

The Role of Public Policy in Fostering Technology-Based Nascent Entrepreneurship

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2.1 INTRODUCTION

The important role of innovation in securing a country's competitiveness and achieving sustained economic growth is beyond controversy. Innovation can yet only occur through entrepreneurial activities (Leyden 2016). As a consequence, governments worldwide try to enhance entrepreneurship by providing and leveraging local factors and resources, thus facilitating the exploitation of entrepreneurial opportunities through the strategic management of places (see Audretsch 2015). Public policy thereby focuses on both active market participants, i.e., incumbent

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entrepreneurs (existing firms), as well as potential market participants, i.e., nascent entrepreneurs (new and young start-ups or the idea thereof). Within recent years, especially the concept of nascent entrepreneurship has attracted increasing attention within the entrepreneurship literature (Davidsson 2006). Nascent entrepreneurs incorporate the entrepreneurial potential, i.e., the potential for economic growth, of a region, especially for advanced nations, thus constitute a promising approach for public policy (Wennekers et al. 2005). Hence, promoting entrepreneurs willing to engage in the high-technology sector, thus considering to start new technology-based firms (NTBFs), is one of the key cornerstones of innovation and technology entrepreneurship policies of the European Union. Consequently, Grilli (2014: 280) notes that “the absence of rapid-growth NTBFs in the European context is deemed by European policy makers to be one of the most worrisome structural weaknesses in Europe and a primary obstacle to meeting the goal of becoming the most dynamic and competitive knowledge-based economy in the world. European policy makers recognize that without a more vibrant and vital high-tech entrepreneurship sector, the European objective of ‘smart’ growth will simply remain out of reach.”

Audretsch (2012: 759) describes nascent entrepreneurs as “individuals who have not actually started a business but are considering doing so or planning to do so.” The motives to start a new firm and become an entrepreneur can thereby differ. Literature in this field distinguishes between two types of individuals based on their motivation to engage in entrepreneurial actions (see Amit and Muller 1995): (1) “push” entrepreneurs who are driven by an economic need, i.e., rational agents trying to escape from unemployment or unsatisfactory working conditions by setting up a business, so-called necessity entrepreneurs, and (2) “pull” entrepreneurs who are motivated by a strive for self-realization, i.e., agents of change exploiting prevalent business opportunities, so-called opportunity entrepreneurs. Independent of the type, both entrepreneurs need to discover entrepreneurial opportunities and exploit respective opportunities (Shane and Venkataraman 2000). Sarasvathy et al. (2003: 142) characterize entrepreneurial opportunities as a “set of ideas, beliefs, and actions that enable the creation of future goods and services in the absence of current markets for them.” But where do entrepreneurial opportunities come from and how are they created? The entrepreneurship literature has traditionally assumed that entrepreneurial opportunities are exogenous and has explained differences in the observed

propensity for entrepreneurship by variations in individual characteristics and abilities to perceive opportunities for entrepreneurial profits (see Kirzner 1973, 1997). More recently, Audretsch (1995) introduced the knowledge spillover theory of entrepreneurship, describing entrepreneurship as the endogenous response to opportunities. Accordingly, entrepreneurial opportunities are not exogenous but endogenously generated by investments in new knowledge, i.e., contexts rich in knowledge: industries with a greater investment in new knowledge experienced greater entrepreneurial activities than industries with low investments in knowledge (see Audretsch and Keilbach 2007). An extensive strand of literature has dealt with the empirical verification of this theory and provided additional evidence concerning the spatial dimension of knowledge spillovers (Audretsch and Feldman 1996; Audretsch and Lehmann 2005; Audretsch and Stephan 1996; Jaffe 1989).

The proposition that entrepreneurial opportunities are systematically created by investments in knowledge and are not exogenous does not only have implications for the private but also for the public sector. The assumption of the knowledge spillover theory of entrepreneurship that entrepreneurial opportunities are endogenously induced by investments in knowledge serves as a justification of an emerging new public policy approach, generating economic growth through the creation of an entrepreneurial society (Audretsch 2009). Due to the shift toward a more knowledge-based society, entrepreneurship policy is emerging as an essential policy instrument to be able to compete in a global and knowledge-based economy and ensure further economic growth (Gilbert et al. 2004). The European Union took account of these developments and launched the Lisbon Strategy and the subsequent Europe 2020 strategy to become “the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion” and promote “jobs and smart, sustainable and inclusive growth” (European Council 2000, 2010). Especially with the Horizon 2020 framework, the heart of the Europe 2020 strategy with almost €80 billion of funding, the European Union wanted to accelerate scientific breakthroughs, discoveries, and innovation as well as promote entrepreneurship (European Commission 2014).

In accordance with the EU’s initiatives, also Germany launched several political initiatives to become an innovation leader in Europe and the world. The most recent and prominent research policies in Germany for

both the public as well as the private sector have been the Leading-Edge Cluster Competition as well as the Excellence Initiative. In the context of the new “High-Tech Strategy 2020,” an initiative to help translate good ideas quickly into innovative products and services by strengthening cooperation between companies, universities and research institutions, the Leading-Edge Cluster Competition aimed at expanding the technological competences of selected regions by creating regional clusters based on the idiosyncratic factors and resources of the respective regions. This initiative has given rise to in total 900 innovations, 300 patents and 40 business start-ups, thus has created an environment which encouraged entrepreneurial activities and served as a breeding ground for technology-based nascent entrepreneurs who succeeded in implementing regional competences in internationally competitive innovations. To incentivize regional partners to exploit their existing potential and establish new cooperational networks, the German government provided funding worth €600 million and finally promoted 15 leading-edge clusters in high-technology industries related to digitization, production, communication, energy and resource efficiency, mobility, logistics, and health (see BMBF 2015b).

