Success components of University Entrepreneurial Ecosystem: A Multi-Method Exploration

Abstract

Despite universities being a significant contributor to entrepreneurship, the components of the university entrepreneurial ecosystem (UEE) responsible for UEE success have not been discussed in the extant literature. Furthermore, the existing literature has not explored the interactions and interrelationships among the different components of UEE that can result in UEE's success. In this study, using a mixed methodology consisting of thematic analysis, TOPSIS, and fuzzy DEMATEL, we have clarified what to expect from a successful UEE. We have suggested a pathway to achieve the same. Our study also helps policymakers and universities to understand and design an appropriate entrepreneurial ecosystem in universities for students. It is one of the pioneering studies focusing on factors of UEE success.

Keywords: Entrepreneurship, entrepreneurial ecosystem, university entrepreneurial ecosystem, entrepreneurial behavior, fuzzy TOPSIS, fuzzy DEMATEL

Graphical Abstract

In figure 1 we present the graphical abstract of our study.

<Figure 1 Here>

Managerial Relevance

This research offers critical substances for policymakers and university administrators. It will help them understand what to expect from a successful University Entrepreneurship Ecosystem (UEE) and how to create an efficient UEE by informing them of the prominent early-stage components of UEE. Our research suggests that irrespective of the domain knowledge of the mentor and mentees, UEE needs to ensure that both parties are on the same page in deciding future actions for the benefit of the venture. Moreover, the ecosystems of emerging countries vary greatly from those of developed countries.

1. Introduction

The term entrepreneurial ecosystem relates to a place with the resources and capability of flourishing and promoting entrepreneurship (Theodoraki et al.,2022; Cetindamar et al.,2020). It consists of components like policy, infrastructure, investment capital, and supportive culture to create an environment for the creation of new ventures (Yalcin et al.,2022; Isenberg, 2010; Spigel, 2017). Other components of the entrepreneurial ecosystem are strong entrepreneurial business networks (Abbas et al., 2019) and social media (Abbas et al., 2019) influencing the business venture's performance. Nowadays, policymakers all over the world are trying to inculcate the spirit of entrepreneurship among the people so that they can become job providers rather than job seekers and help in the economic growth of their region, and in this mission, the universities are playing a considerable role (Isenberg, 2010; Acs et al., 2017). In recent times, in addition to education and research, universities have been on the onus of supporting economic growth by promoting and fostering entrepreneurship (Mele et al., 2022; Breznitz & Zhang, 2019). Universities are trying to provide the perfect entrepreneurial ecosystem in which the students and other stakeholders can prosper in their journey of entrepreneurship (Gibson et al.,2019; Schaeffer & Matt, 2016). The university spinoffs Universities enhance the entrepreneurial orientation and the innovativeness of entrepreneurs, which are critical to surviving in this ever-changing business environment which has become even more competitive after the COVID-19 outbreak (Liu et al., 2022). Previous researchers have described different strategies adopted by universities to promote entrepreneurship (Theodoraki et al., 2018). They have observed that some universities are increasing the focus on knowledge spillovers through events and workshops promoting entrepreneurship (Miller & Acs, 2017). Some universities have also introduced specialized entrepreneurial courses to help students embrace their entrepreneurial desires (Maritz et al. 2016). Moreover, literature has also mentioned that a few of the universities have grown into hubs of technology transfer (Mack &

Mayer, 2016) and incubation centers that provide shared working space, access to investment capital, and resources for product development (Breznitz & Zhang, 2019).

Despite this growing focus on the universities to support entrepreneurship, a handful of studies (Breznitz & Zhang, 2019; Miller & Acs, 2017) have approached studying entrepreneurship in universities from a systematic entrepreneurial ecosystem perspective. Even these studies have focused on providing direction to build a successful UEE. The majority of the studies on entrepreneurial ecosystems have been confined to developed countries, and very few studies have concentrated on exploring the dynamics in emerging countries. India, which is one a rapidly emerging country over the last few years, has put a lot of focus on developing the entrepreneurial ecosystem in the universities by implementing initiatives like the Institute Innovation Council (IIC), National Education Policy (NEP), Atal Incubation centers and Atal Ranking of Institution on Innovation Achievements (ARIIA). So, taking into consideration the emerging status of India and its focus on entrepreneurship, we have set up our study in India and have studied the top technical institutes that are taking measures to facilitate entrepreneurship on their campus. In our study, by adopting a multi-method approach, we have tried to provide the pathway to creating a successful UEE. The rest of the extended paper is as follows; first, we have provided the literature review, followed by the research methodology and research setting. Then, we provide the findings and discussion of our research study. Furthermore, finally conclude with the contribution, limitations, and future scope.

2. Literature Review

In this section, we develop the theoretical background of our study by exploring the research in the field of UEE and analyzing the needs of a successful UEE and the components that contribute to the formation of UEE.

2.1 Success of University Entrepreneurial Ecosystem

In the case of UEE, the majority of the scholars have considered new venture creation by the students as a parameter of success (Taatila, 2010). However, the outcome of UEE has recently expanded from just starting a new venture to developing entrepreneurial behavior (Brien et al., 2019). Characteristics of entrepreneurial behavior are outlined as opportunity seeking, creativity, self-reliance, initiative taking, action orientation, and dealing with uncertainty (Blenker et al., 2006; Haskins, 2018), which comes in handy in all aspects of life, be it industry or personal life (Gibb, 1993). One of the reasons behind this shift is that the established organization encourages intrapreneurship and has an increased focus on innovation. Scholars have also discussed the benefit of entrepreneurial behavior in different managerial and decision-making processes (Gibb, 1993). University focusing on entrepreneurial behavior emphasizes innovation through proper knowledge management, improving organizational performance, and bring societal changes (Abbas et al.,2020; Bakry et al.,2022). Innovativeness is essential to forming an effective High-Performance Work System (HPWS), which is the philosophy of optimizing the workplace to increase the firm's productivity and performance (Asad et al.,2017).

However, the parameters leading to developing entrepreneurial behavior among the students have not been discussed in the literature. In practice, the policymakers of the university just adopt some initiatives and best practices to develop entrepreneurship without a clear understanding of what parameters should be worked on for developing entrepreneurial behavior among the students. This lack of clarity regarding the pathway leading to successful UEE (Stam, 2015; Theodoraki et al., 2022) is a significant hindrance to the development of UEE. In our study, by adopting a multi-method approach, we have identified the parameters that the universities should be focusing on to achieve the outcome of developing entrepreneurial behavior.

2.2 Components of University Entrepreneurial Ecosystem

There has been an enormous increase in entrepreneurship and the number of start-ups in the last few tears. Entrepreneurial ecosystems have recently emerged as a popular concept among entrepreneurship policy and practitioners (Feld, 2012; Theodoraki et al.,2022). Specifically, they are seen as a regional economic development strategy based on creating supportive environments that foster innovative start-ups. It provides an organized attempt to establish environments conducive to increasing the success of newly established ventures (Messina et al.,2020; Mack & Mayer, 2016). An entrepreneurial ecosystem is a concept under which different components that support and help entrepreneurship flourish are considered. Their interaction and interdependencies are analyzed and studied to understand better how the entrepreneurship process transpires (Feldman et al., 2005). However, despite the massive popularity of the term, there is some vagueness in how we can develop a successful UEE (Owen & Vedanthachari, 2022).

