

**TECHNOLOGY AND BUSINESS
INCUBATORS IN INDIA
(A STUDY OF THE INCUBATEE'S PERSPECTIVE)**

PRIYANK NARAYAN



**DEPARTMENT OF MANAGEMENT STUDIES
INDIAN INSTITUTE OF TECHNOLOGY DELHI**

AUGST 2019

© Indian Institute of Technology, Delhi (IITD), New Delhi, 2019

**TECHNOLOGY AND BUSINESS
INCUBATORS IN INDIA
(A STUDY OF THE INCUBATEE'S PERSPECTIVE)**

by

Priyank Narayan

Department of Management Studies

Submitted

in fulfilment of the requirements of the degree of Doctor of Philosophy

to



Indian Institute of Technology Delhi

August 2019

Dedicated to

Dr. Nirmala Narain, Ph.D

&

*Dr. (Prof.) Laxmi Narain,
Ph.D (London School of Economics)*

*My Grandparents who led me onto the
path of academia and research*

Certificate

This is to certify that the thesis titled '**Technology and Business Incubators in India**' being submitted by **Mr. Priyank Narayan** to the Indian Institute of Technology, Delhi for the award of **Doctor of Philosophy** is a bona fide record of research work carried out by him under my guidance and supervision in conformity with rules and regulations stipulated by Indian Institute of Technology, Delhi. The research report and the results presented in this thesis have not been submitted in part or full for the award of any degree or diploma at any other university or institute.

Dr. Harish Chaudhry
Associate Professor
Department of Management Studies
Indian Institute of Technology
Hauz Khas, New Delhi – 110016
India

Acknowledgements

I would like to thank my supervisor **Dr. Harish Chaudhry** for allowing me to work under his supervision. I am highly indebted to Dr. Harish Chaudhry, who gave enough freedom to explore new avenues and motivated me through my research journey.

I am also thankful to my review committee members - Prof. Kanika T. Bhal, Prof. Mahim Sagar and Prof. Sumer Singh for their constructive inputs and suggestions that helped me sharpen my research work.

I would like to thank my family members, specially my wife, Pooja and son, Avyaan, and my parents, who always encouraged me to pursue my research interests. A special word of appreciation for my friends at IIT Delhi; Anurag, Mohita, Sapna and Amit for their support and encouragement.

Priyank Narayan

Abstract

Entrepreneurs are the engines that propel national economic growth and they account for majority of the new job creation in the economy. Small businesses give rise to innovation, productivity, competition and employment generation, and social cohesion as well.

Business Incubators are central to the development of an entrepreneurship ecosystem. It is estimated that there are over 7000 business incubators across the world. Business Incubators are set up to nurture young businesses with an aim to spur the local economy, transfer technology from academia, create jobs, and encourage the spirit of innovation and entrepreneurship. In India there are 132 Technology and Business Incubators (TBIs) spread across the country funded by the Government of India under the aegis of National Science and Technology Entrepreneurship Development Board (NSTEDB). Ninety percent of the TBIs are located in education institutions across the country.

Research on business incubators began in 1984, in the United States. A 35-year period between 1984 till date has been considered and the literature review has been arranged thematically. Analysis of the gaps in literature suggests that there is a dearth of studies from the perspective of the incubatee and virtually no studies have been conducted in the Indian context.

The objective of this research is to identify factors affecting the incubatee performance and propose an incubatee centric framework of incubation. Based on the desired outcome, following research objectives were identified:

- What are the factors that have a positive impact on the performance of incubatees?

- What is the perception of incubatees towards these performance factors during incubation?
- How do the performance factors influence each other?
- What should be a framework of incubation based on the perception of the incubatee?

The research has been approached triangulating both qualitative and quantitative research methodologies. The research started with the **Grounded Theory Method (GTM)** in which 22 incubation experts were interviewed to identify the factors impacting the performance of the incubatees. A total of 7 main factors along with 37 sub factors were identified. The factors identified were Access to Funding, Market Access, Brand of the Host Institution, Incubator Manager, Network and Community, Physical Infrastructure and Support Services.

To ascertain the perspective of the incubatee, 253 incubatees, undergoing incubation for at least 3 months across 26 TBIs in the country were interviewed using a structured questionnaire. The data collected from the incubatees was subjected to **Exploratory Factor Analysis (EFA) and Confirmatory factor Analysis (CFA)** to identify the similarities and dissimilarities between the perceptions of the incubatees. Factors and sub factors corresponding to the Incubator Manager and the Brand of the Host Institution, along with Access to Markets and Funds emerged as key factors impacting incubatees performance while Physical Infrastructure and Support Services scored low in the perception of the incubatees.

