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Entrepreneurial ecosystems: Multiple domains, dimensions and relationships

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ABSTRACT

In this paper we examine the operation of entrepreneurial ecosystems. We use the work of Isenberg (2010) to frame a study of an ecosystem in Ireland. Following a review of the literature and guided by an expert panel (n = 8) we conducted a survey of small business owners (n = 100). Statistical analysis of the survey data revealed sixteen dimensions with a complex system of interrelationships. In the discussion we explain how and importantly why the dimensions can and should be identified and analysed. We propose that although an entrepreneurial ecosystem will align with an extended version of the six domains proposed by Isenberg (2010) each individual ecosystem must be studied to identify its complex system of unique dimensions. Implications for theory and practice, as well as limitations and future research directions, are discussed. It is envisaged that our approach to modelling ecosystems will serve as the basis for further thought and empiricism.

1. Introduction

Borrowed from biology, the metaphor of an entrepreneurial 'ecosystem' is increasingly used by scholars to help describe entrepreneurial activity within a region. Wurth et al. (2022) explain that this contemporary popularity can be traced to two sources: Feld (2012) and Isenberg (2010). The academic literature on entrepreneurial ecosystems has flourished recently (Leendertse et al., 2021) and is now a popular focus of analysis (Theodoraki and Catanzaro, 2021). In their systematic literature review (Alvedalen and Boschma, 2017) identified five key weaknesses in the literature. In this paper we address two of the weaknesses. First, we examine how elements of the ecosystems are connected. Then secondly, we examine which interactions matter most. In adopting this approach, we respond to calls for studies that attempt to model and illustrate entrepreneurial ecosystems (Alvedalen and Boschma 2017; Brown and Mason, 2017; Godley et al., 2021; Leendertse et al., 2021; Maroufkhani et al., 2018; Stam, 2015; Wei, 2022; Wurth et al., 2022).

There are significant gaps in the emergent literature. Research into entrepreneurial ecosystems often focuses on documenting the presence of system components (Mack and Mayer, 2016) and is largely typological and atheoretical (Spigel and Harrison, 2018). Within the literature there has been a limited focus on the interactions and relationships between key domains/elements/actors within ecosystems (Allahar and Sookram, 2019; Cavallo et al., 2019; Hannigan et al., 2021; Kuckertz, 2019; et al., 2021; Mack and

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Mayer, 2016; Roundy et al., 2017). The gap (a significant one) is that while conceptual advancement has been extensive, empirical studies fall short of examining many of the dynamic processes most central to the development of ecosystems (Abootorabi et al., 2021).

To advance knowledge on entrepreneurial ecosystems, the aim of this research is to propose how, and importantly why the domains and dimensions can and should be modelled and illustrated. Specifically, we use Isenberg's "The Domains of the Entrepreneurial Ecosystem" to frame a study of an ecosystem in Ireland. We propose that although an entrepreneurial ecosystem will align with an extended version of the six domains proposed by Isenberg (2010), each individual ecosystem must be studied to identify its complex system of unique dimensions and relationships. Acknowledging that there are multiple options when deciding on the framework, we follow previous research (Davari et al., 2017; Erina et al., 2017; Hosseinzadeh et al., 2022; Liguori et al., 2019; Østergaard and Marinova, 2018) and adopt the work of Isenberg (2010). Although there are differences in the elements proposed by different scholars, we concur with Stam (2015) that the presence of these elements and the interaction between them predominantly determine the success of the ecosystem. Although we wish to advance the model proposed by Isenberg it is not our intention to propose a more complete model. Instead, we wish to show that an adapted version of the model (constructed with the help of an expert panel) will exist in individual ecosystems. We have designed our study in this way because every ecosystem displays distinct idiosyncrasies and characteristics which are spatially, relationally, and socially embedded (Allahar and Sookram, 2019; Alvedalen and Boscham, 2017; Brown and Mason, 2017; Malecki, 2018; MessinaMiller and Hewitt-Dundas, 2022).