UEE provides an excellent ecosystem for the students as it possesses all the components of the entrepreneurial ecosystem (Villani et al., 2017) needed for entrepreneurship. A successful UEE Should also focus on social inclusion, like providing equal opportunities to women entrepreneurs(Ghatak & Bhowmick, 2021; Ge et al., 2022; Neumeyer, 2020). The entrepreneurial behavior imparted by the UEE also helps achieve new success through innovativeness even during a crisis, which is essential to revive industries like hospitality and tourism, which have been highly impacted the most by COVID-19 (Fu & Abbas, 2022). The policymakers have increased the effort to develop universities as entrepreneurial ecosystems. However, not many studies have dealt with understanding the impact of each component of the university entrepreneurial ecosystem on its outcome (Feldman, 2014). Various components comprise the entrepreneurial ecosystem (Isenberg,2010; Spigel, 2017), which we from the literature. These components are discussed in Table 1.

< Table 1 Here>

3. Methodology

We have adopted a multi-method approach for our study. The steps of our methodology are depicted in Figure 2.

<Figure 2 Here>

3.1 Thematic Analysis

For thematic analysis, we have adopted Gioia Method (Gioia et al., 2012). This method was established by identifying patterns and themes of the relationship among constructs within the cases (Patnaik & Bhowmick, 2020). We applied thematic analysis to identify the measures taken by the top technological universities in India.

Our methodology uses the Grounded theory approach, which systematically analyzes the data that has been collected and determines the underlying theme and concepts (Gioia et al., 2012). This approach is best suited for our study as the literature on the UEE is not fully developed (Suddaby, 2006). To perform the thematic analysis, we used the Gioia Method. We have conducted the analysis using MAXQDA Software, which analyzes very complex qualitative data in text, transcripts, or audio. The steps of Gioia Method consist of three steps. The steps are identifying 1st-order concepts (coding), 2nd-order themes, and 3rd-order dimensions are shown in Figure 3.

<Figure 3 Here>

The process starts with coding the data, unearthing the relationship, and identifying the underlying concepts. Coding means highlighting sections of our text – usually phrases or sentences. During coding, we try to find answers to our research question. This coding process leads to first-order concepts. When we begin the first-order analysis and start coding, many concepts emerge. By iterating the process, we finalize a set of first-order concepts to proceed with the study. As the research progresses, we use axial coding (Strauss & Corbin, 1998), seek similarities and differences among the concepts, and group the first-order concepts based on

their similarities. In the next step, by understanding and analyzing the concepts, second-order themes are identified among them. These themes are derived by taking into account several concepts, and they represent the overall essence of those concepts. While deriving the themes, we should have an apparent knowledge of how these themes will move us forward toward attaining our research question and objectives. Deriving a theme is an iterative process, and finalizing the themes may take several iterations.

The next step is to gain deeper insights into our generated themes and understand the more extensive structure developed from these themes. At this point, we treat ourselves as knowledgeable agents and generate third-order dimensions from the themes. The dimensions will combine two or more themes that lead to a more significant concept.

3.2 Fuzzy sets and Linguistic variables

In the next stage of our study, we collected inputs from different stakeholders of UEE. For this purpose, we have used linguistic variables to indicate the influence of components on the determinants instead of a numerical variable. The linguistic variable is explained in words, phrases, or sentences to indicate the relationships. They are used when studying very complex systems as for complex systems; it might be challenging for the respondents to give their opinion quantitatively (Zadeh, 1975a). The linguistic variables are converted into quantifiable terms using fuzzy logic and fuzzy sets and are shown in Table 2.

<Table 2 Here>

We have used triangular fuzzy numbers (TFNs) for our application as it is both convenient and powerful to represent data in a fuzzy environment. TFNs are denoted as a triplet (a, b, c) where the parameters a, b, and c indicate the smallest possible value, the most promising value, and the largest possible value, respectively, that describe a fuzzy event (Sun & Lin, 2009). A triangular fuzzy number is shown in Figure 4.

<Figure 4 Here>

3.3 Fuzzy DEMATEL Method

The DEMATEL method is a structural model that explores the causal relationships among the factors being analyzed (Amirghodsi et al., 2020; Bai & Sarkis, 2013). This method is used to identify the cause and effect relationship among the factors of the model. Two types of groups are then formed in the model namely causal group and effect group.. This methodology helps to confirm the existing interdependence between criteria and determine the relationships of factors in the whole system (Amirghodsi et al.,2020). To take into consideration the dynamics of complex systems and analyse the interdependencies for such fuzzy environment, Lin & Wu (2004) developed the fuzzy DEMATEL approach. The stages of the fuzzy DEMATEL method are discussed below:

Stage 1: Collection and Defuzzification of Data

For a system containing a set of elements A = {a1, a2, ..., an}, the pair-wise relations among the elements are determined using the pair-wise comparison scale shown in Table 2. A group of *p* experts is asked to give pair-wise comparisons of elements to measure the relationship between criteria. So, *p* fuzzy matrices *Z*1, Z2,…, Zp are obtained, each corresponding to an expert.

The fuzzy raw data collced are then defuzzified into crisp set scores whch are used for further anlaysis (Opricovic & Tzeng, 2003). For the defuzzification process we adopted Converting Fuzzy data into Crisp Scores (CFCS) defuzzification method, as proposed by Opricovic and Tzeng (2003). We used CFCS method because when compared to the centroid method, it provides better crisp values.

Stage 2: Calculations

- ***Generating the initial direct-relation matrix***

The initial direct relation matrix, 'A,' is an n×n matrix obtained by pair-wise comparisons in terms of the influences and directions existing between criteria where a_{ij} is denoted as the degree to which the criterion 'i' affects the criterion 'j', i.e.

$A = [a_{ij}]_{n\times n}$ .....(1)

- ***Normalizing the direct-relation matrix***

On the basis of the direct-relation matrix 'A', the normalized direct-relation matrix, 'X' can be obtained through Eqn. (11) and (12) in which all principal diagonal elements are equal to zero.

X=k.A .....(2)

$k = \frac{1}{max_{1\le i\le n} \sum_{j=1}^{n} a_{ij}}$ $i, j = 1,2, \dots \dots \dots, n$ .....(3)

- ***Obtaining the total-relation matrix***

Once the normalized direct-relation matrix 'X' has been obtained, the total relation matrix 'T' can be derived by using Eqn. (13), where 'I' is denoted as the identity matrix.

$T = X(1 - X)^{-1}$ .....(4)

Stage 3: Interpretation

From the total relation matrix derived (T), using Eqn. (5), we derive the degree of influential impact (S) and degree of influenced impact (R) which is calculated as the sum of the rows and sum of columns of total relation matrix using Eqn. (6) and (7) respectively. Whilst the sum of rows shows all direct and indirect influences, given by the factor' i' to all other factors, the sum of the columns represents all direct and indirect impacts received by the factor 'j' to all other factors. We then calculate the horizontal ‘Prominence” axis (S+R), which is equal to the sum of degree of influential impact (S) and degree of influenced impact (R). Also, the vertical “Relation” axis (S-R), is calculated by subtracting the degree of influenced impact (R) from degree of influencial impact (S). Using the relation axis as reference, the causal-effect model is developed. If the S-R value is positive, then it is classified as cause factors and if it is negative then it is classified as effect factors.

