International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 9s, 2025
https://www.theaspd.com/ijes.php

Role Of Atal Incubation Centers In Promoting Entrepreneurship And Innovation Ecosystem

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Abstract
Purpose *– Today, in the entrepreneurial environment, Atal Incubation Centres are becoming key facilitators of innovation and start-up growth in India. These centres provide systematic support systems such as mentorship, funding support, infrastructure, and legal consultation. This research will explore the actual and anticipated services offered by AICs and their contribution to facilitating the entrepreneurship and innovation culture of Rajasthan.*
Design/methodology/approach *– The research employed a descriptive and exploratory research design utilizing stratified random sampling in four AICs in Rajasthan. A structured questionnaire was utilized to gather primary data from 176 incubatees. Data analysis was conducted through SPSS and SmartPLS4, using reliability tests, exploratory and confirmatory factor analyses, regression, ANOVA, and Structural Equation Modeling.*
Findings *– The evidence shows that services such as legal and research support are consistent with the incubatees' expectations, but there are major gaps in areas of mentorship, infrastructure, and funding support. Management and legal services impacted entrepreneurship promotion the most among all the services, followed by infrastructure, technology support, and funding help. SEM model has the ability to explain 74% of the entrepreneurship promotion variance, which confirms the significance of incubation services to ecosystem development.*
Research limitations/implications *– The research is geographically confined to the context of Rajasthan and doesn't control for outside variables such as personal entrepreneurial ability or other support systems. Subsequent research could utilize longitudinal and comparative data over several states to increase the generalizability.*
Originality/value *– The research makes a unique contribution through its empirical investigation of the gap between incubator services promised and delivered and their quantifiable impact on the entrepreneurial ecosystem. The findings offer strategic guidance to policymakers, incubation managers, and stakeholders to maximize incubation models for entrepreneurial sustainable development.*
Keywords: *Atal Incubation Centre, Entrepreneurship, Innovation Ecosystem, Incubation Services, Structural Equation Modeling.*

INTRODUCTION

In the modern era, innovation and entrepreneurship have become widely accepted as the driving forces behind the economic growth of any country (Srikanth et al., 2020). (Schumpeter, 2008) was the first to propose that entrepreneurial operations serve as a means of innovation and are a critical component of economic growth through an act of creative destruction. Firms and organisations that challenge the current situations are introducing innovations into the market today (Máté et al., 2024). Therefore, entrepreneurship converts knowledge to economically sustainable production that has a beneficial effect on growth rates (Jirapong et al., 2021). The assessment of the effectiveness of technological developments and policy measures designed to foster the expansion and growth of entrepreneurs has become the subject of extensive academic and policy debates. In the past, business incubators (BI) have garnered significant attention in this field (Aernoudt & Aernoudt, 2016; Hackett & Dilts, 2004; Leitão et al., 2022).

Table 1: Important definitions

Terms	*Definitions*	*Additional References*
Innovation	Innovation may be broadly defined as the application of discoveries and interventions, as well as the process that results in the creation of new outputs, such as systems, products, or processes (Gloet & Terziovski, 2004).	(Baregheh et al., 2009; du Plessis, 2007)
Entrepreneurship	Entrepreneurship is the ability and willingness to create, coordinate, and oversee a business venture, as well as any associated hazards, in order to generate revenue (Dictionary, n.d.).	(Badran et al., 2020)
Business Incubators	An organization that facilitates the preliminary development of businesses by offering workspace, shared services, and business support (Hackett & Dilts, 2004).	(Hausberg & Korreck, 2021; Sansone et al., 2020)
Startups	Rompho, (2017) has stated connotation of "Start-up as any form company or project that is started by an entrepreneur with the intention of investigating, creating, and proving a business model that has the potential for considerable growth."	(Smes et al., 2004)

BUSINESS INCUBATORS

As initial facilitators, incubators play a crucial role in the start-up ecosystem. They function as a driving force for regional and national economic development. Different categories of incubators are identified: Academic institutions; Non-profit development corporations; For-profit developmental organizations; Venture capital firms, along with various combinations of these. Incubators vary in their strategic frameworks, some are located within a concrete physical setting, while others operate on a digital platform. (Assenova, 2020; Campbell, 1989; Grimaldi & Grandi, 2005a). From a layperson's point of view, business incubation can be defined as a supportive process that helps and educates newly established companies, equipping them with the necessary tools and knowledge to navigate and succeed in the intensely competitive business environment of today (Khandelwal et al., 2025).

Business Incubation Services

Management and Legal Services: Management and Legal Services refer to the support provided to incubatees to help them navigate administrative, strategic, and legal challenges (Peters et al., 2004; Smilor, 1987).

Mentorship: Mentoring involves structured support systems designed to guide and assist startups and entrepreneurs in their growth journey. These services connect incubatees with experienced advisors who help them refine business strategies, make informed decisions, and build industry connections (Aernoudt & Aernoudt, 2016; Pauwels et al., 2016).

Infrastructure Services: Infrastructure services within incubation centers generally encompass shared office environments, conference rooms, high-speed internet connectivity, laboratory amenities, and provision of equipment to startups and incubatees, thereby facilitating their growth and advancement (Barbero et al., 2014; Hackett & Dilts, 2004; Smilor, 1987).

Research & Technology Services: Research and Technology Services refer to the support and resources provided to entrepreneurs to enhance their innovation capabilities and technological advancements. These services often include access to advanced research facilities, technology transfer support, and assistance with intellectual property (IP) management (Grimaldi & Grandi, 2005b; Peters et al., 2004).

Seed & Early-stage funding Services: Seed and early-stage funding services refer to the financial support provided to startups during their initial phases of development. Incubators connect startups with potential investors, provide mentorship on financial management, and sometimes directly invest in startups (Barbero et al., 2014; Peters et al., 2004).

Business Incubation Process Around the Globe

The business incubation process has evolved significantly since its inception, reflecting the changing needs of entrepreneurs and global economic trends. The inception of this procedure can be traced to the Batavia industrial region in New York near 1959, and today it can be observed worldwide (Hannon & Chaplin, 2003; Wasdani et al., 2022). Particularly in the US, the 1980s were a time of expansion thanks to pro-business economic policies. Incubators became more structured, focusing on providing startups with a combination of physical workspace, business development services, and mentorship. Diversification increased in the 1990s, especially with the emergence of tech-focused incubators fueled by the internet boom (Sohail et al., 2023). Many national governments see business incubators as adaptable instruments for supporting start-ups with the overarching goal of promoting employment and economic growth (Phillips, 2002). With robust government backing and an emphasis on innovation and technology, Japan and South Korea are the leaders in Asia. These nations' advanced incubation initiatives greatly increase their competitiveness on the world stage (Chandra & Fealey, 2009).

