



The Munich Entrepreneurial Ecosystem in the Health Sector: Current State and Improvement Areas

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Abstract

The study explores entrepreneurial ecosystems, which emphasize the impact of regional context on entrepreneurship, with a particular focus on the health sector. Given its innovation and knowledge intensity, coupled with industry-specific challenges, the health sector serves as an ideal case for ecosystem analysis. This research aims to qualitatively assess Munich's health sector entrepreneurial ecosystem and to identify actionable recommendations for enhancement. To this end, 15 interviews with entrepreneurs, venture capitalists, angel investors and support organization members are analyzed through computer-assisted qualitative content analysis. Results reveal strengths in demand, talent, knowledge, and intermediaries, while physical infrastructure, ecosystem leadership, and formal institutions score lower. The study provides concrete improvement ideas in the areas of financial support, incubators and networks, entrepreneurial education, availability of information and industry collaboration. These insights can be used to strengthen and expand Munich's entrepreneurial ecosystem, contributing to economic, societal, and technological advancements.

Keywords: biotechnology; digital health; entrepreneurial ecosystems; entrepreneurship; life science

1. Introduction

In recent years, entrepreneurship research has shifted from focusing specifically on the individual entrepreneur to also considering the wider context of entrepreneurship - the entrepreneurial ecosystem.^{1,2} This approach centers around the influence the specific regional context exerts on the entrepreneurial process, providing a systems perspective on entrepreneurship.³ More specifically, entrepreneurial ecosystems can be defined as “a set of interdependent actors and factors coordinated in such a way that they enable productive entrepreneurship within a particular territory”.⁴

Efficient entrepreneurial ecosystems should be of major importance to policymakers, scholars, and practitioners, as an efficient ecosystem facilitates higher entrepreneurial activity, which in turn results in economic growth and job creation.⁵ The impact of entrepreneurial ecosystems can be summarized in three categories: economic, technological, and societal. Economic impacts relate to the increase in regional wealth, prosperity, and reputation. The technological impact refers to the regional technological innovation that is achieved by the actors of the ecosystems, including new ventures, universities, and research institutions. Societal impact can be described as non-monetary outcomes that are beneficial for society, such as the creation of new products and services.⁶

One industry which has been highly relevant in the past decades is biotechnology and the greater health sector. The National Venture Capital Organization (NVCA) even consid-

I would like to thank my supervisor Dr. Svenja Jarchow for her invaluable guidance, support and insightful feedback throughout the entire process of completing this master thesis. A special acknowledgement also goes to the interview partners who generously contributed their time and expertise to this project.

¹ See Stam (2015, pp. 1759-1763).

² See Spigel and Harrison (2018, p. 151).

³ See Stam and van de Ven (2021, p. 809).

⁴ Stam and Spigel (2018, p. 407).

⁵ See Stam and van de Ven (2021, p. 810).

⁶ See Audretsch et al. (2019, pp. 317-319).

ered biotech to be the second most important industry both in terms of investments as well as quantity of deals, the information technology (IT) sector being number one.⁷ The amount of global biotech venture funding has risen significantly during the past decade and reached \$23 billion in 2020, as shown in Figure 1.⁸ The digital health industry also displays rapid growth, with a projected compound annual growth rate (CAGR) of nearly 27% until 2030.⁹ Since the health sector is highly innovative and knowledge is frequently renewed, networks are becoming increasingly important to distribute new knowledge and best practices.¹⁰ This dependence on networks among companies and entrepreneurs in the health sector makes it an interesting industry to study entrepreneurial ecosystems.

Germany has a highly innovative pharmaceutical, biotech, medical technology, and IT sector. Being home to over 400 companies in medtech and over 270 companies active in digital health, the sectors generated € 11.4 billion and € 400 million in revenue in 2018, respectively.^{12,13} The state of Bavaria employs the second highest number of biotech professionals, second only to North Rhine-Westphalia. Munich alone has two biotechnology clusters, the BioM Munich Biotech Cluster and Cluster Biotechnology.¹⁴ Additionally, there are five Digital Health Hubs and Accelerators, including the German Accelerator Life Science/IT and the Digital Health Accelerator.¹⁵ Since the foundation of the BioM in 1997, Munich has developed into a major biotech and health technology center. With two leading universities, the Technical University of Munich (TUM) and the Ludwig Maximilian University of Munich (LMU), and several research institutes such as Max-Planck-Institute for Biochemistry, the city also possesses the necessary institutions to provide talent and knowledge.¹⁶

Entrepreneurial ecosystem research has thus far remained mostly industry agnostic. It is often argued that the benefits of an ecosystem are mostly related to entrepreneurship-specific knowledge, rather than industry-specific knowledge and is therefore relevant to a broad range of industries.¹⁷ However, in the health industry, start-ups face significant barriers to success due to the nature of the industry, namely very long development processes, a strict regulatory environment and complex technologies.¹⁸ Therefore, entrepreneurs in the health sector, including biotech, medtech and digital health, can significantly benefit from both entrepreneurial and industry-specific knowledge in an

ecosystem. Since the metropolitan area of a city is generally viewed to be the most appropriate level of analysis for entrepreneurial ecosystems, the health industry in Munich was chosen as research focus.¹⁹

The objective of this study is to qualitatively assess the entrepreneurial ecosystem in the health sector in Munich. The central research question is “How can the Munich entrepreneurial ecosystem in the health sector become more efficient?”. For this purpose, 15 experts were interviewed, who work within the entrepreneurial process, either as venture capitalists or business angels, support organizations or as entrepreneurs themselves. Based on this analysis, the aim is to develop an understanding of the quality of the different elements of the Munich ecosystem and discover actionable improvements and recommendations to advance the ecosystem.

In the first chapter, I briefly review the literature on the main concepts of entrepreneurial ecosystems, which underpin this study. In the second chapter, the main characteristics of the health industry are explained in more detail. To put the opinions of key stakeholders into perspective, it is vital to understand the distinguishing features of this industry. I then outline the methodological approach used to conduct and analyze the interviews, before describing the results. Next, I discuss the implications of the results, the limitations of this study and key recommendations for ecosystem improvements. The final chapter concludes and presents avenues for future research.

2. Main concepts of entrepreneurial ecosystems

In the following, I introduce the main concepts of entrepreneurial ecosystems, including the elements of an ecosystem and the most frequently used framework, governance approaches, the life cycle theory of ecosystems and critique of the concept.

2.1. Elements of entrepreneurial ecosystems

Entrepreneurial ecosystems combine all elements necessary to facilitate entrepreneurship in a particular region. There have been several proposed frameworks to conceptualize the aspects of entrepreneurial ecosystems. An early approach by Spigel (2017) summarized entrepreneurial ecosystems in three types of attributes: cultural, social, and material. This approach is depicted in Figure 2. According to this concept, cultural attributes refer to a supportive culture and histories of entrepreneurship. Building on this, social attributes such as networks, talent, mentorship, and investment capital facilitate the resources and means to create new ventures. Finally, material attributes encompass policies, universities, infrastructure, open markets, and support services. These attributes should not be seen as distinct layers, but overlapping factors, which support and reinforce one another.²⁰

¹⁹ See Leendertse et al. (2021, p. 478).

²⁰ See Spigel (2017, pp. 50-57).

²¹ Modified, taken from Spigel (2017, p. 57).

⁷ See NVCA (2021, pp. 28-29).

⁸ See Senior (2021, p. 408).

⁹ See Grand View Research (2022, pp. 1-2).

¹⁰ See Lechner and Dowling (1999, p. 320).

¹¹ Taken from Senior (2021, p. 408).

¹² See Germany Trade & Invest (2018a, pp. 2-9).

¹³ See Germany Trade & Invest (2018b, pp. 2-9).

¹⁴ See Germany Trade & Invest (2018b, pp. 2-9).

¹⁵ See Germany Trade & Invest (2018a, pp. 2-9).

¹⁶ See Lechner and Dowling (1999, p. 321).

¹⁷ See Spigel and Harrison (2018, p. 162).

¹⁸ See Baeyens et al. (2006, p. 31).

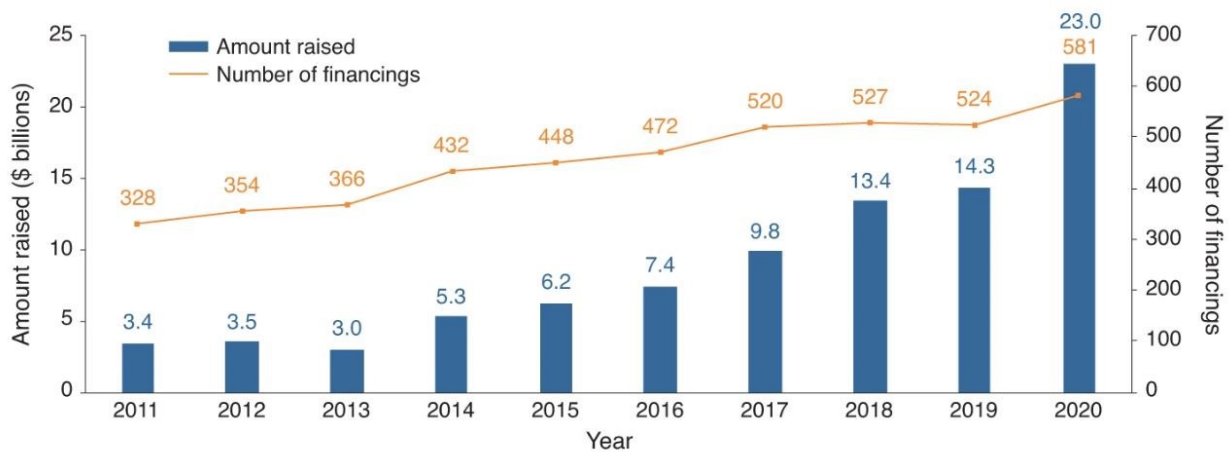


Figure 1: Global venture capital investments in the biotech sector 2011-2020¹¹

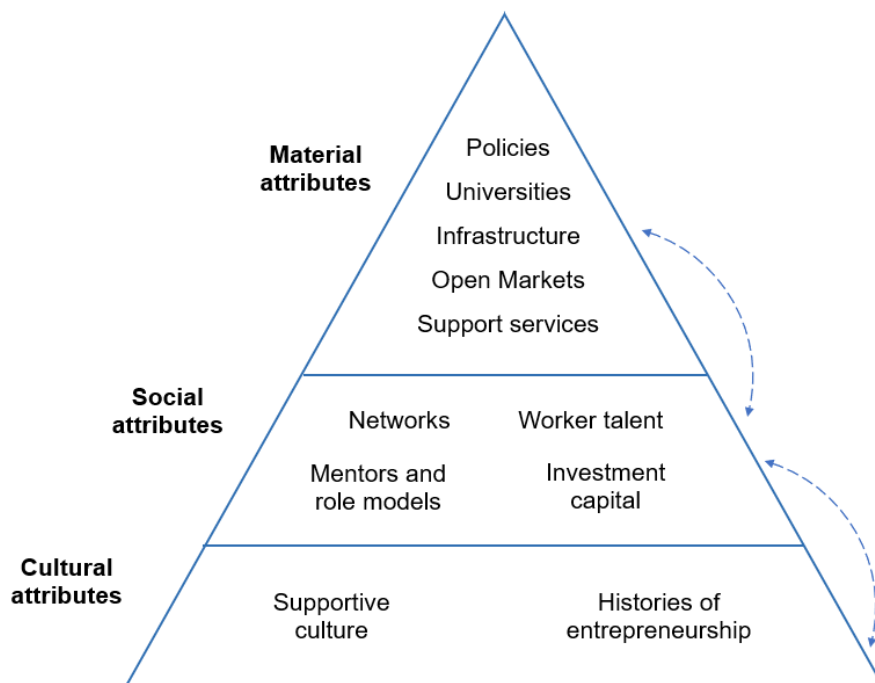


Figure 2: Relationships between the attributes of entrepreneurial ecosystems²¹

This framework was later modified and expanded by Stam and van de Ven (2021), who summarized entrepreneurial ecosystems in an integrative model including ten elements, which is depicted in Figure 3.

