PREPAREDNESS OF INNOVATION & ENTREPRENEURIAL ECOSYSTEM AND FACULTY ENGAGEMENT IN INDIAN HIGHER EDUCATIONAL INSTITUTIONS - A FACULTY PERSPECTIVE STUDY

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ABSTRACT

In the past few years, there has been increasing importance of academic entrepreneurship aligning with Higher Education Institutions (HEIs') overarching mission of fostering innovation and entrepreneurship. This research paper focuses on understanding the relationship between entrepreneurial engagement of faculty members and entrepreneurial ecosystem preparedness in Indian higher education institutions. This study has explored the pivotal role of Ecosystem Preparedness and Faculty Engagement in fostering innovation and entrepreneurship within HEIs. To assess this relationship, 1506 valid responses obtained through selective and simple random sampling, the study applied a descriptive research method and Structural Equation Modeling (AMOS 24).

The study uncovers significant correlations to understand the complex dynamics within the academic ecosystem and their direct implications for fostering innovation and entrepreneurship readiness in HEIs. The outcomes of the study show a positive and significant association between Ecosystem Preparedness and Faculty Engagement in Indian HEIs. The study highlights the mutual interrelation of factors; a robust system, effective strategies, leadership, and a nurturing culture are key pillars ecosystem preparedness. It highlights the significance of fostering a conducive ecosystem while simultaneously nurturing comprehensive faculty engagement in different kinds of entrepreneurial activities. These insights offer practical implications for HEIs navigating the environment for innovation and entrepreneurship.

Keywords: Innovation & Entrepreneurial Ecosystem, Faculty Engagement, Higher Education Institution, Institution's Innovation Council, Structural Equation Modeling, Academic Entrepreneurship.

INTRODUCTION

As per the recent WIPO report, India is ranked 40th as per the latest Global Innovation Index rating 2023 now stands as the third-largest global ecosystem for start-ups and holds the second rank for innovation quality. Higher Education in India (HEI) can play an important role in induction or proving entrepreneurship acculturation amongst students. HEI in India has

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initiated the institution's Innovation Council (IIC), an Initiative of the Ministry of Education in the year 2018. This initiative has been taken to encourage entrepreneurial skills and start-ups through Indian HEIs. The Ministry of Education in India has established an 'Innovation Cell (MIC)' with the aim of fostering a culture of innovation in Higher Education Institutions (HEIs) across the nation (IIC). MIC is committed to achieving this through policy interventions and support mechanisms that create an enabling environment for idea generation, pre-incubation, and the development of high-quality innovations and early-stage startups. This initiative streamlines and sustains innovation and entrepreneurship ecosystems within HEIs, while also providing comprehensive support to inspire and mentor young students in their pursuit of innovation during their academic journey.

HEIs participation is increasing towards academic entrepreneurship, faculty members who are heading innovation cells are actively engaged in innovation initiatives. These faculty members act as a catalyst for entrepreneurial activities or initiatives. There are various factors, which can be encouraging for faculty members for e.g., annual rewards, publications, patents, consulting assignments etc. The faculty engagement in academic activities is diverse (Zsolt Bedő, 2020). The dynamism of faculty engagement with respect to readiness of institution entrepreneurship environment and innovation & entrepreneurial ecosystem preparedness is the main research gap in the context of Indian HEIs.

The research paper focuses upon understanding the different factors related to institution preparedness of entrepreneurship ecosystem and faculty engagement level. It will be also helpful in creating scale or model to check entrepreneurship preparedness of faculty member in Indian HEIs. The novelties of this research lie in several key aspects that contribute to the advancement of knowledge in the field of innovation, entrepreneurship, and higher education in the Indian context. The research unveils a bidirectional relationship between Ecosystem Preparedness and Faculty Engagement. This comprehensive approach provides value by providing a detailed understanding of the various aspects required to encourage innovation and entrepreneurship. The study extends beyond theoretical insights to offer practical recommendations for a collaborative strategy. This emphasis on actionable findings is unique in that it directs educational institutions, researchers, faculty members, and policymakers on specific ways to improve both ecosystem preparedness and faculty engagement at the same time.

LITERATURE REVIEW

In the late nineteenth century, many academic institutions expanded their core mission by embracing research as a supplementary goal alongside their primary focus on teaching (Carlos Bazan, 2022). The pursuit of third mission is characterized by academic entrepreneurship and is depending on various factors, including: (1) the increasing economic dependence on knowledge generation, (2) the incorporation of institutions into local, regional, and national socioeconomic development strategies, (3) the adoption of the Triple Helix model for collaboration among universities, industry, and government, (4) the need to diversify university funding sources, and (5) the introduction of new technologies (Maria Abreu a, 2013) . Academic entrepreneurship has evolved in early nineteenth-century from the American research system. Academic entrepreneurship has increased its significance in recent decades as a means of encouraging academics to become innovative entrepreneurs (Maria Abreu a, 2013) (Shane, 2004). Functional ecosystems should incorporate the faculty's pivotal role as facilitators of an entrepreneurial culture. Recognizing the potential of faculty members as intrapreneurs and catalysts for

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cultivating entrepreneurial environments in academic institutions is of paramount importance. Faculty members have the ability to influence and reshape social norms, thereby endorsing entrepreneurship as a legitimate academic pursuit. The endeavors of institutions to promote entrepreneurship are likely to fall short unless they receive direct support from these influential individuals (Hezekiah Falola, 2018). These components includes, learning about entrepreneurship, educational institutions approach for teaching entrepreneurship, dedicated resources for supporting entrepreneurship such as science parks, incubators, and entrepreneurship centers; entrepreneurship faculty development programs, and the influence of role models (Gustavo HSM, 2020). In the realm of academic entrepreneurship research, it is imperative to extend the prevailing focus, which predominantly revolves around patent-related activities, to encompass a more comprehensive spectrum of entrepreneurial undertakings, encompassing both commercial and non-commercial pursuits (Maria Abreu a, 2013).