Incubation Environment in India

The process of business incubation in India has undergone considerable transformation over the years, influenced by the nation's economic priorities and entrepreneurial landscape. It commenced in the latter part of the 1980s and early 1990s, a period during which India observed the inception of its inaugural incubation centres within esteemed academic institutions such as the Indian Institutes of Technology (IITs) & the Indian Institutes of Management (IIMs). These innovative incubators, supported by governmental initiatives such as the Department of Science and Technology (DST) and various financial institutions, were established to promote technology-driven entrepreneurship within the country (Loganathan & Bala Subrahmanya, n.d.; Khandelwal et al., 2023; Sharma et al., 2015). The establishment of institutions like the National Science & Technology Entrepreneurship Development Board (NSTEDB) and partnerships with global agencies gave rise to more structured incubation programs ((DPIIT), 2024).

In the past five years, the Indian startup ecosystem has experienced extraordinary growth, which has helped to secure its place as the third-largest entrepreneurial environment in the world (NASSCOM, 2023). Through initiatives such as Startup India, Make in India and the Atal Innovation Mission (AIM), the Indian government has actively involved in the development of the startup industry. The establishment of Atal Incubation Centres (AICs) in academic and research institutions located all throughout India is an essential part of the AIM. The AICs offer essential resources and assistance to businesses in their early stages. These resources include seed financing, physical infrastructure, mentorship, opportunities for networking, and training programs. AIM has developed 69 AICs since its inception in 2016, which have resulted in the creation of more than 32,000 employment and the incubation of more than 2900 enterprises. These AICs will help to birth the next generation of innovative entrepreneurs at the same time (AIM, 2016; NITI Aayog, 2021).

Literature review

Table 2: Summary of Literature Review

No.	Authors(s) & Year	Title of the Paper	Research Focus	Findings	Research Gap
1	Muruganantham & Shibulal, (2024)	Incubation in Educational Institutions	Influence of AICs on student entrepreneurial competency	AICs at educational institutions enhance students' entrepreneurial skills and ideation by providing networking opportunities and mentoring.	Need for cross-institutional comparative studies to assess varying impacts.
2	Kalisty, (2023)	Concept of Pre-Incubation	Defining pre-incubation in business	Pre-incubation helps test business ideas in real markets.	Limited research on pre-incubation success metrics.

3	Sudha Mavuri et al., (2023)	Promoting Sustainable Development in Nigeria	Comparative analysis of AICs and similar incubation models	Emphasizes the significance of AICs in promoting sustainable growth via the implementation of strategic mentorship and training initiatives.	Need for a contextual comparative analysis with Indian AICs.
4	Yuefei Deng, (2022)	Supporting Youth Innovation	Role of AICs in university ecosystems	AICs enhance youth innovation by bridging academic research and entrepreneurship, facilitating job creation.	Lack of data on long-term economic impacts and success rates.
5	Hewitt & Janse van Rensburg, (2020)	The Role of Business Incubators in Creating Sustainable SMEs	Impact of business incubators on SMEs in South Africa	Incubators offer financial and technical support to SMEs, improving their sustainability. However, they lack diversity in their support services.	Need for inclusive policies supporting all types of SMEs
6	Lanham-New, (2020)	Incubated Entrepreneurs: A Micro-Sociological Perspective	Experiences of incubated entrepreneurs	Entrepreneurs in incubators benefit from structured support but face challenges due to rigid organizational structures.	Incubator design improvements to foster engagement needed
7	Schutte & Direng, (2019)	Incubation and Business Growth in Botswana	Impact of incubation on entrepreneurship and job creation	Business incubators play a crucial role in enhancing economic development and facilitating employment opportunities, thereby promoting entrepreneurial ventures.	Need for enhanced mentorship and post-incubation support
8	Matyukhina, (2019)	Business Incubator for Regional School-Business Cooperation	Regional collaboration through incubators	Incubators effectively promote school-business collaboration, fostering regional development.	Further studies on long-term impact on regional economies are needed
9	Petrucci, (2018)	Incubation Process of Mid-Stage Startups	Mid-stage startup development	Mid-stage startups benefit from strategic and operational support provided by incubators.	Lack of research on challenges faced by mid-stage startups
10	Sutama et al., (2018)	Business Incubators and College Performance	Impact of incubators on universities	University incubators boost students' entrepreneurial performance and foster start-up culture.	Lack of long-term impact assessment on university-based incubators
11	Ayatse et al., (2017)	Business Incubation Process and Firm	Firm performance and incubation impact	Firms supported by incubators demonstrate higher growth rates, better survival, and increased	Need for exploration of long-term post-incubation

		Performance		financial resilience.	impacts
12	Roberto Guedes de Nonohay et al., (2017)	Entrepreneurial Capacities in Technology Centers	AICs' role in enhancing entrepreneurial coordination	AICs contribute to the internalization of coordination aspects in startups, enhancing links with research centers.	Need for quantitative studies on productivity and growth rates.
13	Pettersen et al., (2015)	Business Incubation and the Network Resources of Start-ups	Network resources of start-ups	Incubators provide start-ups with essential network resources that foster growth.	Need for understanding the long-term impact of network ties
14	Josè Castilla Segura, (2013)	Inclusion in Educational Systems	Role of AICs in educational inclusivity	AICs facilitate social and educational integration for immigrant students, supporting linguistic and cultural adaptation.	Limited comparative studies with mainstream educational systems.
15	Marcelo Farid Pereira et al., (2011)	Technology-based Business Incubation	AICs as catalysts for regional economic growth	AICs facilitate technology commercialization, fostering regional economic growth and innovation.	Lack of cross-regional comparative analysis and longitudinal data.
16	Grimaldi & Grandi, (2005)	Business Incubators and New Venture Creation	Assessing different incubator models	Classifies incubators into four categories and provides a strategic framework for positioning.	More empirical evidence needed on performance differences among models.
17	Tötterman & Sten, (2005)	Start-ups: Business Incubation and Social Capital	Role of social capital in startup incubation	Social networks foster resource exchange and legitimacy for startups.	Limited cross-cultural comparisons of social capital's impact.
18	Lalkaka, (2003)	Business Incubators in Developing Countries	Performance & challenges for incubators in developing nations	Identifies five success determinants including public policy and private sector partnerships.	Need for region-specific policy recommendations.
19	Oyeyemi Adegbite, (2001)	Business Incubators and Small Enterprise Development: The Nigerian Experience	Reviews startup incubators' development in Nigeria.	Seven business incubators currently operate in Nigeria. Highlights successes, shortcomings, and policy recommendations for improvement. There is a need to streamline incubator programme aspects identified.	Need for effective incubator impact assessment and their coordination with relevant government agencies is lacking.

20	Mian, (1996)	The University Business Incubator	Role of university business incubators in supporting research-based firms	University incubators provide a nurturing environment that fosters research commercialization and innovation.	Inadequate data on financial performance of university-incubated firms.
21	Smilor, (1987)	Managing the Incubator System: Critical Success Factors	Success factors for accelerating new company development	Highlights ten critical success factors including mentorship, resource accessibility, and strategic networking.	Lack of longitudinal studies on startup performance post-incubation.

Research Gap

There is a need to conduct regular performance assessments of business incubation centers to ensure their services remain effective and aligned with local incubatees' needs (Al- Mubaraki et al., 2015; Lala & Sinha, 2018; Mishra & Tripathi, 2021; Manniledam & Radha Ramanan, 2021). This assessment should consider infrastructure and service quality, mentorship and training effectiveness, local startup ecosystem involvement, and graduating firm success rates (Lala & Sinha, 2001; von Zedtwitz & Grimaldi, 2006; Wasdani et al., 2022; Adhana, 2020; Srikanth et al., 2020).