In this framework, the ten elements which together form the ecosystem can be divided in two distinct layers: institutional arrangements and resource endowments. Institutional arrangements are regarded to be the formal institutions, culture, and networks, which underpin the ecosystem. Formal institutions, such as the regulatory framework, represent

the fundamental precondition for entrepreneurship. Formal institutions therefore guide and regulate economic action, the acquisition and use of resources and the entrepreneurship process. This element also includes educational institutions, the healthcare system, and law enforcement. The culture element encapsulates the attitude towards and perception of entrepreneurship in society. A supportive entrepreneurial culture can be described as one which highly values entrepreneurship and normalizes the risks and challenges associated with the entrepreneurship process. This not only encourages entrepreneurs to create new ventures, but also increases the willingness of skilled individuals to

²² Modified, taken from Stam and van de Ven (2021, p. 813).

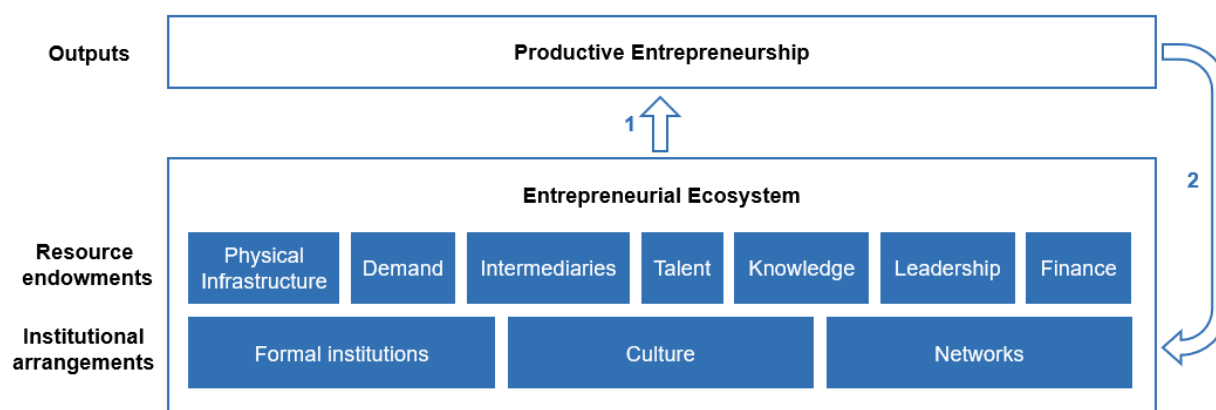


Figure 3: An integrative model of the elements and outputs of entrepreneurial ecosystems²²

work for a young start-up. As a final element in the institutional arrangements layer, entrepreneurial networks facilitate collaboration between the different stakeholders and the distribution of knowledge, talent, and capital within the ecosystem.^{23,24}

Taking a closer look at the second level, the resource endowments refer to physical infrastructure, demand, intermediaries, talent, knowledge, leadership, and finance. The element of physical infrastructure describes the accessibility of the region in terms of transportation, but also the availability of physical space, including office space and laboratories, and the digital infrastructure. Demand refers to the general purchasing power and market size for the novel products and services, which are developed by the entrepreneurs.²⁵ Intermediaries or support services can help young ventures with specific challenges and thereby lower the entry barriers for entrepreneurs, increasing the speed of innovation. Examples of intermediaries include incubators, accelerators, or other support services such as legal advice or consultancies. The element of talent refers to the availability of skilled individuals, both in terms of education and previous experience in the entrepreneurial space or in the industry. Knowledge from private and public organizations and the investment in the development of new knowledge is crucial for the process of innovation and therefore a further vital element in the framework. Leadership provides guidance in the ecosystem by the presence of interest groups and experienced leaders, who can mentor younger entrepreneurs. The final element in the resource endowments layer is finance. The accessibility and supply of finance for long-term and uncertain entrepreneurial projects is a vital resource for successful entrepreneurship.^{26,27}

In combination, these ten elements facilitate productive entrepreneurship and the value it creates as output, which is

portrayed by arrow one in the ecosystem framework. A proxy that is often used to measure productive entrepreneurship is the prevalence of high growth firms in an area. Stam and van de Ven (2021) found a very strong positive correlation between the strength of the ten elements and the quantity of high growth firms in a particular region and thus concluded that the overall quality of the entrepreneurial ecosystem is positively related to entrepreneurial output. Furthermore, their results showed that the ten elements are highly interdependent and co-evolve within a region. Therefore, the elements should be viewed as a whole system to explain the levels of entrepreneurial activity in a specific region.²⁸

Finally, entrepreneurial output feeds back into the ecosystem, which is represented by arrow two in the framework. The research group identified a positive correlation between the prevalence of high-growth firms and subsequent values of the individual elements of the ecosystem. This positive feedback can be explained by two main reasons. First, successful entrepreneurs often share their experience with the ecosystem by becoming e.g., venture capitalists, mentors, or network developers.²⁹ Second, the existence of entrepreneurial activity encourages the creation of new ventures by signaling that entrepreneurship is a legitimate and potentially a successful pathway.³⁰

This framework relies on the assumption that all elements are of equal importance in entrepreneurial ecosystems. Several researchers argue that this is a rather agnostic approach as it can be reasoned that certain elements are more important than others in shaping an ecosystem.³¹ Corrente et al. (2019) investigated the weighting of elements and proposed that some factors are more critical for the success of entrepreneurial ecosystems than others. The research team did not use the same ten elements shown above, however, their analysis suggested that “Culture and Social Norms” is the

²³ See Spigel and Harrison (2018, p. 155).

²⁴ See Stam and van de Ven (2021, pp. 813-815).

²⁵ See Leendertse et al. (2021, p. 482).

²⁶ See Stam and Spigel (2018, p. 415).

²⁷ See Stam and van de Ven (2021, pp. 813-817).

²⁸ See Stam and van de Ven (2021, pp. 827-828).

²⁹ See Stam and van de Ven (2021, p. 827).

³⁰ See Kuckertz (2019, p. 477).

³¹ See Leendertse et al. (2021, p. 483).

most important factor, followed by “Government Programs” and “Internal Market Dynamics”.³²

2.2. Governance of entrepreneurial ecosystems

The governance of entrepreneurial ecosystem is often described as a challenging topic because ecosystems are highly complex structures. In addition, the interdependency between the various elements of an ecosystem makes it difficult for public initiatives to target specific areas for improvement in a particular ecosystem. In addition, governance initiatives to promote entrepreneurship have been found to frequently fail, because strategies that have been successful in other regions are simply replicated in seemingly similar locations.³³

To guide the governance of entrepreneurial ecosystems, researchers have identified several characteristics, which must be considered when devising initiatives to encourage entrepreneurial output: entrepreneurial ecosystems are self-regulating, highly complex and location specific. Firstly, ecosystems are dynamic, self-regulating networks and behave in an unpredictable manner. Governing ecosystems, i.e., changing the self-regulating mechanisms, is therefore extremely challenging, as the outcomes of interventions are difficult to foresee.^{34,35} Secondly, ecosystems consist of various factors and stakeholders, interacting in a complex manner. Entrepreneurs are frequently considered to be the main drivers of the ecosystem; they are however only one factor among many. As previously described, all elements are highly interdependent and co-evolve, therefore if one element is weak, it forms a bottleneck, and the development of the entire ecosystem can start to stagnate. Only if these weaknesses can be overcome, the ecosystem can function effectively and promote entrepreneurial activity.³⁶ Finally, ecosystems are highly location specific and shaped around the local circumstances, such as networks, culture, or geographic location. An approach, which works for one particular ecosystem therefore cannot simply be copied and applied to another location.³⁷

Building on these ecosystem characteristics, governance principles suggested by current entrepreneurial ecosystem literature can be summarized into three main concepts. First, governance initiatives should support self-regulation of the ecosystem in a bottom-up approach rather than governing the ecosystem in a top-down approach. This is grounded in the fact that entrepreneurial ecosystems develop mostly through the complex and uncoordinated interactions of the individual actors.³⁸ Within this stakeholder network, entrepreneurs should act as the central leaders of the ecosystem, as they are best equipped to recognize its possibilities

and limitations. In addition, radical interventions in entrepreneurial ecosystems can have unforeseen consequences, due to their dynamic nature. Therefore, any governance initiative must acknowledge and cultivate the inherent evolutionary potential and support the self-regulation of the ecosystem in a minimally invasive way. As ecosystems behave and react in an unforeseeable manner, it is also recommended to act incrementally to avoid over-steering the ecosystem.³⁹ Stam (2015) summarizes the role of ecosystem governance “as a feeder of the ecosystem rather than as a leader”.⁴⁰

Secondly, creating impactful and effective policies for entrepreneurial ecosystems requires a holistic approach that considers its complexity. As outlined in the entrepreneurial ecosystems framework, these systems consist of different elements, which are all connected and interdependent. Focusing on all stakeholders and their connections therefore reduces silo thinking and improves the overall quality of the ecosystem.⁴¹ Lastly, it is important to preferentially focus on weaknesses of the entrepreneurial ecosystem, rather than trying to further improve the strengths. As mentioned, ecosystems are characterized by bottlenecks, which must be overcome for the system to be efficient at promoting entrepreneurship. The holistic perspective implies that all factors are important in creating an environment conducive to entrepreneurial activities. Therefore, when allocating resources to an ecosystem, its weakest elements should be targeted first to alleviate any bottleneck situations.^{42,43}

Emphasizing these concepts, Isenberg (2010) published nine principles, which should be followed when governing an entrepreneurial ecosystem. In the first five principles, he focuses on the role of local characteristics and the bottom-up process of governance: 1. Stop emulating Silicon Valley, 2. Shape the ecosystem around local conditions, 3. Engage the private sector from the start, 4. Stress the roots of new ventures and 5. Do not over-engineer clusters; help them grow organically. According to these principles, it is crucial to focus on and support already existing local structures, industries, and trends in contrast to creating entirely novel ones. In addition, the author stresses the importance of the long-term and profit-driven motivation and perspective of the private sector in developing self-sustaining ecosystems. In the following three principles, he focuses on creating a culture, which supports ambitious entrepreneurship: 6. Favor the high potentials, 7. Get a big win on the board and 8. Tackle cultural change head-on. Isenberg suggests favoring the most ambitious and growth-oriented ventures to not only maximize the creation of wealth, but also inspire potential future entrepreneurs and reduce the perception of entrepreneurial risks and barriers. With the last principle, he stresses the importance of institutions: 9. Reform legal, bureaucratic, and

³² See Corrente et al. (2019, p. 513).

³³ See Colombelli et al. (2019, p. 505).

³⁴ See Kuckertz (2019, p. 478).

³⁵ See Colombo et al. (2019, pp. 427-428).

³⁶ See Audretsch et al. (2016, pp. 373-375).

³⁷ See Audretsch et al. (2016, p. 360).

³⁸ See Roundy et al. (2018, pp. 8-10).

³⁹ See Kuckertz (2019, pp. 479-480).

⁴⁰ Stam (2015, p. 1761).

⁴¹ See Kuckertz (2019, p. 479).

⁴² See Audretsch et al. (2016, p. 373).

