations are in place in more than 60% of innovation ecosystems. Regional authorities and municipalities in more than half of innovation ecosystems (see Figure 4).
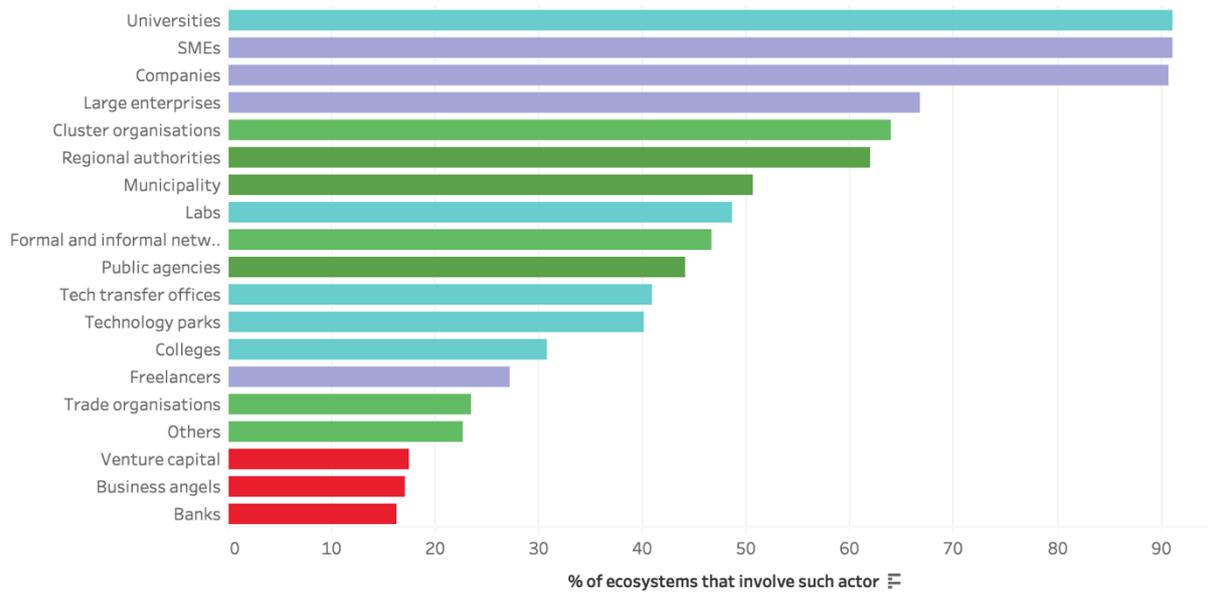
Figure 4 – The number of ecosystems identified that involve certain actors (multiple involvement possible).

4) Expertise and industry sectors

Researchers have highlighted that innovation ecosystems have globally valued special expertise and have activities based on this expertise in common (Launonen & Viitanen, 2011). The European agenda has called for enabling innovation by creating smart specialisation in innovation ecosystems.[4] Therefore, the available expertise and the focus on certain industry sectors becomes an important criterium in order to delineate an innovation ecosystem. Additionally, it has been highlighted that innovation ecosystems can be built around a specific technology (Jackson, 2011). It also needs to be noted, that the focus of an innovation ecosystem can be very broad or very specialized (e.g. an ecosystem that focusses on innovating in the whole creative and cultural industries versus an ecosystem that specialises in innovation around VR). Based on our survey (an open text entry question) one in five ecosystems specialise in the energy sector. Most ecosystems focus on technology development (e.g. VR, AI, sensors) or integrate expertise in ICT or digital areas. Healthcare, creative and cultural industries, construction and automotive specialisation are also very common among innovation ecosystems in Europe (see Figure 5).

[4] See https://ec.europa.eu/jrc/en/research-topic/smart-specialisation.
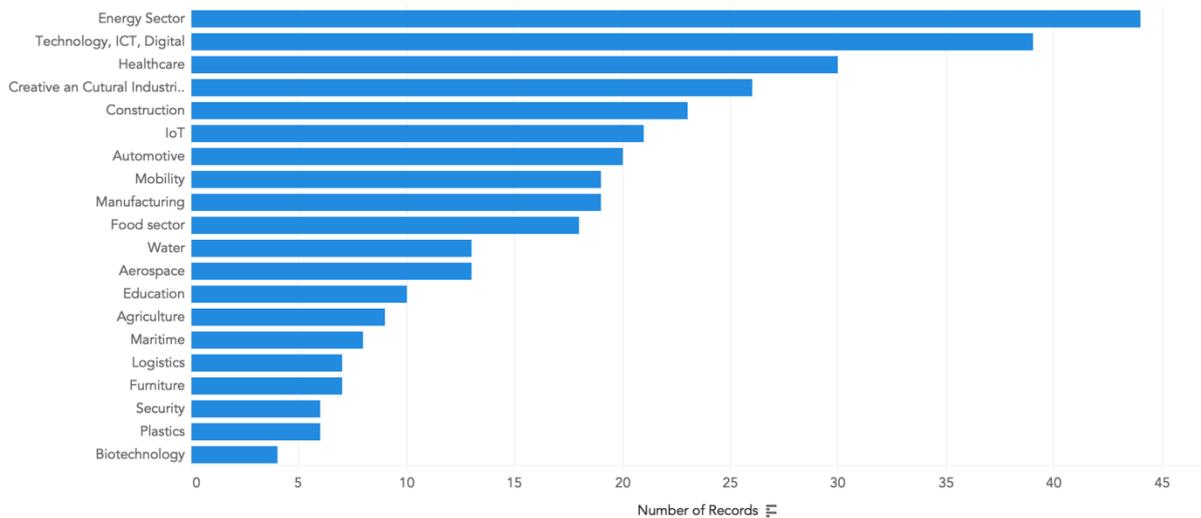
Figure 5 – The number of ecosystems identified in the survey per industry sector focus.

5) Development stage

Research has highlighted that it is important to present the process (including lifecycle) by which ecosystem stakeholders interact and see how they result in different ecosystem patterns (Rong, Hu, Lin, Shi, & Guo, 2015). In cluster theory this includes four main stages (Menzel, Henn, & Fornahl, 2010): emerging, growing, established, transformational (in need of change). The majority of ecosystems in Europe has been identified in the survey as growing and established. Only 16% are emerging innovation ecosystems in Europe. Of course, the type of innovation ecosystem can evolve through all stages. But in delineating an innovation ecosystem, the current stage has a big impact on the functioning and management decisions.
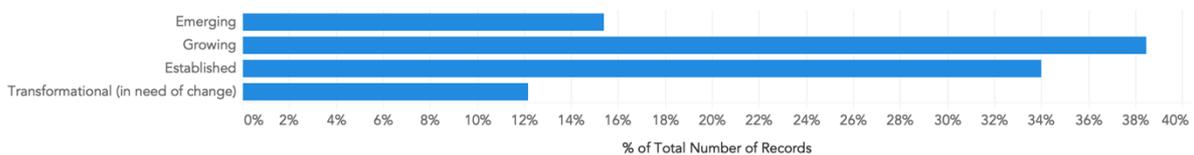

Figure 6- The number of ecosystems identified in the survey per development stage.