Besides interventions in the private sector, policymakers also focused on strengthening the public sector. In 2005/2006, the German government introduced the Excellence Initiative, a higher education policy aimed at promoting top-level research and improving the quality of German universities and research institutions in general. Similar to the Leading-Edge Cluster Competition, also the Excellence Initiative triggered a self-selection process, as every university was given the chance to apply for up to three different funding lines: Graduate Schools to promote young scientists and researchers, Clusters of Excellence to promote top-level research and deepen cooperation between different disciplines and institutions, and Institutional Strategies to develop project-based, top-level university research (see DFG 2013). The government altogether spent €2.7 billion to not only promote cutting-edge research but also facilitate the technology transfer and commercialization of produced knowledge. It is thereby no coincidence that both political measures focused at the interfaces between different disciplines, topics, and perspectives. *Johanna Wanka*, Federal Minister of Education and Research, consequently notes that “it is striking that renowned universities often act as the nucleus of internationally successful clusters. [...] The Excellence Initiative to promote top-level research was a successful

starting point and led as well as the Leading-Edge Cluster Competition to a paradigm shift in German research policies. Both contests were open to all research topics and excellence oriented” (BMBF 2015a).

Common to all these political initiatives, also beyond Germany, is the focus on the high-technology sector. Potential knowledge spillovers, created or stimulated by investments in knowledge, only affect those industries which are rather knowledge-based. Audretsch and Keilbach (2007) examine entrepreneurial activities in both the high technology as well as the low-technology sector and conclude that only high technology, i.e., knowledge-based, new ventures are influenced by potential knowledge spillovers. As political measures and associated public funding are one way of knowledge investment, this chapter purposefully focuses on high-technology entrepreneurship in general and technology-based nascent entrepreneurship in specific. The aim of this study is to discuss political interventions both in the public and private sectors intended to foster technology-based nascent entrepreneurship to then derive recommendations for policymakers aimed at augmenting the efficiency and effectiveness of innovation and entrepreneurship policies in Germany and beyond.

The contribution of this chapter is threefold. First, the role of public policy in fostering technology-based nascent entrepreneurship in the private sector is discussed. Taking Germany and its Leading-Edge Cluster Competition, the mechanisms of public policy in identifying and nurturing technology affine nascent entrepreneurs within cluster networks are discussed as well as the impact and consequences on regional economic growth are highlighted. Second, in the context of Germany’s Excellence Initiative, the influence of universities, shifting toward an entrepreneurial paradigm, on generating high-technology entrepreneurship is emphasized. As the German government wanted universities to more intensively engage in their third mission, i.e., the commercialization of scientific knowledge, academic entrepreneurship and associated technology transfer mechanisms have moved into the focus of policymakers. Scientific entrepreneurs thereby have to articulate different worlds and reshape the boundaries of their organization. It is the scientist in the Principal Investigator (PI) role who shall serve as an illustrative example for scientific technology-based (nascent) entrepreneurship in universities. PIs utilize their networks in both the public and the private sector and enact their environment to exploit entrepreneurial opportunities by leveraging existing resources and factors, thus bridge the gap between

science and industry. As public policy interventions aim at encouraging more scientists to take on the PI role, implications of the Excellence Initiative on academic nascent entrepreneurship shall be discussed. Third, the interdependencies between academia and industry, i.e., the public and the private sector, with the strategic role of universities in fostering entrepreneurial activities in general and technology-based nascent entrepreneurship in specific shall be unearthed, resulting in policy recommendations aimed at augmenting the efficiency and effectiveness of innovation and entrepreneurship policies. The entrepreneurial environment, characterized by sufficient levels of human, social and financial capital, predefines entrepreneurial activities, thus constitutes the breeding ground for (nascent) entrepreneurs and has to be shaped and leveraged by governments to fulfill the ambitious objectives of Germany in becoming a worldwide innovation leader.

The remainder of this chapter is organized as follows. Section 2.2 focuses on the impact of public policy on entrepreneurial activities in general and nascent entrepreneurship in specific, taking the knowledge spillover theory of entrepreneurship and the associated assumption of entrepreneurial opportunities being endogenously induced by knowledge investments as a starting point. Section 2.3 deals with political interventions in the private sector in Germany, i.e., discusses the effects of the Leading-Edge Cluster Competition, whereas Sect. 2.4 highlights the essential role of universities in promoting nascent entrepreneurship not only in the private but also in the public sector in the context of the German Excellence Initiative. A final section concludes and derives policy implications.

2.2 PUBLIC POLICY AND (NASCENT) ENTREPRENEURSHIP

Regional innovation policy has evolved into the mainstream of public policy, as also the understanding of the nature of innovation has altered. McCann and Ortega-Argilés (2013: 211) consequently note that “support instruments have changed from industrial supports to more cross-sectoral supports for value chain developments in particular locations, and there is now also an increasing focus on more socio-economic influences on technology development and usage related to smart growth, energy and sustainable growth and entrepreneurship promotion.” Block et al. (2013) suggest that entrepreneurship finally leads to innovation and economic growth. The interrelatedness of

innovation and entrepreneurship was perhaps first explained by Joseph Schumpeter in his *Theory of Economic Development* (1934) as he understood entrepreneurship as a basic requirement for innovation, facilitating aggregate economic growth. The knowledge spillover theory of entrepreneurship follows this direction in that it identifies new knowledge as the main source of entrepreneurial opportunities and entrepreneurs as the key drivers in commercializing new knowledge (Acs et al. 2013, 2009). Hence, entrepreneurs penetrate the “knowledge filter” and are able to absorb relevant knowledge and transform corresponding ideas and concepts into economic knowledge (Acs and Plummer 2005; Braunerhjelm et al. 2010). Audretsch and Keilbach (2004a) describe entrepreneurship as an important mechanism concerning the transformation of knowledge into diversity, the driving force of regional economic growth. Entrepreneurs thereby stimulate a selection process across available knowledge and as a result facilitate the spillover of knowledge and finally contribute to the commercialization process. Acs et al. (2013) consequently characterize entrepreneurs as a conduit for the spillover of knowledge, contributing to enhanced economic performance by allocating strategic resources. In this context, Huggins and Thompson (2015) note a shift from the traditional focus on stocks of knowledge to dynamic flows of knowledge. Hence, knowledge flows have to be coordinated and managed, i.e., leveraged.