Problem Statement

Atal Incubation Centres (AICs) are crucial to India's entrepreneurial journey, but the effect of the services offered by these centers viz. infrastructure, mentorship, research and technology support, management and legal services, and seed capital on incubatee development is still yet to be explored.

Objectives of the Study

1) To study the policies and practices followed by Atal Incubation Centre.
2) To analyse the gap between services expected as per AIC policy and actual services provided by the incubation centers.
3) To determine the impact of incubation services on promotion of entrepreneurship and innovation ecosystem.
4) To suggest measures for the improvement of performance of AICs for betterment of entrepreneurship and innovation ecosystem.

Theoretical Framework

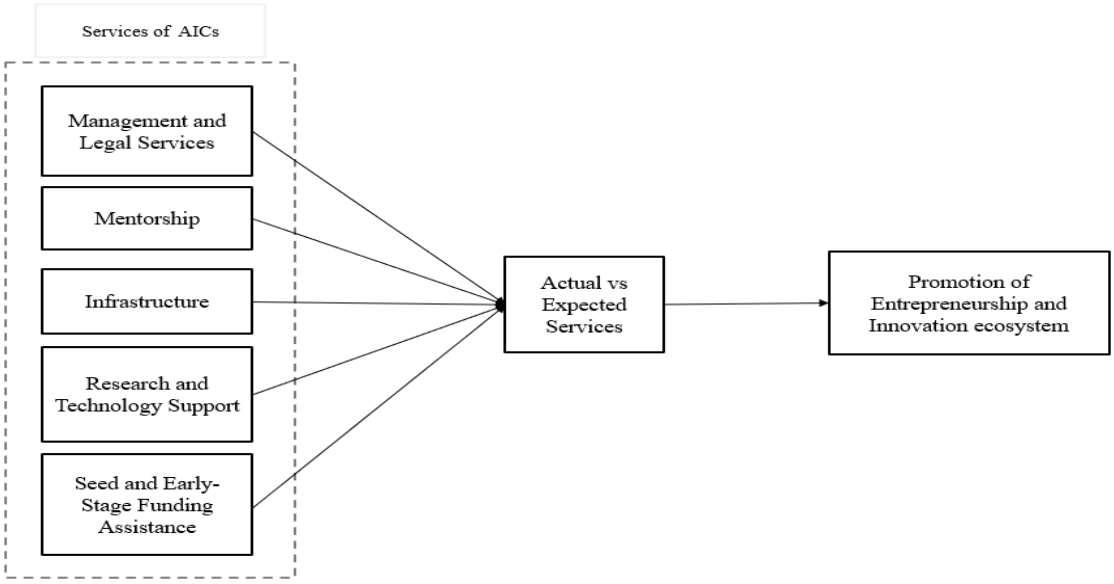

Figure 1: Theoretical Framework

Hypothesis

$H_0$1: There is no significant difference in actual and expected Services by start-ups from incubators.
$H_0$1a: There is no significant difference in actual and expected Management and Legal Services by start-ups from incubators.
$H_0$1b: There is no significant difference in actual and expected Mentorship support by start-ups from incubators.
$H_0$1c: There is no significant difference in actual and expected Infrastructure by start-ups from incubators.
$H_0$1d: There is no significant difference in actual and expected Research and Technology Support by start-ups from incubators.
$H_0$1e: There is no significant difference in actual and expected Seed and Early-Stage Funding Assistance by start-ups from incubators.
$H_0$2: There is no significant impact of incubation services on promotion of entrepreneurship and innovation ecosystem.
$H_0$2a: There is no significant impact of Management and Legal services on promotion of entrepreneurship and innovation ecosystem.
$H_0$2b: There is no significant impact of Mentorship support on promotion of entrepreneurship and innovation ecosystem.
$H_0$2c: There is no significant impact of Infrastructure services on promotion of entrepreneurship and innovation ecosystem.
$H_0$2d: There is no significant impact of Research and Technology Support on promotion of entrepreneurship and innovation ecosystem.
$H_0$2e: There is no significant impact of Seed and Early-Stage Funding Assistance services on promotion of entrepreneurship and innovation ecosystem.

Scope of the research

This study emphases on the Atal Incubation Centres established in the state of Rajasthan, which receive assistance from the Atal Innovation Mission (AIM) under the guidance of NITI Aayog. The AICs for the present research are selected from the list available on the website of AIM, which are in existence from year 2016-2024.

Significance of the Study

The study would immensely benefit all stakeholders and impart a deeper understanding of the role, responsibilities and expectations of Atal incubation programme.

- The data and findings will guide the government in making suitable changes in the incubation policy and lend a basis to view these programmes in the right perspective to continue commitment of resources in it.
- It will furnish meaningful feedback to the incubator management on the perceptions of the incubatees regarding the various incubation services and enable them to shape their offerings accordingly.
- The results of the research will help entrepreneurs to better understand, access and utilize the incubator facilities.

Research Methodology

- Research Design:

This research is mainly exploratory and descriptive; as exploratory research, it investigates the phenomenon of incubator services offered to start-ups. The study is descriptive since it aids in fact-finding analysis with sufficient interpretation.

- Universe of the study:

The Universe for the study is finite which is confined to the Incubatees of Atal Incubation Centres in the state of Rajasthan, which are supported by AIM, NITI Aayog during the year 2016-2024. In all, there are 4 such Centers in Rajasthan, which are in existence and the number of Incubatees is 323 (as on 31st March 2024).

- Sampling Unit:

The sampling unit for the present research are incubatees which are registered at Atal Incubation Centres in

Rajasthan. The incubatees were sourced from the list of incubatees compiled since the centers' establishment, accessible from the selected incubation facilities.

- Sampling Size:

If the specified population is limited, the subsequent equation of (Krejcie & Morgan, 1970) may be employed to ascertain the requisite sample size:

$$S = \frac{X^2 \cdot N \cdot P \cdot (1 - P)}{d^2 \cdot (N - 1) + X^2 \cdot P \cdot (1 - P)}$$

Where:

- S = Required sample size
- N = Population size (323 in this case)
- P = Population proportion (assumed to be 0.5 for maximum variability)
- d = Degree of accuracy (Margin of error, typically 0.05)
- X^2 = Chi-square value for 1 degree of freedom at the desired confidence level (For a 95% confidence level, X^2 =3.841)

Let's calculate it:

$$S = \frac{3.841 \times 323 \times 0.5 \times (1 - 0.5)}{0.05^2 \times (323 - 1) + 3.841 \times 0.5 \times (1 - 0.5)}$$

Calculating with the formula, the requisite sample size for the study is 176.