This study started with the six domains proposed by Isenberg (2010). The six domains are policy, finance, culture, supports, human capital and markets. The work of an expert panel extended the list to ten domains. We initially believed that due to cultural, geographical and infrastructural differences the relative importance and impact of the ten domains would differ. The intention was to provide a measure and weighting for each domain. However, statistical analysis identified a more complex ecosystem of sixteen dimensions. This study presents a data collection process that allows the operation of an entrepreneurial ecosystem to be profiled and analysed. Our method is based on the view that collecting entrepreneurial ecosystem metrics involves developing a methodology that provides insight into the extent to which dimensions can be interdependent and how this relates to entrepreneurial outcomes. The findings section contextualizes the data (see Tables 2–4) by proposing a set of dimensions, with weightings and relationships. The paper concludes by discussing the dynamic processes underlying entrepreneurial ecosystems and identifies significant scope for future research.

1. The entrepreneurial ecosystem

Academics have attempted to construct definitions and theories based on the characteristics and individual elements of an entrepreneurial ecosystem (Audretsch and Belitski, 2017; Cohen 2006; Isenberg 2011; Mack and Mayer, 2016; Mason and Brown, 2014; Moggi et al., 2022; Spigel, 2017; Stam, 2015; Theodoraki and Catanzaro, 2021; Theodoraki and Messeghem, 2017). Acs et al. (2017) explain that in its most abstract sense, an ecosystem is a biotic community, encompassing its physical environment and all the various interactions that occur within. Entrepreneurial ecosystems involve multi-level processes, stakeholders, actors and exist in diverse contexts. Entrepreneurial ecosystems are often significantly impacted by geography, with the physical distance (or territory) between the entrepreneur and ecosystem resources acting as a natural barrier (Pankov et al., 2019). The entrepreneurial ecosystem consists of a complexity and diversity of actors and an associated set of flows and relationships which change over time (Acs et al., 2017; Spilling, 1996; Stam and van de Ven, 2019). The key construct in an entrepreneurial ecosystem is that it is a system. Indeed, 'systemic conditions are the heart of the ecosystem and determine the success of the ecosystem' (Stam, 2015, 1766). Most definitions of an entrepreneurial ecosystem highlight the combination or interaction of elements, often through networks, producing shared cultural values that support entrepreneurial activity. Rather than seeing ecosystems as tangible systems, Spigel (2017) proposes that they can be better understood as ongoing processes through which entrepreneurs acquire resources, knowledge and support, increasing their competitive advantage and ability to scale up.

The literature has primarily produced long lists of factors that might matter, but it is not entirely clear what causes what (Stam, 2015). Liguori et al. (2019) explain that although there are many conceptual attempts to clarify the elements of an ecosystem, empirical evidence is still limited. Indeed, a scarcity of sufficient metrics on entrepreneurial ecosystems makes it difficult to have adequate diagnosis and monitoring in the policy cycle (Leendertse et al., 2021). When a range of elements are presented as a complex ecosystem in which all elements are perceived to influence each other, as often happens in the literature, it becomes extremely complex to

Table 1
The expert panel.

Role	Age	Gender	Edu	Experience	Sector
BIC Manager	52	Male	MSc	20 years	ICT
Gov Agency	48	Female	MSc	10 years	Food & Tourism
Consultant	55	Male	MBA	30 years	HRM
Academic	38	Female	DBA	15 years	Innovation
Industry Rep	61	Male	MA	30 years	Services
Gov Agency	46	Male	MSc	15 years	Medical Devices
Consultant	37	Female	BBS	10 years	Marketing
Hub Manager	46	Female	BBS	8 years	ICT

Table 2
Factor loadings for each Exploratory Factor Analysis.