Entrepreneurship in academic research extends beyond the traditional commitments of teaching and research. It is a risk-taking innovative approach with the potential to provide monetary rewards for both the individual faculty member and the institution as a whole. These financial gains may occur directly or indirectly, because of improved credibility, higher influence, or social advantages, resulting in increased research funding, higher student enrollment, or other rewards, such as access to special tools and resources (Maria Abreu a, 2013) (Carlos Bazan, 2022) developed a conceptual framework and research methodology to measure academics' perceptions of HEIs entrepreneurship goals. This approach emphasizes five different institutional components that collectively provide an entrepreneurial framework: systems, structures, leadership, strategies and culture (Burns, 2005) (Carlos Bazan, 2022). All of these elements are interconnected and mutually helpful. While their alignment is necessary, it is not in itself adequate for effective implementation. They work in harmony, so the absence of one or an excessive focus on one over the others within the entrepreneurial framework may lead to an imbalance (Carlos Bazan, 2022).

Structures It refer to the institutional mechanisms for the dissemination of knowledge. These encompass the physical or organizational entities that facilitate interactions among academics, staff, and students within the institution, as well as with external parties and vice versa (Henry, 2003). A technology transfer and commercialization office, a company incubator, an industrial contact office, a professional development and continuing education office, and an integrated education office are examples of components in the framework of an entrepreneurial architecture (Carlos Bazan, 2022) (Henry, 2003).

Systems encompass the elaborated network of collaboration and interaction that facilitate knowledge exchange within the organization. It also refers to the anticipated patterns of interaction and connectivity among various stockholders, both internal and external to the local entrepreneurial ecosystem and the entrepreneurial architecture (Carlos Bazan, 2022) (Janet Bercovitz, 2001) (M E. H., 2005) (Donald Siegel, 2003). The establishment of these organizational networks plays a pivotal role in transcending institutional boundaries by linking research with commercial prospects. It also allows for the seamless integration of various activities, both academic and non-academic under a cohesive structure (Pablo D'Este, 2011) (Henry, 2003).

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Strategies are designed to achieve the organizational goals and objectives of entrepreneurial institutions. Entrepreneurial institutions often frame various strategies, which can include both financial and non-financial incentives for faculty members and academic department (N, 2001) (M L. A., 2005) (Gideon D. Markman, 2004). These strategies must align with the other components of the entrepreneurial architecture and exhibit flexibility and adaptability to suit the institutional contexts and circumstances (Vorley, 2010) (Jen Nelles, 2011).

Leadership involves the individuals who play pivotal roles in the generation and dissemination of knowledge, as well as the visionaries who steer organizational growth. Leadership often encompasses the establishment of organizational structures and processes, as well as the formulation of organizational strategies. Notably, prominent faculty members who have made significant contributions to research participation, such as signing an agreement of profitable technological license or initiating a startup firm, are crucial leaders in the advancement of the entrepreneurial institution (Jen Nelles, 2011) (Vorley, 2010).

Culture pertains to the collective system of guiding principles, attitudes, assumptions, values, and communication norms that shape an organization. The inclination of a university to engage in entrepreneurial activities is often contingent on its prevailing culture (Carlos Bazan, 2022) (Allison Bramwell, 2008) (Rory P. O'Shea, 2007). While many institution departments align with the principal organizational culture, they may also cultivate their unique subcultures, some of which might exhibit entrepreneurial characteristics. The way employees perceive, experience, and behave is greatly influenced by the prevailing organizational culture (Gary S. Hansen, 1989). The organizational culture plays a significant role in influencing how employees shape their personal and professional objectives, execute their duties, and allocate resources to attain these objectives (Annelore Huyghe, 2016). Among the components of entrepreneurial architecture, perhaps the most difficult challenge lies in reshaping the organizational culture. As changes in opinions and changes in standards become integrated into the organization's operational framework, the process of change typically unfolds at a gradual pace (Carlos Bazan, 2022).

The entrepreneurial architecture framework places strong emphasis on the importance of well-structured systems, visionary leadership for entrepreneurial strategies, and a culture to encourage and cultivate innovation. Despite the fact that structures is the most visible part of the organization (Carlos Bazan, 2022).

An empirical study suggests the positive connection between institution ecosystems preparedness and faculty engagement for supporting entrepreneurial activity (Gustavo HSM, 2020). Entrepreneurial ecosystems anchored in higher education institutions influence faculty behavior and tendency to participate in entrepreneurship support activities, which increases with prior entrepreneurship experience. Faculty members are motivated by driving aspects such as internal and strategic variables; organizational structure, support systems, mission, vision, and reward systems in HEIs (Gustavo HSM, 2020).There are three sorts of academic entrepreneurship: research, teaching, and firm development (L. Ranmuthumalie de Silva, 2012).