6) Scale of operation

Researchers often focus in analysing innovation systems in context of spatial dependencies. Theoretical considerations of scale have been associated with ideas of operation of innovation ecosystems as well. Therefore, many researchers consider different spatial scales, from the international over the national to the regional one, as linked and coordinated for defining the functioning and type of innovation ecosystem (Fromhold-Eisebith, 2007). The survey found that the majority (almost half) of innovation ecosystems in Europe are operating on a regional level. One in four are even working on an international level. Smaller scale operations like city or local levels (offices, neighbourhoods, etc.) are rarer (see Figure 7).
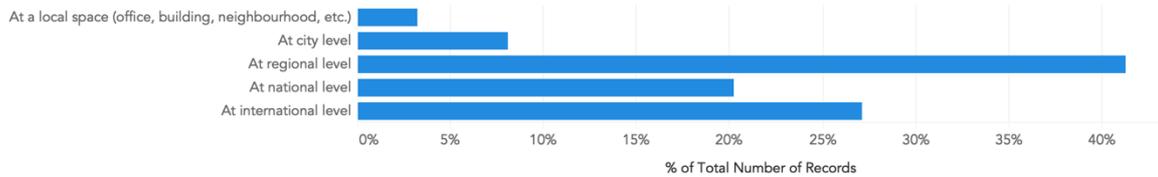
Figure 7 - The number of ecosystems identified in the survey per scale of operation.

7) Central entity (organised or unorganised)

Autio and Thomas (2014) define innovation ecosystem as "a network (…) connected to a focal firm or a platform (…)". Looking at innovation ecosystem and innovation management research, many authors describe such systems through highlighting such central entities while analysing innovation ecosystems around cluster organisations, projects, incubators, etc. An innovation ecosystem can be an organised structure, unorganised by simply building structures of cooperation and collaboration among actors of the system and at different levels in between organised and unorganised. In this context also considerations of business models and financial structures and organisation in general are important for understanding the type and functioning of the innovation ecosystem. In the survey, we have asked how the respondents would classify the innovation ecosystem themselves. We found that most innovation ecosystems are organised or unorganised localised business clusters. Ecosystems are also formed around communities, associations, projects and legal partnerships. Locations like technology parks, labs, and other poles and hubs have been also identified as central entity of innovation ecosystems in Europe (see Figure 8). Therefore, it is important to look at central entities like organisations and places to define innovation ecosystem types.
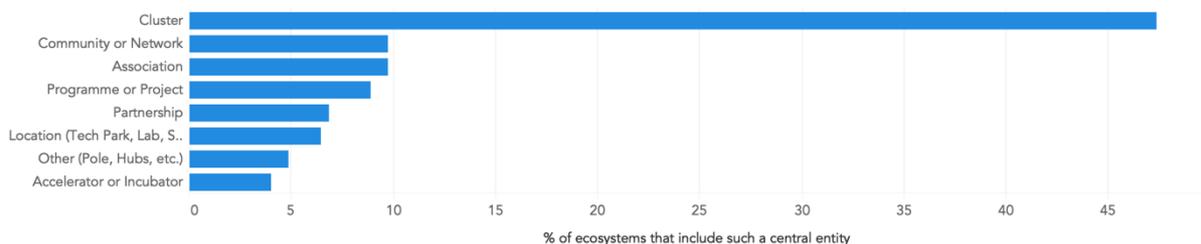

Figure 8 - The number of ecosystems identified in the survey per central entity.

8) Leading / initiating actor(s)

In the context of the emergence of the innovation ecosystem (see 5 above), it is also important to look at leading or initiating actors in innovation ecosystems. While many different roles of actors in innovation ecosystems are important, the leadership roles give essential insights into the types of innovation ecosystems that exists. Dedehayir et al. (2018) found that a significant percentage of the literature focusses on the actions of a central actor, which undertook a leadership role in the birth of the innovation ecosystem stating that such a central role is indispensable for innovation ecosystems. These leading actors take up roles of ecosystem governance, forging of partnerships, platform management and value management. The leading or initiating actor or actors can also be the central entity (see 7 above). However, as these central entities can be unorganised and building the focal point of the ecosystem, the leading actors are more active in their role in the ecosystem and therefore, we decided to differentiate them. The role of leading actors can include a lot of involvement and engagement or a very low to no involvement and influence. In the survey,

we found that more than half of all ecosystems have been formed by governmental effort. Universities also often play there leading or initiating roles. A central individual that is responsible and takes up these roles is also common (see Figure 9).
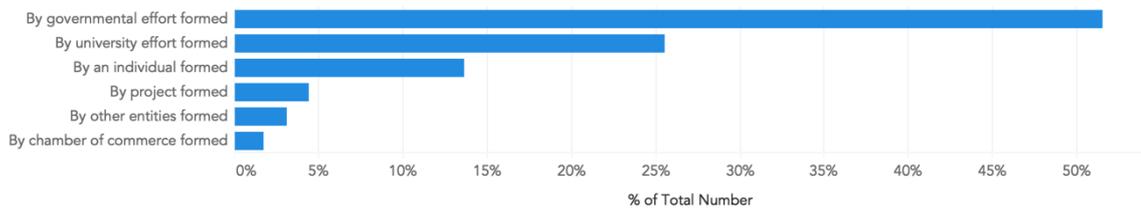

Figure 9 - The number of ecosystems identified in the survey per leading / initiating actor.