$T = [t_{ij}]_{n\times n}$ .....(5)

$S = [\sum_{j=1}^{n} t_{ij}]_{n\times n}$ .....(6)

$R = [\sum_{i=1}^{n} t_{ij}]_{n\times n}$ .....(7)

3.4 Fuzzy TOPSIS Method

The TOPSIS method finds the best alternative from different variables for attaining a particular outcome (Mathew et al., 2020). It works on the principle that the best alternative will have the least distance from the ideal solution (Sun & Lin, 2009). The TOPSIS method is used because of its ability to handle complex systems. The stages of the fuzzy TOPSIS method are discussed below:

Stage 1: Forming Decision Matrix

For a system having n alternatives, A1, A2, . . ., An and m criteria, C1, C2, . . ., Cm. Each alternative is evaluated for the m criteria and is represented in a decision matrix X= $(x_{ij})_{n\times m}$. The weight of the criteria is donated by W = $(w_1, w_2, w_3, \ldots\ldots, w_m)$ be the weight vector of criteria, satisfying $\sum_{j=1}^{m} w_j = 1$.

Stage 2: Calculations

After forming the decision matrix, a set of calculations are done on the decision matrix to determine the ranking of the alternatives. The calculations include finding a Combined Decision Matrix, Normalized Decision Matrix, Weighted Normalized Combined Decision Matrix, Fuzzy Positive (A^*) & Fuzzy Negative (A^-) Ideal Solutions, Euclidean Distances of each alternative from the positive ideal solution, and the negative ideal solution, Relative Closeness of alternative A_i with respect to A* is defined as CC_i. The equations applied for each calculation are shown in figure 5.

<Figure 5 Here>

Stage 3: Interpretation

The alternatives are ranked according to the relative closeness to the ideal solution. The bigger the CC_i, the better the alternative A_i. The best alternative is the one with the greatest relative closeness to the ideal solution.

4. Data collection and Results:

In this section, we present the data collection process and the results of the three methods: thematic analysis, fuzzy TOPSIS analysis, and fuzzy DEMATEL analysis, that we have used in our study.

4.1. Thematic Analysis:

Here we present the data collection process and results of the thematic analysis.

4.1.1. Data Collection for Thematic analysis

For thematic analysis, we collected the objective, mission, and vision statements of the entrepreneurship cell of the Top 10 universities of India according to the ARIIA ranking. We also took interviews with ten experts associated with developing the UEE. These included the head of the Incubation Center and the coordinator of the entrepreneurship cell of the university.

4.1.2. Result of Thematic Analysis

We started the process by coding the data and identifying the 1st-order concepts based on our research objective: "What should be the output of the University Entrepreneurial Ecosystem." During our analysis, we try to find the answer to the question: What does the entrepreneurial ecosystem of universities do? After identifying the 1st-order concepts, we identified the themes and generated 2nd-order themes. From our analysis, we derive groups of concepts that provide the answer to our research question. After multiple iterations, we derived five themes, viz. Develop an Entrepreneurial Mindset, Promote Entrepreneurship as a Career, Guide and Mentor entrepreneurs, provide support to start Entrepreneurship, and Support and

Encourage Ideas. Next, we find the third-order dimensions by combining two or more themes that lead to a more significant concept. We generated two dimensions from the themes viz Develop Entrepreneurial Intention and Encourage Entrepreneurial Action. These dimensions are considered the output of the university entrepreneurial ecosystem, which gives us an idea of what outcome the universities are trying to achieve.

We also created the data structure from our analysis. Creating data structure is crucial as it demonstrates the steps we have followed and how we have reached our findings from the raw data in an extensive form. Figure 6 shows the data structure of our study.

<Figure 6 Here>

4.2. Fuzzy DEMATEL

In this section, we present a brief on how we collected data for conducting the DEMATEL analysis and discuss the results of the analysis.

4.2.1. Data Collection for Fuzzy DEMATEL analysis

In order to apply the Fuzzy DEMATEL method to determine the interdependencies of components of EE in fostering entrepreneurship through the creation of new ventures, we developed survey to identify the impact of one factor on the other factors using the fuzzy linguistic scale. We designed our questionnaire by developing our UEE model by identifying components through a concise review of the literature (Hussain et al., 2019; Abbasi & Toufil, 2021; Abbasi et al., 2021). The model captures the impact of the components on one another, which helps develop a sustainable environment (Li et al., 2022) to increase the firm performance (Mubeen et al., 2021). The respondents were selected from among entrepreneurs, executives associated with entrepreneurship, and students willing to take up entrepreneurship. A total of 10 respondents completed the survey, and their responses were analyzed to evaluate the interdependencies among the eight components of UEE discussed in section 2.

4.2.2. ***Results of Fuzzy DEMATEL***

After the collection of data, we performed the fuzzy DEMATEL analysis and calculated the prominence (S+R) and relation (S-R) axis of the causal diagram, which is shown in table 3. The causal diagram is shown in Figure 7. The components with positive (S-R) values are classified into cause groups, and components with negative (S-R) values have been grouped as effect components.

The components A2, A8, A1, A7, and A6, have positive S+R scores of 1.563, 1.176, 0.821, 0.121, and 0.093, respectively, meaning that they have a greater level of impact on the whole system. Hence, the causal group components consist of Entrepreneurial Education & Training(A2), Policy (A1), Supportive Culture (A8), Mentors (A7), and Network (A6). On the contrary, effect group components Investment Capital (A3), Support Services (A5), and Infrastructure (A4) has negative S-R value of -1.306, -1.120, and -1.348, respectively.

<Table 3 Here>

<Figure 7 Here>

The components of the cause group have more impact on the success of UEE, and the development of these components should be prioritized. Focussing on the cause group components will lead to a better performing UEE and also would lead to the development of other components. Subsequently, by facussing on the causal componnets, the increase in performance of the effect group factors can be achieved.

4.3. Fuzzy TOPSIS

The mechanism for data collection of our study and the results of our fuzzy TOPSIS analysis are elaborated in this section.

4.3.1. Data Collection for Fuzzy TOPSIS analysis

We derived the determinants of entrepreneurial behavior from the two outputs of UEE, i.e., entrepreneurial intention and entrepreneurial action. Further, the theory of planned behavior

(Ajzen, 1991) presents a robust and effective model to analyze the impact of entrepreneurial intention by considering attitude, subjective norm, and perceived behavioral control. Thus taking the aspects presented by the theory of planned behavior (Ajzen, 1991) regarding entrepreneurial intention, we identified Perceived Entrepreneurial Attitude, Perceived Subjective Norm, Perceived Behavioral Control, Perceived Entrepreneurial Intention, and Entrepreneurial Action as the determinants of entrepreneurial behavior for our analysis. The framework for fuzzy TOPSIS analysis is shown in the figure 8.