Entrepreneurial academics and academic entrepreneurs engage in two types of involvement, which range from informal to formal activities (Kristel Miller, 2018) (L. Ranmuthumalie de Silva, 2012). Informal activities, often associated with Entrepreneurial Academics, include networking, collaborative industry projects, joint conference participation, co-authored journal publications, shared supervision, student placements and graduate employment, secondment, executive education, and collaborative research. In contrast, formal

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activities, categorized as Academic Entrepreneurs, includes consultancy and contract research, joint ventures, patents, shared resources, and the establishment of start-up (Kristel Miller, 2018). (Maria Abreu a, 2013) et al. categorized entrepreneurial activities based on the nature of the underlying knowledge and the utilization of different intellectual property (IP) protection methods. A comprehensive spectrum of entrepreneurial activities is defined within a conceptual framework, divided into three primary groups. The first group, referred to as 'formal commercial activities,' encompasses conventional academic entrepreneurial pursuits, including licensing and spinout ventures. These initiatives are generally focused on technological advances that may be protected through established Intellectual Property systems and then commercialized through existing networks such as Technology Transfer Offices (TTOs) (Kristel Miller, 2018) (Maria Abreu a, 2013). 'Informal commercial activity' is the next category, which includes entrepreneurial activities that involve knowledge-based business transactions, which are not protected by intellectual property policies. These activities rely more on tacit knowledge and are often organized with minimal or no involvement from Technology Transfer Offices (TTOs). This category includes contract research, consulting projects, and collaborative research initiatives with non-academic partners (Maria Abreu a, 2013) (Gustavo HSM, 2020). 'Informal commercial activity' is the next category, which includes entrepreneurial activities that involve knowledge-based business transactions that are not protected by intellectual property policies. As a result, these are informal and limited activities in which TTOs are not involved, such as informal guidance, public talks, exhibitions, and general literature publishing (Maria Abreu a, 2013) (Gustavo HSM, 2020) (Kristel Miller, 2018) (Markus Perkmanna, 2021).

MATERIALS & METHODS

Many studies have been conducted to understand the entrepreneurial system in institutional and operational contexts, employing process theories, resource-based theories, and corporate entrepreneurship techniques. Most studies consider commercialization of technology and research outcomes in the form of venture spin-offs and/or licensing to be key features of entrepreneurship in Indian HEIs. There are a variety of elements that contribute to the performance of HEIs in terms of innovation and entrepreneurship, but they vary with every institution. There are no empirical studies available for academic entrepreneurship in the context of Indian HEIs.

This study is conducted to discover the academic entrepreneurship, in terms of ecosystem preparedness and faculty engagement in Indian HEIs. A progressive and transformational entrepreneurial ecosystem is required for a HEI to become entrepreneurial. According to studies, the process of venture formation from HEI is implied by combining process theories, as each theory simply focuses on various components.

Entrepreneurship at university level is more prominent in developed countries than in developing and underdeveloped countries. There is currently a scarcity of substantial literature and empirical study on entrepreneurship in Indian HEIs. Furthermore, many are case studies based; as a result, generalization of results is a problem. As research on innovation and entrepreneurship in Indian HEIs broadens, new opportunities in the areas such as pre-incubators, proprietorship, incentives, incubators, entrepreneurial agility, among others.

The evaluation of Ecosystem Preparedness for innovation and entrepreneurship in Indian Higher Education Institutions (HEIs) utilized the ENTRE-U instrument, which was adapted with context-specific modifications (Carlos Bazan, 2022) (Heiko Bergmann, 2018) (Paul D. Guild,

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2011). On a five-point Likert scale, respondents rated their level of agreement with each questionnaire item. The operationalization of Ecosystem Preparedness in the Indian HEI context encompassed 29 questions, focusing on essential dimensions, including Structure, System, Strategies, Leadership, and Culture (Carlos Bazan, 2022). Most of the literature concentrates on examining the factors influencing faculty engagement in diverse activities. The development and execution of the instrument drew heavily from existing literature, and the assessment of faculty engagement incorporated 21 questions, spanning crucial dimensions such as Leadership, Teaching, Research & Consultancy, and Innovation Commercialization & Start-ups (De Silva, 2012) (Kristel Miller, 2018) (Markus Perkmanna, 2021).

To conduct the research our focus audience was faculty members who are involved in entrepreneurial activities in Indian HEI through the institution's Innovation Council. These faculty members are primary point of contact because they are engaged in mentoring student innovators and potential entrepreneurs in academic setup. The questionnaire was distributed to 4000+ academicians registered under the Ministry of Education, Govt. of India formed a 'Innovation cell (MIC)' with the objective of systematically nurturing the culture of Innovation in HEIs across the country (IIC). A total of 1506 responses were returned, indicating a valid survey response rate of 37.67%. In this line, (Baruch, 2008) claimed 35.5% and (Malhotra, 1998) reported 20%, as the minimum acceptable response rate. The primary research method for this study is to build a conceptual model. It will help in constraint identification and classification through a structured approach. This will support in understanding various types of factors in the entrepreneurial ecosystem preparedness of institutions, faculty engagement and their characteristics. Based on this understanding, a method was established for classification of various factors for the purpose system modelling. A conceptual framework for institution ecosystem preparedness and faculty member engagement needs to be outlined. First, we need to analyze the demographic characteristics of the survey participants and institution offering valuable information regarding. These attributes provide insight into the diversity and composition of the respondents, contributing to a more comprehensive understanding of the research findings.