Incubation Experts were approached with a second questionnaire to collect data for **Total Interpretative Structural Modelling (TISM)**. The framework from TISM was used as an input model for **Structured Equation Modeling (SEM)**. An incubatee centric incubation model was developed after running due checks for model

fit indices. It emerged that performance of incubatees is directly a function of the Incubator Manager and the Brand of the Host Institution of the Incubator. The Access to Funds and Market Access further impact the incubatee performance in the SEM framework.

This study will significantly contribute to analysis of the incubation models and processes in India. With a substantial increase in the funding allocated by the exchequer towards creation of incubators and the start-up eco-system in India, this study will provide the much need perspective of the incubatee, providing significant insight to policy makers and academicians and administrators.

Key Words: Incubators, TBIs, Accelerators, Incubatees, Start-ups, Entrepreneurs, Entrepreneurship, Entrepreneurship Eco-System, Grounded Theory, Factor Analysis, Total Interpretive Structural Modelling, TISM, Structured Equation Modelling, SEM

सार

उद्यमी ऐसे इंजन हैं जो राष्ट्रीय आर्थिक विकास को बढ़ावा देते हैं और वे अर्थव्यवस्था में नए रोजगार सृजन के लिए जिम्मेदार हैं। छोटे व्यवसाय नवाचार, उत्पादकता, प्रतिस्पर्धा और रोजगार सृजन और सामाजिक सामंजस्य को जन्म देते हैं। बिजनेस इनक्यूबेटर्स एक उद्यमशीलता पारिस्थितिकी तंत्र के विकास के लिए केंद्रीय हैं। यह अनुमान है कि दुनिया भर में 7000 से अधिक व्यावसायिक इनक्यूबेटर हैं। व्यावसायिक इनक्यूबेटर्स का गठन स्थानीय अर्थव्यवस्था को गति देने, शिक्षा से प्रौद्योगिकी स्थानांतरित करने, रोजगार सृजित करने और नवाचार और उद्यमिता की भावना को प्रोत्साहित करने के उद्देश्य से युवा व्यवसायों के पोषण के लिए किया जाता है। भारत में राष्ट्रीय विज्ञान और प्रौद्योगिकी उद्यमिता विकास बोर्ड (NSTEDB) के तत्वावधान में भारत सरकार द्वारा वित्त पोषित देश भर में फैले हुए 132 प्रौद्योगिकी और व्यवसाय इंक्यूबेटर (TBI) हैं। TBI के नब्बे प्रतिशत देश भर के शिक्षा संस्थानों में स्थित हैं।

संयुक्त राज्य अमेरिका में व्यापार इनक्यूबेटर्स पर शोध 1984 में शुरू हुआ। 1984 से अब तक के बीच 35 साल की अवधि पर विचार किया गया है और साहित्य की समीक्षा को व्यवस्थित रूप से व्यवस्थित किया गया है। साहित्य में अंतराल के विश्लेषण से पता चलता है कि इनक्यूबेटी के दृष्टिकोण से पढ़ाई में कमी है और वस्तुतः भारतीय संदर्भ में कोई अध्ययन नहीं किया गया है।

इस शोध का उद्देश्य इनक्यूबेट के प्रदर्शन को प्रभावित करने वाले कारकों की पहचान करना और ऊष्मायन के एक इनक्यूबेट केंद्रित ढांचे का प्रस्ताव करना है। वांछित परिणामों के आधार पर, निम्नलिखित शोध उद्देश्यों की पहचान की गई:

- वे कौन से कारक हैं जो इनक्यूबेट के प्रदर्शन पर सकारात्मक प्रभाव डालते हैं?

- ऊष्मायन के दौरान इन प्रदर्शन कारकों के प्रति इनक्यूबेट की धारणा क्या है?
- प्रदर्शन कारक एक दूसरे को कैसे प्रभावित करते हैं?
- इनक्यूबेट की धारणा के आधार पर ऊष्मायन की रूपरेखा क्या होनी चाहिए?