⁴³ See Kuckertz (2019, p. 479).

regulatory frameworks.⁴⁴

Ultimately, ecosystem policy and initiatives can promote entrepreneurial activity, but only under the premise that the basic conditions in the structure of the ecosystem are met. By providing resources to ecosystems, they can be strengthened, but without efficient networks between entrepreneurs, these resources were shown to have only a limited effect.⁴⁵

2.3. Life cycle of entrepreneurial ecosystems

As entrepreneurial ecosystems emerge and develop, they change significantly and typically enter various phases. The lifecycle of ecosystems can be summarized in five stages: the emergence of an ecosystem, the growth phase, the stabilization or maturity phase, the decline phase and finally, a re-emergence phase. The birth phase of an ecosystem starts with an idea leading to new venture creation. This early entrepreneurship can either result from an employee or academic exploiting knowledge overlooked by the incumbent firm or by spin offs when incumbent firms or universities encourage individuals to seize opportunities by creating a new company. This first phase is characterized by a low number of company birth rates in the area and the formation of entrepreneurial networks between them. The subsequent growth phase is characterized by the increased pace of new entrants. In addition, intermediaries start to offer entrepreneurship specific programs and financial capital becomes more easily available. While talent becomes more entrepreneurially minded, this is also the most important bottleneck and source to grow. The end of the second phase is marked by the tendency of incumbent firms to re-integrate startups.^{46,47}

In the stabilization phase firm birth rates are declining, and an increasing number of firms are acquired by incumbents. Other ventures might mature and become more structured and less dynamic. In addition, market opportunities, networks and the entrepreneurial culture starts to weaken. In this phase, effective leadership in the ecosystem is crucial to sustain its development. The decline phase is characterized by a low rate of new venture creation. New ideas and technologies are mainly explored within established firms. However, this is not necessarily accompanied by a decline in overall wealth or competitiveness of the region. The ecosystem leadership potentially reorients itself towards other economic development initiatives. Finally, the region might enter a re-emergence phase, in which the life cycle starts again in an accelerated way. Since the intermediaries, entrepreneurial culture and networks are already in place, entrepreneurs can more easily start new companies and commercialize new ideas.⁴⁸

With each lifecycle stage of an entrepreneurial ecosystem, its ideal governance design also changes. In the birth stage,

the first entrepreneurial ventures often act as catalysts for the creation of an ecosystem. These central actors often initially govern the processes and collaboration in the new ecosystem. Private institutions and support networks rotate around the central actors, providing crucial resources for the sustenance of the ecosystem. Therefore, early ecosystem governance can often be described as rather hierarchical. Once the ecosystem grows and expands, governance typically shifts to a more horizontal governance design, where multiple stakeholders interact and collaborate without the direction of a central player. As entrepreneurial networks become increasingly dense and more actors take central positions within the ecosystem, governance is based on implicit understandings, unofficial routines, and shared norms. Finally, the governance consists of a well-connected network of actors, which together shape and develop the ecosystem.⁴⁹

2.4. Critique of the entrepreneurial ecosystems concept

Despite its recent popularity, the concept of entrepreneurial ecosystems was critiqued for three main reasons: being tautological, showing no clear cause and effect and a questionable level of analysis. First, the concept was claimed to be rather tautological: entrepreneurial ecosystems support the creation of new ventures and wherever there are a high number of successful ventures, there is evidently a good entrepreneurial ecosystem. This relationship links back to the positive feedback successful entrepreneurs have on the local ecosystem. It has been argued that such tautological reasoning ultimately provides little insights to inform public policy or further research.⁵⁰ Second, the concepts of entrepreneurial ecosystems so far merely provide long lists of relevant elements without a clear explanation of cause and effect. There is still no universal consensus about the definition of the ecosystem itself and the coherence and causal interdependent effects of the individual framework elements. While the elements do provide some focus, a more consistent explanation of the framework would provide clearer guidelines for further research and ecosystem governance. To improve this ecosystem explanation, it is necessary to differentiate between the essential and contingent elements of an ecosystem and more clearly define the ideal role of the regulatory institutions and other public organizations.⁵¹ Finally, it is still unclear which general scope and level of analysis is most appropriate with regards to entrepreneurial ecosystems. The boundaries of ecosystems can be defined geographically, focusing on either a country, a region, or a city. Ecosystems could also be defined based on industries or corporations, which offer opportunities for venture creation and growth.⁵²

⁴⁹ See Colombelli et al. (2019, pp. 508-511).

⁵⁰ See Stam and Spigel (2018, p. 415).

⁵¹ See Alvedalen and Boschma (2017, pp. 893-895).

⁵² See Stam and Spigel (2018, pp. 415-416).

⁴⁴ See Isenberg (2010, pp. 42-49).

⁴⁵ See Spigel and Harrison (2018, p. 162).

⁴⁶ See Cantner et al. (2021, pp. 413-417).

⁴⁷ See Mack and Mayer (2016, p. 2123).

⁴⁸ See Cantner et al. (2021, p. 417).

3. Challenges in the health sector

The health industry comprises firms in multiple sectors, such as pharma, (digital) healthcare, biotechnology, medical devices, and diagnostics. Ventures in the health sector often face significant barriers to success by the nature of the industry, namely the long development processes, regulatory difficulties, and highly complex technologies.

3.1. Technological complexity

First, the technologies and product development processes in the health industry tend to be highly complex. For the pharma, biotechnology, and medtech sectors, understanding them in detail often requires deep scientific knowledge of molecular biology and engineering techniques and processes.⁵³

The digital health sector is a further field in the health space, which is home to an increasing number of start-ups including digital therapeutics, health information technology, telehealth and telemedicine, smart devices, and personalized medicine. Digital therapeutics products, for instance, deliver therapeutic interventions to patients via software solutions to prevent, manage or treat a medical disorder or disease. These digital healthcare products frequently integrate advanced technologies, such as machine learning or artificial intelligence, to optimize the treatment of patients and their subsequent health outcomes.⁵⁴

Therefore, investors might have difficulties understanding the technology and the industry environment when evaluating ventures in this industry. Generalist venture capital (VC) firms frequently outsource the due diligence of ventures in the health industry since they lack the capabilities to adequately assess the business model internally. Even specialist investors often miss the expertise in the specific field, which makes it difficult to analyze the investment opportunity and, consequently, challenging for entrepreneurs to secure funding.⁵⁵

3.2. Regulatory complexity

Second, entrepreneurial ventures in the health space need to comply with numerous rules and regulations across all functions of their company, as they are operating in a highly regulated industry. This includes assessments of product quality, clinical and research design, patient safety, but also navigating ethical issues around their products, financial compliance, and training of employees.⁵⁶

Companies in the biotechnology and pharmaceutical area must navigate the regulations for market authorization of drugs in accordance with the International Code of Harmonization. After successfully completing the necessary clinical tests and trials, they must then file an application with the European Medicines Agency or the relevant German agency to receive the approval to license their product.⁵⁷ For medical

devices, the introduction of the Medical Device Regulation in 2021 imposed strict requirements for post market surveillance of the launched products, next to rigorous controls and high expectations regarding the clinical data collected.⁵⁸ For digital health applications (Digitale Gesundheitsanwendung, DiGA) for the detection, monitoring, treatment or alleviation of medical conditions, Germany introduced a new approval process in 2019. To be approved, the DiGA developer must prove a positive healthcare effect by conducting a scientific comparative study.⁵⁹

Within the entire health industry, the increasingly complex regulatory environment represents a serious challenge for young start-ups, especially in an industry where non-compliance likely has significant effects on costs, reputation, and ultimately, patient's lives.

3.3. Long development process

The health industry is characterized by a long development process until a technology is converted into a market ready product. In the pharmaceutical and biotechnology sectors, the entire process from the early discovery phase to market entry takes 15 years, on average. Given the long time to market, these companies require a very high upfront investment to cover all costs connected to the development process. Furthermore, the long development process increases the chances that superior technologies emerge on the market while the product is still under development. These factors make the industry extremely risky.⁶⁰ For medical devices, the process from concept to market takes an average of 3-7 years, where higher risk products are subject to more stringent regulatory processes compared to lower risk products.⁶¹ The development process of digital health products and applications is more variable, although these products must also be validated by clinical studies and subsequently approved. Therefore, the time to market is still significantly higher compared to other industries.⁶²

4. Methodology

In the following section, the research methodology is outlined. This includes the selection of the method, selection of interviewees and the setting of the interviews. For the subsequent analysis, the method for transcribing and analyzing the interviews is explained. Finally, I briefly discuss the employed quality criteria.

4.1. Expert Interviews

4.1.1. Selection of the method

To study the entrepreneurial ecosystem in Munich, semi-structured expert interviews were chosen as the empirical

⁵³ See Baeyens et al. (2006, pp. 31-35).

⁵⁴ See Dang et al. (2020, pp. 2209-2211).

⁵⁵ See Baeyens et al. (2006, pp. 32-35).

⁵⁶ See Deloitte Centre for Health Solutions (2015, pp. 3-8).

⁵⁷ See Price Water House Coopers (2009, pp. 17-18).

⁵⁸ See Maresova et al. (2015, pp. 1508-1510).

⁵⁹ See BfArM (2020, pp. 7-8).

⁶⁰ See Baeyens et al. (2006, pp. 31-33).

⁶¹ See van Norman (2016, p. 278).

⁶² See Dang et al. (2020, pp. 2210-2211).

method. Interviews are one of the most frequently used methods in the field of qualitative research, as they allow for subject-relatedness of the research as well as a detailed description and interpretation of the respective research area.⁶³ The flexibility of qualitative methods such as interviews makes them particularly suitable to analyze complex phenomena such as the multi-level interactions and dynamics of ecosystems.

Qualitative interviews can be distinguished according to the degree of structure. For this study, a semi-structured approach was chosen, where the first part of the interview was guided by the entrepreneurial ecosystem framework. The second part of the interview was less structured and only guided by a small selection of key questions. In contrast to an unstructured interview, better comparability between the interviewees can be achieved and it is ensured that all relevant aspects of the research question are addressed.⁶⁴

Expert interviews are systematic and theory guided interviews with individuals who have exclusive knowledge about a particular topic.⁶⁵ Therefore, interviews were conducted with individuals who possess exclusive knowledge about the entrepreneurial ecosystem in the health area in Munich.

4.1.2. Selection of the interview partners

For the type and quality of information obtained through expert interviews, the selection of interview partners is a decisive influencing factor. Expert knowledge is traditionally tied to a function or professional role. Thus, experts are defined by their position and status as well as the knowledge which is attributed to them.⁶⁶

To capture different perspectives in the ecosystem, entrepreneurs, investors, and support organizations were interviewed, in a similar distribution to Spigel (2017), who interviewed 70% entrepreneurs, 15% investors and 15% others, such as economic development officials.⁶⁷ Of the 15 interviews conducted for this study, 9 were with entrepreneurs (60%), 4 with venture capitalists or angel investors (27%) and 2 with support organizations of the ecosystem (13%).

Comparability between the interviews was achieved by selecting experts in similar positions in the different organizations. Interviewees in the entrepreneur category had all (co-)founded at least one Munich-based company in the industry in the last 10 years. The investors actively invest in biotech, (digital) health or medtech start-ups in Munich. For the support organizations category, the managing directors of two biotech support organizations in Munich were interviewed.

4.1.3. Setting and course of the interviews

The expert interviews were conducted in April and May 2022. The interviews were held via the web conferencing

tool Zoom. The main part of the interview, excluding the introduction and concluding comments, was audio recorded by the Zoom recording function. Each interview started with a brief introduction, followed by a short explanation of the entrepreneurial ecosystem theory and the framework. Finally, the use of the data was briefly explained, and the interviewees were asked whether the interview could be recorded.

Usually, a guideline is used for semi-structured interview methods. This serves as a structuring and steering tool and represents a link between already existing theory and empiricism.⁶⁸ The interview guideline contained the entrepreneurial ecosystem framework and its ten elements. The interviewee was asked to rate the elements on a scale from 1-10 (10 being the highest score) and elaborate on the rating. This was asked to get a tentative understanding for the ecosystem as a whole and be able to better compare the quality of the different elements. In addition, the guideline contained open-ended questions to which the interviewee could respond freely at their own discretion. The order of the questions was flexible and merely served as a guideline during the interviews. At the end of the interview, there was time for a short debriefing and any questions from the interviewee. In total, the interview duration ranged between 25 and 45 minutes.

4.2. Qualitative analysis

4.2.1. Transcription

The analysis of the interviews was started by transcribing every recording. In the first step, the transcription software Happy Scribe was used. The software automatically generated a transcript from the recording, which is generally 80% accurate. To increase the accuracy of the software, approximately 30 words which were used frequently in the interviews were added to its vocabulary manually, such as "entrepreneurship", "pharma" or "venture capital".

In the second step, the generated transcripts were edited manually to further increase the accuracy, insert any segments which were not recognized by the software, and smoothen the text. For this purpose, duplicate words, half sentences, and filler words were deleted. Interview pauses, voice inflections and other non-verbal elements were not taken into account. Finally, the transcripts were exported with timestamps and speaker names.

4.2.2. Qualitative content analysis

The analysis of the interview content was completed using the computer-assisted qualitative data analysis software Maxqda. To analyze the content of the interviews, the methodological approach by Kuckartz was followed. Kuckartz describes three main methods of qualitative content analysis. For this study, the content-structuring analysis was chosen, which can be considered the core method of qualitative content analysis and is displayed in Figure 4. In

⁶³ See Mayring (2016, pp. 20-25).

⁶⁴ See King et al. (2019, pp. 52-60).

⁶⁵ See Kaiser (2014, p. 6).

⁶⁶ See Kaiser (2014, pp. 37-38).

⁶⁷ See Spigel (2017, p. 59).

⁶⁸ See Misoeh (2015, pp. 65-68).

