Analysing the Influence of Components of Entrepreneurial Ecosystem on the Entrepreneurial Process

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Abstract: The entrepreneurial ecosystem is a popular concept because of its systematic approach to analysing entrepreneurship and promoting entrepreneurial activity in the region. However, studies on EE have lacked a framework for indicating the influence that EE components have on entrepreneurship. The authors fill this gap in our research by investigating the influence of the components of the entrepreneurial environment on the entrepreneurial process. Entrepreneurial Intention Development, Entrepreneurial Exploration, and Entrepreneurial Exploitation are the three stages of the entrepreneurial process that were identified. To investigate complex systems and grasp the system's causal linkages, fuzzy cognitive modelling approach was employed. This study provides insights into the relationships between the components of the entrepreneurial ecosystem and the entrepreneurial process, which helps to support entrepreneurship during its different phases.

Keywords: Entrepreneurial Ecosystem, Fuzzy Cognitive Modelling, Entrepreneurial Intention, Entrepreneurial Exploration, Entrepreneurial Exploitation

1. Introduction

Entrepreneurial ecosystem (EE) is a concept through which holistic interventions could be done in order to increase the entrepreneurial capability of the region (Stam, 2015; Alvedalen & Boschma, 2017; Bertello et al., 2022). EE is an interconnected combination of factors such as network, policy, financial capital etc, that help in entrepreneurship (Spiegel, 2017; Mack & Mayer, 2016). Both academics and politicians are interested in the idea of the entrepreneurial ecosystem since it gives them a way to foster an atmosphere and possibilities for entrepreneurship (Malecki, 2018; Feld, 2020; Mason & Brown, 2014) with the aim of strengthening the economy (Liguori et al., 2019; Acs & Szerb, 2007). In spite of the possibilities that the EE provides, there is a gap in the implementation of the concept and establishment of new ecosystems. This can be attributed to the fact that studies exploring the impact of the components of EE on the entrepreneurial process are very few in the literature (Motoyamaet al., 2014; Maroufkhani et al., 2018). There is a need to analyse the impact of the components of EE on entrepreneurship, which will help policymakers to know how each factor of EE affects entrepreneurship and make informed decisions in developing an EE.

In thus study, the authors address this gap and analyse the impact of the components of EE on the three phases of the entrepreneurial process (Shane & Venkatraman, 2006; Ajzen, 1991). The three phases are Entrepreneurial Intention Development, Entrepreneurial Exploration and Entrepreneurial Exploitation. EE gained popularity when Isenberg (2010) suggested using a comprehensive strategy to create an environment that fosters entrepreneurship. For this study, the Isenberg EE model was adopted which consist of six components, namely Policy, Financial capital, Culture, Human Capital, Support and Market. The authors first determine the causal link and the intensity of the connections between the components of EE and the stages of the entrepreneurial process using fuzzy cognitive modelling (FCM). Then simulations of the model is run to examine how the Entrepreneurial process is impacted under certain scenarios.

The remaining part of the article is as follows: the aricle starts by discussing the methodology. In the following sections, the authors identify the causal relationships between the components of EE and the entrepreneurial process, determine the weights of relationships and develop the fuzzy cognitive model. Finally, the authors end our article by providing the conclusion.

2. Methodology

Fuzzy cognitive modelling is a technique for determining the causal links between the constituent parts of complex systems (Özesmi & Özesmi, 2004; Nair et al., 2019; Dursun & Goker, 2022) through the decisions made by experts. Concepts take fuzzy values that are represented by value Ai in the interval [0,1]. The relationships between concepts are described using a degree of causality using linguistic variables for every weight, so weight w_{ij} for any interconnection can range from -1 to 1.

The degree of the causal association between distinct FCM factors-concepts can have either positive or negative signs in the FCM structure, and weight values represent the degree of the causal relationship. The fuzzy cognitive model is governed by the inference rule and a transfer function. This study has used inference rule as the Kosko's activation rule (Kosko,1986) which is given by Equation (1). Fuzzy values are assigned to concepts, and as a result, all concepts store specific numeric values. Transfer functions are used to control transformation of inputs to produce appropriate outputs i.e to maintain the values of the concepts between -1 and +1 (Zare et al., 2022). Researchers use a variety of transfer functions, including a hyperbolic tangent, trivalent, and linear Sigmoid. The hyperbolic transfer function was chosen in this study due to its dependability and correctness, as well as its broad range of output values capacity, and it follows Equation (2).

$$A_i^{(t+1)} = f\left(\sum_{\substack{j=1 \\ i\neq j}}^{M} w_{ji}.A_j^t\right) \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

In the above equation, “t” represents the simulation step or interaction index. $A_i^{(t+1)}$ is the activation value of an concept. $A_j^{(t)}$ is the activation value of all the concepts at step t that indicate a causal relationship towards A_i. Here, f(.) is a transfer function (Napoles et al., 2018). “*i*” is associated with the concept to which the arrows of directed in the fuzzy map. “*j*” is associated with all the “M” concepts that that enter the concept associated with “*i*”.