Next, we need to Identify how factors of institutional ecosystem preparedness influences individual decisions to engage in various entrepreneurial activities. It is critical to study faculty members' assessments on the entrepreneurial ecosystem's readiness and to discover the numerous aspects that influence institutional characteristics. In addition to analyzing ecosystem preparedness, it is equally essential to comprehensively assess faculty engagement across various activities. A systematic analysis of the relationship between ecosystem preparedness and faculty engagement is essential for a comprehensive understanding of how these factors mutually influence each other.

Hypothesis Development

We created a conceptual model and research instrument to analyse faculty perspectives on universities' third goal of entrepreneurship. To investigate the third mission of higher education institutions, the concept of academic entrepreneurial architecture was introduced. The Government of India's 'IIC initiative' seeks to put forward numerous strategies to generate a relevant conceptualization of entrepreneurial architecture in universities. its research focuses on the conceptual elements of entrepreneurial architecture and its implementation in higher education for entrepreneurial transformation.

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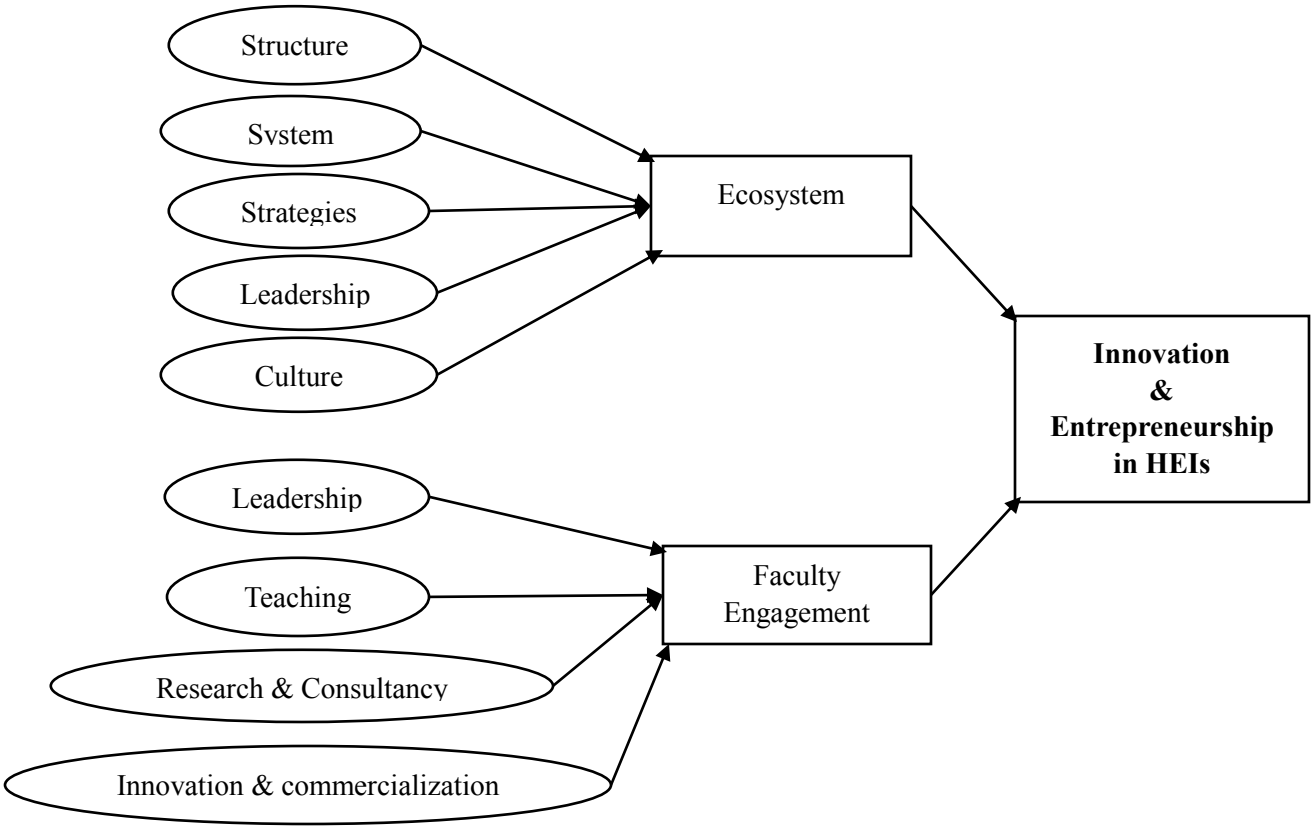

FIGURE 1
CONCEPTUAL FRAMEWORK FOR INNOVATION & ENTREPRENEURSHIP

Hypothesis

H_1: *There is a bidirectional positive relationship between Ecosystem Preparedness and Faculty Engagement.*

H_2: *Educational institutions with higher levels of Ecosystem Preparedness and Faculty Engagement are more likely to produce successful entrepreneurial ventures.*

RESULTS & DISCUSSIONS

In the quest for empirical evidence, a structured questionnaire served as the primary tool for data collection. The questionnaire was thoughtfully crafted, utilizing established scale items to effectively measure the theoretical constructs being studied. The study's focus was on Indian Higher Education Institutions (HEIs), predominantly from the standpoint of academic establishments.