Table 1: Overview of interview partners

Interviewee	Category	Job Title	Area
E1	Support Organization	Managing Director	Biotech
E2	Investor	VC Partner	Biotech
E3	Entrepreneur	Co-founder	Digital Health
E4	Investor	VC Partner	Biotech
E5	Entrepreneur	Founder and CEO	Biotech
E6	Investor	VC Principal	Biotech
E7	Support Organization	Managing Director	Biotech
E8	Entrepreneur	Co-founder and CEO	Digital Health
E9	Entrepreneur	Co-founder and CTO	Digital Health
E10	Entrepreneur	Founder and CEO	Digital Health
E11	Entrepreneur	Founder and CEO	Medtech
E12	Entrepreneur	Co-founder and CEO	Digital Health
E13	Entrepreneur	Founder and CEO	Biotech
E14	Investor	Managing Director and Angel Investor	Healthcare, Biotech
E15	Entrepreneur	Co-founder and CEO	Medtech

this method, the material is typically coded in several phases with deductively and inductively formed categories.⁶⁹

First, the interview transcripts were imported into Maxqda and sorted into three groups based on the type of interviewee: entrepreneurs, investors, and support organizations. After reviewing the initial results, the transcripts were reorganized into the three groups biotech, medtech and digital health, as it became apparent that the categorization along industries displayed greater differences. The first step of the Kuckartz process is initial work with the text and the creation of memos. This step was abbreviated, as the interviews had already been reviewed during the transcriptions. Next, two main categories were defined as “ecosystem status quo” and “ecosystem improvements”. The ten elements of the entrepreneurial ecosystem framework were added as deductive codes to the status quo main category. In addition, a main category “other” was created, to capture any important text sequences which did not fit into any existing codes and to collect passages which indicate any limitations in the research method. The categories were then sequentially assigned to the text sections.

To develop inductive categories for the “ecosystem improvements” main category, all assigned text passages were compiled in one table. Following this, potential subcategories were collected in an unordered list before they were structured and summarized to form the final subcategories. Before the entire list of documents was coded, a trial run with 20% of the data was conducted to test the categories with regards to their applicability to the empirical material. Following this test, precise category definitions were added for every single code, consisting of a category description, the application of the category, and an anchor example showcasing a specific text passage of that category. Finally, the entire

set of interviews were coded applying the inductive codes as described in the category definition.

The content analysis of the interviews was conducted with a vertical orientation focusing on the different categories. To analyze each category, the applicable text passages were filtered using the retrieved segments tool or displayed in the summary grid of Maxqda. In addition, the subcode statistic was used to display the number of interviewees who mentioned a particular subcode to gauge the importance of the respective topic. The rating of the individual ecosystem elements on a scale from 1 to 10 was summarized in a box and whisker plot. If the interviewee gave a range of numbers, the mean of this range was used for subsequent calculations. The calculation of quartiles was performed exclusive the median. Due to the relatively small sample size of 15, the results of this analysis are not generalizable or representative of the entire ecosystem in Munich. Finally, with the help of qualitative and quantitative cross tables displaying relevant text passages separately for each group, the individual groups could be compared in a systematic manner.

4.2.3. Quality criteria

The quality of empirical research is assessed using specific quality criteria. The three quality criteria, which are most often employed in qualitative research are intersubjectivity, reliability and transparency. For intersubjectivity, the subjectively obtained results are made plausible to outsiders by adequately reflecting them. The researcher’s opinion must not be presented as the only correct one and offer different interpretations for readers. This criterion was achieved by clearly outlining the research rationale and reflecting the methodology and results in the discussion section. Reliability refers to the soundness of a measurement method. Since it was impossible to calculate an intercoder reliability, the retest reliability was determined. After the initial coding of the inductive subcategories, three interviews, which correspond to

⁶⁹ See Kuckartz (2020, pp. 129-132).

⁷⁰ Modified, taken from Kuckartz (2020, p. 133).

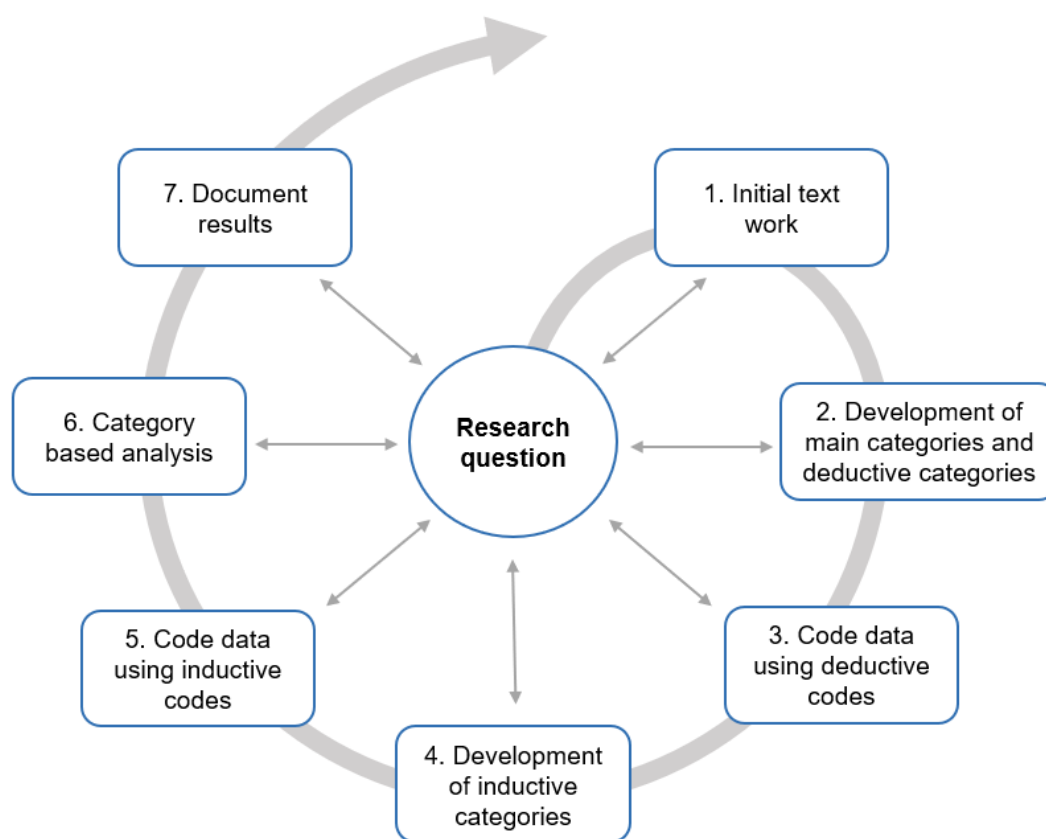


Figure 4: Process of the qualitative content analysis according to Kuckartz⁷⁰

20% of the data, were recoded under the same conditions and the results were compared. The coded sections corresponded almost completely to the previous version except for the length of 10 coded segments. The main parts of the statements, however, perfectly matched. Transparency was achieved by documenting all important steps and thus making them comprehensible to readers. This quality criterion overlaps with the quantitative quality criterion of validity. By precisely documenting the procedure, the relevance of the method becomes apparent.^{71,72}

5. Results

5.1. Ecosystem status quo

In the following section, the results relating to the current state of the Munich ecosystem are described along the ten elements of the ecosystem framework. The element scores by the interviewees are summarized in Figure 5. The elements can be categorized into three groups according to their mean score. Physical infrastructure, leadership and formal institutions were classified as low score elements, as they scored below six. Finance, culture, and networks received mean scores

between six and seven and were thus grouped together as intermediate score elements. Finally, talent, intermediaries, knowledge, and demand scored 7 or above and were thus classified as high score elements.

5.1.1. Low score elements

Starting with physical infrastructure, most experts reported that affordable laboratory and office spaces are difficult to find in Munich. Seven out of the eight biotech experts think that lab space is scarce and can represent a bottleneck for founders looking to start or grow their business. Newly built lab space in incubators is oftentimes too large and therefore expensive for young companies (E5). In addition, it is challenging to secure a space: for the Innovation and Start-Up Centre Biotechnology (Innovations- und Gründerzentrum Biotechnologie, IZB) in Munich, 60 start-ups are currently on the waiting list and the waiting period is estimated to be three years (E1). Larger incubators often also prefer later stage companies to avoid rental losses (E7). E1 describes the situation as follows:

“In my opinion, there is a huge gap here, which also prevents the teams from making progress. At the IZB in Martiensried alone, the waiting list currently has 60 start-ups that want to get in, and

⁷¹ See Flick (2019, pp. 474-483).

⁷² See Kuckartz (2020, pp. 234-237).

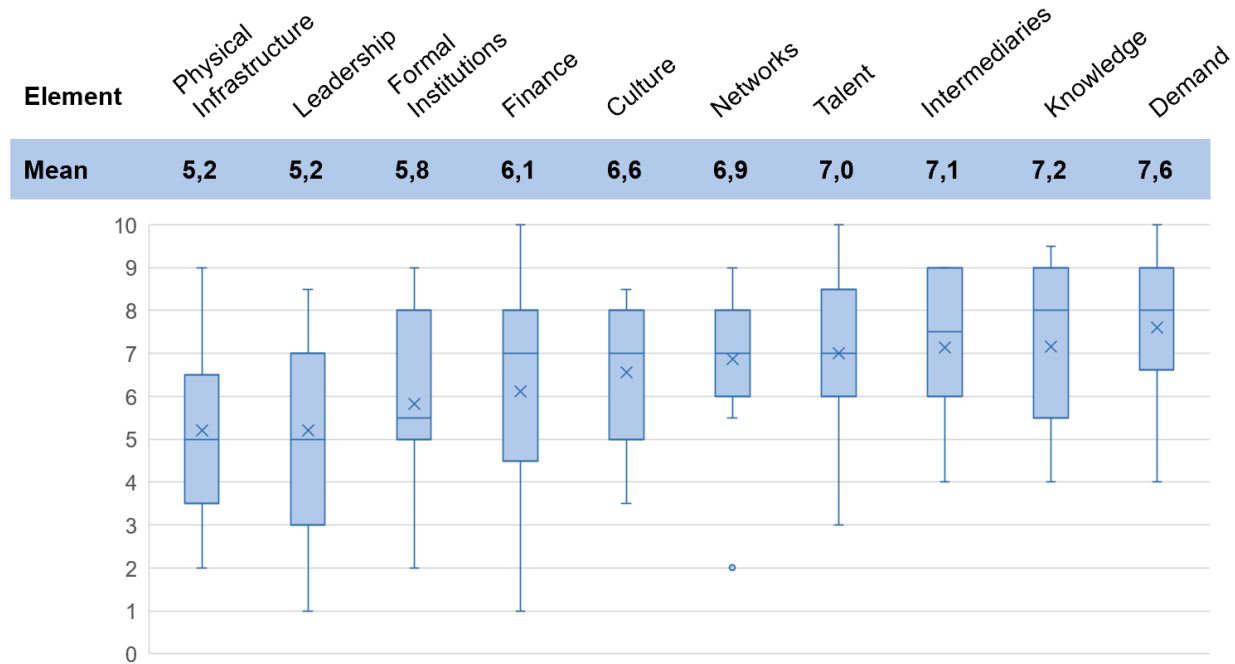


Figure 5: Box and whisker plot of the 15 interviewee's rating of the ecosystem elements

the waiting time is said to be three years, if someone is interested now, and we all know what the time cycles are like in start-ups. In my eyes, space is a big problem in Munich. And in any case, to achieve output, something certainly needs to be done." (E1)

Novel programs like the TUM Venture Lab Healthcare are attempting to counteract this problem by offering office and lab space to founders (E6, E7). The digital health and medtech experts also mention the high cost of office space in Munich, although they oftentimes have lower requirements compared to biotech companies. The high cost of living in Munich represents an additional challenge to young entrepreneurs, which often lowers the risk one is willing to take to start a venture (E2, E10).