The role of policymakers concerning regional development strategies focusing on the creation of conducive entrepreneurial settings for entrepreneurs and the corresponding strategic management of places consists of at least three interconnected dimensions. First, policymakers have to identify and support the development of relevant technological trends at an early stage to provide adequate resources. Hence, an intensive exchange between political responsibilities and market entities has to exist to be able to understand the specific dynamics as well as particular characteristics of any industry sector. However, as Asheim et al. (2011a) claim, a sole copying of best practices is difficult or even impossible due to idiosyncratic regional attributes and the intangibility of regional assets which evolved over time within the respective regional context. Second, localized action is needed with respect to available local resources and existing innovative networks, as well as barriers to entrepreneurship and innovation. Since regional preconditions for innovation have to be taken into consideration, tailor-made policy strategies instead of one-size-fits-all politics have to be implemented to stimulate the creation of new

industrial activities and collaborations. Third, politics have to provide continuing support in removing obstacles and relaxing constraints within entrepreneurial and innovative networks. Nishimura and Okamuro (2011) investigate the effects of direct and indirect support programs of cluster policy and conclude that especially indirect support programmes have a strong impact on innovation outcomes, compared to direct R&D support. Thus, policymakers should rather act as boundary spanners who pave instead of predetermine innovation trajectories.

Public policy consequently aims at leveraging local factors and resources to enhance a place's economic performance, thus increase entrepreneurial opportunities. Policymakers thereby have to take the underlying regional determinants into account to conduct adequate measures fitting into the respective idiosyncratic regional setting. It is important to note that even targeted political interventions might generate positive externalities within and beyond regional boundaries. Due to this interconnectedness, political measures should be coordinated to augment their effectiveness as well as their efficiency to fulfill Audretsch's (2015: 125) mandate of policy as he postulates that "policy can make a difference."

2.2.1 The Importance of Entrepreneurial Ecosystems

In order to draw on the full potential of a region, public policies must not only focus on active market participants, but also on potential market participants, indicating the need for comprehensive political measures. Engaging in entrepreneurial activities, thus starting a new venture is associated with opportunity costs, which highly influence the decision of a potential entrepreneur to start a new business, especially in high barrier industries such as the high-technology sector (Lofstrom et al. 2014). Nascent entrepreneurs continuously evaluate market opportunities and only pursue opportunities that are feasible and exploitable through venture creation. Dimov (2010) refers to this judgement of potential entrepreneurs as the nascent entrepreneur's opportunity confidence which is shaped by the entrepreneur's human capital, but also by the idiosyncratic context the entrepreneur is embedded in. In that sense, Phan (2004: 620) notes that "one cannot fully understand, for example, opportunity recognition as an emergence phenomenon, without being sensitive to its higher contexts—culture, institutional arrangements, and political-economic exigencies." Although the individual remains the

central actor in entrepreneurial endeavors and the individual's resources constitute crucial prerequisites in creating a new business, contextual influences have to be carefully considered as well (Autio and Acs 2010). It is the institutional environment which complements the entrepreneur's individual resources, i.e., human capital and social capital, and influences the likelihood to start a new venture (De Clercq et al. 2013).

Public policies aim at creating such conducive environments for entrepreneurship to stimulate regional economic growth, so-called entrepreneurial ecosystems. Entrepreneurial ecosystems are considered an important element in the fostering of entrepreneurs and their ventures. However, they are many times misunderstood as to what exactly they constitute. Stam (2015: 1764) defines an entrepreneurial ecosystem as "a set of interdependent actors and factors coordinated in such a way that they enable productive entrepreneurship." He goes on to point out that these entrepreneurial ecosystems differ from other concepts "by the fact that the entrepreneur, rather than the enterprise, is the focal point. The entrepreneurial ecosystem approach thus begins with the entrepreneurial individual instead of the company, but also emphasizes the role of the entrepreneurship context" (Stam 2015: 1761). Acs et al. (2014: 479) define an entrepreneurial ecosystem as a, "dynamic, institutionally embedded interaction between entrepreneurial attitudes, abilities, and aspirations, by individuals which drives the allocation of resources through the creation and operation of new ventures." In a study of innovation networks, Rampersad et al. (2010: 794) define those networks as "a loosely tied group of organizations that may comprise of members from government, university, and industry continuously collaborating to achieve common innovation goals." Another popular way to define entrepreneurial ecosystems is based on location within communities or geographic regions (Nambisan and Baron 2013; Cohen 2006). An ecosystem in this context is defined as an agglomeration of interconnected individuals, entities, and regulatory bodies in a given geographic area (Isenberg 2010; Malecki 2011). Participants in an entrepreneurial ecosystem may include venture start-ups, banks, venture capitalists, incubators, accelerators, professional service providers, as well as universities and government agencies that support entrepreneurial activity, which is the focus of this chapter.

In examining the essence of any successful ecosystem, the World Economic Forum (2013) offers eight pillars for a successful entrepreneurial ecosystem: accessible markets; human capital/workforce; funding

and finance; support systems/mentors; education and training; major universities as catalysts; and cultural support. Stam (2015) points to nine attributes that include: leadership, intermediaries, network density, government, talent, support services, engagement, companies, and capital. From these sources it is clear that certain similar elements are needed in any environment. However, Morris et al. (2015) point out that there is a divergence of financial, social, and human capital resources that entrepreneurs have access to in different ecosystems. There can be quite a difference in locations such that entrepreneurs confront more adverse conditions that limit their overall economic productivity, and how that differs depending on the attributes of the technology venture they are creating. Thus, the specific location and type of entrepreneurial venture are important considerations in ecosystems.

Ecosystems are shaped by various entrepreneurial actors who make those systems dynamically adapted to changing context factors and impact their effectiveness. Acs (2010: 167) describes entrepreneurs contributing significantly to prosperity and economic welfare as high impact entrepreneurs who create leveraged start-ups that “engage in the act of innovation: the development and commercialization of disruptive breakthroughs that shift the wealth creation curve at the industry and the individual level.” High impact entrepreneurs thereby require institutional environments which offer new opportunities based on knowledge spillovers and capital (Stenholm et al. 2013). Such environments are characterized by low levels of regulatory burdens and administrative red tape as well as sufficient levels of entrepreneurship capital, i.e., innovative milieus encouraging start-up activities, formal and informal networks, social acceptance for entrepreneurship as well as risk capital sources (Audretsch and Keilbach 2004b).

