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Decoding Asia's VC Landscape: A Logistic Regression Analysis of Investment Criteria in Leading Innovation Hubs

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Abstract: In the ever-evolving landscape of venture capital (VC) funding, understanding the nuanced interplay of investment criteria is essential for entrepreneurs and investors alike. This study delves into the intricacies of VC investment criteria across various stages of a venture's lifecycle within the vibrant innovation hubs of Asia. Employing logistic regression analysis, the research examines the shifting importance attributed to key criteria—such as Entrepreneur's Experience, Product or Service Characteristics, and Financial Characteristics—across the Pre-seed, Seed, and Expansion stages. The findings illuminate the pivotal role of these criteria in shaping investment decisions, offering actionable insights for stakeholders navigating Asia's burgeoning startup ecosystem. Notably, the analysis highlights the dominant influence of Entrepreneur's Experience at critical stages, alongside the discernible impact of Market Characteristics during the Seed phase. By elucidating these dynamics, the research contributes to a deeper understanding of VC investment strategies, empowering entrepreneurs and investors to make informed decisions and drive sustainable venture growth. The subsequent analysis section provides a comprehensive exploration of the findings, along with their implications for future research and practical application in the field of venture capital.

1. INTRODUCTION

In recent years, a notable trend has emerged wherein entrepreneurship has flourished, transitioning from developed to developing nations, thereby fostering innovative solutions to pressing societal challenges through startups. Concurrently, the practice of raising capital through equity sharing in startups has gained considerable traction, underscored by a sophisticated investment landscape. Extensive research in this field highlights the pivotal role of thorough evaluation preceding the disbursement of venture capitalist (VC) funding. This paper aims to delve into the intricate relationship between VC investments and the lifecycle of ventures, elucidating the critical criteria influencing VC decisions at various developmental stages: Pre-seed, Seed, and Expansion.

With a focus on prominent innovation hubs in Asia, including Singapore, China, India, South Korea, Japan, and briefly touching upon Pakistan, this study employs logistic regression analysis to delineate the determinants driving VC investments. The historical trajectory of VC investment criteria research can be traced back to seminal works such as those by Wells (1974), Poindexter (1976), Tyebjee & Bruno (1984), and the seminal contributions of MacMillan et al. (1985 & 1986). The criteria proposed by MacMillan et al. – Personality of an Entrepreneur, Experience of an Entrepreneur, Product or Service Characteristics, Market Characteristics, and Financial Characteristics – continue to underpin contemporary VC investment practices. Subsequent research has refined these criteria and elucidated their nuanced interplay.

To address the challenges posed by a relatively small sample size, this study employs the DEMATEL Method. This method not only mitigates the risks associated with limited data but also challenges assumptions regarding the independence among investment criteria. The analysis reveals intricate dependencies among these criteria, with some exhibiting dominant or causal relationships, while others are influenced by external factors.

An examination of data collected across Pre-seed, Seed, and Expansion stages reveals varying degrees of criterion importance at each stage. For instance, Experience of an Entrepreneur emerges as paramount at the Pre-seed stage, while Product or Service Characteristics assume greater significance at the Seed stage, and Financial Characteristics become more salient during the Expansion stage. Conversely, Market Characteristics exhibit relatively lower importance at the Pre-seed stage, while the

Personality of an Entrepreneur maintains consistent relevance across Seed and Expansion stages. Additionally, the study delves into the dynamics of influence and dominance among these variables, shedding light on their nuanced relationships.

The implications of these findings extend to entrepreneurs seeking VC funding, offering strategic insights tailored to different stages of venture development. Furthermore, avenues for future research are identified, including the exploration of sub-criteria dynamics and the extension of the analysis to emerging markets beyond the purview of this paper.

2. LITERATURE REVIEW

The lifecycle stages of ventures exhibit similarities to those observed in organisational and corporate contexts (Miller and Friesen, 1984; Picken, 2017). A comprehensive understanding of the venture lifecycle typically involves delineating four primary stages: Start-up (Stage 1), Transition (Stage 2), Scaling (Stage 3), and Exit (Stage 4) (Picken, 2017).

2.1. Framework for the Stages of a Venture Lifecycle:

Start-up Stage:
At the inception of a venture, the business concept is defined and validated, often characterized by informal operations overseen by the founders (Picken, 2017). This phase aligns with various terminologies used by researchers, such as "Birth" (Lippitt and Schmidt, 1967), "Stage-one" (Scott, 1971), "Creativity Stage" (Greiner, 1986), and "Entrepreneurial stage" (Quinn and Cameron, 1983).

