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Citation for published version:

Spigel, B 2016, 'Developing and governing entrepreneurial ecosystems: The structure of entrepreneurial support programs in Edinburgh, Scotland', *International Journal of Innovation and Regional Development*, vol. 7, no. 2, pp. 141-160. <https://doi.org/10.1504/IJIRD.2016.077889>

Digital Object Identifier (DOI):

[10.1504/IJIRD.2016.077889](https://doi.org/10.1504/IJIRD.2016.077889)

Link:

[Link to publication record in Edinburgh Research Explorer](#)

Document Version:

Peer reviewed version

Published In:

International Journal of Innovation and Regional Development

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Developing and Governing Entrepreneurial Ecosystems: The Structure of Entrepreneurial Support Programs in Edinburgh, Scotland

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Researchers and policymakers are increasingly employing the concept of entrepreneurial ecosystems to understand the concentration of high growth ventures in certain regions. Ecosystems represent the economic, social, and policy environment surrounding the entrepreneurship process. Public and privately run entrepreneurship support organisations (ESOs) form a critical part of entrepreneurial ecosystems by providing training and resources to entrepreneurs and new ventures. However, the role of ESOs within ecosystems is poorly understood with little conceptual or empirical discussions about how they contribute to the development of successful entrepreneurial ecosystems. To address this gap this paper employs the concept of institutional thickness to identify the optimum structure of support programs within a region. The role of institutional thickness is explored through an investigation of entrepreneurship support programs aimed at technology entrepreneurs in Edinburgh, UK. 43 ESOs are identified and their activities and types of support they provide analysed. The paper argues that there is the need for a new approach to the role of ESOs within ecosystems that looks beyond a single program but instead embraces a more holistic perspective that sees how they work in conjunction to provide support for firms throughout the venture creation and growth process.

1. Introduction

The concept of entrepreneurial ecosystems has enjoyed a growing interest within academic and policy circles. However, the idea that certain regional social and economic environments are conducive to growth-oriented entrepreneurship is not new. There is a long legacy from disciplines such as geography (Malecki, 1997, Ritsilä, 1999), sociology (Sorenson and Audia, 2000), and business research (Dubini, 1989, Bahrami and Evans, 1995) that highlighted the relationships between entrepreneurs and their local economic and social contexts. The recent popularity of the topic has been driven by popular business and management works by Feld's

¹ An earlier version of this paper was presented at the 8th Annual International Conference on Entrepreneurship, Innovation, and Regional Development. I am grateful for the advice and comments of Tim Vorley, Nick Williams, Panayiotis H. Ketikidis and the anonymous reviewer. The errors remain my own.

(2012) and Isenberg (2010) as well as the emergence of a new wave of regional policymakers who see metropolitan economic strategy as a key force for promoting growth (Katz and Bradley, 2013). A major part of the ecosystem agenda is the role of public and private organisations in supporting entrepreneurial activity. While such entrepreneurship support organisations (ESOs) are relatively common — it is rare to find a region in a developed economy without some sort of startup incubator or entrepreneurship training forum — their effectiveness has been questioned (Totterman and Sten, 2005, Lerner, 2009, Qian et al., 2011, Amezcua et al., 2013). Beyond this, the effectiveness of programs are often considered in isolation with little awareness that there are often multiple support programs operating simultaneously within regions.

The purpose of this paper is to critically investigate what we know about the role of ESOs within entrepreneurial ecosystems. Ecosystems represent the regional economic, social, and cultural environment within a region that provides support and resources for growth-oriented entrepreneurs (Spigel, 2015, Stam, 2015). These benefits come from a supportive local culture, networks of investors and advisors, and organisations that provide training and resources to entrepreneurs. These benefits do not develop in a vacuum; they are the result of a continuous process of development driven by the needs of multiple stakeholders in both the public and private sectors. While the platonic ideal of entrepreneurial ecosystems, based on success stories like Silicon Valley or Boulder, Colorado, involves an entrepreneur-led transformation, more detailed histories of these regions demonstrate that the state, philanthropists, and universities play a major role in their development (Lécuyer, 2006). In particular, ESOs run by either the state, social enterprises, for-profit firms, or entrepreneurs themselves, are a key source of entrepreneurial resources and training within communities.

This paper synthesises the main conceptual foundations to contemporary ecosystem theory, in particular work on entrepreneurial clusters. Building on these concepts, the paper suggests that institutional thickness (Amin and Thrift, 1994, Amin and Thrift, 1995) is a useful model to understand the role of ESOs within entrepreneurial ecosystems. This framework is used to explore the governance structure of ESOs in Edinburgh, Scotland. While Edinburgh has a very effective entrepreneurial ecosystem — it is home to the United Kingdom’s only billion-dollar technology startups outside of London — its entrepreneurial support structure is dominated by the public sector rather than the entrepreneurial actors seen as crucial in the development of effective ecosystems. This raises questions about the overall effectiveness of these programs to provided target support and resources to new technological ventures in Edinburgh.

2. Literature review

Entrepreneurial ecosystems are the economic and social environment surrounding the entrepreneurship process: the “complexity and diversity of actors, roles, and environmental factors that interact to determine the entrepreneurial performance of a region or locality” (Spilling, 1996 p. 91). This environment is composed of the local market and labour force, nearby investors and mentors, support programs such as incubators or knowledge transfer centres, and a localised culture that supports the risk taking associated with high-growth entrepreneurship (Isenberg, 2010). Such environments help growth-oriented entrepreneurs in two ways. First, a supportive culture within the ecosystem normalises entrepreneurial activities, increasing both the supply of potential entrepreneurs and the number of people willing to accept the risks of working at, investing in, or otherwise supporting new ventures (Minguzzi and Passaro, 2000). Second, entrepreneurs draw resources such as knowledge spillovers, investment capital, and expert mentorship from their

ecosystem, increasing their ability to survive and grow (Nijkamp, 2003, Audretsch et al., 2011).