2.2.2 *Promoting a Portfolio of Entrepreneurship*

Entrepreneurial ventures are a key to economic growth in several different ways. New ventures can expand existing markets, thereby increasing competition and economic efficiency or they can create entirely new markets by offering innovative products. These new markets present profit opportunities to others, further spurring economic growth (Kuratko 2017). However, because most new ventures start small and many times stay small with a strong likelihood of failing (Carree and Thurik 2003), some argue that public policies which encourage more

people to become entrepreneurs are bad public policy (Acs and Mueller 2008; Shane 2009; Lerner 2010). They argue that the exclusive focus of our public policies should be only on high-growth, high-potential ventures that are introducing major product and process innovations. While there is no question that high-growth ventures (commonly referred to as gazelles) are a huge source of impact on economic growth for any area. Yet, to discourage all other types of ventures actually harms the longer-term economic well-being of society.

In that vein, Morris et al. (2017) introduced a typology of entrepreneurial ventures so as to better define the new venture landscape. Acknowledging the importance of different types of ventures, Morris et al. (2015) developed specific arguments regarding the central economic importance of each type of venture. Based on these arguments, as well as the frameworks developed by Kuratko et al. (2015), the concept of a portfolio approach may be a consideration for public policy efforts aimed at encouraging all entrepreneurial activity that benefits society. As noted by Kuratko et al. (2015: 10), “more than ever, there is a pressing need to develop a comprehensive understanding of the dynamic nature of entrepreneurship—the forms it takes, the process involved, the entrepreneur himself/herself, the venture itself, and the outcomes that derive from its occurrence.”

It becomes evident that entrepreneurial ventures do have an indelible impact on the economies in which they are developed, however, they differ in size, focus, growth rate, and eventual outcomes for societal value. Thus, constructing a portfolio approach with the different types of ventures may be a key step in gaining a deeper understanding of the economic impact and societal value of entrepreneurial ventures. For example, according to Kuratko (2016) the different types of ventures that start up and develop within an economy may be described in the following categories based on size and growth rate:

- *Microenterprise Ventures*: Basic subsistence venture for the entrepreneur with no capacity to reinvest into these ventures. Growth trajectory is extremely low with only day to day survival being the primary motivation, yet, they provide employment and a sense of opportunity for the entrepreneur.
- *Small/Lifestyle Ventures*: Stable income stream venture for entrepreneurs based on a workable business model with modest reinvestments yet difficult to achieve scale in operations. Many times

they are the backbone of a community for products and services, employment opportunities, and a tax base for the local government.

- *Medium Sized Ventures*: These ventures experience moderate but planned growth over time with opportunities for ongoing investment. These ventures generally find unique market niches, have expanded employment opportunities, generate a sizeable tax base, and allow the entrepreneur autonomy and discretion.
- *Gazelle Ventures*: Fast growth ventures that start out seeking markets for exponential growth trajectory. Generally funded by equity capital with a national or global market focus for greater expansion capabilities. They create significant market share, large employment opportunities, huge revenue gains, and tax revenues.

A successful entrepreneurial ecosystem ultimately demonstrates that entrepreneurial firms of all types are embedded in communities. As more ventures are created they can serve to stabilize local economies, support community initiatives, contribute to the tax base, and provide a psychological boost to individuals seeking to pursue their ideas. The value of such contributions is measured not only through social benefits, but in economic returns and potentially more productive use of public monies. The implication is that public policy might be better-served if it encourages entrepreneurial ecosystem development by encouraging all types of ventures (Morris et al. 2015). Such investments can encourage a culture of entrepreneurship, which in turn facilitates even more entrepreneurial activity (Audretsch 2009).

As with any portfolio, by encouraging all types of ventures, the public policies are then balancing a mix of objectives to be accomplished. Included here are some of the areas to balance: supporting incremental and breakthrough innovations to better serve existing markets and also secure the future competitiveness of the economy; supporting newly created markets as well as serving existing local market niches; supporting greater employment opportunities due to the variance in skill requirements and types of compensation with different ventures; and supporting ventures created to find success in the short term as well as the longer term (Morris et al. 2015).

The foundational challenge in public policy development would appear to be one of determining the type of venture in question (e.g., microenterprise, small/lifestyle, medium size, growth, and gazelle) and the growth trajectory with the stage of venture development (e.g.,

pre-start-up, start-up, stabilization, growth) one is attempting to support. Despite the strong rationale of implementing comprehensive public policy approaches that create conducive conditions for the different types of ventures, policymakers tend to favor the high-technology sector, especially since knowledge and technology-based industries tend to exhibit high rates of growth. Although not overrepresented in high-technology industries, young high-growth firms constitute an important pillar for the economic development of a region and consequently have caught the attention, thus are in the focus of public policies (Henrekson and Johansson 2010).

2.2.3 *Promoting High-Growth Entrepreneurship*

Acs and Varga (2005) as well as Wong et al. (2005) investigate the relationship between entrepreneurship, innovation, and economic growth and conclude that especially opportunity entrepreneurship, due to the implementation and creation of knowledge and technology, produces more high-growth firms, thus enhances knowledge spillovers and economic growth. As it is difficult to identify such gazelles at an early stage, Sternberg and Wennekers (2005: 200) advise policymakers to “promote high potential entrepreneurship indirectly, by establishing favorable conditions for knowledge transfer, including adequate intellectual property protection, a well-functioning venture capital market and the presence of spatial agglomerations and/or clusters.” Lamballais Tessensohn and Thurik (2012) examine the entrepreneurial activities across 22 OECD countries and find that opportunity entrepreneurship contributes with about 80% to nascent entrepreneurship (see Fig. 2.1).