To set the context and characteristics of the participating entities comprehensively, the survey encompassed questions regarding both faculty demographics and institutional attributes. Furthermore, the instrument was designed to understand the dynamics of institutional readiness within the purview of faculty members, as well as the extent of faculty engagement in activities related to innovation and entrepreneurship.

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The study was conducted on the higher education institutions in India, encompassing those officially registered under the 'IIC scheme' governed by the Government of India. This deliberate selection approach aimed to cast a wide network, aggregating responses from a diverse cross-section of institutions across the nation. The convergence of responses collected from this survey shall serve as the foundation for subsequent analytical processes. Through careful examination, the gathered data is rigorously studied for hypothesis relationships to address the research questions. In this research paper, meticulous factors were applied for the selection and investigation of key variables. These variables were strategically organized into three primary domains:

***Demographic Variables*:** This covers a range of demographic characteristics related to the survey participants. Specifically, it included gender, age, academic designation, institutional location, and the institution type etc.

***Factors related to the Preparedness of innovation & Entrepreneurial Ecosystem*:** This section comprises questions related to the factors influencing the readiness of institutional ecosystems for the facilitation of innovation and entrepreneurship. It was further divided into the following sub-domains like Structure, System, Strategies, Leadership and Cultural Variables.

***Faculty Engagement*:** Third section was dedicated to the exploration of faculty engagement in innovation and entrepreneurship activities. It was further classified into the following sub-categories like Leadership, Management and Coordination, Teaching, Research and Consultancy, Innovation Commercialization and Start-up.

This comprehensive categorization of variables enabled a systematic study into the elaborated dynamics between demographic attributes, the preparedness of institutional ecosystems, and faculty engagement with innovation and entrepreneurship. The analysis of the research questions, thereby contributing to a robust and holistic understanding of the subject.

To assess the internal consistency of a set of related items or the reliability of variables in the research, the Cronbach's Alpha (α) test was applied. The obtained α value is outlined in Table 1, which provides insight into the robustness of these scales.

Factors Related to Preparedness of Innovation and Entrepreneurship Ecosystem: The construct subtype "Structure" exhibits a strong internal consistency, as indicated $\alpha=0.925$. This indicates that the items related to the structural elements within the ecosystem are closely aligned and consistently measure the intended construct. Likewise, the subtypes "System," "Strategies," "Leadership," and "Culture" demonstrate robust internal consistency, with α values ranging from 0.907 to 0.966. This implies that the items within these subtypes consistently evaluate the corresponding dimensions of the ecosystem's preparedness.

Faculty Engagements: Cronbach's Alpha values range between 0.931 and 0.916 for the engagement-related categories "Leadership", "Management & Coordination", and "Research & Consultancy", indicating excellent internal consistency. These subtypes seem to be reliable measures of faculty engagement in these areas. The "Teaching Related" and "Innovation Commercialization & Start-up Related" subtypes also show acceptable internal consistency with Cronbach Alpha values of 0.913 and 0.911, respectively.

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Overall, the Cronbach Alpha values within this study suggest that most of the measurement scales used are reliable and internally consistent. These analyses provide vital insights on the reliability and quality of the data obtained, improving confidence in the subsequent statistical analyses and findings in this study Table 1.

Table 1
CRONBACH ALPHA TO CHECK RELIABILITY AND CONSISTENCY OF DATASET

Factors	Subtype	Cronbach alpha (α)	
Factors Related to Preparedness of Innovation and Entrepreneurship Ecosystem	Structure	0.925	0.985
	System	0.907	
	Strategies	0.959	
	Leadership	0.938	
	Culture	0.966	
Engagements	Leadership	0.931	0.967
	Teaching	0.963	
	Research & Consultancy	0.916	
	Innovation Commercialization	0.911	

It is important to understand the demographic attributes of the surveyed respondents, representing insights into the composition of the participant data. Table 2 presents an overview of the demographic factors like gender, age group, academic designation, and highest educational qualification. The data reveals a predominant male representation among the faculty respondents, with 61.16% identifying as male. A significant majority of respondents, comprising 74.64%, fall within the age category of 30 to 45 years. This concentration highlights a significant presence of mid-career faculty members in the study and 57.44% of respondents hold the academic rank of Assistant Professor. This distribution emphasizes the prevalence of individuals at this designation level, with implications for the study's insights. The data demonstrates that 55.31% of respondents possess a Doctor of Philosophy (PhD) as their highest educational qualification. This finding highlights the frequency of advanced research degree holders within the surveyed population. The comprehensive explanation of the respondents' demographic profile. These insights provide the necessary context for interpreting and contextualizing the research findings within the broader academic landscape.

A comprehensive overview of the institutions associated with the surveyed respondents is demonstrated in Table 3, throwing light on critical attributes of the academic environment. This section explains relevant attributes of institutional characteristics. A substantial majority of respondents i.e., around 58.96%, are affiliated with institutions situated in urban and semi-urban regions and 33.73% of respondents are associated with institutions located in tier-1 cities. 60.36% are affiliated entities, emphasizing the prominence of this affiliation status within the survey sample. The data prominently highlights that a substantial 80.41% of the participating institutions are characterized as private and self-sponsored institutes. Total 51.93% of the surveyed institutions provide a diverse range of academic offerings, encompassing both technical and non-technical courses, indicative of a comprehensive curriculum. These institutional

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characteristics are critical in contextualizing and increasing understanding of the research findings, providing insights into the educational context in which faculty members are involved.