One of the largest streams of research on entrepreneurial ecosystems has been identifying their most important attributes. This includes factors such as a supportive entrepreneurial culture and history of successful entrepreneurs (Spigel, 2015), the presence of dense social networks of entrepreneurs, investors, and advisors (Zacharakis et al., 2003, Feldman, 2014), research intensive universities that produce both new technological innovations and new entrepreneurs (Harrison and Leitch, 2010), and the presence of open markets with low regulatory barriers (World Economic Forum, 2013). These attributes increase the supply of ambitious entrepreneurs by encouraging risk-taking and innovative activities and improve the survival and growth prospects of new ventures through the resources and support they provide. In many ways an entrepreneurial ecosystem represents this virtuous cycle in which successful entrepreneurship creates the conditions and cultures that spur on further entrepreneurial development.

However, current work on ecosystems can be critiqued on three levels. First, it lacks a strong theoretical foundation. Contemporary views of ecosystems are largely based on histories of successful entrepreneurial regions rather than rigorous research. While there have been attempts to identify entrepreneurial ecosystems through large scale statistical analyses innovation and firm formation rates (e.g. Acs et al., 2014, Audretsch and Belitski, 2016), we know comparatively little about the processes through which ecosystems benefit entrepreneurs . As a result it is difficult to understand the different ways ecosystems change over time and develop different institutional and social structures. A second concern is that much of the existing research on entrepreneurial ecosystems has focused on identifying elements of entrepreneurial ecosystems with little regard for the importance the individual

elements play in the overall functionality of the ecosystem. That is, there has been limited research into how individual aspects such as support programs and policies influence the overall effectiveness of the ecosystem. Finally, there has been little discussion about the governance structure of entrepreneurial ecosystems. Many profiles of entrepreneurial ecosystems tend to be hagiographies that focus on the leadership of individual entrepreneurs in building an ecosystem when the reality of the situation involves the active participation of many other actors from the public and educational sectors.

The conceptual antecedents of entrepreneurial ecosystems provide important insights that can be used to address these critiques. Current thinking on entrepreneurial ecosystems draws on two key literatures: entrepreneurial environments and industrial clusters. While these areas differ in their particularities, they share the belief that there are attributes external to the entrepreneur or the firm but within a region that increase firms' competitive advantages against those outside the region.

2.1. Entrepreneurial environments and contexts

Researchers have long recognised the heterogeneous geography of entrepreneurial activity (e.g. Acs and Audretsch, 1987). Some regions have enjoyed consistently high rates of entrepreneurial activity over the past fifty years while others lag behind. The economic and social environment surrounding the entrepreneurship process is a key factor in explaining this unevenness. Malecki, (1997), building on earlier work by management researchers such as Dubani (1989), Peer (1994) and Spilling (1996) developed the concept of entrepreneurial environments to explore the continued concentration of highly innovative entrepreneurship in particular regions. These environments, built on a foundation of a strong entrepreneurial culture and the presence of universities and other knowledge creating organisations,

“becomes self-reinforcing and sustaining,” preserving the attractiveness of a place for entrepreneurs (Malecki 1997 p. 68).

Such views have been incorporated into newer perspectives of the entrepreneurship process that emphasise the social embeddedness of entrepreneurs in the local and global networks they draw on knowledge, resources, and emotional support from. This is a break with an older tradition that focused on the individual attributes and psychological profiles of entrepreneurs (Dodd and Anderson, 2007). Entrepreneurs draw the resources they require to start and grow the firm through their personal and professional social networks, with the densest and strongest connections often found within their local environment (Schutjens and Völker, 2010). The quality of the social capital and networks of a community will therefore have a significant impact on the ability of entrepreneurs to gather the information, resources, and support they require. While individual attributes such as educational background and prior experience with entrepreneurship still play an important role, the economic and cultural environment surrounding entrepreneurs will have a profound impact on the entrepreneurial journey.

A place's culture plays a crucial role in both the willingness of nascent entrepreneurs to take on the risk of starting a firm but also the willingness of other actors like investors, employees, and mentors to work with the entrepreneur. As shown by Saxenian (1994) and Aoyama (2009), regions with similar resources bases can have vastly different cultural orientations towards entrepreneurship, with some supporting the risk taking necessary for entrepreneurial development and others deprioritising these activities. These cultures develop over time in response to a region's economic history and are resistant to short term policy interventions (Wyrwich, 2012). A supportive culture encourages both potential entrepreneurs

to engage in risk taking activities as well as others to support the new venture by acting as advisors, investors, or employees.

Work on entrepreneurial environments has two implications for our understanding of entrepreneurial ecosystems. First, the quality of the resources within the entrepreneurs' local environment has a strong influence on their future performance. A strong entrepreneurial ecosystem will have a host of opportunities, knowledge spillovers, and a deep labour pool of skilled workers that entrepreneurs draw on, creating an environment that promotes the types of high-growth, innovation based entrepreneurship that are crucial to regional economic development (Bublitz et al., 2015). Second, local cultural outlooks have a major impact on not only the types of resources available within a community but also the ability for entrepreneurs to successfully access them. In this sense the quality of a region's entrepreneurial environment becomes a "powerful determinant of regional... variation in the 'supply' of entrepreneurship" (Klyver and Foley, 2012 p. 562). Cultural attitudes towards entrepreneurship affect the propensity of those who hold these resources to associate with entrepreneurship (Spigel, 2013). Local cultures outlooks that create a high social status for entrepreneurship encourage other people to aid the process, for instance by investing in a high-risk, innovative startup or taking the time to mentor a new entrepreneur (Feldman, 2001). At the same time, local cultures can also work against entrepreneurial activity by stigmatising the risks associated with innovative entrepreneurship (Staber, 2007).