Not only growth ambitions of the entrepreneur but also the respective R&D intensity influences high technology as well as high-growth firms (Stam and Wennberg 2009). Hence, public policies need to offer access to early-stage risk financing to address the specific barriers associated with the creation of new high R&D intensity sectors and firms. It is the lack of such young leading innovators which explain the business research and development deficit between Europe and the USA (Cincera and Veugelers 2010). In their study of entrepreneurial activities across various OECD countries, Lamballais Tessensohn and Thurik (2012) find that 75% of entrepreneurs can be labeled as innovative nascent entrepreneurs compared to 25% of imitative nascent entrepreneurs (see Fig. 2.2). Aggregating both examinations of Lamballais Tessensohn

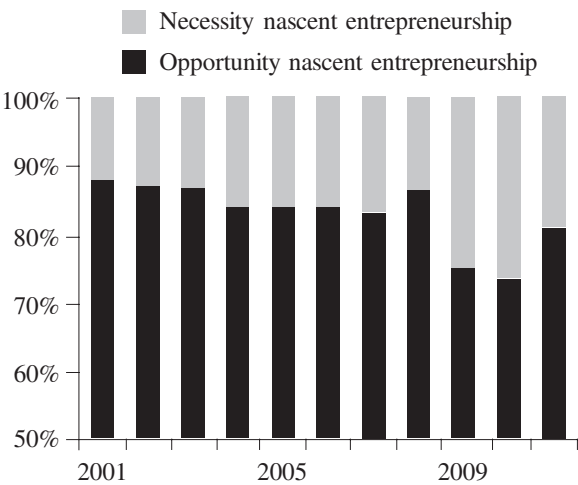


Fig. 2.1 Proportion of necessity to opportunity entrepreneurship aggregated over 22 OECD countries, 2001–2011. (See Lamballais Tessensohn and Thurik 2012: 64)

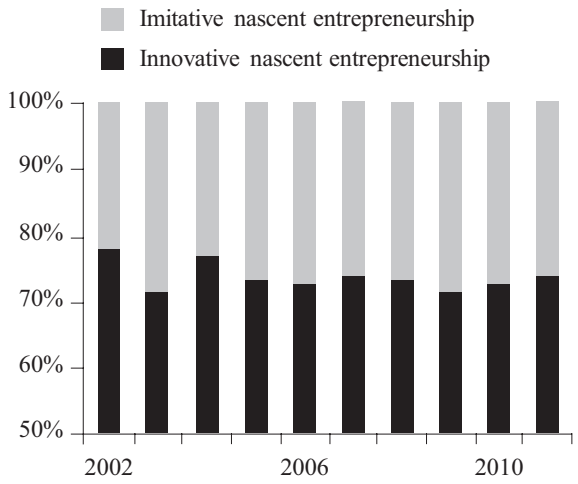


Fig. 2.2 Proportion of imitative to innovative entrepreneurship aggregated over 22 OECD countries, 2002–2011. (See Lamballais Tessensohn and Thurik 2012: 64)

and Thurik (2012) reveals that between 60 and 75% of all nascent entrepreneurs create their own business based on new innovative ideas, thus can be labeled as innovative opportunity entrepreneurs, i.e., the primary target group of policymakers.

By offering direct and indirect support programs, public policy is concerned about shaping entrepreneurial settings and respective orientations of potential entrepreneurs. The creation of a fertile environment for entrepreneurs is thereby no end in itself, but constitutes an essential pillar in regional development strategies. The increase of entrepreneurial opportunities is however only half the story, as entrepreneurs need to exploit respective opportunities to finally add value and contribute to regional economic growth (Alvarez et al. 2013b). As especially technology-based nascent entrepreneurship is associated with high risks, policymakers have to address factors which hinder entrepreneurial endeavors and lower entry barriers in high-technology sectors. On the one hand, policymakers need to develop a deep understanding of high-technology industries and respective mechanisms to be able to provide adequate assistance to guide nascent entrepreneurs. On the other hand, nascent entrepreneurs' insight into market mechanisms and market specific conditions has to be guaranteed in order to ensure an adequate exploitation of created entrepreneurial opportunities.

The European Union and thus Germany continuously try to tackle these issues related to the creation of young innovative technology-based high-growth businesses. The following sections describe the mechanisms of two public policies in Germany, the Leading-Edge Cluster Competition and the Excellence Initiative, and discuss the objectives and effects of these political interventions on the existence of technology-based nascent entrepreneurship. Both initiatives aimed at creating stimulating environments for entrepreneurs in the private and public sector respectively. Due to the fostered public-private sector interactions, both political measures helped to bridge the gap between industry and science, thus opened up new entrepreneurial opportunities for technology-based nascent entrepreneurs. Taking both initiatives together, the Leading-Edge Cluster Competition and the Excellence Initiative had been designed as a holistic public policy approach to leverage existing regional factors and resources and create synergistic outcomes of public-private sector interactions to finally produce economic growth and vitality.

2.3 CLUSTERS AND HIGH-TECHNOLOGY ENTREPRENEURSHIP

Over time, a large body of theoretical and empirical studies has dealt with regional innovation systems and corresponding implications for the regional economic development, highlighting the importance of entrepreneurship and innovation as a source of competitive advantage (Asheim et al. 2011; Capello and Lenzi 2014; Fagerberg and Srholec 2008; Vaz et al. 2014). The existence of regional concentrations of universities and research institutions as the source of knowledge and new ventures and incumbent firms as the exploiter of disseminated knowledge forms the basis of successful cluster development. The formation of clusters is driven by the assumption and growing evidence that regional agglomerations imply positive externalities, enhancing local productivity and finally regional prosperity and competitiveness (Porter 2000). The original awareness concerning the benefits of clusters thereby dates back to Marshall (1890) and his influential work on the *Principles of Economics*. He identified three types of cost advantages associated with regional agglomerations: lower transportation costs for goods, simplified access to human capital due to labor market pooling, as well as an increased efficiency in transferring knowledge and ideas. Among others, scholars like Porter (1990), Krugman (1991), Ciccone and Hall (1996), as well as Ellison and Glaeser (1997) further developed the concept of agglomeration economies and considered the location of a firm, or the spatial dimension in general, as a core element in the creation of competitive advantages and linked the firms' proximity to one another to their actual productivity, hence their overall economic performance. Audretsch and Feldman (1996) finally examined the existence of spatially-mediated knowledge spillovers in various industries and concluded that the propensity of regional agglomerations and clustering is higher where industry R&D, scientific research, and skilled labor are the most important. Thus, especially high-technology firms tend to co-locate as knowledge spillovers are geographically bound and geographical proximity matters (Fischer et al. 2006).