Table 2
RESPONDENTS' PROFILE

	Percentage (%)
Gender	
Female	38.84%
Male	61.16%
Age in years	
<30	9.50%
30-35	19.79%
36-40	21.91%
40-45	23.44%
46-50	13.01%
>50	12.35%
Job Position	
Non-Academician	2.72%
Research Associate	0.86%
Assistant Prof.	57.44%
Associate Prof.	21.58%
Professor	17.40%
Qualification	
UG	2.59%
PG	37.18%
PhD	55.31%
Post-Doc	4.91%

Table 3
INSTITUTION'S PROFILE

	Percentage (%)
Location of Institution	
Rural	21.58%
Semi-urban	16.27%
Urban	42.70%
Metropolitan	19.46%
City Type	
X Type - (A1)- 1st Tier	33.73%
Y Type (A, B-1, B-2) - 2nd Tier	43.43%
Z Type (C or Unclassified Cities) - 3rd & 4th Tier	10.96%
Rural town 5th & 6th Tier	11.89%
Institution Structure	
A Standalone Institute	7.97%
A University	31.67%
An Affiliated Institute	60.36%
Institute Type	
Private-Self-Supported	80.41%
Public Funded	19.59%
Type of Courses Offered by the Institute	
Both: Technical & Non-Technical Courses	51.93%
Non-Technical Course Only	12.88%
Technical Courses Only	35.19%

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Confirmatory Factor Analysis can be used to analyze item loadings, reliability, composite reliability, scale validity, content and concept reliability, and measurement model fit (Fornell C, 1981). To validate a model, it is crucial to satisfy the minimum criteria for a satisfactory fit. Both loading and construct composite reliability should ideally meet the minimum threshold of *0.70* in Confirmatory Factor Analysis, with error variance less than *0.5* and the Average Variance Extracted (AVE) should exceed 0.5. To assess the extent of relationships and the impact between dependent and independent variables, a descriptive research design and Structural Equation Modeling (SEM) were applied.

To examine the variables and evaluate the model's fitness, Structural Equation Modeling was applied using AMOS version 24.0. Model fit indices such as chi-square *(χ2*), chi-square/degree of freedom (*χ2/df*), Normed Fit Index (*NFI*), Comparative Fit Index (*CFI*), Incremental Fix Index (*IFI*), Relative Fix Index (*RFI*), Root Mean Square Error of Approximation (*RMSEA)* and Tucker Lewis Index (*TLI*). These indices provide insights into how well the model aligns with the observed data.

The Chi-square *(χ²) value is* 71.824 with *df & significance level p < 0.001 and t*he results of a regression analysis are presented in Table 4, illustrating the relationships between various variables in our study. In summary, the regression estimates suggest positive relationships between the variables, and the highly significant p-values indicate the strength of these relationships. The standard errors are relatively low, indicating the reliability of the estimates. The results indicate that all measurement items have significant loadings exceeding 0.0, surpassing the minimum item loading standards. Additionally, the critical ratio (C.R.) values are greater than the acceptable threshold of 1.96. Consequently, it is reasonable to conclude that the measurement items are statistically reliable.

Table 4
REGRESSION WEIGHTS OF ECOSYSTEM PREPAREDNESS AND FACULTY ENGAGEMENT

	Variables	**Regression Estimate**	**S.E.**	**C.R.**	**P**
	Structure	.954	.014	65.833	***
Ecosystem Preparedness→	System	.938	.012	75.479	***
	Strategies	1.000			
	Leadership	.921	.013	72.702	***
	Culture	.879	.013	67.517	***
Faculty Engagement →	Leadership	1.067	.033	32.155	***
	Teaching	1.000	.030	33.722	***
	Research & Consultancy	1.000			
	Innovation Commercialization	.968	.021	45.269	***
Note: ***p< 0.001; Critical Ratio (C.R.); Standard Error (S.E.)					

Prior to testing the measurement model, it is important to analyze and correct any reliability and validity issues. In this analysis, we examined the reliability of the observational items through corrected item-total correlation (CITC) and composite reliability (CR), suggesting a CR greater than 0.70 for constructs to demonstrate appropriate psychometric properties, as presented in Table 5. In our study, all constructs exceeded this threshold, indicating their strong reliability. it is customary in the literature to suggest that CITC values should be above 0.30. Our

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research found that CITC values for each construct surpassed this minimum recommended threshold. Based on these results, it is crucial to emphasize that our measurement scales demonstrated robust internal reliability, with no identified issues concerning construct reliability in the proposed measurement model. Additionally, we assessed the reliability of measurement items by examining their loadings. As indicated in Table 5, all measurement items exhibited significant loadings exceeding 0.001, meeting the minimum threshold for item loading. Therefore, we can confidently conclude that the measurement items exhibit strong statistical reliability.