Dimension	Factor Name	Item Code	Factor 1	Factor 2	Factor 3	Total Variance
Policy	***Policy: Importance***	D1_c	0.94	–		
		D1_a	0.93	–		
	Policy: Support	D1_b	–	0.81		
		D1_d	–	0.73		
		% Variance	**45.08**	**28.27**		**73.35**
Finance	***Finance***	D2_d	0.89			
		D2_c	0.83			
		D2_a	0.75			
		D2_b	0.74			
		D2_e	0.49			
		% Variance	**56.47**			**56.47**
Culture	***Enterprise/Innovation***	D3_a	0.78	–	–	
		D3_d	0.74	–	–	
	Strength	D3_b	–	0.76	–	
		D3_c	–	0.63	–	
		D3_e	–	–	0.97[a]	
		% Variance	**27.14**	**22.76**	**20.19**	**70.09**
Supports	***Importance***	D4_d	0.91	–		
		D4_c	0.85	–		
	Access & Assistance	D4_a	–	0.84		
		D4_b	–	0.84		
		D4_e	–	0.51		
		% Variance	**39.12**	**29.51**		**68.63**
Human Capital	***Success***	D5_c	0.88	–		
		D5_b	0.79	–		
		D5_a	0.42	–		
	Accademia	D5_d	–	0.88		
		D5_e	–	0.79		
		% Variance	**36.21**	**23.65**		**59.86**
Markets	***Marketing***	D6_b	0.81	–		
		D6_a	0.79	–		
		D6_d	–	–		
		D6_c	–	0.94[a]		
		% Variance	**38.45**	**27.44**		**65.89**
Business Incubation	***Business Incubation***	D7_d	0.89			
		D7_a	0.86			
		D7_b	0.77			
		D7_c	0.75			
		% Variance	**67.05**			**67.05**
Entrepreneurial Education	***Educational Programs***	D8_a	0.87	–		
		D8_e	0.81	–		
		D8_b	0.58	–		
	Personal Development	D8_c	–	0.93		
		D8_d	–	0.79		
		% Variance	**42.47**	**24.07**		**66.54**
Business Networking	***Business Networking***	D9_b	0.76			
		D9_a	0.74			
		D9_d	0.68			
		D9_c	0.60			
		D9_e	0.58			
		% Variance	**45.26**			**45.26**
Infrastructure	***Positive***	D10_b	0.81	–		
		D10_d	0.68	–		
		D10_c	0.59	–		
	Negative	D10_e	–	0.84		
		D10_a	–	0.69		
		% Variance	**37.86**	**23.00**		**60.86**

[a] Only one item on dimension – item dropped; items loadings below 0.4 are not presented.

disentangle what causes what. Entrepreneurial activities and entrepreneurs do not emerge in isolation, rather the elements exist in a very integrated and complex system with multiple actors (Cowell et al., 2018).

Policy makers are beginning to recognise the merit of a more systems-based form of support for high growth entrepreneurship. Entrepreneurial ecosystems can be industry specific. In an Irish context, the pharmaceuticals cluster in Cork, the social media cluster in Dublin and the medical devices in Galway. Alternatively, an ecosystem may evolve around a single key company to include several in-

Table 3
Descriptive statistics for each of the dimensions.

Variables	alpha	M	SD	Range
Policy: Importance	0.85	5.48	2.10	2–10
Policy: Support	0.25	7.18	1.51	2–10
Finance	0.79	18.48	3.79	5–25
Enterprise/Innovation	0.47	8.75	1.06	2–10
Strength	0.12	5.84	1.24	2–10
Importance	0.79	7.30	1.42	2–10
Access & Assistance	0.60	7.71	1.28	3–15
Success	0.55	7.60	1.34	3–15
Accademia	0.59	6.80	1.68	2–10
Marketing	0.60	8.60	1.23	2–10
Business Incubation	0.83	12.37	3.75	4–20
Educational Programs	0.57	12.11	2.00	3–15
Personal Development	0.50	7.02	1.85	2–10
Business Networking	0.68	18.28	3.22	5–25
Positive	0.52	9.33	2.47	3–15
Negative	0.48	8.05	1.52	2–10

Table 4
Correlations between dimensions.