Table 3: Number of Sample Size for Incubatee

	Centres	**No of Incubatees**	**Incubatee (Sample Size)**
1	Atal Incubation Centres - Manipal University Jaipur. (AIC-MUJ)	64	35
2	Atal Incubation Centres - JK Lakshmipat University (AIC-JKLU)	72	39
3	Atal Incubation Centres - Banasthali Vidyapith (AIC-Banasthali)	131	71
4	AIC Catalyst - Global Institute of Technology (AIC-Catalyst)	56	31
Total	**4 centres**	323	176

- Sampling method:

Stratified Random Sampling is employed in the research as it incorporates stratification based on Incubation Centre (given the existence of four Centres), followed by a random selection of incubatees from each centre to guarantee adequate representation. This methodology assures that the incubatees from each centre are represented in proportion to their respective numbers.

- Variables under study:

Independent variables (AIC Services)	Dependent variable
Management and Legal Services	Promotion of Entrepreneurship and innovation ecosystem
Mentorship	
Infrastructure	
Research and Technology Support	
Seed and Early-Stage Funding Assistance	

- Data Collection:

Primary Data: To understand the ground realities at incubation centres initial contacts were established with the incubator managers (in person / telephonic interview). Then further information was collected from the incubatees with the help of structured questionnaire.

Secondary Data: In the present study data is collected through NITI Aayog and AIM websites, Start-ups

policies in India and Rajasthan and the websites of incubators studied in present research.

- Data Analysis Tool & Techniques: For analysing and interpretation of the collected primary data following techniques are used.
  - Descriptive Statistics
  - For Checking the Reliability & Validity: Cronbach's Alpha, CR & AVE.
  - For Hypothesis Testing: - Statistical techniques such as EFA, CFA, SEM, Regression and ANOVA is used.
  - The data is analyzed through IBM SPSS 22, Smart PLS 4.
- *Pilot Study:*

Reliability refers to the consistency and dependability of a measurement tool or instrument. High reliability means that the tool yields stable and consistent results under similar conditions. A high Cronbach's alpha, typically exceeding 0.70, indicates a favorable degree of internal consistency (Cronbach, 1951).

Table 4: Reliability Statistics

Reliability Statistics	
Cronbach's Alpha	No. of Items
.866	33

Cronbach's Alpha (.866) shows a high level of internal consistency which suggests that our items are reliable in measuring the same construct.

Table 5: Construct and their indicators

Factors	**Indicators**	**References**
Management and Legal Services	• Assist you developing business plan • Helps in conducting feasible study regarding your business area • Provide Marketing Assistance • Assistance regardingskill upgradation and development for modern marketing techniques • Provide Legal Services • Assist in Accounting,Tax, Financial related matters	(Khandelwal et al., 2025; Lalkaka, 2002; Merrifield, 1987; Mian, 1997; Peters et al., 2004; Smilor, 1987; Sahu et al., 2023)
Mentorship Support	• Provide Administrative services • Assist in product development activity • Provide business Counseling • Periodic feedback from you regarding satisfaction with services • Helps in increasing Entrepreneurial skills	(Aernoudt & Aernoudt, 2016; Barbero et al., 2014; Clarysse et al., 2005; Grimaldi & Grandi, 2005b; Mian, 1997; Pauwels et al., 2016)
Infrastructure	• Provide space at below market rate • Provide Library Facility • Helps in providing the affordable infrastructure & office equipment • Provide Communication servicelike phone/fax • Provide Conference room • Facility of Cafeteria • Accessibility 24*7 for co-working space	(Bergek & Norrman, 2008; Clarysse et al., 2005; Merrifield, 1987; Pauwels et al., 2016; Peters et al., 2004; Smilor, 1987; Khandelwal et al., 2023)
Research and Technology Support	• Provide networking support with suppliers and customers • Assist in designing broches, websites and business card • Transformed innovation into	(Barbero et al., 2014; Bøllingtoft, 2012; Bhatia & Khandelwal, 2024; Grimaldi & Grandi,

	product/service • Provide latest information on technological updates • Motivates you toward digitalization	2005a; Merrifield, 1987; Smilor, 1987)
Seed and Early-Stage Funding Assistance	• Reduced early-stageoperational cost helping you start the business with loans & initial investment • Collects informationon key business parameter like employment, revenue, profit • Helps in fund raising& access to venture investment • Helps in soft loan with minimum simple interest • Helps in Govt. grant and loans	(Aernoudt & Aernoudt, 2016; Bergek & Norrman, 2008; Grimaldi & Grandi, 2005a; Pauwels et al., 2016; Smilor, 1987)

Objective 2: To analyse the gap between services expected as per AIC policy and actual services provided by the incubation centers.

Table 6: KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.787
Bartlett's Test of Sphericity	Approx. Chi-Square	201.596
	df	175
	Sig.	.000

The KMO value of 0.787 means that the sampling adequacy for factor analysis is good. The KMO value ranges from 0 to 1. According to (Kaiser, 1974) if the KMO value is below 0.50 then Factor analysis should not be performed.

Bartlett's Test of Sphericity is significant ($\chi^2 = 201.596$, $df = 175$, $p < 0.05$), which supports that the data is appropriate for factor analysis. If the test is significant ($p < 0.05$), it shows that the correlation matrix is not an identity matrix and that the variables are correlated, justifying the use of factor analysis (Bartlett, 1950).

Table 7: Communalities Table

Communalities		
	Initial	Extraction
MLS_1	1.000	.975
MLS_2	1.000	.970
MLS_3	1.000	.833
MLS_4	1.000	.847
MLS_5	1.000	.703
MLS_6	1.000	.538
MS_1	1.000	.669
MS_2	1.000	.591
MS_3	1.000	.715
MS_4	1.000	.677
MS_5	1.000	.675
INF_1	1.000	.566
INF_2	1.000	.669
INF_3	1.000	.605
INF_4	1.000	.618
INF_5	1.000	.601
INF_6	1.000	.975

INF_7	1.000	.562
RTS_1	1.000	.970
RTS_2	1.000	.833
RTS_3	1.000	.847
RTS_4	1.000	.648
RTS_5	1.000	.693
SESFA_1	1.000	.704
SESFA_2	1.000	.696
SESFA_3	1.000	.790
SESFA_4	1.000	.754
SESFA_5	1.000	.571
SO_AIC_1	1.000	.721
SO_AIC_2	1.000	.960
PEIE_1	1.000	.877
PEIE_2	1.000	.687
PEIE_3	1.000	.823
Extraction Method: Principal Component Analysis.		

The communalities table indicates the percentage of variance explained for every variable after extraction by Principal Component Analysis. High communalities (typically above 0.5) suggest that the variable is well represented by the factors (Hair Jr et al., 2010). The majority of variables have high extraction values, which signify good representation in the extracted components.