To assess convergent model validity, Confirmatory Factor Analysis (CFA) was employed. This analysis evaluates whether the measurement model fits the data acceptably. The convergent validity test is instrumental in determining the degree of association between a scale and other variables, as well as with other measures of the same construct. There are three crucial parameters for establishing convergent validity: The AVE should be greater than the measurement error variance for each variable; Composite reliability (CR) values should surpass 0.70; all factor-loading weights should exceed 0.50. Table 5 displays the factor loadings, ranging from 0.75 to 0.98, all of which are statistically significant as they exceed 0.50. The composite reliability for both Ecosystem Preparedness and Faculty Engagement is 0.968 and 0.926, respectively, surpassing the acceptable threshold and demonstrating statistical significance. Furthermore, the AVE values for Ecosystem Preparedness and Faculty Engagement are 0.858 and 0.758, respectively. These outcomes confirm convergent validity, illustrating that each measurement item holds approximately equal importance in measuring the concept of its associated constructs. Following that, the discriminant validity of the proposed framework was assessed to determine the extent to which one construct differs from other constructs within the model. Table 5 displays values that affirm strong discriminant validity: all MSV values are 0.432, which is below the AVE values 0.858 & 0.758 respectively and the square root of AVE 0.926 & 0.871surpasses the inter-construct correlations. As a result, the measuring model is statistically accurate and valid, indicating a strong relationship between Ecosystem preparedness and faculty involvement and their respective items, especially when compared to items from other constructs.

Table 5
VALIDATION OF THE MEASUREMENT OF CFA MODEL FOR ECOSYSTEM PREPAREDNESS & FACULTY ENGAGEMENT

Latent variable	Indicators	Standardized factor loadings	CR	AVE	MSV	Ecosystem Preparedness	Faculty Engagement
Ecosystem Preparedness	Structure	0.89	0.98	0.858	0.43	**0.95**	
	System	0.92					
	Strategies	0.98					
	Leadership	0.91					
	Culture	0.89					
Faculty Engagement	Leadership	0.91	0.93	0.758	0.43	0.66	**0.87**
	Teaching	0.91					
	Research & Consultancy	0.85					
	Innovation Commercialization	0.75					

Note: Maximum Shared Variance (MSV)

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The Structural Equation Modeling (SEM) methodology was used in the study, which is a second-generation multivariate model. Table 6 represents the following model fit indices values i.e. *(χ2/df) = 3.9, CFI =0.997, NFI=0.996, RFI=0.991, IFI=0.997, TLI=0.993, RMSEA=0.045*, Parsimony normed fit index *(PNFI)= 0.5*, and Parsimony comparative fit index *(PCFI)= 0.5* at significance level $p < 0.001$. In conclusion, based on the stated fit indices, the model looks to be an excellent fit to the data.

Table 6
MODEL FITNESS INDICES MEASUREMENT EVALUATION

Statistic Measurement	Test Indices	Test Standards	Result	Model Fit Verification
Absolute Fit Measurement	RMSEA	<=0.08	0.045	Excellent
	CFI	>0.95	0.997	Excellent
	CMIN/DF	<=3.84	3.9	Acceptable
Incremental Fit Measurement	NFI	>=0.9	0.996	Good
	RFI	>=0.10	0.991	Excellent
	IFI	>=0.11	0.997	Excellent
	TLI	>=0.12	0.993	Excellent
	CFI	>=0.13	0.997	Excellent
Parsimony-Adjusted Measurement	PRATIO	>=0.5	0.50	Good
	PNFI	>=0.5	0.50	Good
	PCFI	>=0.5	0.50	Good

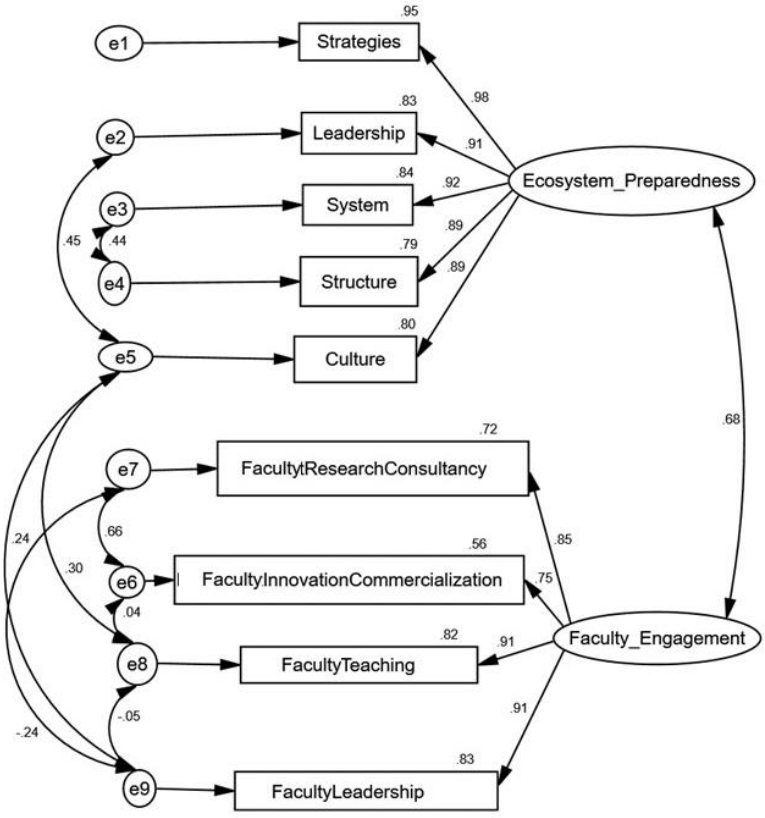

FIGURE 2
STRUCTURAL EQUATION MODEL BETWEEN ECOSYSTEM PREPAREDNESS AND FACULTY ENGAGEMENT

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The model depicted in Figures 1 & 2 illustrates the relationships between Ecosystem Preparedness and Faculty Engagement for innovation and entrepreneurship in Indian Higher Education Institutions (HEIs). All the tested variables exhibit positive path coefficients, signifying that strategies aimed at promoting faculty engagement contribute to enhancing Ecosystem Preparedness.