2.2. Industrial clusters

Research on industrial clusters has deeply influenced thinking about entrepreneurial ecosystems. Unlike the entrepreneurial environment literature that highlights the overall importance of the contextual environment, cluster theory focuses on the specific ways firms gain an advantage by being located near other complimentary firms (Porter, 1998). Early

proponents of cluster theories such as Marshall (1920) argued that firms benefit from being co-located near other firms in similar industries or supply chains who can share common infrastructures, skilled labour pools, and the development of specialised suppliers. More recent approaches have stressed the importance of knowledge spillovers due to the increased interaction between co-located firms (Maskell, 2001). The close proximity of firms allows them to observe and learn from each other and engage in cooperative activities that improve their ability to absorb and process new knowledge.

The importance of inter-firm learning within clusters has clear connections with the literature on learning regions. This work highlighted the importance of *learning* as a key source of regional competitive advantage rather than more traditional production factors like industrial infrastructure (Florida, 1995, Morgan, 1997). Innovation of new products and business models does not take place within the firm, rather it is driven by interactive learning processes between firms, customers, suppliers, and universities. This learning is eased by the geographic and cultural proximity engineered within clusters, providing additional advantages to firms within them (Benner, 2003). However, the learning region concept has been critiqued in recent years for a lack of empirical evidence over how this learning takes place and its actual impact on innovation levels (Rutten and Boekema, 2012).

Entrepreneurial ecosystems closely resemble what Markusen (1996) termed Neo-Marshallian Industrial Districts: clusters built on the interactions between multiple small and medium sized firms that simultaneously cooperate and compete within the same industry. The competitive advantages provided to firms comes from the circulation of tacit knowledge between firms and normalisation of particular firm routines such as cooperation and learning. However, the advantages of Neo-Marshallian clusters generally only develop when the region has specialised in a particular industry, such as biotechnology or high-end fashion (Amin and

Thrift, 1992). Work on entrepreneurial ecosystems has not taken up this argument, focusing more on the circulation of entrepreneurial know-how rather than specific sectorial knowledge (Aldrich and Yang, 2014). As with Neo-Marshallian clusters, entrepreneurial ecosystems are marked by a type of relational organisation and governance that lack a clear power hierarchy or formalised enforcement methods (Bell et al., 2009).

The growth of a cluster reproduces and enhances its advantages, in turn attracting more firms who can cooperate and compete in a stronger marketplace. The concentration of firms with specific needs creates a market for specialised suppliers, either for particular technological needs or support services such as patent lawyers or accountants (Kenney and Patton, 2005). The presence of these support firms create new advantages for firms in the cluster, creating a virtuous cycle in which the cluster is strengthened over time. This creates a space for public support for these needs such as targeted educational programs, research and development programs, or public financing of entrepreneurial ventures. The evolutionary paths of clusters create self-sustaining advantages which are key to the continued success of the cluster.

However, there are clear differences between clusters, learning regions and entrepreneurial ecosystems. Clustered firms gain advantages from being co-located with firms in the same industry or supply chain because they can cooperate to serve larger clients, learn from each other's production techniques, and build up the untraded interdependencies that allow them to learn and innovate more effectively (Storper, 1997). Similarly, learning regions focus on the benefits that firms in the same industry receive from the opportunity to learn new technological and market knowledge from one another. This is not necessarily the case for entrepreneurial ecosystems. Entrepreneurs are more likely to share a core technology (such as computer coding) or a core challenges (growing a new venture) rather than a shared

market or industry. Entrepreneurs within an ecosystem benefit from sharing knowledge and experience about the startup process itself rather than particular sectoral or market knowledge. Unlike traditional industrial clusters which build up a suite of supportive institutions and organisations related to the core industry of a region, entrepreneurial ecosystems are marked by the presence of multiple public and private organisations capable of supporting entrepreneurs across a variety of different industries (Pitelis, 2012). The advantages of an entrepreneurial ecosystem are related to entrepreneurial skills and resources rather than other industrial benefits found in more traditional clusters.

A second major difference between entrepreneurial ecosystems from cluster frameworks is that the primary actor in ecosystems is entrepreneurs rather than the state or major international firms (Stam, 2015). That is to say, previous work in clusters and regional innovation systems has emphasised the role of the state in creating the preconditions for the cooperation, knowledge spillover, and innovation associated with successful knowledge-based economies (Storper, 1997, Asheim et al., 2011). The state acts as a leader to develop new policies that will ultimately affect the activity of firms by supporting particular industries or types of interactions (Rinkinen, 2015). Within ecosystem theory, networks of entrepreneurs are seen as the prime movers in organising the ecosystem to create the resources and attributes they need, with local governments and other actors working to support the efforts of entrepreneurs.

3. Governing entrepreneurial ecosystems

The main method governments have to support entrepreneurial development and the creation of entrepreneurial ecosystems is initiatives to train entrepreneurs, provide financing, or supply other resources they require (Lundstrom and Stevenson, 2006). However, there has been little direct research on the role of governance public policy in entrepreneurial

ecosystems. While ESOs do not constitute an entrepreneurial ecosystem by themselves, they remain a crucial element of any successful ecosystem by helping new startups overcome their lack of resources, training, financing, and access to market. The diffuse nature of power within the entrepreneurship process makes governance a critical factor. The state cannot dictate how entrepreneurs go about starting and running a business nor can it dictate people's attitudes toward risk and investment. Rather, ESOs work within existing social frameworks and networks of existing firms, entrepreneur-led initiatives, and institutions in order to deliver services and resources to entrepreneurs (Amezcuca et al., 2013).

Based on his experience as a champion of Boulder's entrepreneurial ecosystem, Feld (2012 p. 25) makes the clearest argument for how an ecosystem should be structured, writing: "The most critical principal of a startup community is that entrepreneurs must lead it." Feld argues that most policy-driven attempts to build entrepreneurial ecosystem fail due to a lack of engagement with the on-the-ground needs of entrepreneurs. In his view, entrepreneurs must be in a position to articulate a vision for their entrepreneurial environment and take the leading role in creating the various groups, networks, and programs that will deliver the support they desire.