The ongoing shift toward a more knowledge-based economy implies several changes not only for the knowledge production but also for the exploitation and actual application of new scientific knowledge and critically affects regional economic development and cluster formation—also in high-technology sectors (Wolfe 2005: 168). The existence of

“knowledge factories” is a necessary, however not sufficient prerequisite concerning knowledge spillovers, as scientific knowledge has to be converted through entrepreneurial activities into economic knowledge, i.e., new and innovative products, services or processes (Acs and Plummer 2005). Knowledge spillover entrepreneurship depends on the entrepreneurs’ absorptive capacities that allow them to understand new knowledge, recognize the value of new knowledge, and finally commercialize new knowledge by creating a firm (Qian and Acs 2013). In this context, Modrego et al. (2015) highlight the positive effect of scientific and technological infrastructure within clusters that facilitate the exploitation of entrepreneurial opportunities. Different types of infrastructure, i.e., highway, railway, knowledge and broadband infrastructure, influence entrepreneurial decision-making and start-up activities, thus play a crucial role in entrepreneurship and cluster development (Audretsch et al. 2015a). Delgado et al. (2010: 514) confirm this view as they link the existence of strong clusters to higher growth in new business formation and start-up employment: “while at a (narrow) industry level firms may compete for a given pool of resources, the cluster environment that surrounds an industry will increase the pool of competitive resources and reduce the barriers of entry for new firms. Strong regional clusters enhance the range and diversity of entrepreneurial start-up opportunities while also reducing the costs of starting a new business.” Due to the positive impact of clusters on entrepreneurship, Rocha and Sternberg (2005) suggest that both cluster and entrepreneurship policy should be designed together to create synergistic outcomes.

2.3.1 Cluster Policy in Germany: The Leading-Edge Cluster Competition

The “High-Tech Strategy 2020” was a political approach in Germany to create such conducive environments by providing regional subsidization as well as networking support to foster entrepreneurship, innovation, and finally regional wealth (BMBF 2014). The Leading-Edge Cluster Competition was launched in 2007 as a part of the “High-Tech Strategy 2020” by the German Federal Ministry of Education and Research (BMBF) and supported in total 15 high-technology cluster initiatives throughout Germany, which were selected in three rounds of competition, providing a total €600 million of funding from 2008 till 2017. The initiative focused on both strengthening existing industrial

sectors and respective firms as well as creating dynamic environments for start-ups which should facilitate the exploitation of entrepreneurial opportunities. Especially knowledge-oriented start-ups with the potential of becoming technology leaders, thus shaping and changing market structures had thereby been considered as the core objective of this political program. In order to utilize the full potential of subsidized regions, public and private fundings were offered to encourage nascent entrepreneurs to start and develop technology-based high-growth ventures as well as strengthen the competitive position of incumbent firms. Based on the close proximity of nascent entrepreneurs to incumbent small and medium sized companies and multinational corporations as well as research institutions and universities, potential market participants should be supplied with valuable assistance to facilitate the go-to-market phases and lower entry barriers associated with the high-technology sector. The outstanding role of this political intervention, compared to previous public policy measures is justified by the fact that the selection of subsidized clusters was not primarily accomplished by politicians but initiatives and corresponding regions had to apply for the respective contest rounds. Hence, instead of just selecting and subsidizing specific regions, this policy framework triggered a self-selection process of regions inhering sufficient prerequisites for a sustainable development of local innovation and entrepreneurship systems. The approach aimed at reducing information asymmetries and helped regions identify and allocate idiosyncratic local resources prior to the actual political intervention.

Due to the considerable differences between East and West Germany concerning the regional endowment, the Leading-Edge Cluster Competition pursued two different targets: enhancing the economic development of low endowment regions and sustaining the existing momentum of high endowment regions. Fritsch (2004) compares growth regimes in East and West Germany by investigating market dynamics between 1993 and 2000 and concludes that vast differences in the levels of entrepreneurship exist: being located in East Germany constitutes a competitive disadvantage. The Leading-Edge Cluster Competition wanted to reduce these economic inequalities and develop the competitiveness of regions and industries across Germany. *Margret Wintermantel*, President of the German Academic Exchange Service (DAAD) and member of the jury of the Leading-Edge Cluster Competition, consequently perceives the Leading-Edge Cluster Competition as “a clear signal that Germany is investing heavily in

innovation and leading-edge research, promoting regional strengths and going to great lengths to create and further develop a positive climate for innovation and start-ups” (BMBF 2015b: 12). As a result, public cluster policy is a form of regional policy which tries to leverage local resources and factors to stimulate entrepreneurial action. Following the accompanying evaluations of the Rhineland-Westphalia Institute for Economic Research (RWI), the Leading-Edge Cluster Competition created an important momentum for the development of regions by intensifying the networking of innovative actors from industry and science (RWI 2014). Start-ups, as well as small and medium sized companies, in high-technology industries thereby occupied an important position in respective cluster networks, as it were the entrepreneurial activities of these firms which drove the formation of partnerships and strategic alliances which finally led to the desired synergistic innovative outcomes.

Audretsch et al. (2016) investigate the effects of the Leading-Edge Cluster Competition on new venture creation by considering not only the political initiative itself but also the regional endowment and conclude that the direct effect of this public policy intervention, i.e., the labeling effect of being excellent, was rather low compared to the impact of local research institutions and universities and the associated innovative milieu on new venture creation. Accordingly, the Leading-Edge Cluster Competition succeeded in selecting regions which were able to efficiently utilize the established windows of opportunity created by the initiative, hence contributed to the capacity building of regions which were able to mobilize and leverage their resources—resulting in increased entrepreneurial action. Boosting interaction and cooperation across different disciplines and both the public and the private sector and encouraging the exploitation of potentials generated by respective interactions finally lead to 40 technology-based high-growth business start-ups within the selected 15 leading-edge clusters. Provided support services for the successful market entry of start-ups and spin-offs thereby enabled nascent entrepreneurs to strongly contribute to the knowledge and technology transfer between business and science. Thus, the focus of public cluster policy as well as entrepreneurship policy should be on the creation and development of conducive environments which may function as the breeding grounds for (nascent) entrepreneurial activities (see Mueller 2006). The aim of respective measures has to be to overcome prevalent bottlenecks within regions while considering idiosyncratic regional prerequisites. This in turn may reduce entry barriers related to

start a new business and simultaneously stimulate entrepreneurial activities of potential entrepreneurs. Intensifying formal and informal networks by fostering public and private sector interactions forms the basis for innovative nascent entrepreneurship, the creation of new businesses and finally regional economic growth.