<Figure 8 Here>

After preparing the framework, we collected data from 7 representatives of the Entrepreneur cell responsible for fostering the entrepreneurial ecosystem in universities and 8 Entrepreneurs who started their start-ups on campus from top technical institutes in India. We asked them to indicate the influence of the components of the Entrepreneurial ecosystem in achieving a successful UEE. The respondents were asked to indicate the influence in linguistic terms, as shown in table 2. After the data collection, we had 15 decision matrices, one for each respondent.

4.3.2. Results of Fuzzy TOPSIS Analysis

This research aims to construct a fuzzy TOPSIS model to evaluate different components that constitute the EE that influences the entrepreneurial behavior among the students in a university. Experts evaluate the importance of the components, and then the uncertainty of human decision-making is taken into account through the fuzzy concept. We calculated the fuzzy closeness co-efficient (CC_i) by following the steps discussed in section 4.2.1. The ranking is done based on the value of CC_i. The values of fuzzy distance, closeness coefficient, and rank of the components of the university entrepreneurial ecosystem are shown in Table 4. The ranking of the components is also demonstrated in Figure 9.

From our proposed study we find that A6 (Network) > A2 (Entrepreneurial Education & Training) > A7 (Mentors) > A8 (Supportive Culture)>A4 (Infrastructure) > A3 (Investment Capital) > A1 (Policy) >A5 (Support Services). We find that network, entrepreneurial education & training, mentor, and supportive culture are the top 4 components that impact students' entrepreneurial behavior.

The network emerges as the top component, and the reason for this could be that it helps entrepreneurs in more than one way. In the literature on entrepreneurship and the entrepreneurial ecosystem, a dense network is stated to be important in supporting entrepreneurial activity (Cohen, 2006; Spigel, 2017). It is easier for the entrepreneur to assemble the resources to start an enterprise in a dense network. The network also helps entrepreneurs access resources and financing that are not accessible to others and provides a platform for opportunity recognition. A strong network can be created in the university through various events where the students could be allowed to interact with the top industrialist and entrepreneurs. These connections could help the students in the future when they would start their endeavors. Thus, developing a strong network of entrepreneurs, industrialists, and alumni should be of top priority for universities.

<Table 4 Here>

<Figure 9 Here>

The second most crucial component of the university entrepreneurial ecosystem in achieving entrepreneurial behavior is entrepreneurial education and training. It provides students with the knowledge and skills required for entrepreneurship (Theodoraki et al., 2018). Universities can develop this component by organizing events and workshops that enable students to learn the required entrepreneurship skills.

The next most crucial component is the mentor. Mentors help entrepreneurs hone their skills and develop their entrepreneurial capabilities (Motoyama et al., 2014). They are also motivated to start a new venture and guide the entrepreneurs throughout the journey. The universities can have entrepreneurship ambassadors that will mentor the students when needed. Regular sessions can also be organized between mentors and students. The faculty members of universities can also act as mentors and help students in their entrepreneurial journey.

The fourth most important component is supportive culture. Supportive culture being among the top components of the entrepreneurial ecosystem in developing entrepreneurial behavior is not a surprise, as numerous studies indicate the positive influence of supportive culture on the individuals taking up entrepreneurship (Neck et al., 2004). The supportive culture encourages normalizing the view toward entrepreneurship and removes its stigma.

5. Discussion

We start our discussion by exploring the determinants of entrepreneurial behavior. We also explore the success components of UEE and how UEE can be crucial in dynamic and uncertain times such as COVID-19.

5.1 Determinants of Entrepreneurial Behavior

Entrepreneurial behavior cannot be developed instantly but is developed over time by developing the entrepreneurial intention and performing entrepreneurial actions on a regular and consistent basis. From our study, we identified developing entrepreneurial intention and encouraging entrepreneurial action, leading to the outcome of the university entrepreneurial ecosystem.

Entrepreneurial Intention: Entrepreneurial intention is an entrepreneur's willingness to take up entrepreneurship (Ajzen, 1991). There is a high probability that an individual who intends

to start a new venture and become an entrepreneur will constantly look for opportunities and resources and eventually take up entrepreneurship (Sanchez et al., 2017). Of all the determinants of entrepreneurial behavior, entrepreneurial intention has been given the most importance (Krueger & Carsrud, 1993). The theory of planned behavior (Ajzen, 1991) presents a robust and effective model indicating that intention is the best indicator of behavior.

Entrepreneurial Action: Entrepreneurship is a process and not an event. In the journey of entrepreneurship, an entrepreneur has to execute different tasks. These tasks may include opportunity recognition, market analysis, data collection, prototyping, finance, etc. These are some of the actions that an entrepreneur performs to start and run their venture (Krueger et al., 2000). Performing these entrepreneurial actions continuously and consistently is essential to developing entrepreneurial behavior (Alvarez & Barney, 2007). In this context, entrepreneurial action is defined as any activity entrepreneurs might take to exploit opportunities and form businesses (Shane & Venkataraman, 2000).

5.2 Success Components of UEE

We initiated our study to identify the components needed to achieve the success of UEE and establish the interactions of the components of UEE. We identified that to be successful, UEE needs to develop entrepreneurial behavior. Then we explored the interaction among the components of UEE by adopting fuzzy DEMATEL and fuzzy TOPSIS methods.

By implementing fuzzy DEMATEL analysis, we identified the cause group components: Entrepreneurial Education and Training, Policy, Mentors, Network, and Supportive Culture. The effect group components consist of investment capital, infrastructure, and support services. The development of cause group components will eventually lead to the development of the effect group components. If by promoting entrepreneurship through favorable policies and developing components like Entrepreneurial education & Training, Network, Mentors, and Supportive culture, the students of UEE develop a liking towards

entrepreneurship and want to take up a career in entrepreneurship, then the policymakers are bound to develop the other components like investment capital, infrastructure, and support services to help the student entrepreneurs embark on their next phase of entrepreneurship.

The fuzzy TOPSIS analysis has strongly supported the impact of the cause group components. From fuzzy TOPSIS analysis, we found that except for policy, all other components in the cause component group, i.e., entrepreneurial education and training, network, mentors, and supportive culture, form the top four components of UEE and form the cause component group.

These results are interesting and surprising because when policymakers and practitioners take the initiative to develop an entrepreneurial ecosystem, the main focus is creating the environment for attracting investors and creating infrastructure to support entrepreneurship (Cao & Shi, 2021). However, from our analysis, this does not seem to be the case for UEE. UEE is different from a macro entrepreneurial ecosystem at a country or regional level (Theodoraki & Messeghem, 2017) mainly due to the type of entrepreneurs involved in the ecosystems. If we consider the entrepreneurial ecosystem, then the actors there, the entrepreneurs, generally have had entrepreneurship training and have the requisite skills and knowledge to carry out the activities of entrepreneurship. So, their main requirement from the entrepreneurial ecosystem is to provide opportunities for raising capital and have infrastructure and support services for starting their venture. However, this is not the case in UEE. UEE is different in the sense that the actors here are the students who do not have much prior knowledge of entrepreneurship and its process. They need to be groomed and trained to think and act like entrepreneurs. So the requirements of UEE are different from the entrepreneurial ecosystem, and the components that seem essential and significant for the entrepreneurial ecosystem are not the same in UEE. There is no one size fits all for the entrepreneurial

ecosystem (Isenberg, 2010). Thus, while developing a UEE, a somewhat different approach to a regional entrepreneurial ecosystem needs to be taken (Motoyama et al., 2014).