However, there are substantial challenges in reaching Feld's vision of an entrepreneur-led ecosystem. Pitelis (2012) suggests that the issue of appropriability is a barrier to cultivating entrepreneur-led ecosystems. Entrepreneurs are needed to create support organisations, mentor other entrepreneurs, and act as network builders to help establish and maintain an entrepreneurial ecosystem. These activities require an inordinate amount of time and effort on the part of entrepreneurs, who already have substantial responsibilities within their own firms. It is difficult for entrepreneurs to perceive the benefits of starting or joining these types of organisations if they cannot see successful examples around them. A

supportive entrepreneurial local culture can help overcome this barrier. Cultures that create a high social status for entrepreneurship and which normalise intensive networking help actors understand the value of participating in an entrepreneurial ecosystem. Recent work on dealmakers within entrepreneurial communities suggests that associating entrepreneurial support with civic pride is a powerful motivator for highly networked individuals to actively contribute to their ecosystem (Feldman and Zoller, 2012). As Feldman (Feldman, 2014 p. 4) argues: “a spirit of authenticity, engagement, and common purpose if the particular feature that differentiates successful [entrepreneurial] places.” However, a supportive culture alone cannot catalyse the entrepreneur-led initiatives that Feld sees as central to an ecosystem.

This leaves a major role for the state in supporting ESOs. While there is general agreement that ESOs are crucial, there has been relatively little work about how these programs support the development of a successful entrepreneurial ecosystem. Case studies by the Kauffman Foundation are amongst the few sources that address this topic (Motoyama et al., 2014, Motoyama and Watkins, 2014). These reports call for a broader view of support organisations that goes beyond the role of individual programs and embraces a more cohesive view of the resources provided by multiple organisations. But while the authors suggest that linkages between ESOs are critical to provide the appropriate support to firms at different stages of the venture creation and growth process, there is still a major research gap around how these programs should coordinate and integrate with more informal groups and social norms.

Prior research on ESOs have tended to focus on the effectiveness of individual programs rather than on the larger community of support programs within a region (e.g. Amezcua et al., 2013). They have primarily examined the success or failure of individual programs based on the impact they have had on client firms or the larger regional economy

(Brown et al., 2015). This ignores the fact that most regions have multiple entrepreneurship programs run by a variety of actors including local governments, universities, economic development agencies, and third sector community groups. Each have different goals, but they act in concert to develop and provide resources and support to new entrepreneurs and growing ventures. Their effects cannot be considered in isolation.

Acknowledging the role of the state raises the question of which state: regional public bodies such as city governments or universities; sub-national governments such as provincial or state governments; national bodies in the form of national governments; or super-national bodies such as groups such as the European Union or the OECD all fund or operate ESOs. Most often, entrepreneurship support is provided by all four levels of government, creating issues of multi-level governance. While economic development has been traditionally the purview of national governments, in many jurisdictions this responsibility has been downloaded to regional governments or uploaded to larger units such as the EU for funding and coordination (Pike et al., 2015). Despite these changes, interactions between bodies at all levels is necessary for successful policy making and service delivery (Piattoni, 2010). However, it is difficult to create Feld's vision of ESOs supporting entrepreneur-led initiatives when funding and power for public investment is held outside the region because different levels of government have competing agendas of who must be served by public investment. For example, a national government might be more interested in reducing the unemployment rate through self-employment initiatives while a local government would prefer to invest in high-tech areas of strength that require a longer investment horizon. This creates a tension between the need for more outside resources to support entrepreneurship — particularly within economically disadvantaged regions — and the need for the state to be responsive to the immediate needs of current entrepreneurs.

Work on clusters provides useful guidance about the role of the state in creating a fertile environment for entrepreneurship, but it gives fewer explicit policy models.

Institutional thickness, a concept that developed out of early thinking on the clusters within a globalised economy, provides a more compelling model for the role of public, non-profit, and private organisations in helping to create an environment conducive to the formation of an entrepreneurial ecosystem. As originally described by Amin and Thirft (1994; 1995), institutional thickness refers to regions with a large number of economic development and support organisations who exhibit high levels of interaction and cooperation between them with well established goals, power relations, and a shared vision of a common regional goal. Institutional thickness is a governance structure of clusters that helps preserve their competitive advantage. This configuration of state and non-state institutions help ‘territorialize’ production systems, counterbalancing the tendency for firms to relocate to lower-cost regions. Networks of support programs, educational organisations, and more informal collaborative cultures provide firms with a competitive advantage that they would lose if they moved their production or management functions away from the region (Keeble et al., 1999).

Two elements of institutional thickness are important to support the development of entrepreneurial ecosystems. The first is a diverse array of support programs targeting different industries and types of entrepreneurs. Both public and private social enterprises can develop small yet focused programs to target specific areas of need, such as academic entrepreneurship, green technology, or getting existing firms ready for venture investment. Ideally these programs are either run by entrepreneurs themselves or developed based on intensive market research. Second, strong connections between these programs to ensure that their services cover the entirety of the entrepreneurship process, from initial idea to growth to

the final exit. This allows programs to ‘hand off’ entrepreneurs as their needs change, providing more entryways for entrepreneurs to engage with support programs and ensuring continued support throughout the entrepreneurship process. Strong connections between programs also helped create the shared goals and sense of mission associated with institutional thickness.

5. Governance in Edinburgh’s entrepreneurial ecosystem

5.1. Entrepreneurial support in Edinburgh, Scotland

Edinburgh, Scotland is one of the most successful areas for growth-oriented, technology-based entrepreneurship in the United Kingdom. It ranks in the top ten of British cities in terms of the number of firms founded, patents per capita, and percentage of the population with higher education qualifications (Tech City UK, 2015). The city boasts a major research university, the University of Edinburgh, as well as two other universities with strong engineering, business, and life science programs. Along with its traditional strengths in finance the city boasts strong concentrations of leading firms in software industries, creative services, and life sciences.