Table 8: Total Variance Explained

Total Variance Explained									
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	12.205	39.370	39.370	12.205	39.370	39.370	6.238	20.122	20.122
2	1.963	6.333	45.703	1.963	6.333	45.703	3.594	11.595	31.717
3	1.772	5.718	51.421	1.772	5.718	51.421	2.734	8.819	40.536
4	1.616	5.213	56.633	1.616	5.213	56.633	2.555	8.241	48.777
5	1.507	4.862	61.496	1.507	4.862	61.496	2.163	6.977	55.754
6	1.362	4.392	65.888	1.362	4.392	65.888	2.153	6.947	62.701
7	1.150	3.711	69.599	1.150	3.711	69.599	2.139	6.898	69.599
8	.928	2.994	72.593						
9	.880	2.840	75.433						
10	.795	2.564	77.997						
11	.710	2.289	80.287						
12	.673	2.172	82.459						
13	.654	2.110	84.569						
14	.562	1.813	86.383						
15	.525	1.693	88.075						
16	.506	1.632	89.707						
17	.430	1.386	91.093						
18	.402	1.295	92.388						
19	.355	1.145	93.533						
20	.347	1.119	94.653						
21	.320	1.032	95.685						
22	.289	.934	96.618						

23	.271	.873	97.492						
24	.251	.808	98.300						
25	.212	.684	98.984						
26	.184	.593	99.577						
27	.131	.423	100.000						
Extraction Method: Principal Component Analysis.									

Total Variance Explained helps in determining the number of factors to retain in the model. Factors that contribute more to the total variance are considered more meaningful for interpretation. Factors with eigenvalues greater than 1 are generally considered significant (Kaiser, 1960). A cumulative variance of about 60-70% is generally considered satisfactory (Hair Jr et al., 2010). The TVE table points out that the initial seven components together explain 69.6% of the overall variance following rotation, showing an effective representation of the data set. The rotation also stabilizes variance distribution, with Component 1 contributing 20.1% to the overall variance.

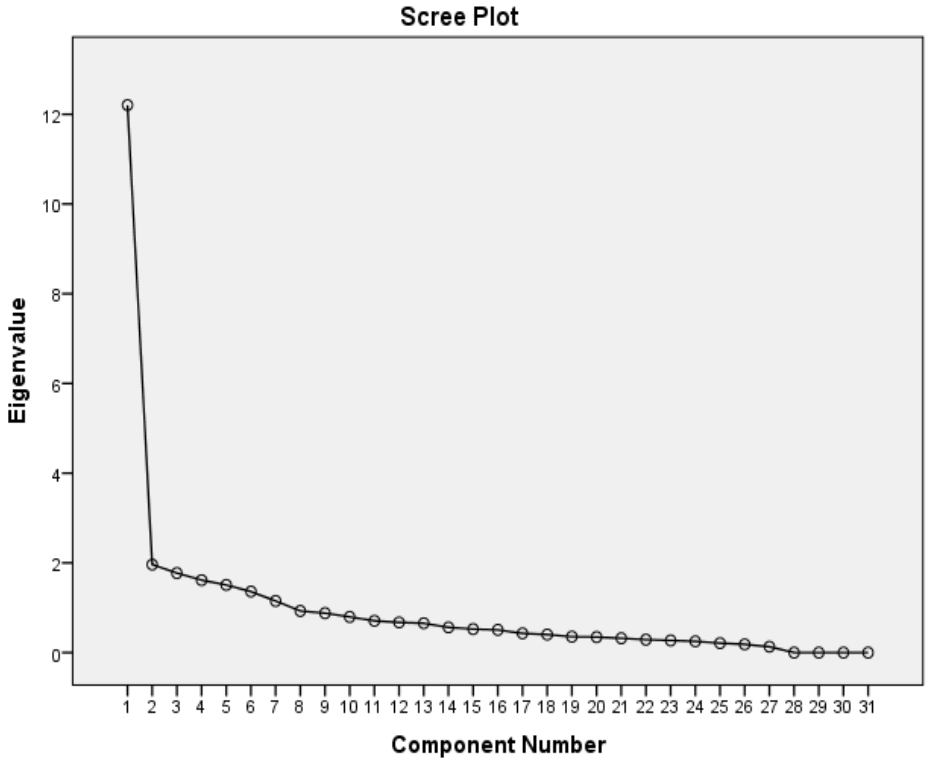

Figure 2: Scree Plot

The scree plot shows a sharp drop in eigenvalues after the initial few components, indicating that the first seven components are responsible for explaining the majority of the variance. The elbow point at Component 7 identifies the number of factors to retain.

Table 9: Factor Loadings

Parameters	Items	Factor Loadings
Management and Legal Services	MLS_3: Provide Marketing Assistance	0.883
	MLS_4: Assistance regarding skill upgradation and development for modern marketing techniques	0.883
	MLS_5: Provide Legal Services	0.804
	MLS_6: Assist in Accounting, Tax, Financial related matters	0.728
Mentorship Support	MS_1: Provide administrative services	0.634
	MS_2: Assist in product development activity	0.769

	MS_3: Provide business Counselling	0.718
	MS_4: Periodic feedback from you regarding satisfaction with services	0.640
	MS_5: Helps in increasing Entrepreneurial skills	0.748
Infrastructure	INF_1: Provide space at below market rate	0.756
	INF_2: Provide Library Facility	0.801
	INF_3: Helps in providing the affordable infrastructure & office equipment	0.788
	INF_4: Provide Communication service like phone/fax	0.713
	INF_5: Provide Conference room	0.762
	INF_7: Accessibility 24*7 for coworking space	0.715
Research and Technology Support	RTS_2: Assist in designing broches, websites and business card	0.701
	RTS_3: Transformed innovation into product/service	0.700
	RTS_4: Provide latest information on technological updates	0.801
	RTS_5: Motivates you toward digitalization	0.849
Seed and Early-Stage Funding Assistance	SESFA_1: Reduced early-stage operational cost helping you start the business with loans & initial investment	0.851
	SESFA_2: Collects information on key business parameter like employment, revenue, profit	0.643
	SESFA_4: Helps in soft loan with minimum simple interest	0.877
	SESFA_5: Helps in Govt. grant and loans	0.742
Services offered by AICs	SOAIC_1: Overall, the business incubator is a good platform to start a new business by entrepreneurs/individuals and to promote entrepreneurship	0.854
	SOAIC_2: Business incubators support the development of start-ups by providing management and legal services, mentorship support, infrastructure, research and technology support and seed and early-stage funding assistance	0.899
Promotion of Entrepreneurship and Innovation ecosystem	PEIE_1: Business incubators provide a wonderful professional environment that boots the motivation and productivity of entrepreneurship	0.741
	PEIE_2: Business incubators provide an opportunity to create innovative business ideas	0.714
	PEIE_3: Business incubators help entrepreneurships for survival and entrepreneurship development.	0.866

Factor Loadings indicate how strongly each variable is associated with a factor, helping to interpret the meaning of the factors. High factor loadings suggest that the variable strongly relates to that factor. Loadings above ±0.50 are considered significant and highly relevant (Stevens, 2002). The study considers retaining indicators with loadings ≥ 0.6, improving convergent validity. Removing weak indicators (loadings < 0.6) eliminates less reliable items, leading to a more stable and interpretable model (Ahmed et al., 2020; Hair Jr et al., 2010; Sarstedt et al., 2021).The loadings in the table indicate the magnitude of the contribution of each item to its corresponding parameter, ranging from 0.634 to 0.899. High loadings like " Provide Marketing Assistance " (0.883) and " Helps in soft loan with minimum simple interest " (0.877) represent high relevance to their respective constructs.