The success components of UEE are also critical in the context of uncertainty. The world has faced huge uncertainty during the COVID-19 pandemic, which led to a crisis in all walks of life, be it health, economic, or energy (Geng et al.,2022). The impact of COVID-19 was such that there were massive technological changes in operation, and everything was forced to go online, from education to work-from-home (Rahmat et al.,2022). However, there are important aspects to learning too. Many B2C companies emerged and used social media to take their product to the masses (Zhou et al., 2022), thus using the crisis in their favor and establishing a new venture. The UEEs can include such learnings in the entrepreneurial education system to prepare future entrepreneurs for any upcoming uncertainty. During the pandemic, many incubated entrepreneurs have focused on social responsibilities through concepts like design thinking and frugal innovation. These qualities are in high demand in the industry as studies have highlighted the significant positive impact of employee behavior and corporate social responsibility on business performance (Li et al.,2022; Zhang et al.,2022). The UEEs can create a supportive culture within and outside the ecosystem so that future entrepreneurs can focus on social causes, resulting in sustainable development (Ghatak et al., 2021).

Thus through our study, we identify the components that should be given more priority while developing UEE. Although all components serve their purpose in entrepreneurial ecosystem development and are essential in different phases of entrepreneurship, understanding which components are more important and how they will eventually lead to the development of the other components can go miles into developing a fostering UEE.

6. Contribution

Our study has contributions to both theory and practice. Contributions have been elaborately discussed in the following sections.

6.1. Theoretical Implications

Our study contributes to the literature on the entrepreneurial ecosystem and, more specifically, the literature on UEE. We also contribute to extending the studies on emerging economies, and our methodological approach opens new doors to analyze and assess the complex phenomenon of the entrepreneurial ecosystem

6.1.1 Contribution to Entrepreneurial Ecosystem Literature

Research on the entrepreneurial ecosystem has seen massive traction since 2010 when Isenberg suggested that entrepreneurial ecosystems could be developed through a holistic approach (Isenberg, 2010). The ecosystem approach to studying and understanding entrepreneurship has much focus due to its systematic nature (Neumeyer, X., 2020; Lô & Theodoraki, 2020). However, literature on the entrepreneurial ecosystem has dealt chiefly with identifying the components that constitute the ecosystem rather than understanding the dynamics of the components (Lô, & Theodoraki, 2020; Spigel, 2017). Through our study, we have contributed to understanding the dynamics of the entrepreneurial ecosystem. Our contribution also lies in identifying which components have more impact on the ecosystem and should be given more focus which the Entrepreneurial ecosystem literature has lacked. We established the interdependencies among the components, explored their interaction in UEE, and identified the cause group components and effect group components of UEE. We also determined the essential components on which particular focus should be given in the early stage of developing UEE. It gives an understanding of which components have the most influence on the development of UEE. Analyzing these type of interaction among components of the entrepreneurial ecosystem have been very rare in entrepreneurial ecosystem literature.

6.1.2 Study in Emerging Economy

Entrepreneurial ecosystem has generally been studied in developed countries. Few studies have concentrated on studying the entrepreneurial ecosystem of emerging countries and focus on how to develop the ecosystem in these countries (Malecki, 2018). The ecosystem of emerging countries varies greatly from developed countries, and there is a need for research in emerging countries. In our paper, we have addressed this gap by studying the entrepreneurial ecosystem of universities in India.

6.1.2 Study Focusing on Emerging Economy

The entrepreneurial ecosystem has generally been studied in developed countries. Few studies have concentrated on studying the entrepreneurial ecosystem of emerging countries and focus on how to develop the ecosystem in these countries (Malecki, 2018). The ecosystem of emerging countries varies greatly from developed countries, and there is a need for research in emerging countries. In our paper, we have addressed this gap by studying the entrepreneurial ecosystem of universities in India.

6.1.3 Contribution to Methodology

Literature on the entrepreneurial ecosystem has primarily used a qualitative approach to studying an ecosystem, with very few cases of a quantitative approach (Maroufkhani et al., 2018). Though a qualitative study, our use of the fuzzy TOPSIS and fuzzy DEMATEL method has a quantitative approach that has not been employed much in entrepreneurial ecosystem literature. We are first to use these techniques in the entrepreneurial ecosystem domain to determine the importance of the components of the UEE and explore the interaction among the components of the UEE. Our approach to studying such a complex and interrelated system like the entrepreneurial ecosystem will open doors for many more such studies to understand the dynamics of the entrepreneurial ecosystem.

6.2 Managerial Implications

With the view of the implementation of UEE, our study contributes by providing policymakers insights on how to approach establishing an efficient UEE. We also provide implications on how the UEE impacts the mentor-mentee relationship and the role of incubation centers in engaging students in entrepreneurship.

6.2.1 Developing University Entrepreneurial Ecosystem

Policymakers are looking to develop an entrepreneurial ecosystem in universities of their region to foster entrepreneurship. We provide them with all the required information and analysis to make an informed decision. The first problem with the development of UEE is not being able to decide on the expected output. Our study identifies the outputs policymakers should try to enhance while developing the university entrepreneurial ecosystem to develop entrepreneurial behavior. While developing UEE, most of the emphasis from the beginning is put on providing and arranging resources for forming and launching start-ups. However, our study shows that the primary objective of UEE should be to develop Entrepreneurial behavior through increasing Entrepreneurial Intention and encouraging students to perform entrepreneurial action, which leads to the development of entrepreneurial behavior. This entrepreneurial behavior will definitely assist students in every aspect of life. It may also lead to students launching their start-ups not during graduation but even in the future.

There are different components of UEE, and sometimes it is impossible for policymakers to concentrate on developing all the components simultaneously. Our study analyzes the components that have more importance and impact that need special attention. Thus, instead of developing all the components together, the policymakers will have an adequate understanding of what should be developed first and what will follow.

6.2.2. Gap between Mentor and Mentee

Faculties of different disciplines are generally associated with these entrepreneurial ecosystems. One of the participants, who is a co-founder and part of IIT incubation centers, said

"The sole purpose behind joining this was to improve our product. I was already carrying my product when I entered this campus. But my mentors keep on telling me to focus on how to sell my product. Initially, it was a bit frustrating."

Incubation centers should be careful about the expectation of the founders and co-founders. It might be necessary for the venture to focus on something else, but before asking founders to do the same, mentors need to bring the co-founders on the same page. They need to teach the entrepreneurs about the basics of entrepreneurship to understand and appreciate the suggestions. So, UEE needs to be proactive irrespective of the domain knowledge of the mentor and mentees, and both should be on the same page in deciding future actions for the benefit of the venture.