शोध को गुणात्मक और मात्रात्मक दोनों अनुसंधान विधियों के त्रिभुजिंग से संपर्क किया गया है। शोध ग्राउंडेड थ्योरी मेथड (जीटीएम) के साथ शुरू हुआ, जिसमें इनक्यूबेटों के प्रदर्शन को प्रभावित करने वाले कारकों की पहचान करने के लिए 22 ऊष्मायन विशेषज्ञों का साक्षात्कार लिया गया था। 37 उप कारकों के साथ कुल 7 मुख्य कारकों की पहचान की गई थी। पहचाने जाने वाले कारक थे एक्सेस टू फंडिंग, मार्केट एक्सेस, होस्ट इंस्टीट्यूशन के ब्रांड, इनक्यूबेटर मैनेजर, नेटवर्क एंड कम्युनिटी, फिजिकल इन्फ्रास्ट्रक्चर एंड सपोर्ट सर्विसेज।

इनक्यूबेटी के परिप्रेक्ष्य का पता लगाने के लिए, देश के 26 टीबीआई में कम से कम 3 महीने के लिए ऊष्मायन से गुजरने वाले 253 इनक्यूबेट, एक संरचित प्रश्नावली का उपयोग करके साक्षात्कार किया गया था। इनक्यूबेट्स से एकत्र किए गए डेटा को इनक्यूबेटरी फैक्टर एनालिसिस (ईएफए) और कंपर्मेंटरी फैक्टर एनालिसिस (सीएफए) के अधीन किया गया था ताकि इनक्यूबेट्स की धारणाओं के बीच समानता और असमानताओं की पहचान की जा सके। इनक्यूबेटर मैनेजर और ब्रांड ऑफ होस्ट इंस्टीट्यूशन के लिए फैक्टर और सब फैक्टर, एक्सेस टू मार्केट और फंड्स इनक्यूबेट के प्रदर्शन को प्रभावित करने वाले प्रमुख कारक के रूप में उभरे जबकि फिजिकल इन्फ्रास्ट्रक्चर और सपोर्ट सर्विसेज ने इनक्यूबेट की धारणा में कम स्कोर किया। इनक्यूबेशन एक्सपर्ट्स को टोटल इंटरप्रेटिव स्ट्रक्चरल मॉडलिंग (TISM) के लिए डेटा इकट्ठा करने के लिए दूसरी प्रश्नावली के साथ संपर्क किया गया था। TISM के ढांचे का उपयोग

स्ट्रक्चर्ड इक्वेशन मॉडलिंग (SEM) के लिए एक इनपुट मॉडल के रूप में किया गया था। मॉडल फिट सूचकांकों के लिए उचित जांच के बाद एक इनक्यूबेट केंद्रित ऊष्मायन मॉडल विकसित किया गया था। यह उभरा कि इनक्यूबेटों का प्रदर्शन सीधे इनक्यूबेटर प्रबंधक और इनक्यूबेटर के मेजबान संस्थान के ब्रांड का एक कार्य है। फंड्स एंड मार्केट एक्सेस की पहुंच SEM ढांचे में इनक्यूबेट के प्रदर्शन को और प्रभावित करती है।

यह अध्ययन भारत में ऊष्मायन मॉडल और प्रक्रियाओं के विश्लेषण में महत्वपूर्ण योगदान देगा। भारत में इनक्यूबेटों के निर्माण और स्टार्ट-अप इको-सिस्टम के लिए राजकोष द्वारा आवंटित धन में पर्याप्त वृद्धि के साथ, यह अध्ययन नीति निर्माताओं और शिक्षाविदों और प्रशासकों को महत्वपूर्ण अंतर्दृष्टि प्रदान करते हुए, इनक्यूबेट के अधिक आवश्यकता परिप्रेक्ष्य प्रदान करेगा।

मुख्य शब्द: इनक्यूबेटर्स, टीबीआई, एक्सलेरेटर, इनक्यूबेटर्स, स्टार्ट-अप, एंटरप्रेन्योर, एंटरप्रेन्योरशिप, एंटरप्रेन्योरशिप इको-सिस्टम, ग्राउंड थ्योरी, फैक्टर एनालिसिस, टोटल इंटरप्रेटिव स्ट्रक्चरल मॉडलिंग, TISM, स्ट्रक्चर्ड इक्वेशन मॉडलिंग, SEM