Table 10: Cronbach's Alpha, Composite Reliability and Average Variance Extracted

Parameters	Items	VIF	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)

Management and Legal Services	MLS_3: Provide Marketing Assistance	1.674	0.844	0.896	0.684
	MLS_4: Assistance regarding skill upgradation and development for modern marketing techniques	1.593			
	MLS_5: Provide Legal Services	1.898			
	MLS_6: Assist in Accounting, Tax, Financial related Matters	1.488			
Mentorship Support	MS_1: Provide administrative services	1.262	0.748	0.830	0.595
	MS_2: Assist in product development activity	1.593			
	MS_3: Provide business Counselling	1.705			
	MS_4: Periodic feedback from you regarding satisfaction with services	1.517			
	MS_5: Helps in increasing Entrepreneurial skills	1.349			
Infrastructure	INF_1: Provide space at below market rate	1.738	0.851	0.889	0.573
	INF_2: Provide Library Facility	2.183			
	INF_3: Helps in providing the affordable infrastructure & office equipment	1.886			
	INF_4: Provide Communication service like phone/fax	1.811			
	INF_5: Provide Conference room	1.881			
	INF_7: Accessibility 24*7 for coworking space	1.581			
Research and Technology Support	RTS_2: Assist in designing broches, websites and business card	1.529	0.767	0.849	0.586
	RTS_3: Transformed innovation into product/service	1.438			
	RTS_4: Provide latest information on technological updates	1.67			
	RTS_5: Motivates you toward digitalization	1.821			
Seed and Early-Stage Funding Assistance	SESFA_1: Reduced early-stage operational cost helping you start the business with loans & initial investment	2.178	0.784	0.863	0.614
	SESFA_2: Collects information on key business parameter like employment, revenue, profit	1.35			
	SESFA_4: Helps in soft loan with minimum simple interest	2.454			
	SESFA_5: Helps in Govt. grant and loans	1.567			
Services offered	SOAIC_1: Overall, the business	1.413	0.702	0.869	0.769

by AICs	incubator is a good platform to start a new business by entrepreneurs/individuals and to promote entrepreneurship				
	SOAIC_2: Business incubators support the development of start-ups by providing management and legal services, mentorship support, infrastructure, research and technology support and seed and early-stage funding assistance	1.782			
Promotion of Entrepreneurship and Innovation ecosystem	PEIE_1: Business incubators provide a wonderful professional environment that boots the motivation and productivity of entrepreneurship	1.421	0.793	0.819	0.603
	PEIE_2: Business incubators provide an opportunity to create innovative business ideas	1.406			
	PEIE_3: Business incubators help entrepreneurships for survival and entrepreneurship development.	1.268			

The table assesses the important parameters through VIF, Cronbach's Alpha, Composite Reliability (CR), and Average Variance Extracted (AVE) to ensure construct validity and reliability. High Cronbach's Alpha and CR scores in parameters, e.g., Management and Legal Services (Alpha = 0.844, CR = 0.896), reflect internal consistency and precise measurement. AVE is a measure of convergent validity; it checks weather items of a construct are truly representative of that construct. AVE ≥ 0.50 shows that the construct explains more than half of the variance of its indicators, confirming convergent validity (Fornell & Larcker, 1981).

Table 11: Fornell and Larcker's criteria

	Infrastructure	**Management and Legal Services**	**Mentorship Support**	**Promotion of Entrepreneurship and Innovation ecosystem**	**Research and Technology Support**	**Seed and Early-Stage Funding Assistance**	**Services offered by AICs**
Infrastructure	0.757						
Management and Legal Services	0.746	0.827					
Mentorship Support	0.649	0.678	0.771				
Promotion of Entrepreneurship and Innovation ecosystem	0.541	0.648	0.586	0.777			

Research and Technology Support	0.491	0.601	0.642	0.738	0.766		
Seed and Early-Stage Funding Assistance	0.466	0.590	0.598	0.644	0.648	0.784	
Services offered by AICs	0.348	0.546	0.534	0.560	0.628	0.700	0.877

Fornell and Larcker's criteria shows the results of discriminant validity assessments across several constructs. It assesses whether a construct is truly different from other constructs by comparing the square root of the AVE with the correlations between constructs. The square root of AVE should be higher than its correlation with any other latent variable (Fornell & Larcker, 1981).

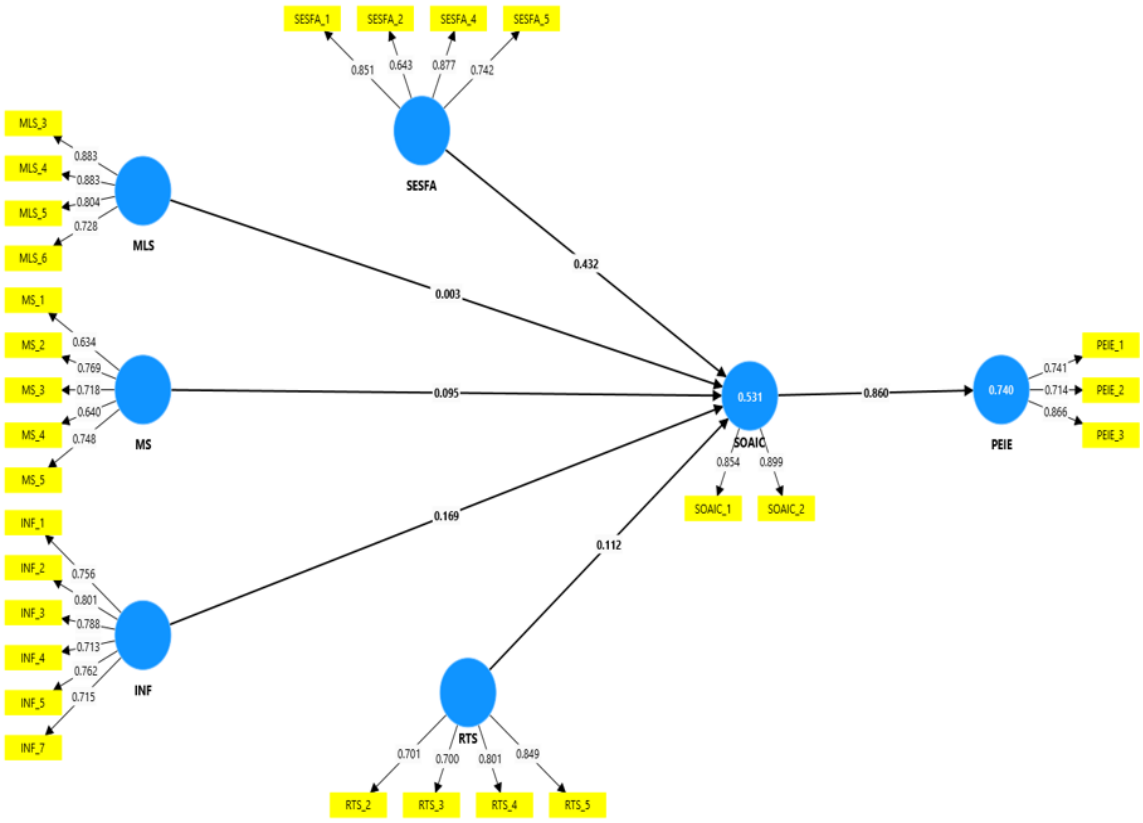

Figure 5: Structural model

The model depicts the structural relationships between constructs such as Infrastructure (INF), Management and Legal Services (MLS), and Mentorship Support (MS), with their corresponding factor loadings. It shows the direct and indirect impact on Promotion of Entrepreneurship and Innovation Ecosystem (PEIE) through Services offered by AICs (SO_AIC).