2.4 UNIVERSITIES AND KNOWLEDGE-BASED ENTREPRENEURSHIP

Authors like Hayter (2013) as well as Ghio et al. (2015) reviewed the extant empirical literature on knowledge-based entrepreneurship and the underlying knowledge spillover theory of entrepreneurship, highlighting the important strategic role of universities within networks and strategic alliances for the entrepreneurial success. Not unlike firms, universities cannot act independently from their regional endowment, but have to establish and join innovation networks to foster knowledge creation and transformation and finally contribute to value creation activities (see Lehmann and Menter 2016). Universities constitute essential pillars in regional innovation systems and corresponding technology transfer processes (see Perkmann et al. 2013). In the last few years, they have gained the attention from policymakers who are mainly concerned about sustainable regional development strategies (Audretsch et al. 2015b). In the course of governments trying to leverage local resources and coordinate activities of respective ecosystem actors, an emerging strand of literature focuses on the specific role of universities pursuing and fostering entrepreneurial activities that eventually shape regional competitiveness (Audretsch et al. 2012; Guerrero et al. 2014, 2015; Lehmann 2015). Shifting toward an entrepreneurial paradigm, universities' tasks of teaching and research are increasingly expanded toward the commercialization of knowledge or the support thereof, the so-called third mission (Etzkowitz et al. 2000). On the one hand, universities enhance the level of human capital within a region and thus increase regional wealth (see Carree et al. 2014). Formal education and training related to entrepreneurship, so-called entrepreneurship-related human capital assets, significantly contribute to the transformation of existing markets and the creation of new markets, i.e., create entrepreneurial opportunities for potential entrepreneurs, enhance their absorptive capacities and thus stimulate the exploitation thereof (Martin et al. 2013; Marvel and

Lumpkin 2007). On the other hand, universities shape regional innovation systems and associated economic performance by collaborations with industry (see Cunningham and Link 2014) and commercializing activities (see Abreu and Grinevich 2013). An essential element for efficient and effective university–industry technology transfer processes thereby constitutes the existence of an adequate resource stock of the university, i.e., experienced technology transfer personnel as well as adequate incentive structures rewarding entrepreneurial endeavors (O’Shea et al. 2005).

Different political mechanisms have been institutionalized to sustain and increase the positive effects of university-based knowledge and university-developed technology entrepreneurship. Policies thereby affect both the public and private sector and try to promote public-private partnerships and associated knowledge flows (Faulkner and Senker 1994). Whereas innovation policies try to create synergistic outcomes of public-private sector interactions, higher education policies aim at improving the quality of both teaching as well as research activities of universities and stimulate commercialization efforts. As respective knowledge spillovers, i.e., entrepreneurial innovation patterns, are subject to regional context conditions (Autio et al. 2014; Camagni and Capello 2013), Autant-Bernard et al. (2013) argue that original strategies have to be built to reinforce regional innovation processes and ease the diffusion and capture of knowledge.

2.4.1 University Policy in Germany: The Excellence Initiative

With the introduction of the Excellence Initiative, a university policy initiative aimed at promoting top-level research in order to make Germany a more attractive, internationally competitive research region, Germany tried to implement “original strategies” to sustainably create competitive advantages by putting universities and research institutions into a central position within regional innovation systems while considering regional idiosyncratic prerequisites (DFG 2013). The provision of adequate conditions for efficient technology transfer processes thereby focused on the development of future technologies and markets as well as the creation of strategic research collaborations between the public and private sector. Policymakers aimed at creating an academic environment stimulating and encouraging entrepreneurial activities, thus promoting technology-based nascent entrepreneurship.

The Excellence Initiative was organized by the German Research Foundation (DFG) and the German Council of Science and Humanities (WR) and provided a total of €1.9 billion to fund selected universities in three areas: Graduate Schools, Clusters of Excellence as well as Institutional Strategies. All three funding lines aimed at promoting interdisciplinary top-level research to enhance Germany's competitiveness in the higher education sector and strengthen Germany's position in the international domain. The core objective of this program was to further exhaust the universities' innovative capabilities and potential of creativity and facilitate the commercialization of produced knowledge and ideas by encouraging public-private sector interactions. *Doris Ahnen*, State Minister of Rhineland-Palatinate for Education, Science, Further Education and Culture consequently notes that "the Excellence Initiative has sparked a pioneering spirit at universities, along with new ideas and diverse new forms of cooperation between universities and non-university research institutions. The Initiative has thus made a significant contribution to overcoming the frequently lamented pillarization of the German science system" (DFG 2013: 13).

In the course of the Excellence Initiative, selected universities were enabled to establish an innovative, dynamic, and fertile academic environment for nascent academic entrepreneurs through public funding. Klarl et al. (2016) investigate the effects of the German Excellence Initiative on university performance and conclude that especially the announcement of the provision of additional public funds and respective efforts of universities to engage in the competition, not the initiative itself, triggered diverging performance paths within the German higher education system. Thus, this research confirms the initiated self-selection process among German universities, as only those universities applied which possessed sufficient resources to compete on an international scale and create fruitful environments for cutting-edge research. An example of a conducive academic ecosystem for (nascent) entrepreneurs can be found at the Technical University of Munich (TUM). Promoted as one of the first excellence universities in Germany, the Technical University of Munich launched the Institutional Strategy 'TUM. The Entrepreneurial University' in 2006 to focus on cutting-edge research, nurture young scientists and researchers and establish a culture of entrepreneurship and diversity (TUM 2016). The TUM imposed entrepreneurial approaches in various areas such as energy, natural resources, communication and information, mobility,

and infrastructure and encouraged the transcending of boundaries of all kinds. Thus, TUM's strategy was designed to foster diversity and interdisciplinary research, promote closer interaction with industry, and encourage growth-oriented technology spin-offs, i.e., entrepreneurial actions.