Contents

S No.	Title	Page
	Certificate	
	Acknowledgements	
	Abstract	
	List of Figures	
	List of Tables	
I	Chapter- 1 Introduction	1
	1.1 Introduction	1
	1.2 Definition of Entrepreneurship	2
	1.3 Business Incubation and the Entrepreneurship Ecosystem	4
	1.4 Business Incubators across the world	5
	1.5 Objectives of Business Incubators	8
	1.6 Business Incubation in India	12
	1.7 Research Objectives	15
	1.8 Research Purpose	15
	1.9 Organization of the study	16
II	Chapter- 2 Literature Review	19
	2.1 History of Research on Business Incubation	20
	2.2 Defining Business Incubation	26
	2.3 Typology of Incubators	32
	2.4 Institution and University-based Incubation Hubs	39
	2.5 Measures of Performance of Business Incubation	47
	2.6 Theories of Business Incubation	59

	2.7 Economic impact of Business Incubators	65
	2.8 Global and Regional Studies on Business Incubation	72
	2.9 Key Findings and Gaps in Literature	75
III	Chapter- 3 Technology and Business Incubation in India	89
	3.1 Incubation as a Policy tool in India	89
	3.2 Current Status of Incubators in India	91
	3.3 Funding agencies and the schemes in India	94
	3.4 Models of Business Incubation in India	100
	3.5 Best Practices & Success Factors in Indian Incubation	103
	3.6 University based Incubation in India	106
	3.7 Social Incubation	107
	3.8 Key Social Incubators in India	110
	3.9 Private and Corporate Business Incubation	112
	3.10 Significant Incubation Centers in India	114
	3.11 Motivation for this Study	116
IV	Chapter- 4 Research Objectives and Methodology	117
	4.1 Research Questions	117
	4.2 Research Objectives	118
	4.3 Methodology	118
	4.4 Rationale for Selecting Statistical Methods	123
	4.5 Grounded Theory Methodology	123
	4.6 Sampling Methodology	127
	4.7 Factor Analysis	129
	4.8 Total Interpretive Structural Modeling (TISM)	130

	4.9 Structural Equation Modelling (SEM)	130
V	Chapter- 5 Data Analysis and Findings	133
	5.1 The Qualitative Study	133
	5.2 Sampling	133
	5.3 Data Collection	135
	5.4 Exploratory and Confirmatory Factor Analysis	142
	5.5 Determinants of EFA and CFA for each Factor	144
	5.6 Developing Incubation Framework using TISM	183
	5.7 SEM for Incubation Model	191
VI	Chapter- 6 Conclusion	197
	6.1 Discussion	197
	6.2 Results	199
	6.3 Key Outcomes and Recommendations	202
	6.4 Job Description of Incubator Manager	203
	6.5 Limitations of the study	204
	6.6 Future Scope of work	204
VII	References	207
IX	Annexures	245
	A1 List of TBIs (Technology Business Incubators) in India	245
	A2 Questionnaire: Incubatee Perspective	263
	A3 TISM Questionnaire	267
	Brief Profile	271

List of Figures

Figure No.	Title	Page
Figure 1.1	Number of business incubators worldwide	6
Figure 1.2	Theoretical impact of an incubator	11
Figure 2.1	The evolution of business incubators services	30
Figure 3.1	State wise distributions of Technology Business Incubators (TBIs) in India	92
Figure 4.1	Methodology and Flow of the Research Design	121
Figure 5.1	Steps Followed in Grounded Theory Methodology	139
Figure 5.2	CFA Measurement Model for Access to Funding	149
Figure 5.3	CFA Measurement Model for Incubator Manager	153
Figure 5.4	CFA Measurement Model for Market Access	158
Figure 5.5	CFA Measurement Model for Brand of Host Institute	163
Figure 5.6	CFA Measurement Model for Physical Infrastructure	168
Figure 5.7	CFA Measurement Model for Support Services	173
Figure 5.8	CFA Measurement Model for Networking and Community	177
Figure 5.9	TISM Model for Incubation success	191
Figure 5.10	SEM based Incubatee success model	195