Leadership also represents a scarce resource in the health ecosystem in Munich. As E1 and E14 point out, the feedback loop from productive entrepreneurship back into the ecosystem does not function properly yet, as not enough companies have gone public or failed yet. For this continuous feedback, the critical mass must be greater, and in Munich the start-up wave, especially in the digital health space, is still at the beginning (E8, E14). Although there are some successful founders, they are often not available as mentors and supporters (E1, E7, E14). The experts often draw the comparison to the USA, where a significantly higher number of successful entrepreneurs share their learnings with the ecosystems and act as angel investors and mentors (E6, E8). E8 also comments that successful founders tend to move to Berlin at some point, where the ecosystem is larger compared to Mu-

nich. E15 and E14 describe leadership in Munich as follows:

"Very bad, far too little. Some people even come to me to hear how to set up a healthcare start-up, and I'm really still at the beginning". (E15)

"I think there are simply not many of them in total. Everything is still relatively young. There are some who are very, very successful, but they are not available every day as mentors. Of course, you have a lot of people who tried something, but have now ended up in another job because it did not work out. But a lot of them are still trying to figure out whether it will work. They are in their third or fourth or fifth year. So, finding mentors definitely needs the most improvement." (E14)

Formal institutions in Germany, such as the regulatory framework and public support programs were also often mentioned as a main pain point for entrepreneurs. Legal processes are very bureaucratic, time intensive and paperwork heavy:

"I think Germany is very, very difficult in that respect. We have also experienced that. You are kept from starting a business, because you have to do so much next to it. You would prefer to focus on the product or the customers, however you have so much bureaucracy that you have to deal with." (E3)

"It is essentially the case that for a small company, if you are talking about tax law, things are

difficult to manage. So, it's simply the administrative framework, and in this respect, I would describe this part as a nuisance, as an obstacle that we are pretty much left alone with." (E5)

In addition, E2, E5 and E11 claimed that the tax system is suboptimal for young companies and systems in the Netherlands, or the UK are more accommodating to startups. In terms of official support programs, there are various funding and support programs in Munich and Bavaria (E1, E4, E6, E8). However, these institutions often have certain structural weaknesses, such as the absence of incentive structures which encourage innovation. In Germany, employees of such programs mostly earn a civil service salary, opposed to the USA, where these employees are entrepreneurially incentivized and receive carry as in VCs (E1). However, the Munich ecosystem seems to be more efficient when it comes to certain processes. In comparison with other German ecosystems, E4 points out that processes such as starting a company or interacting with the commercial register is significantly quicker in Munich:

"Certain processes that are super bureaucratic are perhaps not quite so bureaucratic in Munich. Setting up a company or interacting with the commercial register, for example, is simply three times faster here than in Berlin, just as an example. So, there are certain things that are easy here, that the local network has understood." (E14)

5.1.2. Intermediate score elements

The elements finance, culture and networks were rated between six and seven, on average. With regards to finance, there is a solid venture capital industry based in Munich:

"Munich is considered the center for biotech venture capital. That is not Berlin, that is not Hamburg, that is Munich." (E2)

E6 mentions an increase in the number of biotech funds in Germany and that many funds are starting to invest earlier. Next to VCs, Munich is home to a good angel network due to the high number of wealthy individuals (E8). In sum, most experts agree that young ventures with a solid idea and good team can in most cases attain seed financing. For later stage financing rounds, however, several experts claim that the financing landscape in Germany is suboptimal, and companies often move to different countries:

"The biggest problem in Europe, not only in Germany, is that the stock exchanges are not here for the companies. That means that the complete cycle of capital is not closed in Germany. This means we finance companies with state money, then we add private money. And if they then want to acquire growth capital, the company

needs to go to the US. This means that the technology we have financed, the know-how we have built, is transferred to the other country and that is also where the roll-out of the product takes place." (E4)

"For the later growth phase, Series B, there are many companies that have huge problems and must resort to international investors. And because we do not have any late-stage investors, the profits are always realized abroad." (E15)

Some entrepreneurs also experienced problems connecting with investors and finding the right investor for the right project, especially if they were not part of entrepreneurial networks (E9, E14). Especially biotech founders also claimed that the risky nature of the business can make it challenging to secure even seed financing (E5, E9, E12). Finally, there are several options of public funding, such as EXIST or Bayern Kapital, which, however, have also been described as slow and relatively risk averse (E5, E15).

The entrepreneurship culture depends largely on the defined scope. Most interviewees agree on this and confirm, that the entrepreneurial culture is very strong in the various networks and programs in Munich:

"Culture is such a bubble. I would say that within our bubble the culture is really good. But I wouldn't say that it has already arrived in society at large." (E1)

"But I would say that the culture in which we founded the start-up i.e., in the CDTM space, is very, very good. There is a lot of support and openness for new things." (E3)

Outside of this community, society is still often skeptical of entrepreneurial projects and prefers professions with higher safety, especially in scientific disciplines. This is also reported for academic scientific and medical programs, where students are discouraged from starting their own business. E2 and E6 describe this culture as follows:

"One of the first compliments I got when I started at Bayer was when people asked me where I worked. They said "Oh, nice, safe job". So that's what people think of first, a secure job. And of course, you can't build an entrepreneurial ecosystem with that." (E2)

"My professors used to give me a disparaging look at university when I said I wanted to start a company. That is something which is not really accepted here yet." (E6)

However, several experts mentioned a paradigm shift, leading to more openness towards entrepreneurship in society (E6, E7, E9, E15). Due to prominent examples in the sector, more people are aware of the fact that entrepreneurship plays an important role in our economy:

“We are sensitized to the fact that start-ups can become an important pillar of society. [...] And I hope, for example, that we have seen from the example of BioNTech that when we have a company that really takes off, it really does have a society-changing effect. [...] I think we have a great ecosystem with entrepreneurship to raise awareness that something like this is possible.” (E15)

In terms of networks, there are a couple of very strong and supportive entrepreneurial networks in Munich with many meetups and conferences, however, they do not reach all entrepreneurs. There is also a clear divide between digital start-ups and healthcare and life science start-ups. For the digital sector, there are many networks, such as the Center for Digital Technology and Management (CDTM), TechFounders and Plug and Play. All five digital health founders agree that Munich has extremely powerful and supportive networks (E3, E8, E9, E10, E12); as E8 states:

“When I came to Munich twelve years ago, I knew that I wanted to start a company someday and connecting with like-minded people was surprisingly quick in Munich if you are keen.” (E8)

On the other hand, the biotech and medtech founders feel that the networks in this sector are not strong enough. Next to the BioM and the newly founded Venture Lab Healthcare there are not many offers:

“There is something, but it can definitely be stronger to get to the point that we would say okay, there is productive entrepreneurship here.” (E1)

Finally, entrepreneurs in all areas think that the networks do not reach everyone, and the options can be diffuse, fragmented, and small scale, which can make it confusing for entrepreneurs to find the right support system (E5, E10, E14).

5.1.3. High score elements

The elements talent, intermediaries, knowledge, and demand were all rated above 7, on average. The common consensus on talent among the experts was that due to highly ranked universities with yearly increasing student enrolment and prestigious research institutes, there are many well-educated scientists and management students (E1, E5, E6). Especially at the TUM and LMU, there are individual professors and chairs which specifically promote entrepreneurship (E6). The only exception is the area of computer science, where talent is a very scarce resource (E9). Due to the high presence of high-tech companies and research institutes, talent also often stays in Munich after university. There is also a mindset shift in that skilled individuals are more willing to work for a young start-up, despite it being a riskier option compared to conglomerates (E6, E8). However, E15

mentioned that it can still be very difficult to recruit skilled talent, since many professionals prefer the working conditions in larger companies such as a higher salary and fewer hours and value the freedom and responsibility in a start-up less.

Intermediaries were also rated very positively by most interviewees. E1 described the intermediary landscape as follows:

“Support structures, especially in the early phase, be it for accounting, for financing, but also for freelance consultants, CROs and CDMOs, are becoming more established.” (E1)

Within certain ecosystem structures, such as the CDTM, intermediaries were described as very strong with a lot of support available (E3). There were only two negative aspects mentioned. First, due to the plethora of intermediaries it can be difficult to find the most appropriate services for a specific stage (E9, E12). And second, many of the intermediaries, such as accelerators, are operated by non-entrepreneurs (E5, E15). E15 described his experience as follows:

“They’re not in your shoes, they can’t understand it, they’re not really interested, and we were also unfortunate with the mentors we have there.” (E15)

The scientific, technological and entrepreneurship knowledge was praised by most interviewees. As a result of the universities LMU and TUM, the various research institutes in the city, such as the Max Planck Institute and the Helmholtz Center, and the abundance of innovative companies, there is a lot of knowledge tied to the respective groups and chairs:

“We actually have a lot of knowledge. Above all, it feels like new chairs and research groups are formed every semester on precisely this topic, so bioinformatics with life science. We have an excellent basis with LMU and TUM as elite universities here plus all the collaborations that we have at the biotech locations like Martinsried.” (E9)

Lastly, demand was the element with the highest average score. Most experts stated that Munich has a very extensive industry in the health sector and therefore has many potential cooperation partners and customers:

“We also have an extremely good industry in Munich. That means we have the target cooperation partners right on our doorstep” (E6)

“The demand in Munich is higher compared to other regions or large cities in Germany. Many companies are simply a step ahead. They are a bit more modern, and often simply larger with the many DAX companies that are based here.” (E10)

The only critique expressed by several experts was that companies are not always willing to cooperate with start-ups. The healthcare sector, for instance, is overburdened already, and therefore healthcare professionals often do not have time to test new solutions. Other teams are overwhelmed by the many projects being implemented, especially regarding digitization, and are therefore skeptical when it comes to new digital products (E12, E14, E15).

5.2. Ecosystem improvements

Next to assessing the ecosystem, the interviewees were asked whether they could formulate any improvement ideas for the Munich ecosystem. The answers were summarized into five main areas: financial support, incubators and networks, entrepreneurial education, availability of information and industry collaboration. The number of experts who had suggestions in each area is displayed in Figure 6.

5.2.1. Financial support

The most frequently mentioned improvement area was financial support. The suggestions in this area were summarized in three main categories, which are shown in Figure 7: early-stage financing, entrepreneurship incentives and public funds. The numbers in the subcode statistic refer to the number of experts who mentioned a specific topic.

In total, nine experts advocated the improvement of early-stage financing in Germany. According to the entrepreneurs, traditional support programs are very bureaucratic, and it can take up to 18 months until the financial means are received. This means that projects are significantly slowed down or cannot be started. It was often mentioned that entrepreneurs should have easier access to smaller grants to support the initial ideation phase:

“I could imagine that it would be helpful if you could get little money with less effort to be able to do proof of concept.” (E5)

E2 suggested diversifying the standard entrepreneurship support programs, depending on the individual idea. The standard twelve to eighteen months are simply too short for many projects in the life sciences. Therefore, according to E2, it would be more appropriate to have a spectrum of funding periods for different projects. E7 suggested implementing a solution like the Small Business Innovation Research programs in the US. With such a program, the company could first apply for a small amount of funding and subsequently must prove how they utilize the money. In a second round, they are eligible to receive higher amounts of funding, which is also when business angels often join. E8 mentions that while EXIST is a great program, it is very academically driven. In his view, it would be appropriate to create programs which reward smaller funds to enable an initial ideation phase or proof of concept, even in a non-academic context. E12 suggests the creation of a separate public fund for health start-ups provided by the Ministry of Health. It is argued by E12 that the yearly healthcare costs in Germany amount to € 400

billion, so setting up a fund of € 500 thousand to promote start-ups in the health sector, which could lead to innovation and cost efficiencies, would be a reasonable option. Finally, several experts think that the ecosystem needs more support for young professionals or students to enable them to develop ideas and start businesses during their studies:

“For individuals who have a sound idea, contribute € 800/900 every month for two or three years. That’s € 10.000 a year, that’s not a lot of money. But for a student, that’s the difference between trying something out and waiting tables.” (E14)

E14 calls this type of proposed support program “Entrepreneurial Bafög” and points out that it could be tied to a mentorship program. In return for this funding, recipients would be obligated to participate in a buddy program when they have completed their studies. This could entail sharing their experience and lessons learned with the ecosystem, even if they have not become successful founders. This program could also be established in different formats, depending on the size of the program and the amount of funding. With regards to larger programs, such as EXIST, this could include contributing as a sparring partner in other projects.