9) Actions / goals

As stated in the definition, innovation should be one of the objectives of an innovation ecosystem. However, an innovative environment and support of innovation can be created through multiple actions and set goals of innovation ecosystems. Of course, these actions and goals are not always clearly defined or set and agreed upon. We can find such defined actions and goals, if the innovation ecosystem is centrally organised in an organisation or entity. Still, being part of and participating actively in an innovation ecosystem for all actors always comes along with common goals that the entities of the innovation ecosystem share. Therefore, these actions and goals clearly define what types of innovation ecosystem exist and can rank from direct actions to very broad goals. Goals and actions can be very different from innovation ecosystem to innovation ecosystem. Sölvell et al. (2003) found that organised ecosystems or clusters share six main goals that relate to actions: (1) research and networking, (2) expansion, (3) innovation and technology, (4) education and training, (5) commercial cooperation and (6) policy action. We translated these into the survey (multiple answers were possible) and found that the majority of innovation ecosystems focus of course on innovation and technology development. Actors also take part in the innovation ecosystem to strengthen collaboration, promote the ecosystem and to get access to training and education among others (see Figure 10).
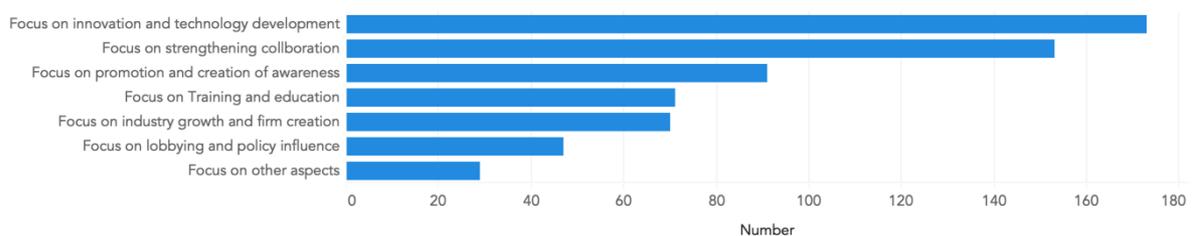
Figure 10 - The number of ecosystems identified in the survey per actions / goals.

The nine identified criteria can be brought together into a typology model for innovation ecosystems. We can distinguish the criteria between two categories: (1) Criteria defining the scale of the innovation ecosystem (city size, access to number of actors, scale of operation) and (2) criteria defining the focus of the innovation ecosystem (existing expertise and sector focus, access to types of actors, leading actors, central entity and actions / goals). Additionally, they can be distinguished between predefined criteria (criteria that are predefined for the city or region and cannot be changed ad hoc) and undefined criteria

(criteria that can be influenced when an innovation ecosystem is being developed and managed). Undefined criteria can already be in place or not be in place in a city or region depending on the development stage (e.g. a central entity like a lab is in place and takes up a leading role of the innovation ecosystem). Figure 11 below summarises the model. The arrows in the visualisation represent the interdependence among the criteria: The city size can determine the access to the number of actors, which can influence the scale of operation; Existing expertise is dependent on the types of actors available which can influence who leads / initiates the ecosystem, which central entity is defined and what goals are determined.
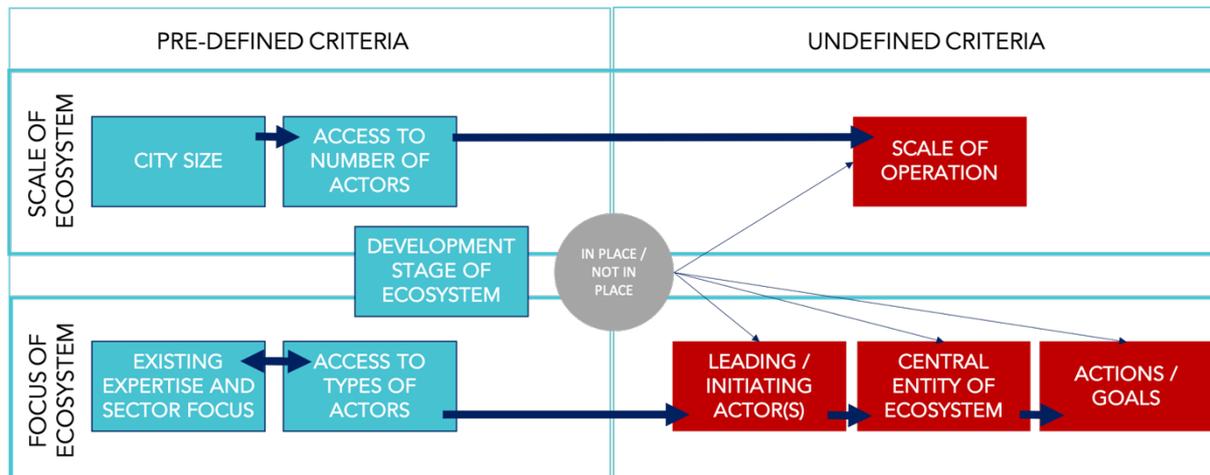
Figure 11 – The criteria model for an innovation ecosystem typology.

Additionally to the interdependence of the criteria, we can also bring the criteria together by scaling them along different measures. This means we can index the criteria in a common model. We argue, that the here presented model that is based on the research, covers the most influential criteria that have an impact on the functioning and management of the innovation ecosystem while at the same time gives guidelines into how innovation ecosystem managers can define their own innovation ecosystem while looking at the dependencies and points that can be influenced. Therefore, we have developed a polar model that can visualise different innovation ecosystems and make them directly comparable. Figure 12 shows the visualisation of the model in a polar chart.
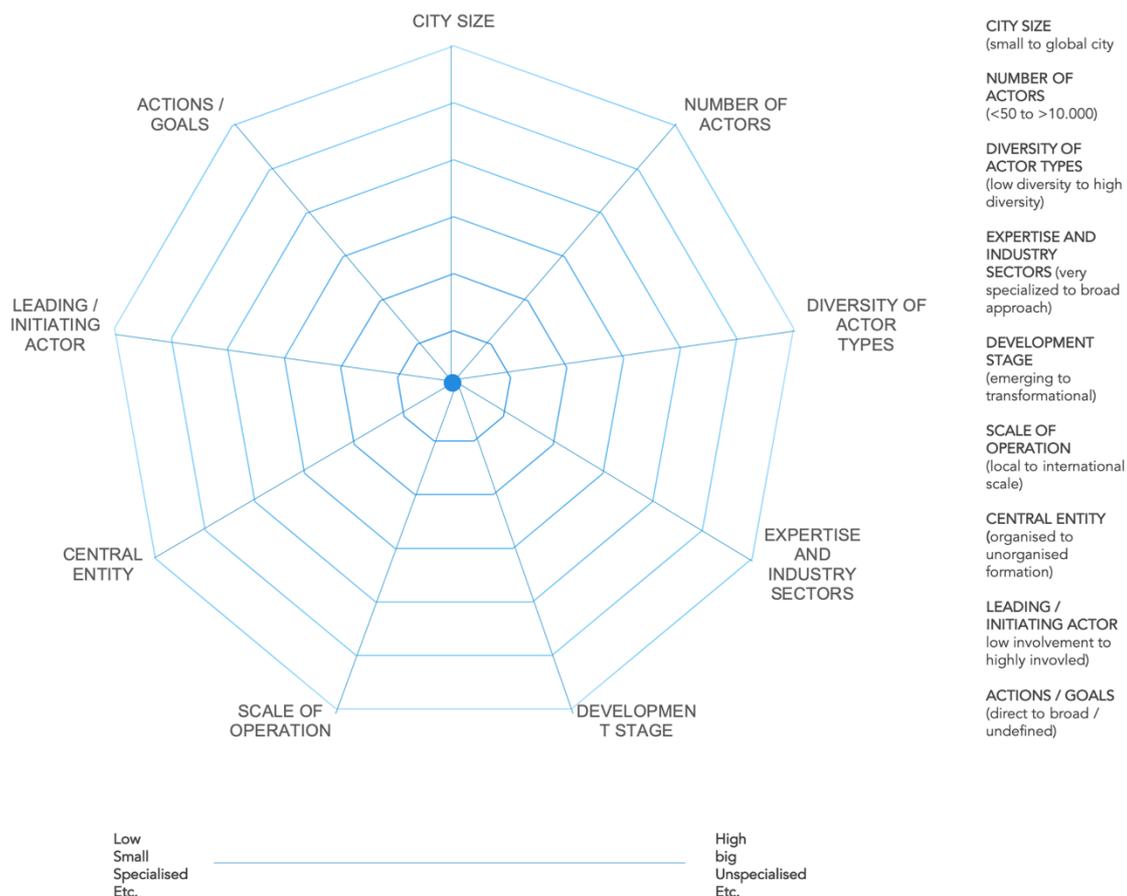
Figure 12 – The polar visualisation of the model / index of innovation ecosystem types.