Table 12: PLS-SEM Results

Paths	Hypothesis	Path Coefficients/R^2	P values	Hypothesis Accepted/Rejected

Effect on Services offered by AICs		$R^2 = 0.531$		
By Management and Legal Services	$H_0$1a: There is no significant gap of Management and Legal Services on Services offered by AICs	0.003	0.393	Accepted
By Mentorship Support	$H_0$1b: There is no significant gap of Mentorship Support on Services offered by AICs	0.095	0.001	Rejected
By Infrastructure	$H_0$1c: There is no significant gap of Infrastructure on Services offered by AICs	0.169	0.001	Rejected
By Research and Technology Support	$H_0$1d: There is no significant gap of Research and Technology Support on Services offered by AICs	0.112	0.505	Accepted
By Seed and Early-Stage Funding Assistance	$H_0$1e: There is no significant gap of Seed and Early-Stage Funding Assistance on Services offered by AICs	0.432	0.008	Rejected
By Services offered by AICs	$H_0$1: There is no significant gap in perceived and expected Services by start-ups from incubators.	0.860	0.000	Rejected
Effect on Promotion of Entrepreneurship and Innovation ecosystem		$R^2 = 0.740$		

$H_0$1: There is no significant difference in actual and expected Services by start-ups from incubators.

$H_0$1a: There is no significant difference in actual and expected Management and Legal Services by start-ups from incubators. As per the results (p = 0.393) is greater than (p = 0.05) which suggest that we are accepting null hypothesis here.

$H_0$1b: There is no significant difference in actual and expected Mentorship support by start-ups from incubators. As per the results (p = 0.001) is less than (p = 0.05) which suggest that we are rejecting null hypothesis here.

$H_0$1c: There is no significant difference in actual and expected Infrastructure by start-ups from incubators. As per the results (p = 0.001) is less than (p = 0.05) which suggest that we are rejecting null hypothesis here.

$H_0$1d: There is no significant difference in actual and expected Research and Technology Support by start-ups from incubators. As per the results (p = 0.505) is greater than (p = 0.05) which suggest that we are accepting null hypothesis here.

$H_0$1e: There is no significant difference in actual and expected Seed and Early-Stage Funding Assistance by start-ups from incubators. As per the results (p = 0.008) is less than (p = 0.05) which suggest that we are rejecting null hypothesis here.

The model accounts for 53.1% of variance in Services offered by AICs with $R^2 = 0.531$ and 74% of variance in Promotion of Entrepreneurship and Innovation Ecosystem with $R^2 = 0.740$.

1. The moderate R^2 value for Services offered by AICs suggests that the chosen independent variables are relevant and contribute significantly to the model.
2. This high R^2 value suggests that incubation services are strong predictors of entrepreneurship growth.

Objective 3- To determine the impact of incubation services on promotion of entrepreneurship and innovation ecosystem.

Table 13: Model Summary

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.748[a]	.612	.575	.214
a. Predictors: (Constant), Management and Legal Services, Mentorship Support, Infrastructure, Research and Technology Support and Seed and Early-Stage Funding Assistance				

The Model Summary of a Multiple Regression Analysis, evaluate the impact of the predictors - Management and Legal Services, Mentorship Support, Infrastructure, Research and Technology Support, and Seed and Early-Stage Funding Support—on the dependent variable (Promotion of Entrepreneurship and Innovation Ecosystem).

- R = 0.748 indicates a strong positive relationship between the predictors and the outcome variable. According to Cohen (1988), an R value above 0.70 is considered strong, suggesting that the model is effective in predicting the dependent variable.
- Model account for 61.2% of the variance ($R^2 = 0.612$) The adjusted R^2 of 0.575 further supports the model's good fit.

Table 14: ANOVA

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	28.671	5	4.778	12.085	.000[b]
	Residual	66.823	170	.395		
	Total	95.494	175			
a. Dependent Variable: Promotion of Entrepreneurship and Innovation Ecosystem (Business problem resolved by registering in Incubator Centres)						
b. Predictors: (Constant), Management and Legal Services, Mentorship Support, Infrastructure, Research and Technology Support and Seed and Early-Stage Funding Assistance						

ANOVA (Analysis of Variance) examine the overall significance of the regression model. It determines if the independent variables collectively explain a significant portion of the variance in the dependent variable. The test indicates that the regression model is significant ($F = 12.085$, $p < 0.05$) that the predictors as a group explain the variance in the dependent variable, " Promotion of Entrepreneurship and Innovation Ecosystem." This validates the significance of the predictors in the model. Cohen (1988) suggests that an F value above 10 is considered highly significant, confirming the model's overall predictive power.

Mean Square for Regression (MSR) = 4.778, it Represents the average explained variance per predictor and the Mean Square for Residual (MSE) = 0.395, which reflects the average unexplained variance in the model. A lower MSE indicates a better fit and less error in prediction.

Table 15: Regression Coefficient

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.556	.169		8.604	.000
	Management and Legal Services	.465	.053	.444	8.764	.000
	Mentorship Support	.117	.065	.125	1.802	.073
	Infrastructure	.161	.068	.185	2.356	.020
	Research and Technology Support	.167	.062	.162	1.683	.049
	Seed and Early-Stage Funding Assistance	.227	.050	.128	1.529	.007
a. Dependent Variable: Promotion of Entrepreneurship and Innovation Ecosystem						

$H_0$2: There is a significant impact of incubation services on promotion of entrepreneurship and innovation ecosystem.

$H_0$2a: There is no significant impact of Management and Legal services on promotion of entrepreneurship and innovation ecosystem. Management and Legal Services have the most significant positive impact (β = 0.444, p = 0.000), which suggest that we are rejecting null hypothesis here.

$H_0$2b: There is no significant impact of Mentorship support on promotion of entrepreneurship and innovation ecosystem. Mentorship Support shows a positive but insignificant effect (β = 0.125, p = 0.073), which suggest that we are accepting null hypothesis here.

$H_0$2c: There is no significant impact of Infrastructure services on promotion of entrepreneurship and innovation ecosystem. Infrastructure (β = 0.185, p = 0.020) also significantly contribute to problem resolution, which suggest that we are rejecting null hypothesis here.

$H_0$2d: There is no significant impact of Research and Technology Support on promotion of entrepreneurship and innovation ecosystem. Research and Technology Support (β = 0.162, p = 0.049) also significantly contribute to problem resolution, which suggest that we are rejecting null hypothesis here.

$H_0$2e: There is no significant impact of Seed and Early-Stage Funding Assistance services on promotion of entrepreneurship and innovation ecosystem. Seed and Early-Stage Funding Assistance has a positive and significant impact (β = 0.128, p = 0.007), which suggest that we are rejecting null hypothesis here.