In addition to early-stage financing options, four experts mentioned ideas which involve creating financial incentives to start a business, especially in the early stage, when it is too early for private investors. As joining a start-up involves a lot of risk, some experts suggest counterbalancing this with tax incentives:

“As an employee of a young company you are exposed to an increased risk because the company might no longer exist in two years. This is not rewarded in terms of taxation.” (E4)

E2 and E4 both mention simplification of the tax on stock options for young companies. In addition, E10 suggests support programs in terms of discounted office spaces or equipment. E7, on the other hand, suggests altering the amortization policy for the invested capital:

“If I make a loss in this sector, I can’t write it off against profits I have made in the real estate sector, for example. [...] This is regulated differently in other countries. Yes, that is perhaps where I still see the greatest need.” (E7)

Finally, two experts discussed possibilities to improve the structure and functioning of public grants. Especially, they mentioned that public support programs could be much more closely linked to the private sector, including VCs and larger companies:

“I would like to see the formal institutions, if they include funding programs by the government or the states, to be much more closely linked to the

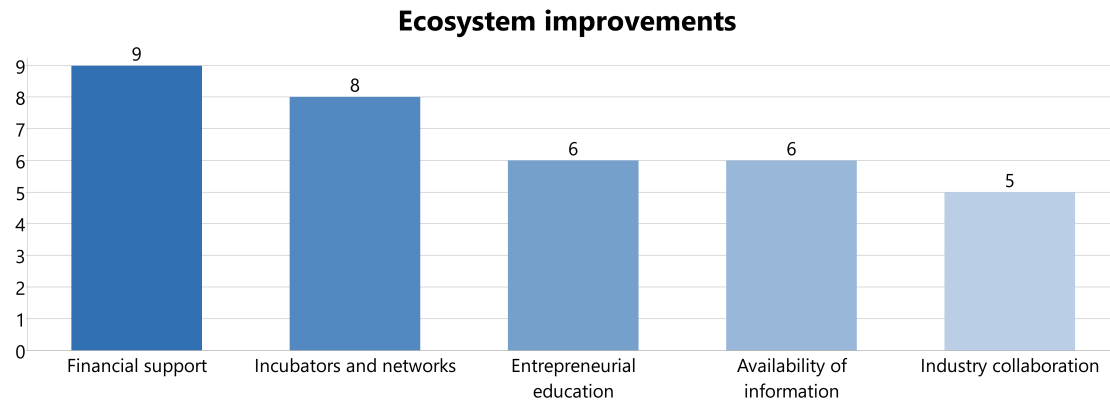


Figure 6: Subcode statistic ecosystem improvements

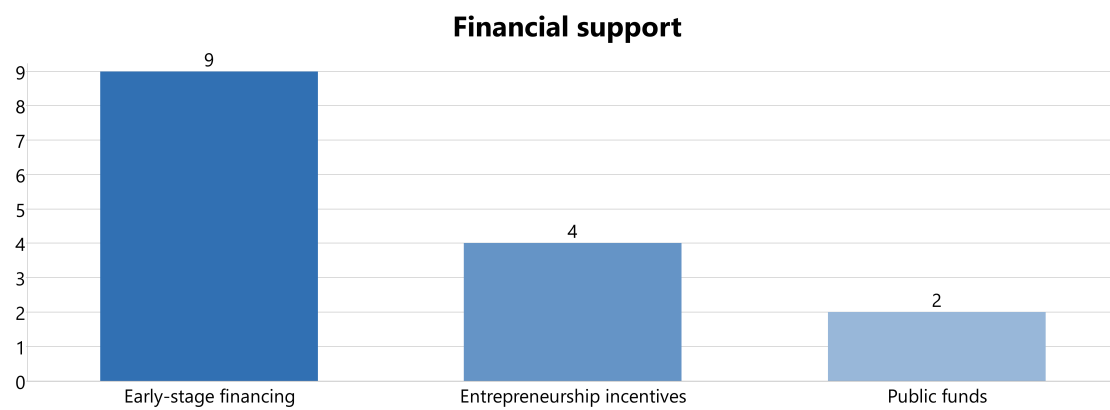


Figure 7: Subcode statistic financial support

private sector. I mean private, whether it is venture capital or biotech companies or pharmaceutical companies, but in such a way that projects can be promoted that actually have a realistic chance, because we often think that millions are squandered where you know from day zero that nothing will be released to the market.” (E2)

They suggest that a counterbalance is developed, including representatives from the private sector in the decision making. In addition, it is suggested that these committees are incentivized in a different way, similar to the incentive structure in a VC:

“In the private sector, the company’s money is your money. And then you make decisions very differently. And you can incentivize people in such a way that they make these decisions much more attentively or much more forward-looking.” (E2)

5.2.2. Incubators and networks

The second improvement area was mentioned by eight experts and concerns incubators and networks. The suggestions were classified into the two areas networks and mentorship and incubator refinement, as shown in Figure 8.

Seven experts suggested improving the current networks and mentorship programs in Munich. E1 highlights the fact that due to the high complexity of the healthcare and life science sector, strong networks and the exchange of knowledge is critical. It is also important for aspiring founders to know that a support network of other founders and intermediaries exists. E6 states that these networks should include founders, patent lawyers, regulatory consultants, and experienced industry professionals to, for instance, identify the right experiments. For this network to function, E6 also adds that incentive structures need to be in place to motivate participants. In terms of implementation, it is proposed to create a campus structure where these project teams and different network participants can meet. Several experts would also prefer more coaching by founders, who experienced the process firsthand. For instance, E8 describes that programs and classes teaching fundraising and finance were often taught by VCs, who were mainly interested in getting information from the start-ups. The interviewee suggests integrating more founders, who have experienced the same journey:

“Letting more independent founders speak at events would probably be helpful. Founders who have gone through all the phases and who could point out exactly what is available.” (E8)

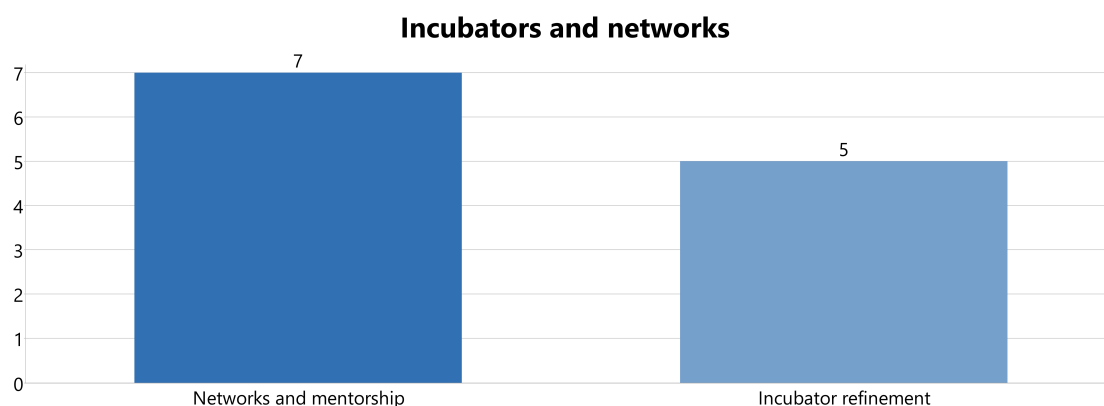


Figure 8: Subcode statistic incubators and networks

E5 agrees with this and comments that founders have a lot more relevant practical knowledge and could, for instance, teach other entrepreneurs how to connect with investors. And finally, as already mentioned in the financial support chapter, E14 suggested combining public funds with a mentorship program, where funded entrepreneurs agree to engage in a support network to share their experience with the next generation of entrepreneurs.

In addition, five experts had ideas how incubators could be improved and expanded. Since affordable lab space is scarce in Munich, it was suggested by four experts to create shared lab space, for instance in the form of an incubator (E5, E6, E7, E8). These labs should ideally be equipped with materials and devices to enable young teams to test ideas easier. Sharing this space with other teams would significantly reduce the cost and additionally lead to an increased exchange between the teams. For instance, E7 talks about the effect of collaboration during an international bootcamp:

“I must say, through the conversations that the people and the teams have with each other, they get more know-how than through the advice of experts. So, you can learn quite well from the mistakes made by others.” (E7)

Furthermore, E7 calls for a cross-sectional incubator to connect the life sciences with medtech and IT. Finally, E9 suggests expanding incubators to accommodate for more participant batches and perhaps even specialized batches with more specific topics, for instance clinic automation.

5.2.3. Entrepreneurial education

One improvement area mentioned by six of the interviewees is entrepreneurial education. This includes increased entrepreneurial education during and potentially even before university and improving entrepreneurial culture in general. The number of experts who mentioned each point is displayed in Figure 9.

Firstly, four interviewees thought that entrepreneurial education could be improved during university programs, especially for medical and scientific disciplines (E1, E6, E8, E11).

E1 explains that even though students in these degree programs would be predestined to start companies in this field, this aspect is not covered at all in their studies. E1 and E6 therefore both suggest that students in scientific and medical programs could be made more aware that even basic research cannot always be altruistic but should also lead to product development. E11 also proposes teaching entrepreneurial competences across more degree programs and not merely in business studies. He further suggests interdisciplinary offers for PhD programs for students who are interested in starting a company:

“TUM is the entrepreneurial university. You could really consider whether you could incorporate more interdisciplinary elements into the curricula.” (E11)

Finally, E11 suggests starting lecture series with the start-up scene or bringing start-up fairs directly to the university campus to naturally promote the exchange between academia and founders.

The two experts E4 and E8 suppose that entrepreneurial education could be promoted even before university, starting in secondary school. E4 explains that this education should be started early on to create an understanding of entrepreneurship in school and apprenticeships. E8 agrees and states that these programs must not only be aimed at university students but should be started earlier in the various secondary schools:

“I cannot see any reason why you have to pursue an academic career to understand that you can also found.” (E8)

Finally, three interviewees mentioned the need to improve the entrepreneurship culture in the ecosystem (E4, E5). They suggest that by already starting entrepreneurial education in school, a better understanding of entrepreneurial values could be created. These include personal responsibility, risk awareness and distancing ourselves from the general culture of envy. Furthermore, failure should not be viewed

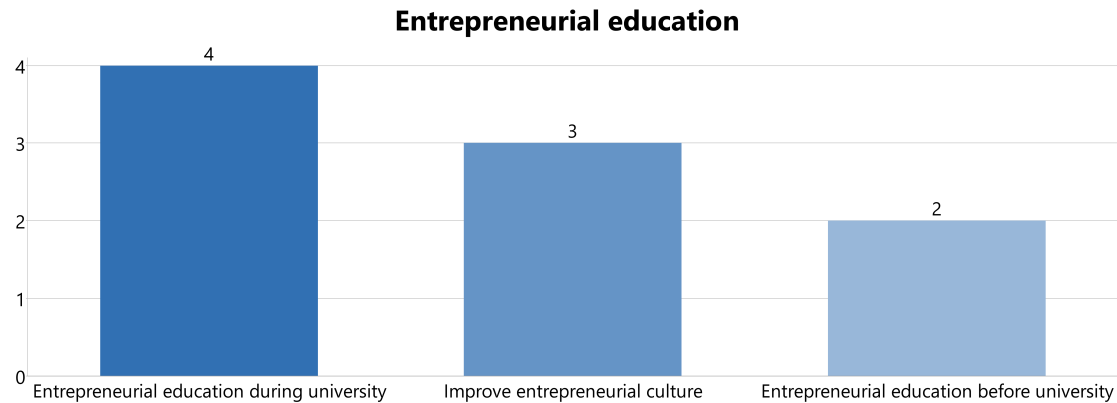


Figure 9: Subcode statistic entrepreneurial education

as a stigma, but should be viewed as a normal process and an opportunity to learn and improve. They explain these points as follows:

“Someone who achieved something must be seen in a positive light. This starts very early and here we must improve a lot.” (E4)

“It must be completely normal for someone to totally fail with the first two companies and then it just becomes the third.” (E5)

To improve the culture, E6 suggests highlighting successful ventures of the health sector even more, as they are in the tech industry:

“You don’t see it much in biotech or in health care, even though it has such a huge impact on all of our lives. That should also happen much more.” (E6)

5.2.4. Availability of information

It was highlighted by six experts that the availability of information could be improved in the Munich ecosystem. This includes the creation of an information platform and an overview of the available networks, as shown in Figure 10.

Four experts suggested creating a platform with information regarding topics such as taxes, hiring and cooperation partners (E3, E5, E8, E9). E5 explains that it is extremely difficult to find contacts for certain practicalities, for instance payroll accounting and tax advisors, as a young business, especially without groups such as the CDTM or Manage&More. E9 adds, that every start-up experience bears similar problems and challenges. At the moment, this information is exchanged repeatedly between individual founders or in networks:

“You have to click through the networks and ask and ask and ask until maybe someone knows something. Sure, it’s the normal process, but as I said, many of these questions are repeated every few months by different founders. You

could probably also bundle them together somewhere.” (E9)

E3 and E9 suggest an open-source platform, which can be edited and expanded by founders and contains a list of contacts for certain areas and general best practices. In addition, E8 thinks the information on financing options for each respective start-up phase provided by independent founders would be extremely useful.