B. THE PREVELANT ARCHETYPES OF INNOVATION ECOSYSTEMS IN EUROPE

While the model above gives insights into how types of innovation ecosystems can be modelled by defining and scaling nine predefined and undefined criteria, the goal of this study was also to find the archetypes (what combinations of these criteria build the most prevalent existing innovation ecosystems). Based on coding of survey answers and cluster analysis using Pearson correlation (nodes coded in similar ecosystems displayed in clusters), we have analysed what combinations of criteria are most prevalent among the 247 innovation ecosystems in Europe. We have found that the combinations of criteria are very divers. There are no clear characteristics of ecosystems that are always or often applied in the existing innovation ecosystem (e.g. there are no clear relations between the sector focus on the involved actors or scale of operation and number of actors involved). We found rather that innovation ecosystems are highly divers and there are no clear archetypes of innovation ecosystems, but rather a multitude combining very divers criteria.

Still, using the size of the city, in which the innovation ecosystem is located, we can find several criteria that more regularly combined and related than others. The analysis gives therefore insights into the most prevalent types of innovation ecosystems in Europe (being limited by the clear diversity of innovation ecosystems in Europe). Figure 13 summarises four found archetypes of innovation ecosystems in Europe distinguished among city sizes and the

most often related characteristics with them (see ANNEX 3 for the cluster analysis visualisation that built the basis of the findings presented).

Figure 12 shows, that innovation ecosystems are often built around technology parks and integrate research organisations and public agencies. Innovation ecosystems in medium-sized cities have often large enterprises involved, municipalities and are larger small ecosystems of less than 50 actors. Large cities often host innovation ecosystems that are built around formal networks, which involve formal networks and integrate more than 1000 actors. Innovation ecosystems in very large cities integrate actors like universities and more often also venture capital and banks are involved. Cluster organisations are in place. These four archetypes are just highlighting which kind of combinations of the criteria of the model developed above are found often together. Other combinations exist and are as well common, showing how divers innovation ecosystems in Europe are.

SMALL CITY
- Research organisations
- Public agency
- Technology Park

MEDIUM CITY
- Lab
- Large enterprises
- Municipality
- <50 actors

LARGE CITY
- Formal network
- Freelancers
- >1.000 actors

VERY LARGE CITY
- University
- Venture Capital
- 100-1.000 actors
- Banks
- Cluster organisation

Figure 13 – The prevalent innovation ecosystem archetypes in Europe.

CRITERIA AND SUCCESS-FACTORS FOR INNOVATION ECOSYSTEMS IN EUROPE

The above presented prevalent archetypes do not give any insights into the **successfulness** of the criteria integrated in an ecosystem. Based on the expert opinions (who have been asked how successful the surveyed ecosystems are in their opinion), we can delineate what factors are the most successful. We focus on the undefined criteria of the model, as these can be influenced by ecosystem managers. Generally, the survey findings show, that more than 60% of the respondents assess the elaborated ecosystem as extremely or very successful (see Figure 14).
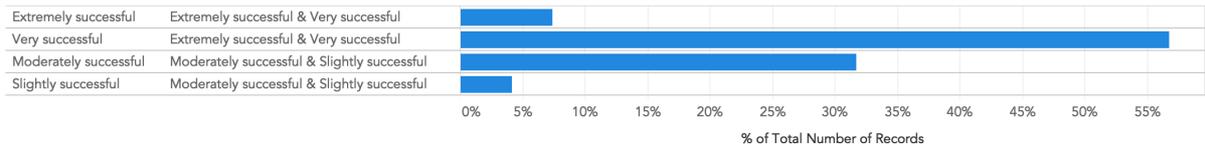
Figure 14 - The number of ecosystems identified in the survey categorised per successfulness.

1) Scale of operation

Around 70% of experts assessed innovation ecosystems that operate on a national level as most successful. International and regional level operated ecosystems are similar successful (see Figure 15).
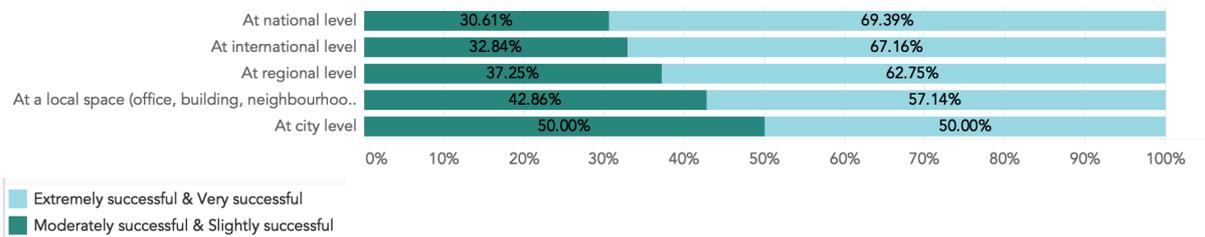
Figure 15 – The percentage of extremely and very successful innovation ecosystems per scale of operation.