$$f_1(x) = \frac{e^{2x}-1}{e^{2x}+1} \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$

3. Determine the Causal Relationships between components of EE and the Entrepreneurial Process Phases

Finding the causal connection between the components and the determinants of the entrepreneurial process phases is the next step of our modelling. This study is based on the Entrepreneurial Ecosystem of India. In order to examine the connections, the authors assembled a broad panel of seven experts on the entrepreneurial ecosystem and took semi-structured interviews to explore the relationships among entrepreneurial ecosystem and the entrepreneurial process. The interviews were conducted between October 2022 and February 2023. The panelists were selected from different types of stakeholders of the Entrepreneurial Ecosystem consisting of entrepreneurship educators, incubation center head, entrepreneurship cell head and an entrepreneur. The details of the experts are given in Table 1. They were asked to specify whether a factor has an influence on the entrepreneurial process in a positive, negative, or neutral manner and to quantify that impact using linguistic words in accordance with the guidelines in Table 2.

Table 1: Details of Panelist for our study

Panelist #	Designation	Organisation
1	Executive	Indian Institute of Technology Madras Research Park
2	Executive	Science and Technology Entrepreneurs’ Park (STEP), Indian Institute of Technology Kharagpur
3	Executive	NSRCEL Business Incubator, Bangalore
4	Professor	Indian Institute of Technology Kharagpur
5	Entrepreneurship Cell Head	Indian Institute of Technology Madras
6	Founder	XYZ Ltd
7	Founder	ABC Ltd

Table 2: Fuzzy Value Corresponding to Linguistic Value

Linguistic Value	Numeric Value	Fuzzy Value
Very Low Influence (VL)	1	(0, 0, 0.25)
Low Influence (L)	2	(0, 0.25, 0.5)
Medium Influence (M)	3	(0.25, 0.5, 0.75)
High Influence (H)	4	(0.5, 0.75,1.00)
Very High Influence (VH)	5	(0.75,1.00,1.00)

The authors acquired five sets of relationships after the interviews, one from each expert. Combining all of the sets yielded 13 associations; however, to improve our model's performance and create the fuzzy cognitive map, the relationships reported by at least three experts were chose, yielding the following ten relationships. These relationships examined by our model is listed below.

R1: Policy has positive influence on Entrepreneurial Intention

R2: Policy has positive influence on Entrepreneurial Exploitation

R3: Finance has positive influence on Entrepreneurial Exploration

R4: Finance has positive influence on Entrepreneurial Exploitation

R5: Culture has positive influence on Entrepreneurial Intention

R6: Support has positive influence on Entrepreneurial Exploration

R7: Support has positive influence on Entrepreneurial Exploitation

R8: Human Capital has positive influence on Entrepreneurial Exploration

R9: Market has positive influence on Entrepreneurial Exploration

R10: Market has positive influence on Entrepreneurial Exploitation

4. Finding the Causal Relationships Weights

Finding the strength of the associations comes next after determining the causal relationships, which are done using the linguistic weights provided by the panel. Triangular fuzzy numbers (TFN) are used to first transform the linguistic concepts into fuzzy numbers, after which they are defuzzified back into crisp numbers. According to Opricovic and Tzeng (2003), defuzzification is the process of choosing a particular crisp set element from an original output fuzzy set that transforms fuzzy numbers into crisp set scores. This study applied the Opricovic and Tzeng (2003) defuzzification procedure known as Converting Fuzzy Data into Crisp Scores (CFCS). The final combined strength of the relationships is shown in table 3.

Table 3: Strength of the Causal Relationships

	Entrepreneurial Intention	Entrepreneurial Exploration	Entrepreneurial Exploitation
Policy	0.813		0.79
Finance		0.73	0.866
Culture	0.774		
Support		0.681	0.754
Human Capital		0.659	
Market		0.676	0.836

5. Fuzzy Cognitive Mapping & Dynamic Scenario Analysis

Using the "Mental Modeller" software for our study the Fuzzy Cognitive Map of enttrepreneurial ecosystem was developed which is shown in figure 1. The authors run simulations of the created model to assess the effect on the system's outcome for various situations. Six simulations were chosen for our research. Each EE component received the maximum activation value of 1 in each of the six scenarios, while the activation values for the other EE components remained at 0.