Furthermore, four experts propose a greater transparency with regards to which networks and support programs are available to start-ups (E3, E8, E10, E14). At the moment, the knowledge of certain networks is mostly conveyed via word of mouth or in specific entrepreneurship programs and therefore does not reach every start-up. E14 suggests linking the public support programs such as public grants more closely with the networks:

“You could perhaps oblige every program or network supported by state or regional funds to be listed on some kind of marketplace. Then the young, committed people can educate and orient themselves.” (E14)

In addition, E10 emphasizes that start-ups which are not associated with an accelerator program or university require more guidance which networks are available. He suggests that this information could be provided when founders interact with institutions anyway, for instance when registering a business.

5.2.5. Industry collaboration

Finally, five experts advocated improvements with regards to the collaboration with industry partners. The improvement points were categorized into two areas: improving the connection with industry and creating a standard framework for collaboration, as shown in Figure 11.

Several experts argue that, although Munich has an extensive health sector related industry and therefore high demand, these companies are often not accessible to start-ups. E14 suggests that existing institutions such as the Chamber

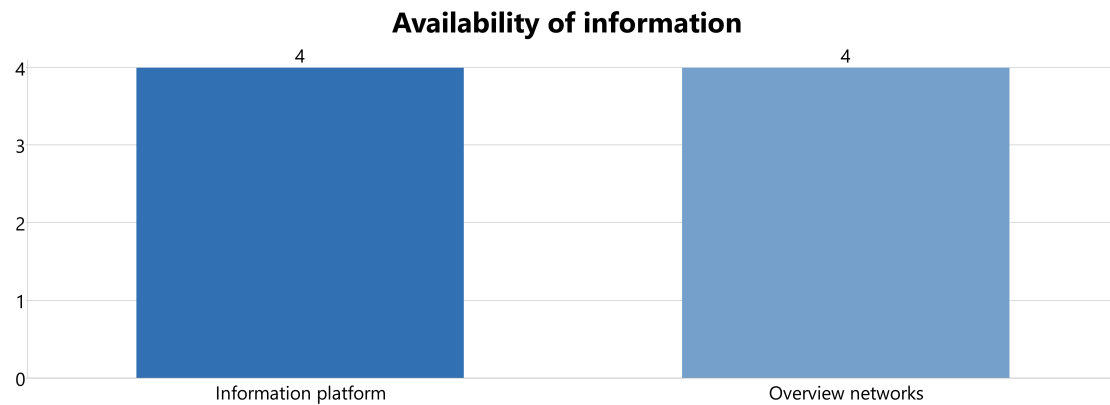


Figure 10: Subcode statistic availability of information

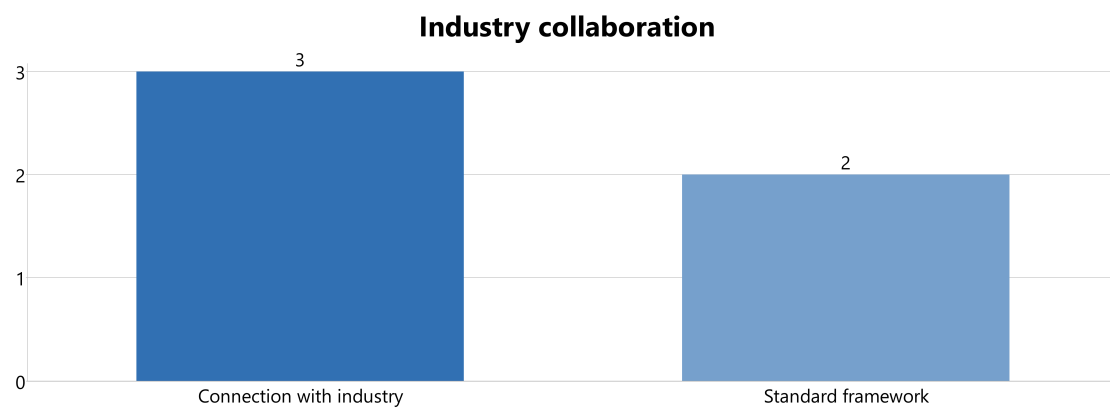


Figure 11: Subcode statistic industry collaboration

of Industry and Commerce (Industrie- und Handelskammer, IHK), which is in part financed by company contributions, could create a portal and perhaps provide low threshold funding for increased exchange. E12 highlights the need for more initiatives promoting structured cooperation projects between start-ups and industry:

“We need functioning projects with pharmaceutical companies and healthcare actors, who really commit to carrying out joint projects with start-ups in a certain time frame including certain payments.” (E12)

In addition, E9 advocates more mentorship from and collaboration with industry in the very early stage. He especially sees improvement potential in the collaboration with healthcare professionals as they are chronically overworked. The interviewee also suggests expanding programs such as Innovate Healthcare to foster communication between students and the respective clinics and making them available at an earlier stage.

Lastly, E6 and E15 suggest the implementation of a standard framework for the cooperation of start-ups and the health sector. For founders it can be challenging to connect with healthcare professionals to test their solutions, as many

healthcare providers have reservations due to regulatory or compliance reasons or other concerns. However, the requirements are often the same:

“Actually, the questions are always the same. People have to get an interface to the data and the hospital infrastructure to try things out. And meet with relevant doctors, who are sensitized to the fact that they can help to drive innovation in their daily hospital routine.” (E15)

Therefore, the two experts propose a standard intellectual property deal to establish cooperation between large health care providers and young researchers and founders by lowering the barrier for clinics to engage in this type of partnership. As an example, E15 mentions the office of technology licensing in Stanford, which facilitates the collaboration with clinics and the distribution of royalties.

5.3. Alternative ecosystem framework

Two interviewees mentioned potential approaches for an alternative framework of the entrepreneurial ecosystem elements. The framework described by E14 is illustrated in Figure 12. According to the interviewee, formal institutions, in the sense of educational and research institutes, and talent

form one side of the framework. These two elements correlate with each other as talent emerges from the institutions. On the other side, he positions demand and finance, where ideas can be tested and are supported by financial resources. Networks form the connection between the two sides. The networks are also responsible for creating the culture which surrounds the entire ecosystem and ensuring knowledge is exchanged between the different elements and stakeholders. Physical infrastructure would be considered as flanking element, which does not work in isolation, but supports the ecosystem. E1 adds that for him the networks are a combination of intermediaries, knowledge, leadership, talent, and physical infrastructure and that all these factors together constitute a strong network.

6. Discussion

In the following, the research findings are discussed in the light of the research question and the current literature in the field of entrepreneurial ecosystems. Following this, the methodological approach is critically reflected, and research limitations are discussed.

6.1. Discussion of the results

The aim of this study was to qualitatively evaluate the Munich entrepreneurial ecosystem in the health sector to gain an understanding of the current state of the different elements and develop recommendations to advance the ecosystem. Therefore, the central research question was defined as “How can the Munich entrepreneurial ecosystem in the health field become more efficient?”. In the following, the main research findings from the expert interviews are discussed, taking into consideration the theoretical concepts of entrepreneurial ecosystems and the present research question.

With regards to the current life cycle stage, the Munich ecosystem is likely still in its growth phase. This phase is marked by an increasing number of new start-ups, support programs and financing options and talent becoming more entrepreneurially minded.⁷³ The results of the interviews confirm this proposition. First, it was mentioned multiple times by several interviewees that there is a mindset shift among students, academics, and industry professionals towards the start-up sector and entrepreneurial projects. Second, specialized support structures such as intermediaries and networks are increasingly available for the health sector. Multiple experts commented that there is still an insufficient number of networks in Munich, but they are noticing constant improvements. For instance, new programs such as the TUM Venture Lab Healthcare are being formed. And third, the leadership feedback loop into the ecosystem is not fully established yet, as there are not enough experienced founders yet in Munich. Multiple experts think that this is a

function of time and are confident that the amount of leadership and feedback to the ecosystem will improve in the next years, as more companies in the sector either become successful or fail.

The interviews revealed the perceived quality of each element and improvement ideas, which were grouped into five key areas. According to the literature on ecosystem governance, it is important to particularly focus on the weaknesses of the ecosystem, as they can form bottlenecks and obstruct further development and growth.⁷⁴ Therefore, the improvement ideas will be discussed in order of the corresponding ecosystem elements, starting with the lowest scored element. Physical infrastructure and leadership were rated as the weakest parts of the Munich ecosystem. In terms of the infrastructure, most experts criticized that affordable laboratory and office space is scarce in Munich. The available incubators often have long wait times and tend to favor later stage companies. To improve this weakness, several experts suggested the creation of more shared lab space within incubators, where several teams share equipment and office space. Not only would this option be more affordable for very early-stage start-ups, but the resulting exchange between the entrepreneurs has been claimed to be highly educational. Leadership has been rated equally low by the interviewees. On one hand, there are simply not enough successful founders in the health sector in Munich. On the other hand, the few existing leaders are often not available as mentors in the ecosystem. Leadership is a function of time and the consequence of a productive ecosystem. Therefore, to increase leadership, the ecosystem as a whole must be supported so it can generate productive entrepreneurship and ultimately valuable leadership. However, there has been one actionable improvement idea, namely the creation of “Entrepreneurial Bafög”, which combines early-stage financing of students and young professionals with the creation of more mentorship and entrepreneurship examples in Munich. Obliging funded students to share their entrepreneurship experience would increase the availability of mentorship in the ecosystem. In accordance with governance principles in ecosystem literature, these two factors should be given the highest priority when designing governance initiatives.

The element of formal institutions, including the regulatory framework and public initiatives, is the third of the low score elements. According to Corrente et al. (2019), “Government Programs” are the second most important factor determining the success of ecosystems, as they can significantly accelerate or inhibit the growth of start-up companies.⁷⁵ The interviewees often criticized the highly bureaucratic processes and the lack of tax incentives for start-ups. Furthermore, the incentive structure of public fund committees has been claimed to be inefficient. In terms of improvement ideas, several experts mentioned the need for financial incentives for entrepreneurs, such as simplification of the tax

⁷³ See Cantner et al. (2021, pp. 413-417).

⁷⁴ See Audretsch et al. (2016, p. 373).

⁷⁵ See Corrente et al. (2019, p. 513).

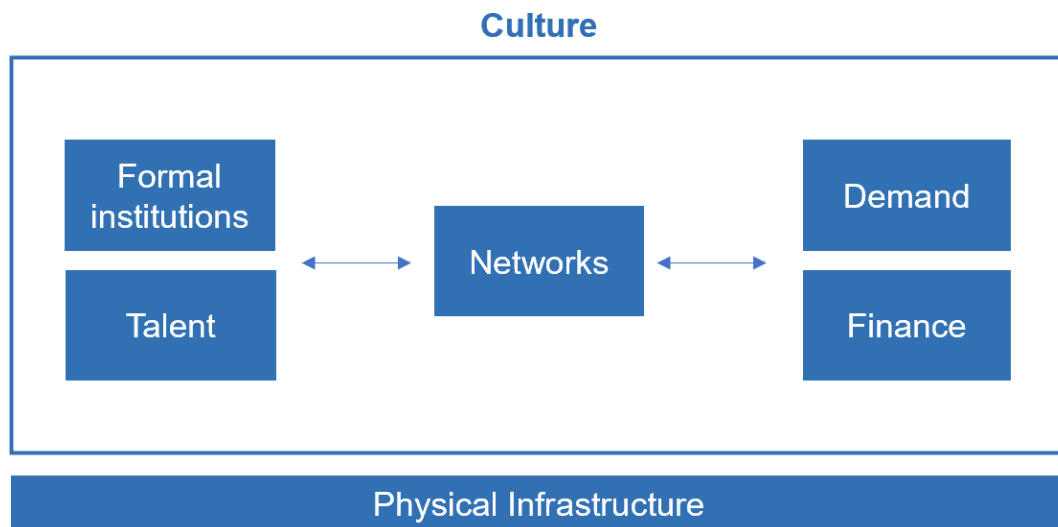


Figure 12: Alternative entrepreneurial ecosystem framework

on start-up stock options or discounted office space. Isenberg (2010) also emphasizes the need to reform the regulatory framework to enable productive entrepreneurship. This can include removing administrative and legal barriers and setting the right financial incentives.⁷⁶ The interviewees also suggested linking public support programs more closely to the private sector by creating more balanced committees and incentivizing decision makers with carried interest. This suggestion corresponds to the third principle of Isenberg (2010), which states that the public sector should be engaged in designing entrepreneurship policies and programs.⁷⁷ Although reforming formal institutions is a difficult and lengthy process, it can significantly contribute to accelerating entrepreneurship. However, this approach cannot be effective in absence of the other improvements mentioned in this section.