2) Central entity of innovation ecosystem

Around 80% of experts assessed innovation ecosystems that have an incubator as central entity as very successful. Associations, cluster organisations, projects, and technology parks are similarly often successful (see Figure 16).
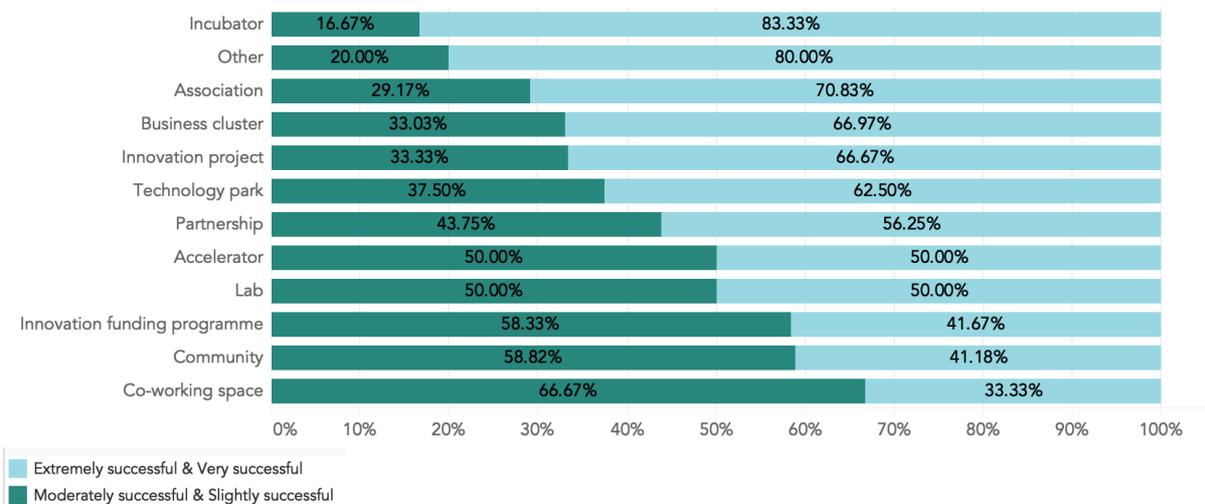
Figure 16 – The percentage of extremely and very successful innovation ecosystems per central entity.

3) Leading / initiating actor(s)

Experts who assessed an innovation ecosystem that was initiated by a single leading individual see them as very successful. Also, other leading or initiating actors have a high likelihood to be successful (see Figure 17).
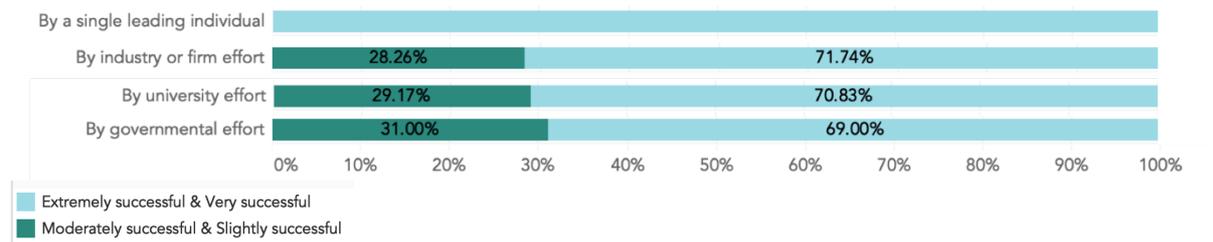
Figure 17 – The percentage of extremely and very successful innovation ecosystems per leading / initiating actor(s).

4) Actions / goals

If an innovation ecosystem focusses its actions and goals on innovation and technology development, industry growth and firm creation, or provision of education and training, more than 60% of ecosystems have been reported to be very successful (see Figure 18).
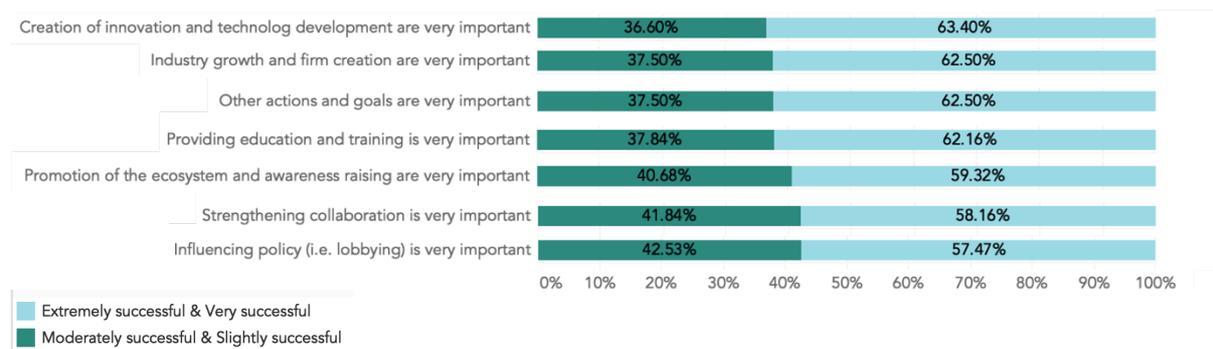

Figure 18 – The percentage of extremely and very successful innovation ecosystems per actions / goals.

CONCLUSION AND RECOMMENDATIONS

This short and introductory study had the goal to develop (1) a typology of innovation ecosystems and create (2) criteria, which can be used by cities to classify themselves and develop the best strategies to develop innovation ecosystems and set the first outline of an innovation ecosystem index. The findings and consequent recommendations can be summarised as follows.

SUMMARY OF FINDINGS:
- Innovation ecosystems are highly complex structures. A one size fits all strategy for ecosystem development does not exist.
- Based on the literature study and survey results, a typology of innovation ecosystems can be created through applying nine criteria, that are either pre-defined or can be influenced by ecosystem managers. Many different combinations of these criteria can be envisaged: (1) city size, (2) access to number of actors, (3) development stage, (4)

scale of operation, (5) existing expertise and sector focus, (6) access to types of actors, (7) leading actors, (8) central entity, and (9) actions / goals.

- Innovation ecosystem managers can look at the pre-defined criteria and the criteria that are in place in their innovation ecosystems to create relations with the undefined criteria when developing an innovation ecosystem (see Figure 11).
- Innovation ecosystem mangers can scale the nine criteria to visualise and make their ecosystem comparable to other types using the developed polar chart model, which creates an indexing system for innovation ecosystems (see Figure 12).
- Based on the analysis of 247 ecosystems, we can derive four prevalent archetypes that exist in Europe (see Figure 13).
- Looking at how successful the ecosystems that have been surveyed are seen, we found that certain undefined criteria are more likely to create a successful ecosystem than others. This includes that innovation ecosystems operating at a national or international level are more likely to be successful than innovation ecosystems operating on city or local level; innovation ecosystems that include an incubator, an association, a cluster organisation, a project, or a technology park are more likely to be successful than innovation ecosystems involved with communities or co-working spaces; and leading individuals are highly connected to successful ecosystems.
- These findings can support decision making processes in developing successful innovation ecosystems in Europe.