Specifically, the regression value between Leadership and Ecosystem Preparedness is *0.91 ($p < 0.001$)*. This indicates that when Ecosystem Preparedness increases by 1 unit, Leadership tends to increase by 0.91 units. In other words, a higher level of Ecosystem Preparedness is associated with better Leadership. Similarly, the effects of System, Structure, Strategies, and Culture on Ecosystem Preparedness are 0.92, 0.89, 0.98, and 0.89 ($p < 0.001$), respectively. These findings suggest that a well-prepared ecosystem significantly contributes to fostering innovation and entrepreneurship in HEIs. Faculty Engagement has a substantial relationship with Faculty Leadership, Teaching, Research Consultancy, and Innovation Commercialization, with positive values of *0.91, 0.91, 0.85, and 0.75* (*$p < 0.001$*). This implies that these factors play a crucial role in driving Faculty Engagement in innovation and entrepreneurship within HEIs.

Furthermore, the covariance between Ecosystem Preparedness and Faculty Engagement also exhibits a strong positive relationship with a coefficient value of 0.68. A positive covariance suggests that a well-prepared ecosystem positively influences Faculty Engagement in innovation and entrepreneurship in Indian HEIs. These findings highlight the interdependence of Ecosystem Preparedness and Faculty Engagement, underlining the necessity of both in promoting an innovation and entrepreneurial culture in Indian HEIs.

CONCLUSION

Based on the analysis presented, it is evident that there exists a significant interdependence between Ecosystem Preparedness and Faculty Engagement for innovation and entrepreneurship in Indian Higher Education Institutions (HEIs). The results of our study illustrate that both Ecosystem Preparedness and Faculty Engagement exhibit positive path coefficients, indicating that efforts to promote Faculty Engagement contribute to the enhancement of Ecosystem Preparedness and vice versa.

The regression weights highlight the strength of these relationships. Leadership, System, Structure, Strategies, and Culture all significantly impact Ecosystem Preparedness, underscoring the role of a well-prepared ecosystem in fostering innovation and entrepreneurship within HEIs. Faculty Leadership, Teaching, Research Consultancy, and Innovation Commercialization exhibit strong positive relationships with Faculty Engagement, emphasizing the crucial role these factors play in driving Faculty Engagement in innovation and entrepreneurship. Furthermore, a well-prepared ecosystem positively influences Faculty Engagement in innovation and entrepreneurship within Indian HEIs.

In conclusion, our findings weigh the importance of creating an environment that is conducive to both Ecosystem Preparedness and Faculty Engagement. A collaborative strategy that develops a culture of innovation and entrepreneurship inside Indian HEIs is critical for the sector's growth and development. By enhancing both Ecosystem Preparedness and Faculty Engagement, Indian HEIs can better position themselves in the competitive landscape of the 21st century. These findings are beneficial for educational institutions, researchers, faculty members,

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and policymakers in India who are seeking to increase entrepreneurship and innovation in higher education.

According to our findings, additional institutional support is needed at multiple levels, including the Innovation and Incubation Center, the University, the institution, and the department level. It also states that academics who engage in informal entrepreneurial activity may benefit from institutional support mechanisms. Encourage institutions to formally recognize the value of informal entrepreneurship. It will aid in emphasizing potential benefits such as improved reputations, the opportunity to contribute to societal welfare, and financial incentives.

Our research also highlights the importance of entrepreneurship training, particularly for younger, more junior, and female academics who lack business skills or expertise. It will assist us in identifying a skill and experience gap among potential participants and advises bridging this gap through targeted training and support.

The constraints of our analysis include that many institutes are in their early stages of development and will mature with time. A subsequent survey might be done to conduct a comparative research on the impact of institutional preparation and faculty engagement in academic entrepreneurship over time.

As a result, in future research, we might include the motivation component of faculty members to better understand the complete ecosystem of academic entrepreneurship at Indian HEIs. Future research could look at the specific nature of the benefits of informal entrepreneurial activity and assess their worth. It will assist in recognizing the significance of a more in-depth understanding of the benefits in order to provide specific policy suggestions.

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Received: 28-Mar-2024, Manuscript No. AMSJ-24-14676; **Editor assigned:** 29-Mar-2024, PreQC No. AMSJ-24-14676(PQ); **Reviewed:** 29-May-2024, QC No. AMSJ-24-14676; **Revised:** 26-Jun-2024, Manuscript No. AMSJ-24-14676(R); **Published:** 19-Aug-2024

Citation Information: Sahu, D., Goutam, A., Gaur, P., K Jain, S., & Salunkhe, U. (2024). Preparedness of innovation & entrepreneurial ecosystem and faculty engagement in indian higher educational institutions - a faculty perspective study. *Academy of Marketing Studies Journal, 28*(S6), 1-16.