The devolution of economic development responsibilities to the Scottish Government has led to a major role for public support for technology entrepreneurship in Edinburgh’s economy (Keating, 2005, Brown et al., 2015). Scottish Enterprise, the main Scottish economic development organisation, distributed more than £250 million in aid and grants to entrepreneurial ventures in 2014-15, with a particular focus on growth-oriented technology ventures (Scottish Enterprise, 2015). This support is delivered through dozens of ESOs that are run by Scottish Enterprise itself or through external organisations supported by groups such as Scottish Enterprise, the Scottish Funding Council, universities as well as independent ESOs unconnected with the Scottish government. Some of these such support organisations

provide general advice and guidance for entrepreneurs in any sector while others provide very targeted assistance for firms in priority sectors.

The complex array of organisations providing support for entrepreneurs raises questions about their coordination and overall role in Edinburgh's entrepreneurial ecosystem. To better understand the relationship between the resources and support these organisations provide and the entrepreneurship process in Edinburgh an analysis of the various ESOs targeting technology entrepreneurs was conducted as part of a larger investigation. ESOs were identified through government publications, consultations with key informants, and monitoring Scottish entrepreneurship media outlets. The criteria for inclusion in the analysis were (1) the program is targeted at technology entrepreneurs, broadly defined, (2) the program is serves entrepreneurs in Edinburgh rather than being a general nation-wide program, and (3) the program has an actual support staff and resources rather than being an initiative of another organisation (for example, a grant distributed by a university department to support academic entrepreneurship would not be considered a support program). In total, 43 ESOs were identified using these criteria. This is necessarily an incomplete and conservative list as there is a constant churn as new programs are introduced and moribund ones are shut down.

Edinburgh also has multiple ESOs aimed at non-technology entrepreneurs. The largest amongst these is Business Gateway, a program funded by local city councils that provides basic training and support for new entrepreneurs. This includes information on how to file for corporate and tax registration, business plan preparation, and market research. While some technology entrepreneurs use its services, it is designed to serve all entrepreneurs no matter their industry or growth prospects. Other organisations provide support for specific market sectors, such as Creative Edinburgh specialise in design-based entrepreneurs by providing

incubation space for designers and specific support for their unique needs like IP consulting or The Melting Pot which supplies seed financing and training for social entrepreneurs. However, outside of the technology sector there is no critical mass of programs that can provide resources and support for all stages of the startup process. As will be discussed below, this is a crucial element of the role of ESOs within Edinburgh's entrepreneurial ecosystem.

The websites and other public materials of these ESOs were analysed in order to provide a basic overview of the types of services they provide and their relationships with other stakeholders in Edinburgh's entrepreneurial ecosystems. Given the breadth of different programs available in Edinburgh, an analysis of their published material, including their mission statements, annual reports, and descriptions of the different events, training sessions, and support they offer is the most effective way to create a broad understanding of their role in the ecosystem. However, there are significant weaknesses with this approach. Not all their avenues of support may be reported in their documents and some discontinued events or resources may still be advertised on websites. However, this method allows for an initial analysis of the types of support provided that can be used to better understand the role of ESOs within entrepreneurial ecosystems. These problems are compounded by continual changes in Scotland's startup scene. New programs are continually being created, especially small, informal groups organised primarily by entrepreneurs while others cease operation or merge with other programs. The findings here must be taken as a static picture of a very dynamic ecosystem.

ESOs services were categorised according to the typology developed by Moyoyama and Watkins (2014) who identify two core functions of ESO: broad and functional (see Table 1). Broad support types focus on providing general resources to aid the entrepreneur with

their overall entrepreneurial journey, such as mentorship, networking, and financial advice. Broad support is crucial for developing new capabilities and resources within the ecosystem. They provide types of support that are essential to the overall functioning of the ecosystem, such as venues for networking and knowledge sharing, that may be difficult for individual entrepreneurs to develop on their own. Functional support provides more targeted solutions to problems entrepreneurs face at specific stages of their firm development, such as helping refine their business model during the initial startup phase or providing subsidised office space in incubators and accelerators as they scale up.

Based on the services provided by the ESOs in Edinburgh, two new types of support were added to the 'broad' category: inspiration and ecosystem coordination. Inspiration are programs whose goal is to inspire new entrepreneurs by publicising success stories. This helps increase the social legitimacy of entrepreneurship in the community and helps motivate entrepreneurs through their challenges. Ecosystem coordination refers to organisations that attempt to build and sustain an entrepreneurial community and ensure cooperation between different bodies. Three types of support were added to the functional category: training, non-competition awards, and direct financing. Training refers to programs providing specific training services to entrepreneurs, for instance by educating them about the startup process or obtaining outside funding. Non-competition awards refer to awards given to entrepreneurs that do not involve a pitching competition but are based on other criteria, such as the overall quality of a business plan or application. Finally, direct financing programs provide either equity financing, loans, or grants to new ventures.

Table 1 Around Here

5.2 Attributes of ESO activity in Edinburgh

As shown in Figure 1, ESOs in Edinburgh provide more broad rather than functional support. On average, each ESO provided 3.6 forms of broad support and 1.8 forms of functional support. Networking were the most popular support activity, with 26 out of the 43 ESOs (60%) providing them. This may be due to the lower cost of putting on networking events compared with other types of entrepreneurial support activities. Training and mentoring were also popular support activities, with 37% and 32% of ESOs offering these services, respectfully. The least common activities were people finding, where the organisation proactively connects the entrepreneur with advisors, investors, or other individuals who can help the venture grow, and financial advising. This is likely due to the extensive social capital and knowledge of the local entrepreneurial community necessary to identify the specific individuals an entrepreneur needs to know based on their unique context and to broker the creation of those relationships. This may be difficult for many ESOs, especially large ones that need to deliver services across Scotland rather than just Edinburgh.

Figure 1 around here

ESOs were further classified based on the stages of a venture's lifecycle they provide support for. Services can be supplied at the idea stage, where the entrepreneur has an idea for a new venture but it needs refining, the pre-start phase where they are developing a business model and plan, the startup phase at which the entrepreneur has founded a new venture and is in the process of developing and selling their product, and finally the growth phase where the firm is expanding its market. ESOs differ in their focus, with some concentrating their resources only on one stage, such as the idea or growth phase, while others cover multiple phases of the entrepreneurship process. Figure 2 suggests a somewhat even distribution of ESOs with at least a partial focus on these stages. The majority of ESOs provided services for one or two stages; only two organisations had services for three or more phases. The lower

number of programs for the growth phase of entrepreneurial ventures may be a concern given the growing realisation about the importance of firms with high-growth potentials for economic development. However, firms at this stage need far more specialised support that is difficult for smaller or less focused ESOs to provide.