RECOMMENDATIONS:

- The next step for future research is to create measurable and objective KPIs from an economic perspective (in contrast to this study, which was based on the subjective opinion of the experts regarding the successfulness and performance of the investigated innovation ecosystems), to delineate what successful strategies for innovation ecosystems are and to make them better comparable among the typology developed here. These KPIs should be seen as performance indicators of innovation ecosystems and include for example the measurable influence on innovation output, industry and employment growth, attraction of companies, formation of new companies, and more.
- The focus of such research should be on the undefined criteria that can be influenced by innovation ecosystem managers / leadership. For example, it has been reported that leading and initiating actors can have a very strong influence on the performance of an innovation ecosystem. But it is still not clear what grade or scale of involvement and influence is needed to strengthen performance and what type of actors are best to take up such a role.
- Future research can use these findings to create more in-depth knowledge of successful innovation ecosystems and investigate in more detail the trajectories and management decisions that can lead to successful development in order to create a tool set for cities. This toolset should integrate a clear index for innovation ecosystems, for which this study created a first outline for.

ANNEX 1: LITERATURE STUDY AND FRAMEWORK

1. LITERATURE STUDY AND REFERENCE LIST

For this study, we borrowed insights and approaches that have been developed in the context of value chains, networks, clusters and ecosystems and bring this into the context of innovation ecosystems in Europe. The following reports and articles have been analysed and referenced throughout the study.

REFERENCE LIST

Autio, E., & Thomas, L. (2014). Innovation ecosystems. The Oxford Handbook of Innovation Management, 204–288.

Dedehayir, O., Mäkinen, S. J., & Ortt, J. R. (2018). Roles during innovation ecosystem genesis: A literature review. Technological Forecasting and Social Change, 136, 18–29.

Fromhold-Eisebith, M. (2007). Bridging scales in innovation policies: How to link regional, national and international innovation systems. European Planning Studies, 15(2), 217–233.

Jackson, D. J. (2011). What is an innovation ecosystem. National Science Foundation, 1.

Launonen, M., & Viitanen, J. (2011). The Global Best Practice for Managing Innovation Ecosystems and Hubs. Helsinki, Hubconcepts.

Menzel, M.-P., Henn, S., & Fornahl, D. (2010). Emerging clusters: a conceptual overview. Emerging Clusters: Theoretical, Empirical and Political Perspectives on the Initial Stage of Cluster Evolution, 1–13.

Rong, K., Hu, G., Lin, Y., Shi, Y., & Guo, L. (2015). Understanding business ecosystem using a 6C framework in Internet-of-Things-based sectors. International Journal of Production Economics, 159, 41–55.

Sölvell, Ö., Lindqvist, G., & Ketels, C. (2003). The cluster initiative greenbook: Scotland's digital media and creative industries CI, the U.K. In The cluster initiative greenbook (1st ed., pp. 59–63). Retrieved from https://www.hhs.se/contentassets/f51b706e1d644e9fa6c4d232abd09e63/greenbooksep03.pdf

Von Leipzig, K., & Dimitrov, D. (2015). Cluster development in the SA tooling industry. South African Journal of Industrial Engineering, 26(3), 110–124.

FURTHER READINGS

For additional insights in innovation ecosystems and current research on the topic, see the following references, which inspired the here presented research:

Asheim, B. T., & Isaksen, A. (2002). Regional innovation systems: the integration of local 'sticky'and global 'ubiquitous' knowledge. The Journal of Technology Transfer, 27(1), 77–86.

Atwa, S. M., Ibrahim, M. G., & Saleh, A. M. (2017). Green Business Parks Towards Sustainable Cities. WIT Transactions on Ecology and the Environment, 214, 9–19.

Carayannis, E., & Grigoroudis, E. (2016). Quadruple innovation helix and smart specialization: Knowledge production and national competitiveness. **Форсайт**, 10(1 (eng)).

Cooke, P., & Memedovic, O. (2003). Strategies for regional innovation systems: learning transfer and applications. Citeseer.

Cooke, P., Uranga, M. G., & Etxebarria, G. (1997). Regional innovation systems: Institutional and organisational dimensions. Research Policy, 26(4–5), 475–491.

de Vasconcelos Gomes, L. A., Facin, A. L. F., Salerno, M. S., & Ikenami, R. K. (2018). Unpacking the innovation ecosystem construct: Evolution, gaps and trends. Technological Forecasting and Social Change, 136, 30–48.

Doloreux, D., & Parto, S. (2005). Regional innovation systems: Current discourse and unresolved issues. Technology in Society, 27(2), 133–153.

Durst, S., & Poutanen, P. (2013). Success factors of innovation ecosystems.

Gheorghiu, R., Andreescu, L., & Curaj, A. (2016). A foresight toolkit for smart specialization and entrepreneurial discovery. Futures, 80, 33–44.

Markkula, M., & Kune, H. (2015). Making smart regions smarter: smart specialization and the role of universities in regional innovation ecosystems. Technology Innovation Management Review, 5(10).

Rabelo, R. J., & Bernus, P. (2015). A holistic model of building innovation ecosystems. IFAC-PapersOnLine, 48(3), 2250–2257.

Traitler, H., Watzke, H. J., & Saguy, I. S. (2011). Reinventing R&D in an open innovation ecosystem. Journal of Food Science, 76(2), R62–R68.

Zahra, S. A., & Nambisan, S. (2011). Entrepreneurship in global innovation ecosystems. AMS Review, 1(1), 4.

2. RESEARCH FRAMEWORK

Based on the literature study, a framework was developed. The framework was specifically based on the research expertise and output of imec – SMIT – VUB. The study is grounded in

previously published articles by imec – SMIT - VUB[5], which guided the research process. The research framework is developed based on the so-called 7 P framework, an analysis framework, that depicts the most important parameters for cluster and ecosystem analysis. As the 7 P framework was developed based on cluster research, the parameters have been adapted to fit the research context of innovation ecosystems. Table 1 depicts the 7 parameters and their definition, which have been translated to create the basis for the typology, criteria and the connected survey for innovation ecosystems in Europe.