The availability of finance was rated mostly positively by the interviewees, stating that Munich is home to a good network of VCs and other private investors. Still, the most frequently mentioned improvement point for the Munich ecosystem was to increase early-stage financing and enable entrepreneurs to obtain small grants in an uncomplicated manner. These ideas include diversifying the current support programs to enable life science start-ups to be funded for longer time periods and creating programs which supply an initial low amount of funding, followed by potential successive rounds. It is surprising that no suggestions were expressed regarding the main point of criticism, which is the lack of later stage financing options in Germany. However, it can be argued that counteracting this problem is rather difficult since this is mainly caused by the lack of large stock exchanges and late-stage investors.

⁷⁶ See Isenberg (2010, p. 49).

⁷⁷ See Isenberg (2010, p. 44).

The entrepreneurial culture was described to be very strong within networks, but not as pronounced in broader society. Corrente et al. (2019) declared culture and the associated social norms as the most important factor impacting the success of entrepreneurial ecosystems.⁷⁸ In line with these findings, six interviewees proposed measures to increase entrepreneurial education to improve the entrepreneurship culture in Munich. Since natural scientists, engineers and medical doctors are the most qualified to start a business within the health sector, it is important to include optional entrepreneurship courses in their studies. In addition, promoting entrepreneurial education before university can not only create this understanding for entrepreneurship earlier, but also sharpen the awareness in other professions in the sector, such as nurses and technical assistants. Finally, it is suggested by the experts to highlight successful companies in the health sector to improve the culture. These ideas match two of Isenberg's principles "Get a big win on the board" and "Tackle cultural change head-on". He emphasizes that visible, successful ventures can reduce the public perception of risks and barriers associated with entrepreneurship.⁷⁹ These initiatives are relatively cheap and easily implemented compared to other suggestions like financial incentives and incubator development. In addition, a good entrepreneurial culture is widely regarded to be of paramount importance for a successful ecosystem and should therefore be prioritized within governance initiatives.

Several improvement ideas relate to the entrepreneurial networks in Munich, which have been given an intermediate score. The principles of entrepreneurial governance contend that entrepreneurs should act as central leaders within the stakeholder network of the ecosystem.⁸⁰ This is reflected by

⁷⁸ See Corrente et al. (2019, p. 513).

⁷⁹ See Isenberg (2010, p. 47).

⁸⁰ See Kuckertz (2019, p. 479f).

the desire of the interviewees to see more entrepreneurs in key positions of networks and incubators. However, this is directly dependent on the presence of successful founders and leadership. One relatively straightforward improvement for networks is to create an overview of the existing networks and support programs, for instance by informing founders when they are registering their business. This simple measure would help to increase the reach of current programs to more start-ups.

The elements of talent and intermediaries have been generally rated very positively. Owing to the two major universities TUM and LMU, there is a lot of skilled talent in Munich compared to other German cities. Intermediaries are also sufficiently available and are becoming more specialized towards the health sector. With regards to knowledge, four interviewees suggested the creation of an information platform to share information regarding practicalities such as taxes, cooperation partners and hiring, as all start-ups encounter similar challenges. Lastly, demand was the highest rated element in the Munich ecosystem. Nevertheless, one of the five improvement areas relates to this factor. Despite the presence of many large companies in Munich, they must be made more accessible to start-ups. This should include stronger match-making by existing institutions such as the IHK. Moreover, two experts advocated a standard framework for the collaboration with hospitals and healthcare professionals. Although the healthcare sector is currently already overburdened, the one-time investment in such a framework could reduce the required time for future projects, which could in turn lead to more innovation in the health sector.

The entrepreneurial ecosystems theory was frequently critiqued in recent literature for its tautological concept and its missing explanation of cause and effect. The same points were raised in several interviews, and two experts even outlined an alternative approach to the ecosystem framework. The suggested framework by E14 addresses the criticized weaknesses of the framework, as it starts to clarify relationships and interdependencies between the elements. Furthermore, the approach differentiates between critical elements, such as talent, culture, networks, demand and finance, and flanking means such as physical infrastructure. Although it can be argued that physical infrastructure is also essential in building an ecosystem as it provides the space for entrepreneurship and innovation to occur, it cannot be allocated the same weight as the central actors of the ecosystem, such as talent, and rather functions as enabler.

The elements leadership, intermediaries, and formal institutions in terms of a regulatory framework were not yet clearly positioned in the framework by E14. E1 mentioned that intermediaries and leadership should form part of the networks, and by that logic be placed in the center of the framework. It can be argued that leadership strongly correlates with networks, as these are often shaped and operated by leaders of the ecosystem. Intermediary services could either form part of networks or act as ecosystem enabler, supporting ventures whenever necessary. In my opinion, the regulatory framework can be positioned next to the physical in-

frastructure as an ecosystem enabling element. Regulations such as taxation are flanking factors, which guide and regulate entrepreneurship, but should not act as a central force. Although this alternative framework is by no means complete, it can provide a starting point for further refinement to ultimately arrive at a structure which clarifies the cause and effect between the elements and can therefore provide some insight to inform further research and ecosystem policy.

6.2. Discussion of the methodological approach

The qualitative approach to the research question had the advantage that, despite the relatively low number of participants, a lot of opinions on the Munich ecosystem and suggestions for improvement could be acquired. The experts were purposefully not guided in any direction, which resulted in honest reviews of the current strengths and weaknesses of the ecosystem and a variety of improvement areas and concrete recommendations.

The selection of interview partners focused on founders, investors and managing directors of support organizations in the wider health field. However, the associated fields of biotech, medtech and digital health are very different in their resource requirements, product development cycles and customers. For example, while life science start-ups require laboratory space with elaborate equipment and materials, digital health start-ups simply require a small office space and computers. Their products and customers are also very different. While product development cycles in life science and medtech typically take years to complete and require extensive clinical trials and subsequent regulatory approval, many digital health products can be developed significantly faster and tested more easily and on a broader audience. These differences complicated the generation of main improvement areas applicable to the entire health sector.

By only selecting entrepreneurs, investors and support organizations, the measurement of the entrepreneurial ecosystem parameters was potentially slightly biased. This study neglected other stakeholders of the entrepreneurial ecosystem such as customers in larger corporations and start-up employees. Therefore, especially the culture parameter might have an upward bias, as the interview participants tend to be surrounded by entrepreneurial networks and support groups with a strong entrepreneurial mindset. As described in the results section, many companies and healthcare providers are perceived to have certain reservations about the cooperation with young start-ups and talent oftentimes prefers the working conditions in larger corporations. However, this study aims to reflect the thoughts and opinions of the central stakeholders of the ecosystem and does not intend to provide an objective measurement. In addition, the selection of experts was aligned with a similar study in the research field by Spigel (2017), who conducted a case study on two ecosystems in Canada.⁸¹

⁸¹ See Spigel (2017, p. 59).

To structure the analysis and the interview guideline, the entrepreneurial ecosystems framework was used. Although the framework was helpful in organizing the elements and provided a structure for the expert interviews, it has several shortcomings. First, although the elements are collectively exhaustive, which the experts all agreed on, they are not entirely mutually exclusive. This makes it extremely difficult to analyze the elements individually and understand their role in the ecosystem. For instance, formal institutions, talent, and knowledge strongly correlate with each other. Formal institutions such as good universities form the basic condition for well-educated talent. Knowledge, on the other hand, is often tied to chairs and professorships at universities and to the talent conducting the research or operating a company. Intermediaries and formal institutions are also not always selective, as networks and support programs by formal institutions could be allocated to both elements. For instance, TUM Start-up Consulting is a consultancy service by the university to support students or scientists at TUM who want to start their own company and could be attributed either to the formal institutions or intermediaries.

In addition, with the present selection of interviewees, not every element was applicable to every participant. For instance, the element of finance was difficult to rate for founders who have grown their company organically and therefore never obtained external financing through public grants or private investors. The elements are also not all easily applicable to one single location. In terms of intermediaries, it is not important that all necessary intermediate services like consultancy services and legal advice are situated in Munich. Many interviewees utilize services and collaborate with consultants, who are based in Berlin or even outside of Germany. Demand is also not constrained to one location, as the health sector is a global industry. Furthermore, the framework assumes that all ten elements are equally important in an entrepreneurial ecosystem. However, it can be easily argued that certain elements should be given a stronger weighting, such as demand and finance, without which a company could not sustain itself. Finally, the results obtained were limited by the defined sample size. Theoretically, it would be optimal to conduct expert interviews until no new insights can be gained. Unfortunately, due to time restrictions this was not possible.

As part of the analysis, the rating of the individual elements by the interviewees was illustrated in a box and whisker plot, including the calculation of the mean and quartiles for each element. Despite the primarily qualitative form of analysis, this form of presentation seemed appropriate to give an impression of the perceived quality of the different elements. Due to the small sample size of 15, these numbers are not generalizable since they merely express the opinions of the selection of experts and are therefore purposefully not mentioned frequently in the rest of the thesis.

7. Conclusion

The objective of this study was to qualitatively assess the entrepreneurial ecosystem in Munich and generate recommendations for improvement, answering the research question "How can the Munich entrepreneurial ecosystem in the health sector become more efficient?". The aim of the thesis was achieved by extracting suggestions from the expert interviews and subsequently organizing and summarizing them into five main improvement areas. First, financial support could be improved by offering more early-stage financing, entrepreneurship incentives as well as updating the structure of public funds. Second, incubators could be refined to offer more shared laboratory space and batches, and networks and mentorship need to be improved, for instance by incorporating more founders. Third, entrepreneurial education should be increased both before and during university and successful ventures need to be highlighted more. Fourth, the availability of information needs to be improved for founders. This includes creating an overview of the available networks and a platform with information about practicalities in the entrepreneurship process. Finally, collaboration with industry needs to be simplified, by creating a stronger matchmaking process and generating a standard framework for cooperation projects.

These findings are not only valuable for the study of entrepreneurial ecosystems, but also have practical applications. The research community can benefit from the alternative ecosystems framework to enhance the ecosystems framework. Incorporating the internal dynamics and relationships within an ecosystem is essential for a more nuanced understanding of how entrepreneurial ecosystems result in productive entrepreneurship. Perhaps even more importantly, the results offer an assessment of the entrepreneurial ecosystem in the Munich health sector and potential areas for improvement. As stated in the literature review, governance initiatives often fail to accomplish the desired results, as strategies are simply copied from other locations.⁸² Therefore, it is crucial to focus on local characteristics to devise governance initiatives aiming to improve the ecosystem. This case study on the Munich ecosystem identifies the local strengths and weaknesses and suggestions by central stakeholders of the ecosystem. Consequently, these results can be taken as a starting point for a strategy to make this ecosystem more effective. The results of this study might also lead to indications in similar research and knowledge intensive fields. Industries such as aviation and automotive have similarly long development periods and therefore similar ecosystem requirements.

Further research avenues in the field of entrepreneurial ecosystems could encompass the refinement of the framework and case studies in other geographic locations or with a broader selection of interviewees. As elaborated in the research limitations, the ecosystems framework is not entirely

⁸² See Colombelli et al. (2019, pp. 505-507).

mutually exclusive and does not clarify the connections between the elements. For further research on entrepreneurial ecosystems, it could be helpful to further rethink the framework and incorporate the relationships and connections between the elements. In addition, the development of a dynamic perspective to explain the evolution of an ecosystem over time would be useful to arrive at a holistic understanding of entrepreneurial ecosystems. Secondly, this type of case study could be applied to other locations, for instance Berlin, to create an understanding of the quality of other ecosystems in the health sector. Further research could also look at the topic from a broader perspective, such as consulting a broader selection of interviewees. By including, for instance, employees of start-ups and industry professionals collaborating with entrepreneurs, a larger proportion of stakeholders would be covered which might offer a more realistic understanding of the ecosystem.

The entrepreneurial ecosystem in the health sector in Munich has gained considerable momentum and is currently growing in size. The related biotech, medtech and digital health industries generate a real impact for our economy, society, and technological expertise. Therefore, it should be of utmost importance to policymakers, investors, and other ecosystem stakeholders to support and further expand this entrepreneurial ecosystem.

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