6.2.3. Engaging students with the Incubation centers

Many IITs have incubation centers where many start-ups work throughout the day. However, all the IITs do not equally encourage students' and founders' interactions. From the interaction with different stakeholders of UEE, we learned that when the students are directly engaged with the entrepreneurs (incubation centers inside the campus), it helps them understand and appreciate what they have learned in the entrepreneurship classes. In the word of one of the participants-

"We have labs to do things practically. Initially, I have selected entrepreneurship just to add one CV point. Initially, I felt it is like humanities, and we need to read and give answers. But, when I started working with start-up X, I realized that this working experience is just like our ECE lab. I felt really good. Especially once the co-founder allowed me to participate in an

interview where he was asking a customer how to improve the product. It was a mind-blowing experience." Hence, we highly recommend engaging students with co-founders.

7. Limitation and Future Scope

Our study focused on determining the output of the UEE and analyzing the interaction among the components of the UEE. One of the limitations of our study was that to focus on UEE in emerging countries; we based our study only on the universities in India. However, similar studies can be performed in other emerging countries to understand better the relationship of components of UEE in emerging countries' perspectives. We also concentrated our study on one particular type of entrepreneurial ecosystem, i.e., UEE. Nevertheless, the problem of unidentified relationships and interaction among the components of the entrepreneurial ecosystem is not only constrained to UEE, but this gap is prevalent in the whole entrepreneurial ecosystem literature. Studies can be conducted in different levels of Macro, Meso, and Micro entrepreneurial ecosystems, and the dynamics among them can also be studied. Comparative studies can also be made by taking our study as a baseline of how the interactions among the components of UEE differ from other types of ecosystems. Thus our study has the potential to open new doors and direction of research in entrepreneurial ecosystem literature and explore the relationships and dynamics of the complex intertwined entrepreneurial ecosystem.

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Table 1: Brief description of components of UEE

Component Name	Description	Reference
Policy	Policies are the rules and regulations that are created to support entrepreneurship in the region	(Mason & Brown, 2013)
Entrepreneurial Education and Training	Entrepreneurship Education and Training seeks to provide students with the knowledge, skills, and motivation to encourage entrepreneurial success	(Bramwell et al., 2008; Hayter, 2016)
Investment capital	It is the availability of money for starting and running a firm. There are different sources to raise capital in an	(Malecki, 2018; Pasayat,

	entrepreneurial ecosystem like venture capital, angel investors, crowdfunding, etc.	Bhowmick, Roy, 2020)
Infrastructure	The infrastructure of an UEE comprises the transport system, internet availability, working spaces, telecommunication, and several others facilities like Incubation centers and innovation labs.	(Feld, 2012; Almansour, 2022)
Support services	Support services are the services that a new start-up may need in the early stage of its formation. These services may range from different domains like lawyers, accountants, advisors, etc	(Kenney & Patton, 2005; Bandera & Thoma, 2018)
Network	Network is the connection and contacts that the university has established with various stakeholders of entrepreneurship that can help student in their entrepreneurial journey.	(Abbas et al., 2019; Neck et al., 2004)
Mentors	Mentors are individuals who can guide entrepreneur and help them make critical decisions in different stages of start-up and increase the chances of formation and survival of the firm.	(Motoyama et al., 2014)
Supportive Culture	Cultural attributes are the underlying beliefs and outlooks about entrepreneurship within a region. The two main attributes that comprise the supportive culture are entrepreneurship's cultural attributes and histories.	(Neck et al., 2004; Cohen, 2006)

Table 2: Fuzzy Value Corresponding to Linguistic Value

Linguistic Value	Numeric Value	Fuzzy Value
No Influence (N)	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)

Table 3: Prominence and relation axis for the causal diagram

Components of UEE		Prominence and relation axis for the causal diagram			
		S	R	S+R	S-R
A1	**Policy**	1.466	0.646	2.112	0.821
A2	**Entrepreneurial Education & Training**	2.861	1.298	4.160	1.563
A3	**Investment Capital**	1.337	2.643	3.979	-1.306
A4	**Infrastructure**	1.264	2.384	3.649	-1.120
A5	**Support Services**	1.143	2.491	3.634	-1.348

A6	**Network**	2.403	2.310	4.712	0.093
A7	**Mentors**	1.964	1.843	3.807	0.121
A8	**Supportive Culture**	2.755	1.579	4.334	1.176

Table 4: Closeness Coefficient value and Ranking of Components of Entrepreneurial Ecosystem

	Components	d_i^*	d_i^-	CC_i	*Rank*
A1	**Policy**	1.003	0.559	0.358	7
A2	**Entrepreneurial Education & Training**	0.577	1.128	0.661	2
A3	**Investment Capital**	1.000	0.570	0.363	6
A4	**Infrastructure**	0.726	0.782	0.519	5
A5	**Support Services**	1.063	0.415	0.281	8
A6	**Network**	0.608	1.311	0.683	1
A7	**Mentors**	0.669	1.093	0.620	3
A8	**Supportive Culture**	1.046	1.449	0.581	4

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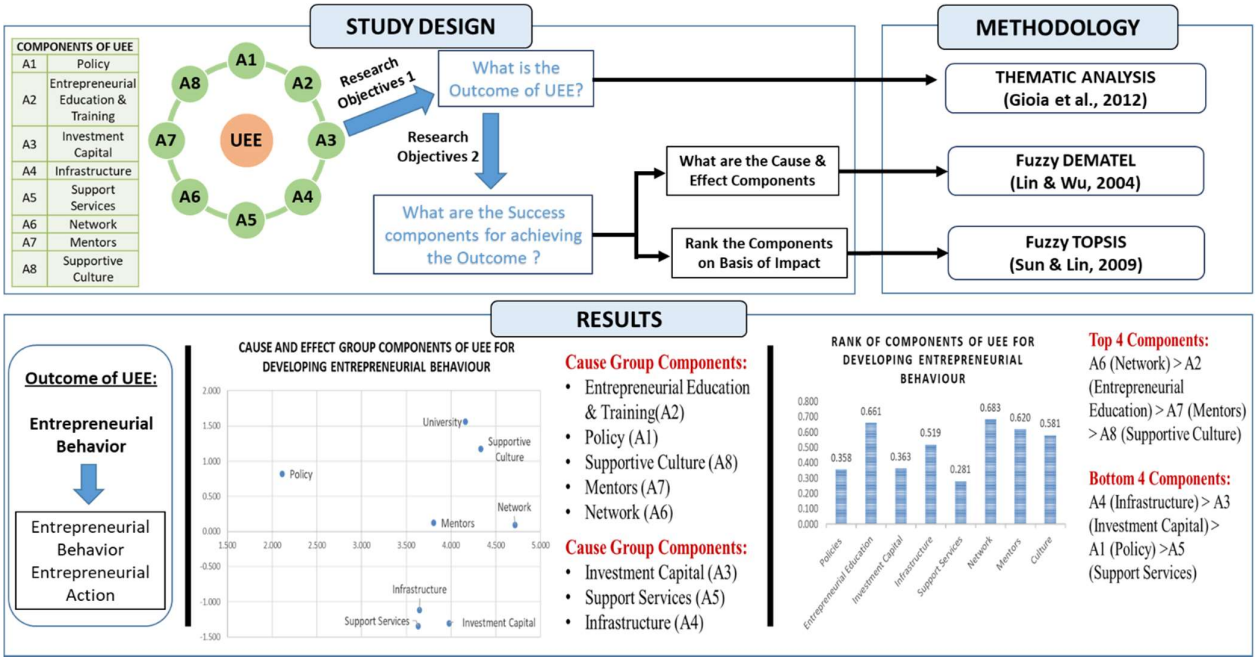