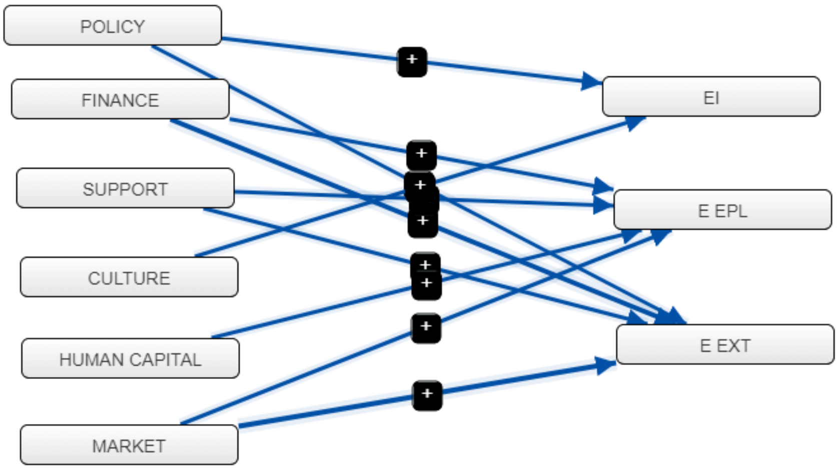

Figure 1: Fuzzy Cognitive Model of Entrepreneurial Ecosystem

The findings show that each component of EE has a specific function and has the most impact in one or two phases of the entrepreneurial process. The policy has a significant impact on entrepreneurial intention and entrepreneurial exploitation, but it has not much impact during the entrepreneurial exploration phase. Results also indicate that material components like financial capital and support have a great impact during the exploration and exploitation phase, but their impact in the intention development phase is not seen. Human capital has an impact only during the exploration phase. Market component also has a substantial impact during the exploration and exploitation phase. The culture component of the EE highly influences the entrepreneurial intention of the entrepreneur, but it does not provide much influence on the exploration and exploitation phase. The result of each scenario indicating the impact of each component on the different phases of the entrepreneurial process is shown in Table 4.

Table 4: Simulation scenarios and the Impact on Phases of Entrepreneurial Process

Scenario #	Scenario	Impact Activation value of Phases of Entrepreneurial Process (IAV)		
		Entrepreneurial Intention	Exploration	Exploitation
1	Act Value(Policy=1; Other Components=0)	0.67		0.66
2	Act Value(Finance=1; Other Components=0)		0.62	0.71
3	Act Value(Culture=1; Other Components=0)	0.65		
4	Act Value(Support=1; Other Components=0)		0.56	0.64
5	Act Value(Human Capital=1; Other Components=0)		0.58	
6	Act Value(Market=1; Other Components=0)		0.59	0.68

6. Discussion

6.1 Holistic Intervention to Develop EE and Facilitate Entrepreneurial Process

Entrepreneurship helps in the region's economic and social development, resulting in policymakers increasing the entrepreneurial activity (Ferreira et al., 2023; Leendertse et al., 2022). The studies dealing with entrepreneurship ahead mostly focused on examining the entrepreneur's characteristics and some phases of entrepreneurship like ideation, funding, development of infrastructure etc. The entrepreneurial ecosystem provides a systematic approach towards building a conducive environment for entrepreneurship (Alam et al., 2023). In the following section, we will discuss how policymakers can take action in supporting the entrepreneurial process through the EE approach

The first phase of the entrepreneurial process is developing the entrepreneurial intention. The essential components for entrepreneurship are generally considered to be infrastructure, support, and finance, among others, but our results show that this is not the case for developing entrepreneurial intention. Finance has the least impact on intention, and the components having the most impact are culture and policy. Thus in the initial stages of the entrepreneurial ecosystem development, the main focus should be on developing the culture of entrepreneurship and creating policies for the easy starting of a business. In the entrepreneurial exploration phase, the most important components that the policymakers should be focusing on is support, human capital and market. Finance also is a critical component at this stage that supports the startup to carry out its activities. As the phases of entrepreneurship progress from intention to exploration to exploitation, the impact of finance increases. To support the startups in their growth, the most impactful components are finance and policy. During this stage much of the business model and operations are determined and funding provides the impetus for its operation and expansion. Policy also plays an important role during this stage by creating a conductive environment for doing business.

6.2 Contribution:

EE has gained immense focus over the years as a systematic approach towards supporting entrepreneurship in the region (Spiegel, 2017; Alaassar et al., 2022). However, the lack of study focusing on the influence of the components of ecosystem on entrepreneurship has hindered the development of EE. Our study addresses this gap in the EE literature by analyzing the impact of each component of the EE on the different stages of entrepreneurship. Our use of fuzzy cognitive modelling to examine a complex system such as EE is unique to the literature and can open new doors for analysis of the EE. Our study enables policymakers to take more informed intervention for development of EE. Entrepreneurship is not an activity but a journey that starts from the desire to stand out from the rest and do something different (Adam and Fayolle, 2015; Van Gelderen et al., 2015); which finally leads to establishing a new venture that changes the way things are done in society. This journey has different phases, and the needs and requirements for each phase are entirely different. Through our study, we have identified the type of facility that an entrepreneur needs at each phase of the journey. Policymakers can gain insights into the requirement of each stage of entrepreneurship and arrange the same for the entrepreneurs. Thus our study aims to provide new directions for EE research and contribute to the development of a robust EE framework.

7. Conclusion

This study has identified the impact that the components of EE have on each phase of entrepreneurship which will help policymakers make informed decisions about which resources to provide during which stage of entrepreneurship and understand the influence of the EE on entrepreneurship. The study also identified the type of facility an entrepreneur needs at each phase of the journey. Our examination of a complex system like EE uses fuzzy cognitive modelling, which is novel in the literature and may lead to new insights into EE analysis. Thus our study aims to provide new directions for EE research and contribute to the development of a robust EE framework.

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