****Figure 2 around here****

As shown in Table 2, the majority of ESOs in Edinburgh are financed either directly or indirectly by public organisations like Scottish Enterprise, the Scottish Funding Council, the City of Edinburgh, or one of the city's universities. Twenty (46%) of the ESOs analysed either are fully public bodies, 15 (35%) are non-profits whose funding comes from a public body. Five (12%) are public-private partnerships where a public organisation funds a private enterprise to deliver entrepreneurial support services. Three ESOs (7%) are for-profit organisations who do not receive substantial government support. There are differences in the types of support ESO based on their funding structure. Not for profit ESOs provide few functional resources targeted on specific firms but do provide an array of different broad resources. Public private partnerships, in which for-profit firms contract with public funders to produce resources and support, provided the highest rate of functional supports. Private ESOs provided the highest overall number of different forms of support.

*****Table 2 Around Here*****

A number of these public and public-private organisations are funded through major governmental programs, most frequently Scottish Enterprise, the Edinburgh City Council, or the University of Edinburgh (which itself often funnels funding from Scottish Enterprise). Scottish Enterprise is the dominant actor in the broader Scottish network of entrepreneurial support programs, directly or indirectly sponsoring dozens of different programs which range from broad business advice for entrepreneurs in all sectors to programs specifically targeted

at high growth firms in designated sectors such as oil and gas, biotechnology, and software development. Of the 43 programs analysed as part of this project, only nine (21%) did not receive a majority of their funding from a public source such as Scottish Enterprise. Most of these independent programs are informal networking groups. The only major actor in Edinburgh's entrepreneurial ecosystem not to receive substantial public financing is Codebase, a privately financed technology incubator facility established in 2013.

6. Institutional thickness in Edinburgh's entrepreneurial ecosystem

The number of ESOs operating in Edinburgh suggest that its entrepreneurial ecosystems contains the type of institutional thickness critical to preserving the region's competitive advantage. ESOs serving Edinburgh range from large, broad programs that provide generic training any entrepreneur to much smaller and more focused programs designed to help provide mentorship, financing, and support to specific types of entrepreneurs in priority sectors. These ESOs make up an important part of Edinburgh's entrepreneurial ecosystem, providing resources and support to entrepreneurs that they would not otherwise necessarily have. The sheer number of programs designed to assist technology entrepreneurs suggests some degree of institutional thickness. The collection of programs available in Edinburgh can provide assistance across the entire entrepreneurship process, from the pre-idea stage until growth and eventual exit. These programs offer a wide variety of different services, including broad support that builds up the strength of the entire ecosystem and more functional support to provide targeted resources and capabilities to certain firms.

But the institutional thickness of ESOs in Edinburgh's ecosystem is derived from more than their quantity alone. Many of the ESOs analysed in this study have either formal or informal relationships with other programs. Some aimed at the idea and pre-start phase will refer their clients to other programs more appropriate for their later stages of growth. This is

particularly true for large programs like Business Gateway, a Scottish Enterprise funded program that provides general business advice and support for all new businesses, from small one-person retail establishments to high-tech startups. They are specifically positioned to refer high-growth firms to other Scottish Enterprise programs and business plan competitions run by other organisations. Similarly, academic entrepreneurs who first engage with the University of Edinburgh's startup support program Launch.ED to develop an initial business idea might be encouraged to apply for further entrepreneurship support and funding from other programs such as the Royal Society of Edinburgh's Enterprise Fellowship or to enter the ScottishEdge or Converge Challenge startup competitions in order to secure follow-on funding.

The formal and informal referral relationships between ESOs is crucial for their overall impact. This allows individual programs to specialise in specific industries or startup phases, such as incubators for the creative industries or business plan competitions for academic entrepreneurs, rather than trying to replicate services to provide support for all phases of development. This allows entrepreneur-led programs can target what they see as the immediate needs of the ecosystem — such as how StartEDIN, a local startup lobbying and coordination group, focuses on labour market shortages for startups — without having to necessarily having to provide other services such as entrepreneur training or financial advising.

The role of Scottish Enterprise as a major funder of entrepreneurial initiatives in Scotland allows it to set the general direction and mission for many of the ESOs in Edinburgh. In this sense it can be seen as helping Edinburgh's entrepreneurship support community develop a common vision for an economic development path. However, the extent to which this common vision is based on the unique needs of Edinburgh's economy is

questionable. The overall mission of Scottish Enterprise is focused on the economic development needs of the entire nation, which vary from the rural economy of the Highlands, the petroleum cluster in Aberdeen, and the design hub of Glasgow. While Scottish Enterprise is a nominally independent agency, its priorities are set by the Scottish Government who often steer support towards sectors of the economy they deem important. The focus on Scotland-wide priorities makes it difficult for Scottish Enterprise to concentrate on the unique economic paths found in Edinburgh or other communities.

One of the most interesting facets of Edinburgh's ESO community are the number of programs dedicated to strengthening the overall ecosystem. Of the 43 ESOs analysed, 5 (11%) had some sort of ecosystem coordination role. This includes both Scotland wide organisations like ScotlandCanDO, a program run by the Scottish government to build a more cohesive Scottish entrepreneurship community as well as local groups like StartEDIN, an entrepreneur-led community group. This suggests a strong interest amongst policymakers, entrepreneurs, and other ecosystem actors in organising the different activities of various ESOs to ensure that they cover areas of need.