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Policy: Importance	–															
Policy: Support	.12	–														
Finance	.16	.22	–													
Enterprise/Innovation	−.03	.11	.27	–												
Strength	.03	**.335**[a]	−.14	−.03	–											
Importance	.07	.15	**.539**[a]	.21	−.09	–										
Access & Assistance	.01	.05	**.475**[a]	**.338**[a]	−.20	**.560**[a]	–	.								
Success	.11	.09	.04	**.311**[a]	.03	.14	**.280**[a]	–								
Accademia	−.03	.16	.16	**.260**[b]	−.07	.11	.11	.19	–							
Marketing	−.10	.10	.15	.20	−.04	.04	.14	.21	−.09	–						
Business Incubation	.16	.18	**.306**[b]	.18	−.03	**.235**[b]	**.280**[a]	**.405**[a]	**.493**[a]	−.16	–					
Educational Programs	−.22	.03	.23	**.377**[a]	.04	.21	.09	.18	.250[b]	.10	.20	–				
Personal Development	.12	.11	.16	**.226**[b]	.07	.10	**.224**[b]	**.388**[a]	.16	.12	**.554**[a]	**.286**[a]	–			
Business Networking	.08	.02	.07	**.353**[a]	−.05	.19	.19	**.260**[b]	**.326**[a]	−.14	**.437**[a]	**.478**[a]	**.276**[b]	–		
Positive Infrastructure	−.18	**.314**[a]	.18	.11	.21	.07	.04	.08	**.326**[a]	**−.254**[b]	**.283**[b]	**.300**[a]	.16	**.305**[a]	–	
Negative Infrastructure	−.10	.11	.29	−.02	**.226**[b]	.04	.10	−.04	.09	.08	.04	.11	−.08	.08	**.302**[a]	–

[a] Correlation is significant at the .01 level.
[b] Correlation is significant at the .05 level.

dustries i.e., the FinTech cluster in the northwest of Ireland. Entrepreneurial ecosystems are to some extent geographically bounded and as the Irish examples illustrate are not related to a particular size of urban area.

2. Theoretical framework

It is not within the scope of this article to present a critique of the merits of all the models of entrepreneurial ecosystems proposed in the literature. Wurth et al. (2022) provide an excellent overview of recent advancements in ecosystem scholarship. Essentially the extant literature refers to elements, domains or attributes and to a limited extent the interactions between them. We have chosen Isenberg (2010) 'The Domains of the Entrepreneurial Ecosystem' as our theoretical framework. Many of the recent studies on entrepreneurial ecosystems are built on Isenberg's (2010) framework and definition (Audretsch et al., 2019; Mack and Mayer, 2015; Stam, 2015). We propose that the work of Isenberg (2010) offers a distinctive perspective on the clustering of economic activity with a focus on entrepreneurial activity.

Isenberg (2010) proposed that elements of an ecosystem interact in complex and specific ways that lead to unique configurations of different of elements within the ecosystem. Isenberg identified the need for: a conducive culture, enabling policies, leadership, finance, human capital, and a range of supportive institutions. Isenberg proposed that the entrepreneurship ecosystem includes six key domains. These are: policy (leadership, government); finance (financial capital); culture (success stories, societal norms); supports (infrastructure, support professions; non-governmental institutions); human capital (labour, educational institutions); and markets (early customers, networks). The emphasis is on local and regional environments and the conditions required to generate and support ambitious entrepreneurship. Isenberg claims that each context requires its own ecosystem. This is beacuse the components of the system include several units and pieces that interact in different and distinctive ways. Since its original publication a series of

variations in the number, naming of the domains have been proposed (Audretsch and Belitski, 2017; Haarhaus et al., 2020; Liguori et al., 2019). In addition, Franco-Leal and Diaz-Carrion (2020) explain that all the elements have been considered equally important by previous research but that a focus on specific elements of an entrepreneurial ecosystem is potentially a promising direction for future research. Therefore, we undertook this study in order to help policymakers identify priorities and focal components of entrepreneurial ecosystems.