2.4.2 Principal Investigators as Role Models for Nascent Academic Entrepreneurs

The urge of governments for scientific breakthroughs and new industry creations is associated with a change in conducting research within universities. Curiosity-driven research, i.e., supply-driven (basic) research, has to a certain extent shifted toward society-driven research, i.e., demand-driven (applied) research (Geuna 2001). This changing rationale has brought academic research closer to the private sector, thus strengthening university–industry collaborations and respective funding schemes (Guerzoni et al. 2014). In this context, a new role model has evolved, the PI, who enacts his/her environment and bridges the gap between industry and science, thus functioning as a boundary spanner, science and market shaper (Mangematin et al. 2014). PIs take on the role as scientific entrepreneurs, shape new horizons and reshape boundaries between the public and the private sector (Casati and Genet 2014). An emerging strand of literature focuses on key individuals within innovation networks taking on these tasks (see Menter 2016). It is the PI who coordinates multi-stakeholder networks, acquires resources and acts as a boundary spanner to bridge the gap between the creation of knowledge, i.e., science, and the exploitation of knowledge, i.e., industry (Boehm and Hogan 2014). Not unlike the entrepreneur, PIs engage in the commercialization of knowledge, shape and reshape the boundaries of their institution, organizations, knowledge or even whole markets (Casati and Genet 2014).

PIs create conducive environment themselves as well as with the help of political programs and consequently build the breeding ground for further entrepreneurial action. Thus, PIs act as role models for nascent academic entrepreneurs as they are transforming their scientific, economic, and societal ecosystem, shaping and articulating novel research avenues, and mobilizing scientific and industry networks, hence bridging academia and industry (Cunningham et al. 2016). Based on the Excellence Initiative's strive for developing project-based, top-level

university research, scientists were encouraged and also enabled to take on the PI role for large-scale, multi-disciplinary, multi-partner projects. It is the vision of the entrepreneur as well as his/her entrepreneurial capability which attracts nascent academic entrepreneurs to engage in the commercialization of knowledge and act as boundary spanners closing the knowledge gap between universities and firms (Kidwell 2014). Hence, the Excellence Initiative can be considered as an important component of comprehensive regional development strategies in Germany, as this program aimed at mobilizing and leveraging existing factors and resources and helped to establish entrepreneurial-driven universities, able to contribute to economic growth beyond their traditional tasks of teaching and research.

2.5 CONCLUSION

The mandate of public policy is the improvement of the economic performance of a place, i.e., policymakers are requested to make the most out of scarce local resources and factors (Audretsch 2015). Therefore, adequate strategies have to be implemented in order to facilitate value creation and enable market participants to effectively contribute to regional economic wealth and prosperity. Since the level of entrepreneurship as well as the propensity of entrepreneurial interaction among regional entities constitute important cornerstones of regional development strategies, entrepreneurship and innovation policies are increasingly considered as essential instruments in shaping a region's competitiveness to achieve superior economic performance (Audretsch and Walshok 2013). The formation and management of entrepreneurship and innovation networks as well as respective ecosystems increasingly gain complexity due to three reasons: an increasing number of involved entities; an increasing density in terms of collaborations; a wider geographical distribution. In the course of addressing these challenges, public policy needs to provide an effective framework for innovation which offers opportunities for knowledge-based entrepreneurship (Karlsson and Warda 2014).

Governments worldwide have adopted various direct and indirect policy measures to create conducive environments for (nascent) entrepreneurs which should facilitate the exploitation of entrepreneurial opportunities and the creation of new ventures. However, respective initiatives have recently aroused serious criticism by renowned scholars like Shane (2009) or Brown and Mason (2014) who argue that the majority of

entrepreneurial firms are micro firms with limited growth potential generating only few jobs, thus little wealth. They call for a recalibration of entrepreneurship policies which should deliberately promote technology-based, high-growth companies, i.e., create incentives for innovative high-technology firms instead of the “typical” start-up companies.

In its strive for becoming an innovation leader in Europe and the world, Germany has launched several policy initiatives in both the public and the private sector to leverage existing local factors and resources and increase the number of entrepreneurial opportunities exploited by (nascent) entrepreneurs in knowledge intensive, high-technology sectors. With the Leading-Edge Cluster Competition and the Excellence Initiative, policymakers aimed at encouraging entrepreneurial action by creating fertile environments for (nascent) entrepreneurs and lowering entry barriers associated with the creation of entrepreneurial firms. Especially the Leading-Edge Cluster Competition thereby tried to create a positive climate for technology-based innovation and high-growth start-ups. By fostering public–private sector interactions, both political programs succeeded in achieving synergistic outcomes resulting in a multitude of innovative business start-ups and spin-offs able to compete globally. Thus, nascent entrepreneurs were enabled to absorb knowledge spillovers and transform new ideas and knowledge into innovative marketable products and services.

The sole focus on high-technology, high-growth entrepreneurship is a necessary, yet not sufficient approach for fostering nascent entrepreneurship comprehensively. Welter et al. (2016) call for a reconsidered perspective on public policy interventions that should embrace the heterogeneity of entrepreneurship. As we mentioned earlier, Kuratko (2016) argues that a more diverse approach to effective public policy and entrepreneurship is needed to balance the different types of entrepreneurial ventures which coexist within entrepreneurial ecosystems. Thus, public policy should rather enlarge and improve the total pool of ventures instead of limiting its focus exclusively on high-growth firms (Morris et al. 2015). Accordingly, different, more effective strategies should be adopted for the different types of ventures which help address imbalances within regions and strengthen local competitiveness to finally augment regional economic vitality.

Future research on entrepreneurship and associated policies should consequently incorporate the highlighted multifaceted view on (nascent) entrepreneurship, thus provide a holistic view on the effects of public

policies on entrepreneurial activities. More studies are needed which evaluate the impact and effectivity of public policy interventions aimed at increasing regional wealth. As public money is a scarce resource, further guidelines and strategies for policymakers have to be developed to fulfill Audretsch's (2015: 126) mandate of the strategic management of places as he states that "places are competing against other places, some of which have a coherent and compelling strategy to enhance economic performance. Surely, these places will have better development prospects than places lacking such a strategy."

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