The structure of ESOs in Edinburgh meets the basic definition of institutional thickness. However, it is unclear clear the extent to which their offerings meet the collective needs of the ecosystem. Many programs, especially those aimed at the idea and startup phase, provide more generic resources and support that can be found in most areas throughout the United Kingdom. More locally-specific programs are able to provide harder to provide resources such as connecting entrepreneurs with mentors. However, it is difficult to evaluate the extent to which they help new startups develop a durable competitive advantage similar firms outside the ecosystem.

7. Conclusion

Support programs are a single facet of a larger entrepreneurial ecosystem. While these programs act as a way to channel resources and guidance to entrepreneurs they do not by themselves constitute an entrepreneurial ecosystem. An ecosystem is based around the entrepreneurs, investors, advisors, and workers of a region along with underlying cultural and social attributes that underlie the entrepreneurship process. Though ESOs are not the centre of ecosystems they can be seen as force multipliers which can build on and accentuate the existing attributes and networks of a region and provide a way to access resources that are not otherwise available.

The quantity and variety of ESOs in Edinburgh suggest that a broader perspective is needed to understand their role within entrepreneurial ecosystem. It reminds us that most regions have dozens of different programs whose goal is to support entrepreneurs. Some may be run by the regional government or funded by national or super-national bodies while others will be organised by local entrepreneurs or philanthropists. In order to understand how the ecosystem operates and how it will develop in the future requires understanding the complex networks and relationships between these programs and other aspects of the local entrepreneurial environment. No single program provides all the resources and support a new venture needs as it progresses through its entrepreneurial path. Rather, a multitude of organisations provide a smaller number of specialised types of support and resources, such as training, networking, and financial assistance, that firms access as they require them. These organisations work in concert to provide a wider array of targeted support options for firms. Beyond this, there is a class of ESOs that do not provide direct services to entrepreneurs at all but instead focus on coordinating the larger entrepreneurial ecosystem. This call attention to the importance of the universe of services offered by the broader constellation of ESOs rather than focusing on the efforts of one particular organisation.

As of yet there are few metrics or models to judge the effectiveness of support ESOs within an entrepreneurial ecosystem. ESOs can be very useful to individual entrepreneurs while doing very little to build the overall ecosystem. Drawing on existing work on clusters and institutional economic geography, institutional thickness may be an appropriate model for the structure and governance of support organisations within entrepreneurial ecosystems. Multiple programs can effectively provide a wide array of services and support to entrepreneurs across a variety of different sectors and stages of development. To function effectively these programs should exhibit some level of coordination based on a shared vision. Scottish Enterprise serves as a centralised leader who creates a shared vision through its support for many of the ESOs present in Edinburgh. However, the effectiveness of Scottish Enterprise as this kind of leader is questionable given that its focus extends far beyond Edinburgh and beyond support for growth-oriented technology ventures. Large-scale organisations are not in a position to develop within the constraints of existing regional paths and economic trajectories.

At the same time it is necessary to question the effectiveness of state-led programs in the formation and reproduction of an effective entrepreneurial ecosystem. The prominence of nation-wide programs sponsored by Scottish Enterprise suggests that the largest programs are not well positioned to focus on community building in Edinburgh. While there are several entrepreneur-led, grass-roots organisations in Edinburgh, they lack of the resources of larger organisations like Scottish Enterprise. The local entrepreneur-led organisations have limited influence over these larger programs. This may mean that although there are many ESOs serving Edinburgh's entrepreneurial community, they lack a common vision of the city's economic future that would allow them to build an effective, unified network of support programs.

The findings from this research call for a more holistic approach to understanding the role of ESOs within entrepreneurial ecosystems that looks beyond the functions of a single program but instead embraces a wider view over how they provide resources and support to startups. Few if any programs provide all the services an entrepreneur needs; a network of different programs is necessary to support entrepreneurs at all stages of development from the first inklings of an idea to the final growth and exist of a new venture. Thus, while a region might have a very effective startup bootcamp to help new entrepreneurs create a new venture, the lack of more specialised follow-on services from other programs will act as a barrier to creating an effective entrepreneurial ecosystem.

From a policy perspective, this research makes two important points about how regional governments can support a strong entrepreneurial ecosystem. First, they should avoid one-size-fits-all solutions where a single agency tries to provide all types of possible support at all stages of the start-up and growth process. A larger number of smaller programs can more effectively facilitate entrepreneurial training and knowledge exchange by specialising in particular fields or markets. This leaves more space for independent groups to form their own organisations to address specific areas of need that might go unnoticed by a larger and less nimble top-down solution. Second, program directors should look for links and complementarities between different programs and help sign-post entrepreneurs to different programs as their needs change. By creating a pipeline of programs entrepreneurs can engage in, an ecosystem can ensure that founders can find the appropriate types of support they require as their needs change over time. This diffuse, overlapping strategy will mean that there are duplicated resources and inefficiencies. However, this structure means that entrepreneurs are able to engage with a diverse field of support programs that target their specific needs.

More research is necessary to judge if the current governance model of Edinburgh's ESO community is able to effectively serve local entrepreneurs and help sustain a successful entrepreneurial ecosystem. The goal of the present research was not to evaluate the effectiveness of ESOs in Edinburgh or their ability to provide the resources entrepreneurs require. Further research is necessary to explore the connections between ESOs in Edinburgh and the extent to which their missions are controlled by outside organisations like Scottish Enterprise as opposed to local entrepreneurs. Beyond this, more research is required to understand how entrepreneurs themselves work with ESOs to develop their skills, extend their networks, and obtain resources. Entrepreneurs' use of support programs is their ultimate test of effectiveness and more information on how they utilise support programs will provide valuable insights into the overall place of ESOs within entrepreneurial ecosystems.