3. Methodology

This study utilizes a mixed method approach (Bryman, 2012; Creswell and Clark, 2011) In this study we collected data in two stages. **Stage 1:** to add further depth and nuance to the design of our questionnaire, an expert panel (n = 8) was formed. The participants were purposefully chosen as they were directly involved as key actors within the ecosystem. There were two meetings (March–April 2021) of the expert group, each lasting 1 h and facilitated by the research team. Members of the research team took notes during this session, and these notes were confirmed by the expert group participants. The participants were as follows (Table 1):

The expert panel supported two tasks. First, the panel worked to support the creation of a revised list of the domains proposed by Isenberg (2010). The panel identified a list of ten domains (Culture, Markets, Entrepreneurial Education, Business Networking, Supports, Human Capital, Finance, Policy, Infrastructure and Business Incubators). The list of ten domains contains some overlap. As an example, supports is identified and then separately business incubation. This can be attributed to the presence of a very large and influential business incubator within the case study ecosystem. The second task involved the expert panel reviewing a list of survey questions which were developed based on insights from the literature review (Mack and Mayer, 2016; Maroufkhani et al., 2018; Pankov et al., 2019; Spigel and Harrison, 2018; Theodoraki and Messeghem, 2017). Then the panel allocated the questions to each of the ten domains. The use of an expert panel allowed the questionnaire to be constructed, not based on a singular view but upon collective input.

Stage 2: a survey was conducted with small business owners, based within an entrepreneurial ecosystem. The survey (appendix 1) explored the experiences of the small business owners, with a focus on their activities and needs in relation to the ten domains. We used the LinkedIn networking platform to identify a sample (n = 250) and to promote the online survey. A total of 100 participants took part, a response rate of 40 percent. The online survey was administered in Qualtrics (May–June 2021). The survey began with a short section, of seven questions on personal characteristics and then five questions relating to each of the ten domains. The survey included a total of fifty-seven questions. The average time for completion was 12 min. Likert scales and comment boxes were used.

4. Findings

Initially, a series of exploratory factor analyses was conducted on each of the individual domains to examine the factor structure, this was followed by simple descriptive counts and internal consistency statistics. The psychometric properties of each of the ten domains was examined. Each of the multi-item constructs were examine in ten separate Exploratory Factor Analysis (EFA). All ten analyses employed Principal Axis Factoring with Direct Oblimin and factors with Eigen values over 1 reported for each of the EFAs. Loadings below 0.4 were suppressed. The findings are reported in Table 2.

Finance, business incubation, marketing and business networking were all reported as a single factor. The other domains were reported to have two dimensions. Culture reported three dimensions. However, as the third dimension had a loading below 0.4 it was not included. At this stage of our analysis, we reconvened the expert panel. We did this to create new labels for our expanded list of dimensions (n = 16). The outcome was the following naming conventions for a 16-dimension ecosystem: policy importance, policy support, finance, culture of enterprise, cultural strength, supports importance, supports access, human capital success, human capital success, marketing, business incubation, educational programmes, personal development, business networking, infrastructure positive; and infrastructure negative. We acknowledge that even with the input of an expert panel that the approach to naming dimensions is subjective. But we emphasize the value of the process as it supports an insightful dialogue about the multi-dimensional nature of individual ecosystems.

Having developed a profile of the ecosystem, the next stage was to run descriptive analysis. Table 3 presents the descriptive statistics for mean, standard deviation, and score range. For all the dimensions, higher scores represent less agreeableness or less importance towards the area. Alpha reliability tests were conducted with some dimensions reaching favourable to very favourable levels while other dimensions reported less than favourable (below 0.6). This stage of the analysis helps us to understand the relevant importance of each dimension.

Next, Pearson's correlation coefficient was calculated between variables to explore for possible associations.