Place	…the **geographical scale** and **local conditions** influencing the ecosystem.
Proximity	…the **topographical** and **topological** nearness influencing the ecosystem.
Population	…the scale of the ecosystem in **quantity** of actors and **concentration / relevance** for the place linked to the development phase.
Profile	…the **type** of actors and their **functions** within the ecosystem.
Path-dependency	…the **historic ligation**, the origins and historically developed **patterns** influencing the ecosystem.
Policy	…the policy and governance **tools** from all **levels** influencing the ecosystem.
Performance	…the **endogenous** and **exogenous** externalities that the ecosystem produces.

Table 1 – The 7 P framework for ecosystem analysis.

ANNEX 2: SURVEY MODEL

The framework and definitions were translated into a survey. The survey was created and distributed with Qualtrics. The respondents could integrate up to three innovation ecosystems. Table 2 below shows the questions and the connections of the questions to the 7 P framework.

INTRODUCTION
Welcome to the survey.* This survey is for experts who are or have been involved in innovation ecosystems in Europe. Innovation ecosystems are here defined as the structures that are formed between actors that pursue technology development and innovation as one of their objectives. This can include **cluster initiatives, funding programmes, incubators, labs, technology parks, projects, partnerships, communities, associations and any localised connected groups of individuals, firms, governmental and academic organisations.** The definition is kept broad, as the aim of the survey is to create insights into what kind of innovation ecosystems exist in Europe (that can go beyond the definition given above), and how governments can support local innovation ecosystems in the future. **We are looking for insights about one or more innovation ecosystems, in which you are or have been involved in.**

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[5] Komorowski, M. (2017). A novel typology of media clusters. European Planning Studies, 25(8), 1-22. Komorowski, M. (2016). The seven parameters of media clusters: An integrated approach for local cluster analysis. International Journal of Media & Cultural Politics, 12(2), 171-191.

Your answers will be completely anonymous, analysed in combination with other experts' responses and in GDPR compliance.

Survey length: 5 minutes

For more information and to contact us, click here.

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* This survey is part of the Digital Transition Partnership, which brings cities, EU countries and the European Commission together to provide more efficient public services and a better knowledge exchange between cities in Europe. The research is carried out by imec- SMIT -VUB, a research centre in Brussels that focusses on innovation and smart city research.

Category of framework	Question	Question Type	Fixed (1) or flexible (2) criteria	No
Tell us about one of the innovation ecosystems that you are or have been involved in.				
Profile	What is the name of the innovation ecosystem? (If the ecosystem that you would like to describe doesn't have an official name, feel free to enter a name that in your opinion describes the ecosystem best.)	Text fill		1
	How would you best describe the ecosystem? - (Organised) business cluster - Innovation funding programme - Incubator - Accelerator - Co-working space - Lab - Technology park - Innovation project - Partnership - Community - Association - Other localized connected group (please specify)	Choice	(2)	2
Place	Where is the innovation ecosystem located?	Drop down for country and text fill for city	(1)	3
	How big is the city approximately? - XS (less than 50.000 inhabitants) - S (50.000 – 100.000) - M (100.000 - 250.000) - L (250.000 – 500.000) - XL (500.000 – 1.000.000) - XXL (1.000.000 – 5.000.000) - Global (more than 5.000.000) (Based on OECD Definition https://ec.europa.eu/regional_policy/sources/docgener/focus/2012_01_city.pdf)	Choice	(1)	4
Proximity	At what scale does the innovation ecosystem operate? - At a local space (please specify) - At neighbourhood level - At city level - At regional level (which one:)	Choice	(2)	4

	- At national level - At international level			
	What are the objectives and how important are these objectives for the ecosystem and / or its members (to the best of your knowledge)? - Enable innovation / technology development - Provide education / training - Strengthen collaboration - Influence policy (i.e. lobbying) - Create awareness / promote the ecosystem - Create firm / industry growth - Other (please specify) (The categories are inspired by Cluster Initiative Greenbook: https://www.hhs.se/contentassets/f51b706e1d644e9f a6c4d232abd09e63/greenbooksep03.pdf)	5-point Likert scale between not at all important to extremely important	(2)	5
Population	How many actors are involved in the ecosystem (approximately)? (This can include members of the ecosystem or actors who have or are involved in activities of the ecosystem.)	Dropdown	(1)	6
Profile	In what industry sector(s) does the ecosystem operate in?	Text fill	(1)	7

	What kind of actors are involved in the ecosystem?
	- Industry
	  o Companies
	  o SMEs
	  o Freelance
	  o Large enterprises
	- Academia
	  o Universities
	  o Colleges
	  o Tech transfer offices
	  o Labs
	  o Technology parks
	- Public bodies
	  o City-level authorities
	  o Regional authorities
	  o Agencies
	- Finance
	  o Banks
	  o Venture capital
	  o Business angels
	- Other
	  o Media
	  o Formal and informal networks
	  o Trade organisations
	  o Cluster organisations
	(Adapted from https://www.researchgate.net/publication/285550004 _Cluster_development_in_the_SA_tooling_industry/fi gures?lo=1)
		Choice (multiple)	(2)	8

Path-dependency	At what stage is in your opinion the ecosystem at the moment? - Emerging - Growing	Choice		9

	- Established - Transformational (in need of change) (Based on cluster life cycle framework model.)			
Policy	By whom or how was the ecosystem started? - By governmental effort - By industry or firm effort - By university effort - By other means (please specify)	Choice (multiple)	(2)	10
Performance	How successful is the ecosystem in your opinion in achieving its objectives?	5-point Likert scale between not at all successful to extremely successful		11
Re-do survey				
	Are you involved in any other innovation ecosystem? And would you share your insights with us? (If yes, click here and fill in the survey again.)	Choice		
Conclusion				
	Thank you for your answers. They have been recorded. - Email - I would like to receive the final report. - I am interested in participating in follow-up and related research.	Choice		

Table 2 – The survey for innovation ecosystem experts in Europe.