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Table 1: Types of ESO support

	Support Type	Definition
Broad	Ecosystem Coordination	Creating community of entrepreneurial actors within a region; helping to bring together different parties to develop new programs and agendas
	People finding	Identifying relationships between entrepreneurs and important actors with unique skillsets and backgrounds (e.g. technologists, investors, customers)
	Networking	Providing venues and events for entrepreneurs to build their own social networks
	Financial advising	Providing general financial advice for entrepreneurs as they build their new ventures
	Inspiring	Disseminating stories of successful entrepreneurs to encourage entrepreneurs and help build a supportive entrepreneurial culture
Functional	Business model advising	Professional advising on firm business models
	Training	Entrepreneurial training (e.g. opportunity recognition)
	Business plan competitions	Awards (monetary or otherwise) for firms based on their business plan or business plan pitch
	Market research	Professional market research and due diligence to identify competitors and customers
	Space and incubation	Subsidized office space in an incubator or accelerator
	Awards	Any award, monetary or otherwise, for a firm that does not include a business plan component
	Direct financing	Investment or loans to a startup firm

Table 2: Organisational Structure of ESOs in Edinburgh

Type of Organization	Number	Average Broad Support	Average Functional Support	Total Average Support
Public	20	2.6	2.3	4.9
Private	3	3.9	2.2	6.1
Not for Profit	15	3.6	1	4.6
Public Private Partnership	5	3	2.6	5.6

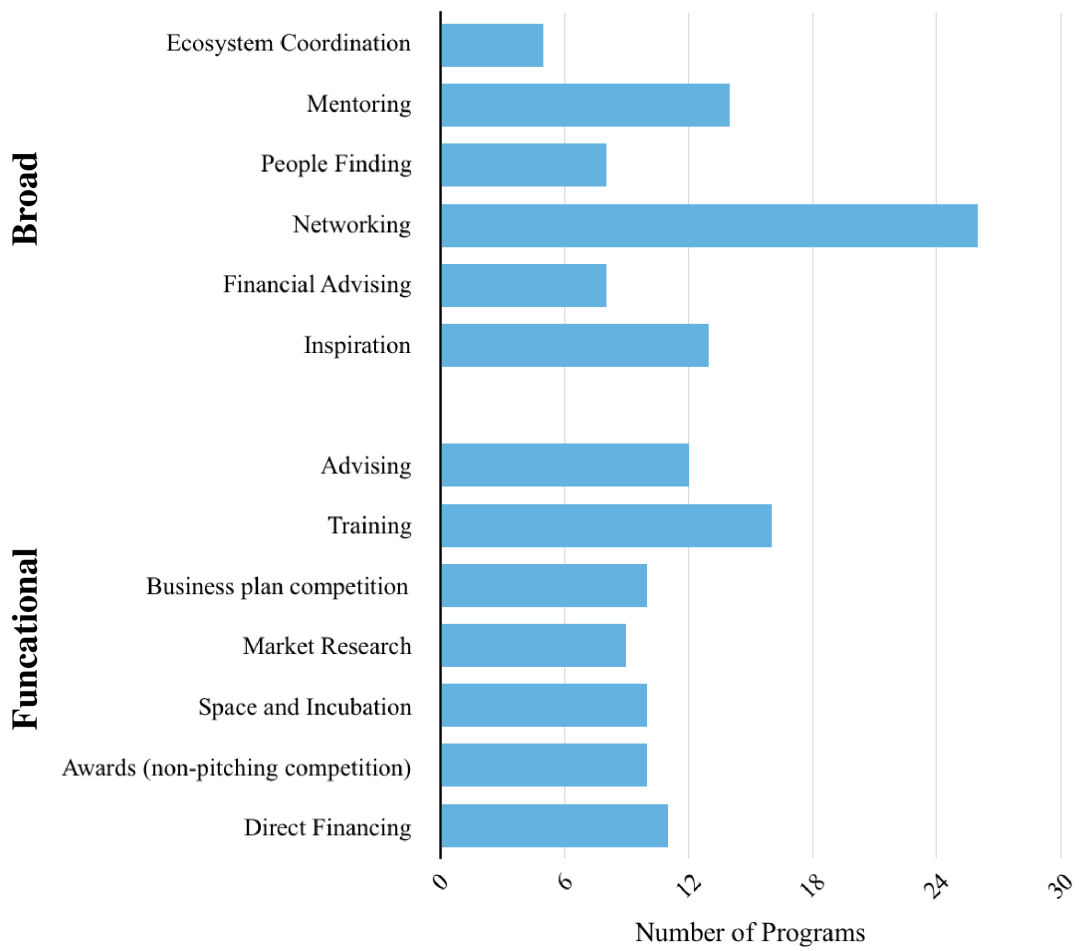


Figure 1: Types of support offered Edinburgh ESOs

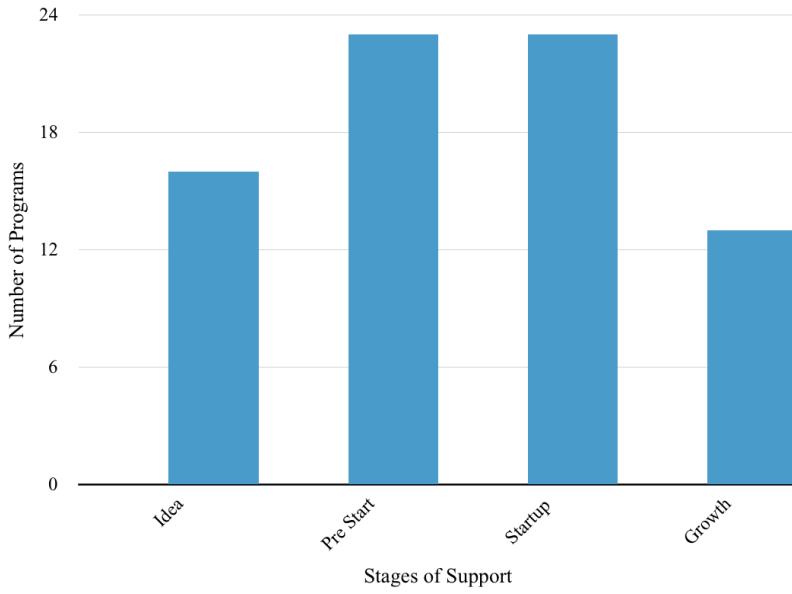


Figure 2: Stages of support of Edinburgh ESOs