Evidence presented in Table 4 provides an overview of the complex, multi-dimensional relationships that occur within an entrepreneurial ecosystem. The following text provides an overview of the data presented in Table 4. This narrative based stage is critical our proposed approach to the study and understanding of ecosystem. Developing a narrative supported by data will allow stakeholders to develop focused interventions and resource plans, that match the specific needs of their unique ecosystem.

Perceptions around **policy** support are significantly related with **cultural strength** ($r = .335$, $p < .01$) and **positive infrastructure** ($r = 0.314$, $p < .01$). Perceptions around **finance** are positively and significantly related to **policy importance** ($r = 0.539$, $p < .01$), **access & assistance to** supports ($r = 0.475$, $p < .01$) and **business incubation** ($r = 0.306$, $p < .05$). F**inance** and cultural **strength** are related to **negative infrastructure** ($r = 0.226$, $p < .05$).

Interestingly, **enterprise & innovation** is related to several factors such as **access & assistance** ($r = 0.338$, $p < .01$)**, success** ($r = 0.311$, $p < .01$)**, academia** ($r = 0.260$, $p < .05$)**, educational programs** ($r = 0.377$, $p < .01$)**, personal development**

(r = 0.226, p < .05), and **business networking** (r = 0.353, p < .01). Support **importance** is related significantly to both **access & assistance** (r = 0.560, p < .01) and **business incubators** (r = 0.235, p < .05).

Regarding **access & assistance** is significantly related to **success** (r = 0.280, p < .01), **business incubators** (r = 0.280, p < .01) and **personal development** (r = 0.224, p < .05). **Success** is significantly related to **business incubators** (r = 0.405, p < .01), **personal development** (r = 0.388, p < .01), and **business networking** (r = 0.260, p < .01). **Academia** is significantly related to **business incubators** (r = 0.493, p < .01), **business networking** (r = 0.326, p < .01) and **positive infrastructure** (r = 0.326, p < .01).

M**arketing** is only significantly related inversely to **positive infrastructure** (r = −0.254, p < .05). **Business incubation** is significantly related to **personal development** (r = 0.554, p < .01), **business networking** (r = 0.437, p < .01) and **positive infrastructure** (r = 0.283, p < .05). **Educational programs** are significantly related to **personal development** (r = 0.286, p < .01), **business networking** (r = 0.478, p < .01) and **positive infrastructure** (r = 0.300, p < .01). **Professional development** and **business networking** are significantly related (r = 0.276, p < .05). **Business networking** and **positive infostructure** are also significantly related (r = 0.305, p < .01). Finally, both **positive** and **negative infrastructure** are significantly related (r = 0.302, p < .01).

5. Discussion and emergent approach to the study of entrepreneurial ecosystems

Haarhaus et al. (2020) explain that existing research has applied a rather static framework to the investigation and study of entrepreneurial ecosystems. There are multiple theories and frameworks that can be used to conceptualize an entrepreneurial ecosystem. Many of the frameworks proposed in the literature have similar elements (Brown and Mason, 2017; Feld, 2012; Mack and Mayer 2016; Spigel and Harrison, 2018; Stam and van de Ven 2019). In this paper we have used Isenberg (2010) to guide our study of an entrepreneurial ecosystem. The foundations of this theory helped aid the understanding of the entrepreneurial ecosystem, before the work of an expert panel, subsequent survey and statistical analysis identified the dimensions and the complex relationships between dimensions that exist within the entrepreneurial ecosystem.