Objective 4: To suggest measures for the improvement of performance of AICs for betterment of entrepreneurship and innovation ecosystem.

As per the outcomes of the analysis, the following recommendations and suggestions can be outlined to strengthen the performance of AICs in promoting the entrepreneurship and innovation ecosystem:

1. **Enhance Mentorship Programs**
   Mentorship support has a significant positive effect on AIC services (path coefficient 0.095, p = 0.001) indicating that better mentorship translates into improved service perception.
   To enhance the mentorship program:
   - Build a strong mentor network with industry experts.
   - Develop structured mentorship plans for early-stage startups.
   - Regular mentoring sessions with industry experts can further enhance incubation outcomes.
2. **Improve Infrastructure support**
   A noticeable gap in infrastructure support (Path coefficient = 0.169, p = 0.001) suggests that physical and digital infrastructure at AICs needs improvement.
   - Invest in co-working spaces, R&D labs, and prototyping facilities.
   - Collaborate with universities for technology-driven incubation.
   - Provide high-speed internet, cloud computing resources, and digital tools to enhance remote collaboration.

3. **Increase Funding Opportunities**
   Funding has the strongest impact (Path coefficient = 0.432, p = 0.008), meaning better funding opportunities directly improve startup success. But there is a gap in availability which requires, expanding funding avenues and simplifying funding access.
   - More investment programs and grants- expand government grants, venture capital, and private investments.
   - Introduce sector-specific funding programs for startups.
   - Better funding distribution mechanisms
4. **Optimize Management & Legal Services**
   There is no significant difference (p = 0.393) in perceived and expected Management and Legal Services by start-ups from incubators, but the week Path coefficient = 0.003 indicates minimal impact, which means startups either do not perceive legal/management support as crucial or these services are not effectively utilized by them. Possible reasons can be:
   - Startups may already have alternative legal/management support.
   - Regulatory complexity may dilute the perceived benefits.

   This area requires significant improvement to be more effective. AICs needs to:
   - Provide targeted legal and business consultancy services.
   - Simplify regulatory compliance processes for startups.
5. **Enhance Research & Innovation Support**
   No significant gap was found in Research & Technology Support with a moderate impact (Path coefficient = 0.112, p = 0.505) indicating that research and technology support are relatively sufficient.
   - Strengthen collaboration between AICs and research institutions.
   - Stronger R&D linkages between AICs and universities.
   - Customized technology solutions for different types of startups.
   - Provide AI, data analytics, and emerging tech solutions.
6. **Addressing Actual vs. Expected Services Gap**
   There is a significant difference between what startups expect from AICs and what they receive (Path coefficient = 0.860, p = 0.000).
   Suggestion:
   - Conduct regular feedback mechanisms to align services with startup needs.
   - Increase transparency in service offerings and ensure incubators deliver on promised resources.
7. **Enhancing the Overall Innovation Ecosystem**
   The overall R^2 for Entrepreneurship and Innovation Promotion is 0.740, suggesting that 74% of the variance is explained by the model, which is a strong indicator of impact.
   Recommendations:
   - Expanding Incubation to Tier 2 and Tier 3 Cities: Implement rural incubation models focusing on agritech, social enterprises, and grassroots innovations.
   - Strengthening Industry Linkages: Encourage sectoral incubation clusters where start-ups within similar industries collaborate and share resources.
   - Promoting Global Market Access for Indian Start-ups
8. **Feedback-Driven Program Improvement:** Implement regular feedback loops with incubatees to continuously refine and enhance program offerings, mentorship quality, and operational efficiency.
9. **Decentralized Incubation Models:** Address geographical constraints by adopting a hub-and-spoke model with satellite incubation centers in tier-2 and tier-3 cities. Implement virtual incubation programs for remote mentoring, networking, and resource access, enabling broader reach.
10. **Skill Development Workshops:** Organize regular workshops on critical entrepreneurial skills, including financial literacy, digital marketing, intellectual property management, and leadership development, to empower startups for sustainable growth.

11. **Mental Health and Well-being Support:** Acknowledge the psychological strain inherent in entrepreneurship and offer mental health support services, encompassing counseling and stress management workshops, to enhance the well-being and productivity of startup founders.

Strengthening these areas will enhance the overall incubation ecosystem in India, leading to higher startup success rates, economic growth, and technological advancements. These recommendations, combined with a strategic approach to ecosystem integration and startup empowerment, will significantly enhance AICs' impact on entrepreneurship and innovation.

Findings

Effect in relation to Services offered by AICs to Incubatees:

- There is no significant difference in perceived and expected Management and Legal Services and Research and Technology Support by start-ups from incubators.
- There is a significant difference in perceived and expected Mentorship, Infrastructure and Seed and Early-Stage Funding Assistance support by start-ups from incubators.
- Services offered by AICs highly influence entrepreneurship (Path coefficient = 0.860), improving incubation quality will significantly contribute to India's startup ecosystem growth.
- The model explains 74% of the variance in entrepreneurship promotion, making it highly predictive.

Effect on Promotion of Entrepreneurship and Innovation Ecosystem:

- Management and Legal Services have the most positive influence, followed by Infrastructure, Research and Technology Support, and Seed/Early-Stage Funding on Promotion of Entrepreneurship and Innovation Ecosystem. This highlights their importance in building a supportive entrepreneurial ecosystem.
- Mentorship Support does not significantly impact the promotion of the ecosystem, suggesting that while it enhances services, it may not directly contribute to ecosystem development.

Limitations & Future Scope

1) The study is limited to the AICs of Rajasthan and may not generalize to AICs of other states.
2) While the study focuses on services of AICs, other important factors such as alternative supportive mechanisms, entrepreneurial competencies are not included in the study. These external factors may also significantly influence promotion of entrepreneurship and innovation ecosystem
3) Future research could:
    - Explore the moderating effect of industry type or startup stage.
    - Investigate longitudinal effects to capture the impact over time.
    - Include qualitative insights to better understand the non-significant relationships.
4) The findings emphasis the need to explore additional variables to more thoroughly clarify the unexplained variance, thus revealing prospective pathways for improvement through the integration of further predictors. This undertaking may encompass the examination of alternative supportive mechanisms, including networking opportunities, strategic alliances, or entrepreneurial competencies, which could potentially augment the predictive precision of the model.

Conclusion and Discussion

1. Positive and significant results, indicates that the support offered meets startups' expectations. Services offered by AICs significantly promote entrepreneurship and innovation, highlighting the importance of comprehensive incubation support.
2. The Model of a Multiple Regression Analysis is robust and effective, explaining a substantial portion of the variance in the dependent variable. However, the unexplained variance suggests room for improvement by considering additional predictors.
3. To maximize impact, AICs must adopt a targeted approach by tailoring their services according to the specific needs of startups at different growth stages.
4. By addressing the identified gaps and leveraging high-impact services, AICs can improve their value proposition, attract high-potential startups, and contribute significantly to innovation-driven economic development.
5. These insights underscore the importance of a holistic service approach, combining strategic mentorship, robust infrastructure, and seamless access to funding and legal assistance. AICs that

effectively integrate these components are better positioned to enhance incubatee satisfaction and drive regional entrepreneurial ecosystem growth.

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