List of Tables

Table No.	Title	Page
Table 1.1	Primary and Secondary Objectives of Incubators	10
Table 2.1	Evolution of Research Question in Business Incubation	22
Table 2.2	Notable papers in the field of Incubation research	24
Table 2.3	Commonly Adopted Definitions of Business Incubation	27
Table 2.4	Comparison of Incubator, Accelerator and Co Working Spaces	35
Table 2.5	Summary of Studies conducted on University Based Incubation Models	44
Table 2.6	Key Success Factors in Business Incubation	50
Table 2.7	Indicative studies on the success and performance indicators of business Incubators	54
Table 2.8	Theories of Business Incubation	62
Table 2.9	Major studies in the incubation by international agencies	70
Table 2.10	Most cited papers in the Technology Business Incubation	76
Table 3.1	Classification of Indian incubators as per their value addition	102
Table 3.2	Incubation stakeholder engagement models	105
Table 3.3	Social Incubation models in India	107
Table 4.1	Summary of Research Question, Research Objective and Methodology Used	122
Table 5.1	Region-wise distribution of the incubators	144
Table 5.2	KMO and Bartlett's Test for Access to Funding	145
Table 5.3	Total Variance Explained for Access to Funding	146
Table 5.4	Reliability Statistics for Access to Funding	146

Table 5.5	Rotated Component Matrix for Access to Funding	146
Table 5.6	Fit Indices for Access to Funding	148
Table 5.7	CFA factor Loadings for Access to Funding	148
Table 5.8	Independent Sample T-Test for Hypothesis 1	150
Table 5.9	KMO and Bartlett's Test for Incubator Manager	150
Table 5.10	Reliability Statistics for Incubator Manager	151
Table 5.11	Total Variance Explained for Incubator Manager	151
Table 5.12	Rotated Component Matrix for Incubator Manager	152
Table 5.13	Fit Indices for Incubator Manager	153
Table 5.14	CFA factor Loadings for Incubator Manager	153
Table 5.15	Independent Sample T-Test for Hypothesis 2	154
Table 5.16	KMO and Bartlett's Test for Market Access	155
Table 5.17	Total Variance Explained for Market Access	155
Table 5.18	Reliability Statistics for Market Access	156
Table 5.19	Rotated Component Matrix for Market Access	156
Table 5.20	Fit Indices for Market Access	157
Table 5.21	CFA factor Loadings for Market Access	158
Table 5.22	Independent Sample T-Test for Hypothesis 3	159
Table 5.23	KMO and Bartlett's Test for Brand of Host Institute	159
Table 5.24	Total Variance Explained for Brand of Host Institute	160
Table 5.25	Reliability Statistics for Brand of Host Institute	160
Table 5.26	Rotated Component Matrix for Brand of Host Institute	161
Table 5.27	Fit Indices for Brand of Host Institute	162
Table 5.28	CFA factor Loadings for Brand of Host Institute	162
Table 5.29	Independent Sample T-Test for Hypothesis 4	163
Table 5.30	KMO and Bartlett's Test for Physical Infrastructure	164

Table 5.31	Total Variance Explained for Physical Infrastructure	165
Table 5.32	Rotated Component Matrix for Physical Infrastructure	166
Table 5.33	Reliability Statistics for Physical Infrastructure	167
Table 5.34	Fit Indices for Physical Infrastructure	167
Table 5.35	CFA factor Loadings for Physical Infrastructure	167
Table 5.36	Independent Sample T-Test for Hypothesis 5	169
Table 5.37	KMO and Bartlett's Test for Support Services	169
Table 5.38	Total Variance Explained for Support Services	170
Table 5.39	Reliability Statistics for Support Services	171
Table 5.40	Rotated Component Matrix for Support Services	171
Table 5.41	Fit Indices for Support Services	172
Table 5.42	CFA factor Loadings for Support Services	172
Table 5.43	Independent Sample T-Test for Hypothesis 6	173
Table 5.44	KMO and Bartlett's Test for Networking and Community	174
Table 5.45	Total Variance Explained for Networking and Community	175
Table 5.46	Reliability Statistics for Networking and Community	175
Table 5.47	Rotated Component Matrix for Networking and Community	176
Table 5.48	Fit Indices for Networking and Community	176
Table 5.49	CFA factor Loadings for Networking and Community	177
Table 5.50	Independent Sample T-Test for Hypothesis 7	178
Table 5.51	Summary and Findings from EFA and CFA	178
Table 5.52	Reachability Matrix	184
Table 5.53	Post-iterative matrix	184
Table 5.54	Partitioning Matrix (Iteration 1)	186
Table 5.55	Partitioning Matrix (Iteration 2)	186
Table 5.56	Partitioning Matrix (Iteration 3)	187

Table 5.57	Partitioning Matrix (Iteration 4)	187
Table 5.58	Interaction Matrix	188
Table 5.59	Interaction Matrix (Interpretive Matrix)	189
Table 5.60	Fit Indices for Incubator host Branding Model	195
Table 5.61	Standardized Regression Weights for SEM Model	195