5.1. Implications for practice

Leendertse et al. (2021) explain that despite the popularity of the entrepreneurial ecosystem concept, there is a scarcity of credible, accurate and especially comparable metrics of entrepreneurial ecosystems. Our theorizing about the importance of the relationships between the multiple dimensions of an entrepreneurial ecosystem has several implications for scholars and policy makers. The data and approach presented in this paper shows that in-depth research is needed to first, identify the dimensions of individual ecosystems and secondly, to measure the relationships that exist between the dimensions. We cannot assume that ecosystems are the same or be understood using a standard framework. Although we can consider a homogenous set of domains as a starting point, each ecosystem will have a different number and different types of dimensions. The dimensions will take many forms and require customised naming. The dimensions will not share the same level of importance and the relationships between dimensions will vary. Tackling the weakest elements of entrepreneurial ecosystems is likely to provide the most efficient and effective way of improving the overall quality of the entrepreneurial ecosystem (Ács et al., 2014).

Every region has some level of entrepreneurial activity and a growing number have entrepreneurial ecosystems. Indeed, O'Connor and Audretsch (2022) report that recently a number of studies have linked entrepreneurial activity to an ecosystem and context that illustrates the broad adoption of the term 'entrepreneurial ecosystem'. The approach to measurement presented in this paper, has implications for attempts to profile and measure the functioning of entrepreneurial ecosystems. This is an important contribution because multiple authors including Round *et al.* (2017) report that work on ecosystems has found that, because of their complexity, they cannot be effectively assessed using simple, "count-based" metrics.

The literature on entrepreneurial ecosystems, specifically Isenberg (2010) provides a starting point for studies of entrepreneurial ecosystems that extend the domain or element descriptions and captures the unique, multi-dimensional nature of each ecosystem and the relationships between dimensions. Using the approach presented in this paper, new research can be undertaken in an attempt to respond to the challenge posed by Wurth et al. (2022) and show that the entrepreneurial ecosystem concept is capable of explaining entrepreneurial dynamics in a variety of contexts.

To some extent this study advances and completes the initial model proposed by Isenberg (2010). However, our central aim is not to add yet another descriptive model to the extant literature. Instead, our contribution is to challenge scholars to pause their attempts to describe the elements and domains of ecosystems and instead move our research agenda to the study of ecosystems so that through multiple case studies and empiricism we can start to identify the multiple domains, dimensions and relationships that exist within unique ecosystems.

5.2. Limitations and future research

We acknowledge the limitations of our study. Isenberg (2010) was the first to shape entrepreneurial ecosystems into domains and sub-domains, and therefore is a credible and appropriate framework. However, other authors may select other frameworks and/or from earlier work on ecosystem modeling. Our sample size is small, and a greater number of respondents would add additional perspective. Our approach to naming the dimensions is subjective, but we would argue that the use of an expert panel provides credibility. This study offers several additional directions for future research. We have highlighted the continued relevance of frameworks which propose a variety, but often similar sets of key elements within an entrepreneurial ecosystem. Additional studies, of other

ecosystems are needed to enhance the approach proposed in this paper. These studies may include larger sample sizes to help validate more sophisticated data analysis. We invite researchers to further test, validate, refute and/or develop our approach.

6. Conclusion

Entrepreneurial ecosystems are by their nature dynamic and evolutionary (Spigel and Harrison, 2018). It is now accepted among policymakers that for entrepreneurs, to be successful, there needs to be a conducive ecosystem (Maroufkhani et al., 2018). The defining, capturing and understanding of the activities that occur within an entrepreneurial ecosystem is complex and challenging (Audretsch and Belitski, 2017; Brown and Mason, 2017; Cowell et al., 2018; Kuckertz, 2019; Stam and van de Ven, 2019; Theodoraki and Catanzaro, 2021). However, we have presented an approach to modelling an entrepreneurial ecosystem which can be replicated in other jurisdictions. The replication of this study (with refinements and enhancements) is an important next step because entrepreneurial ecosystems 'must be appreciated as uniform in theoretical framing but unique in specific configuration' (O'Connor and Audretsch, 2021, 21).