Figure 1: Graphical Abstract of our study

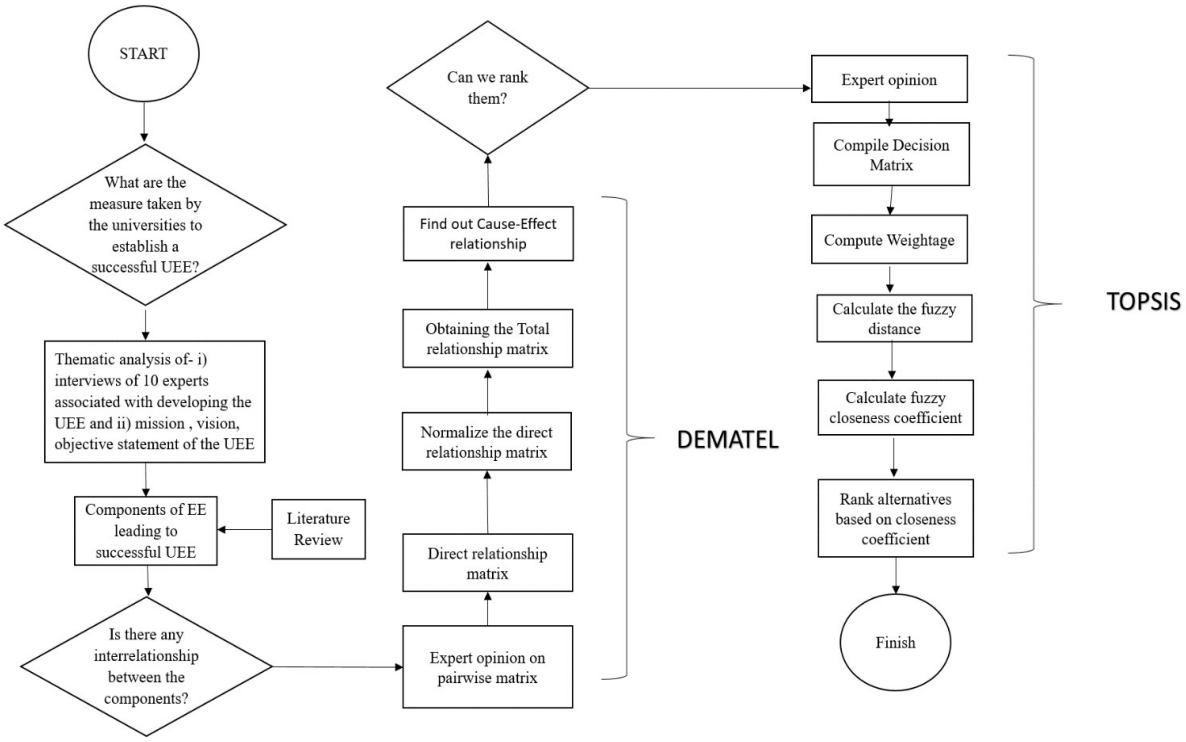

Figure 2: Flowchart of Methodology

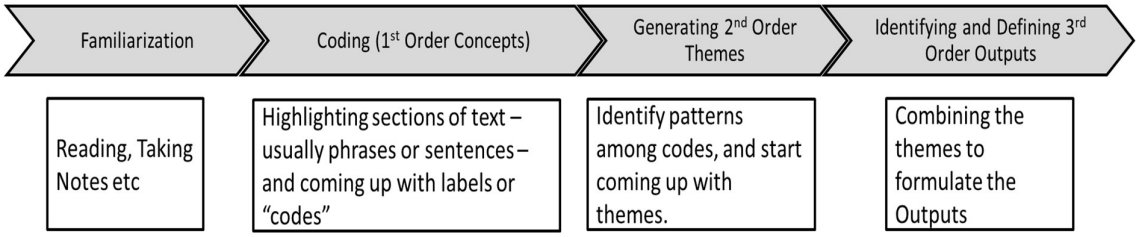

Figure 3: Gioia Method

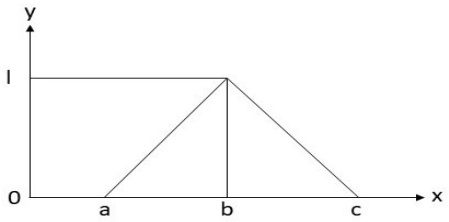

Figure 4: An Example of Triangular Membership Function

	Equations
Decision Matrix (X)	X= $(x_{ij})_{n\times m}$ Where, $x_{ij}= (a_{ij}, b_{ij}, c_{ij})$ And $a_{ij} = \frac{1}{K}\sum_{k=1}^{n} a_{ij}^{k}$, $b_{ij} = \frac{1}{K}\sum_{k=1}^{n} b_{ij}^{k}$, $c_{ij} = \frac{1}{K}\sum_{k=1}^{n} c_{ij}^{k}$
Combined Decision Matrix (R)	$R = (r_{ij})_{n\times m}$ r_{ij} is normalized criteria/attribute Where , $r_{ij} = \left(\frac{a_{ij}}{c_j^*}, \frac{b_{ij}}{c_j^*}, \frac{c_{ij}}{c_j^*}\right)$ $and\ c_j^* = max_i\{c_{ij}\}$
Weighted Normalize Combined Decision Matrix (V)	$V = (v_{ij})_{n\times m}$ $v_{ij}^* = r_{ij} * w_j$ where, $w_j$is the weightage of each criteria
Fuzzy Positive Ideal Solution (A^*) **Fuzzy Negative Ideal Solution (A^-)**	$A^* = \{v_1^*, v_2^*, \dots\dots, v_m^*\}$ Where $v_j^* = max_j v_{ij}$ $A^- = \{v_1^-, v_2^-, \dots\dots, v_m^-\}$ Where $v_j^- = min_j v_{ij}$
Euclidean distances of each alternative from the positive ideal solution and the negative ideal solution	$d_i^* = \sqrt{\sum_{j=1}^{n}(v_{ij} - v_j^*)^2}$ i = 1, 2, 3,.....,m $d_i^- = \sqrt{\sum_{j=1}^{n}(v_{ij} - v_j^-)^2}$ i = 1, 2, 3,.....,m
Relative Closeness of the alternative A_i with respect to A* (CC_i)	$CC_i = \frac{d_i^-}{d_i^* + d_i^-}$ i = 1, 2, 3,.....,m