ANNEX 3 – THE METHODS

1. DATA GATHERING METHOD

- In a first step, a literature study was conducted. Using resources including google scholar and Web of Science relevant articles have been analysed including research not only on innovation ecosystems but also industry cluster, value chain and value network literature, innovation management and network / collaboration studies.
- The insights of the literature study have been used to create a short survey, that is based on11 questions. The survey was created in Qualtrics.[6]
- Using a survey method makes sure to have integrated a number of different ecosystems going beyond the limits of a literature study, as current literature is often limited by focussing on a single case study and successful innovation ecosystems.
- The survey method also allows the researcher to directly extract relevant and comparable information about innovation ecosystems in Europe.
- The survey was distributed to 2.514 identified experts of European innovation ecosystems. These experts include managers of ecosystems, cluster organisation representatives and participants in innovation ecosystems from Europe.
- The experts have been identified through desk research. The following sources have been used:

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[6] See https://www.qualtrics.com/.

a) European Cluster Collaboration Platform[7] (a platform, which is funded by the EU programme for the Competitiveness of Enterprises and SMEs (COSME))

b) EUROCITIES[8] (a network of local governments of over 140 of Europe's largest cities and over 45 partner cities)

c) B-HIVE[9] (a European collaborative innovation fintech platform that brings together major banks, insurers and market infrastructure players and lists a number of incubators in Europe)

d) Transatlantic ICT Forum[10] (a platform to benefit policy debate and provide expert opinions and recommendations related to transatlantic dialogues for EU-US ICT R&I cooperation between Europe and North America, which also provides a list of European innovation funding agencies)

e) EBN[11] (a network of around 150 quality-certified EU|BICs (business and innovation centres) and 70 other organisations that support the development and growth of innovative entrepreneurs, start-ups and SMEs)

- Email addresses of experts of these sources have been scraped using the Webscraper[12] development tool, that was programmed and run on google chrome.

- Additionally, the survey was distributed through the Digital Transition Platform network.

- The survey was distributed using Qualtrics.

- In total 325 responses were collected with a response rate of 13%. After cleaning the collected responses for duplicates (i.e. responses about the same ecosystem) and invalid responses (e.g. responses about ecosystems outside of Europe), information about a total of 247 innovation ecosystems could be collected and analysed.

- It needs to be noted that there are certain limitations to the applied method:

    a) In order to collect the data, questions were kept closed meaning that multiple choice options based on the literature study were created. This limits in how far respondents could describe the innovation ecosystems. More insights could be found in future research, which allows experts to share more insights in a more flexible manner.

    b) The sources used to identify the experts are of course biased towards certain types of innovation ecosystems. The researcher tried to create a mix of different sources, so that a variety of experts were invited to take part in the study. However, the biggest set of email addresses has been the European Cluster Collaboration Platform (more than 1000). Therefore, also innovation ecosystems that are present in organised clusters, are possibly overrepresented in this study. Other innovation ecosystems types could have been overlooked or are less represented,

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[7] See https://www.clustercollaboration.eu/cluster-list.

[8] See http://www.eurocities.eu/.

[9] See https://b-hive.eu/news-full/2016/11/21/100-acceleratorsincubators-in-europe.

[10] See http://discoveryproject.eu/funding-agencies-directory/.

[11] See https://ebn.eu/.

[12] See https://webscraper.io/.

which can influence the findings. This needs to be kept in mind, when reading the results of the study. To overcome this, the survey asked the experts to include information about more than one innovation ecosystem, which more than half of the respondents did. This should balance the bias out.

2. DATA ANALYSIS METHOD

- The survey answers have been cleaned and structured using Microsoft excel.
- A first analysis was conducted using Tableau[13] for data visualisation to find the distribution of ecosystems among the criteria.
- The data from the survey (to also include open ended questions, that could specify some insights and to analyse questions that integrated multiple answers possible) has additionally been coded by hand using Nvivo[14] and the search term function.
- The findings of the coded information have been also analysed and visualised in Tableau.
- Additionally, a cluster analysis using Nvivo using the Pearson correlation including chosen nodes based on coding similarity has been conducted to find the most prevalent innovation ecosystem types among the innovation ecosystems analysed. The findings have been interpreted to find the four archetypes as presented above. The findings are visualised in Figure 19 below.

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[13] See https://www.tableau.com/.
[14] See https://www.qsrinternational.com/nvivo/.

Nodes clustered by coding similarity

- Technology Park involvement
- Technology, ICT, Digital
- Trade organisation involvement
- University involvement
- Venture Capital involvement
- Water
- XL City
- XXL City
- 100-500 actors
- 500-1,000 actors
- 50-100 actors
- Aerospace
- Agriculture
- Automotive
- Bank involvement
- Biotechnology
- Business Angel involvement
- Cluster organisation involvement
- College involvement
- Company involvement
- Construction
- Creative an Cutural Industries
- Ecosystem in need of change
- Education
- Emerging Ecosystem
- Energy Sector
- Established ecosystem
- Food sector
- Formal and informal network involvement
- Freelancer involvement
- Furniture
- Global City
- Growing ecosystem
- Healthcare
- IoT
- L City
- Lab involvement
- Large Enterprise involvement
- Less than 50 actors
- Logistics
- M City
- Manufacturing
- Maritime
- Media involvement
- Mobility
- More than 1,000 actors
- Municipality involvement
- NGO involvement
- Other research organisation involvement
- Plastics
- Public Agency involvement
- Regional Authority involvement
- S City
- Security
- SME involvement
- Tech Transfer Office involvement

Figure 19 – the cluster analysis of coding similarity among nodes coded in the innovation ecosystems.

ANNEX 4 - ABOUT THE AUTHOR

Marlen Komorowski, Researcher SMIT

Marlen Komorowski is currently doctoral candidate in communication studies at Vrije Universiteit Brussels (VUB) and works at imec – SMIT. She holds two Bachelor degrees (Bachelor of Honours in International Management, Bachelor of Science in Economics and Law) and completed her Master's degree in International Communication Studies at VUB in 2013 summa cum laude. Her expertise lies in quantitative and qualitative research methods while focussing on regional economics, clustering, business models for innovation, ecosystem research and policy analysis. Since 2013, she has been focussing on developing her expertise in industry cluster and ecosystem research. She published relevant articles in that context in renowned international, scientific journals:

- Komorowski, M. (2017). A novel typology of media clusters. *European Planning Studies*, 25(8), 1-22.
- Komorowski, M. (2016). The seven parameters of media clusters: An integrated approach for local cluster analysis. *International Journal of Media & Cultural Politics*, *12*(2), 171-191.

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SMIT (Studies on Media, Innovation and Technology) is a research group of the VUB (Vrije Universiteit Brussel) and is part of imec. SMIT specializes in three domains that are essential for innovation, including living labs (involvement of people in innovation), privacy, ethics and literacy (integration of public values into the design of innovation) and market and policy research. Within its market and policy research unit, SMIT has more than 25 years of experience in research on positioning, strategy and planning and measuring of impact of business and policy interventions. The services SMIT offers in market and policy research include: Policy scan and technology strategy: How can you optimize your innovation roadmap in light of the current policy and market context? (Go-to) market assessment: What value will your innovation deliver to stakeholders and how can this be enhanced? Participatory policy design: How can you involve stakeholders in policy development?

- Please find more information via http://smit.vub.ac.be/.