Credit author statement

Simon Stephens: Conceptualization and Writing, Chris McLaughlin: Conceptualization and Formal analysis, Leah Ryan: Investigation, Manuel Catena: Investigation. Aisling Bonner: Formal analysis.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix 1. Questionnaire

Code	In this section I ask you to consider the importance of policy
D1_a	'The government legislation of my country is designed to support small businesses and enterprise'
D1_b	What is the importance of government policy in encouraging enterprise activity (e.g. tax friendly)
D1_c	Are you satisfied with the policy of your country in assisting entrepreneurs and small businesses?
D1_d	Do you believe you are made aware of the most current policies regarding enterprise?
	In this section I ask you to consider the importance of finance
D2_a	How important are Government loans to entrepreneurs in your community?
D2_b	How important are Venture Capitalists to entrepreneurs in your community?
D2_c	How important is debt forgiveness to entrepreneurs in your community?
D2_d	How important is capital assistance from government agency funds for entrepreneurs in your community?
D2_e	'Without access to financial assistance, the development of my small business would have been a major challenge?'
	In this section I ask you to consider the importance of Culture
D3_a	'Culture has an impact on the drive of enterprise within a community'
D3_b	'Wealth creation is a key motivating factor for entrepreneurs in my community?
D3_c	Is business failure a fear for entrepreneurs in your community?
D3_d	How important is it for an entrepreneur to be creative and innovative in order to be successful?
D3_e	Do you believe your community has an enterprise culture?
	In this section I ask you to consider the importance of supports
D4_a	How important are the services provided by non-government institutions to entrepreneurs in your community?
D4_b	How important are advisors to entrepreneurs in your community?
D4_c	'I have accessed accounting services for my small business'
D4_d	'I have accessed legal services for the development of my business'
D4_e	'I am aware of technical experts in my area who could assist in the development of my small business'
	In this section I ask you to consider the importance of human capital
D5_a	How important are success stories in encouraging entrepreneurship in your community?
D5_b	'Successful entrepreneurs in my society are acknowledged and spoke highly of''
D5_c	'I am aware of local successful entrepreneurs within my community'
D5_d	How important are 3rd level graduates (IT degrees, Business degrees, etc.) to an entrepreneur in your community?
D5_e	'Being located near a third level institute is beneficial to my small business'

(*continued on next page*)

Code	In this section I ask you to consider the importance of policy
	In this section I ask you to consider the importance of markets
D6_a	How important is face- to – face marketing for businesses in your community?
D6_b	How important is word of mouth marketing for businesses in your community?
D6_c	How important is traditional news/radio/tv for advertising businesses in your community?
D6_d	How important is social media for advertising businesses in your community?
	In this section I ask you to consider the importance of business incubators
D7_a	'I am aware of business incubators in my community'
D7_b	'A business incubator was fundamental in the creation/development of my small business'
D7_c	Do you believe it is important to have access to a business incubator?
D7_d	'I understand the role of a business incubator'
	In this section I ask you to consider the importance of entrepreneurial education
D8_a	Do you agree that entrepreneurial education encourages enterprise activity?
D8_b	How important is the availability of entrepreneurial training programmes/courses to entrepreneurs in your community?
D8_c	'I am aware of training programmes in my community which can assist myself and my small business',
D8_d	'I have attended a training programme/course in order to develop my small business'
D8_e	'Entrepreneurial education should be integrated into the primary and secondary educational curricula'
	In this section I ask you to consider the importance of business networking
D9_a	How important are network/forum/support group to entrepreneurs in your community?
D9_b	'Networks encourage entrepreneurship in my community'
D9_c	How important are Multinational Corporations as networks to entrepreneurs in your community?
D9_d	'I have accessed networks or support groups for my business'
D9_e	'Local enterprise conferences/events take place within my community'
	In this section I ask you to consider the importance of infrastructure:
D10_a	'The quality of infrastructure in my area has a negative impact on the development of my company'
D10_b	'The quality infrastructure of my area has a positive impact on the development of my business'
D10_c	'The infrastructure of my area does not concern nor effect my business'
D10_d	'It is fundamental for my business to be located near an airport/port'
D10_e	'I believe there is room for improvement regarding the infrastructure of my local area'

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