Figure 5: Equations for calculations of Fuzzy TOPSIS Method

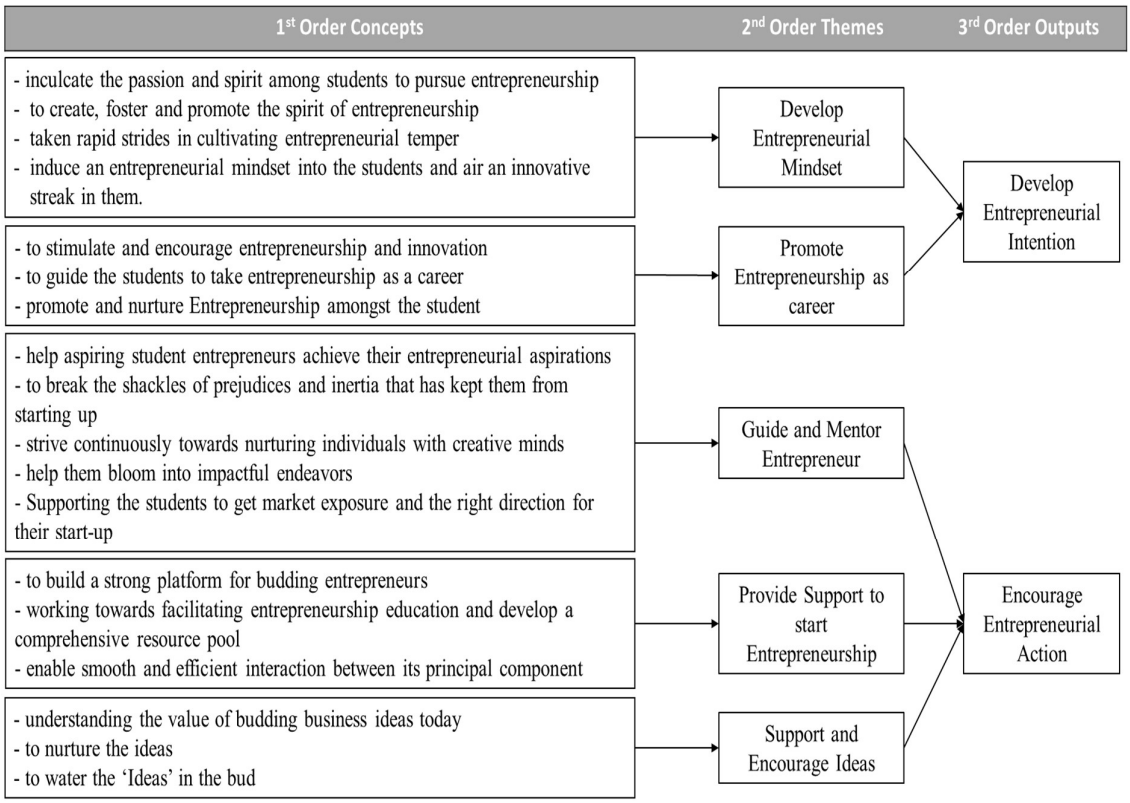

Figure 6: Data structure of thematic analysis

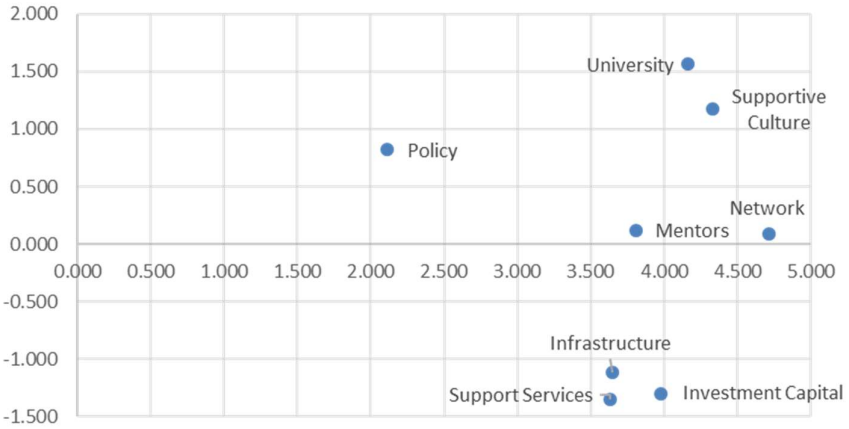

Figure 7: Cause and Effect Group Components of UEE

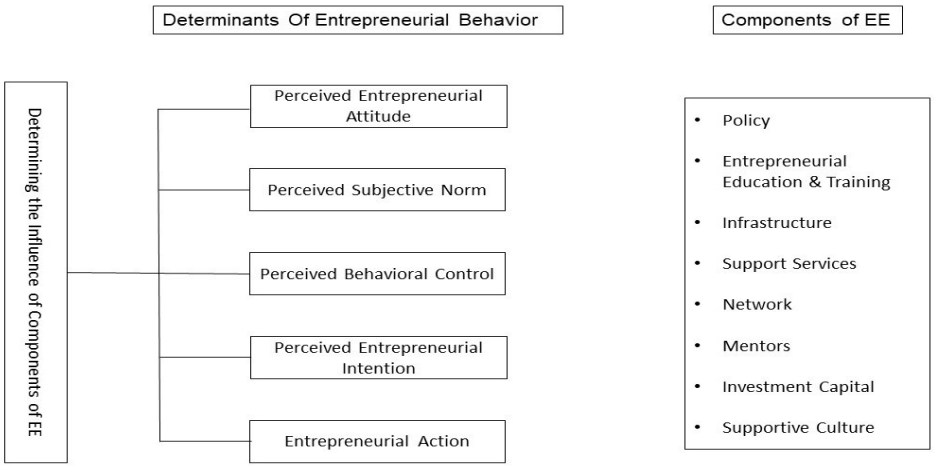

Figure 8: Framework for Fuzzy TOPSIS Analysis (Developed by the authors)

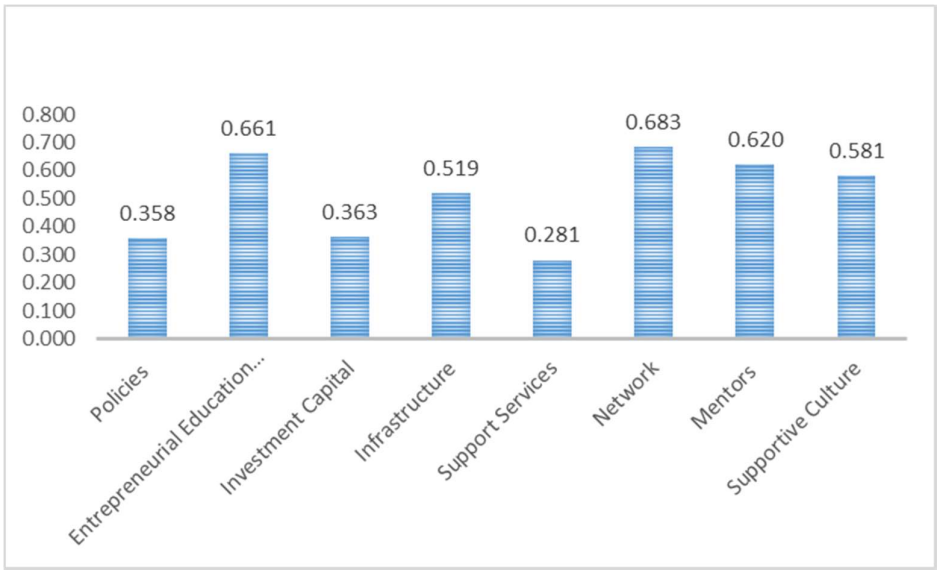

Figure 9: Ranking of Components of University Entrepreneurial Ecosystem