Transition Stage:
As the venture progresses, foundational elements conducive to scalable growth are established. Early successes in product acceptability and customer base development mark this phase, often referred to as the "Rapid Growth Stage" (Downs, 1967), "Go-Go Organization stage" (Adizes, 1979), or "Second Stage" (Lyden, 1975).

Scaling Stage:
The venture experiences a phase of rapid revenue growth and formal structure consolidation. This phase, characterized by strengthened organizational frameworks, is identified by terms like "Direction Stage" (Greiner, 1986), "Stable Organization Stage" (Katz and Kahn, 1978), or "Maturity Stage" (Adizes, 1979).

Revival Stage:
In this phase, ventures pursue expansion and diversification strategies to consolidate their market presence and product/service offerings. Increased investments in research and planning accompany efforts to adapt to evolving market dynamics. This stage is recognised by designations such as "Coordination Stage" (Greiner, 1986) or "Elaboration of Structure Stage" (Quinn and Cameron, 1983).

Exit Stage:
The final stage of the venture lifecycle involves strategic decisions regarding the future trajectory of the venture, including potential IPOs, private sales, mergers, or acquisitions (Picken, 2017).

While various frameworks exist to describe organisational growth stages, the five-phase model proposed by Miller and Friesen (1984) has garnered significant attention due to its comprehensive delineation of the venture lifecycle (Kazanjian and Drazin, 1989).

2.2. Criteria Utilised by Investors or VCs to Fund Ventures:

Venture Capitalists (VCs) play a pivotal role in the success of ventures, with entrepreneurs often seeking their investment due to the expertise and networks they bring, particularly in the absence of traditional financing avenues in the early stages of a venture (Van Auken, 2001).

The process of funding a startup entails a meticulous evaluation by Venture Capitalists (VCs) who consider various factors before making investment decisions. Researchers have identified distinct categories that VCs assess when evaluating a venture's suitability for funding. For instance, Tyebjee and Bruno (1984) outlined four primary categories: market potential, management team, competition analysis, and product evaluation. MacMillan et al. (1985) expanded upon this framework by consolidating 27 investment criteria into five headers: entrepreneur's personality, experience, product/service characteristics, market structure and potential, and financial considerations (Macmillan et al., 1987; Timmons et al., 1987; Robinson, 1988; Hall and Hofer, 1993).

The validity of MacMillan's (1985) criteria has been corroborated by numerous studies across different countries and markets. Research conducted by Knight (1994) in Canada, Sweeting (1991) in England, Ray (1991) in Singapore, Ray and Turpin (1993) in Japan, Rah, Jung and Lee (1994) in South Korea, and Riquelme (1994) in Europe consistently reaffirmed the significance of these criteria (Zutshi et al., 1999). Furthermore, empirical testing in various contexts, such as management companies' decision-making processes in the Netherlands and the USA, has reinforced the applicability of these criteria (Vinig and de Haan, 2002).

Recent literature reviews have delineated two major groups of VC investment criteria: those prioritising managerial skills (MacMillan et al., 1985; Zutshi et al., 1999; Vinig and de Haan, 2002; Kollman and Kuckertz, 2010; Visagie, 2011) and those emphasising market potential, growth, and product quality (Zacharakis and Meyer, 1998; Tyebjee and Bruno, 1984). Key areas identified by VCs as significant considerations before investing include top management, market dynamics, product attributes, risk assessment, return potential, exit strategies, contractual agreements, strategic positioning, customer base, and competitive landscape (Khanin et al., 2008).

In-depth research has further explored the specific criteria deemed crucial by VCs. Kollmann and Kuckertz (2010) analysed 15 criteria across 81 VCs, confirming their importance and alignment with the broader framework proposed by MacMillan et al. (1985). Refer to Annexure 4 for the comprehensive account of the research as per the investment criteria.

2.3. Investment Criteria of VCs at different stages of a venture lifecycle:

The criteria for investment by venture capitalists (VCs) vary depending on the stage of the start-up in its lifecycle. The significance of investment criteria fluctuates from the early-stage to the late-stage of a start-up (Carter & Van Auken, 1994). Various studies have identified distinctions in venture financing across different stages. According to Stanley Pratt, there are six stages in a start-up where venture capitalists offer funding:

1. Seed financing
2. Start-up
3. First-stage financing
4. Second-stage financing
5. Third-stage financing
6. And Bridge financing."

A recent development in the area suggests that there are only five stages of a venture lifecycle funding:

1. Pre-seed
2. Seed
3. Start-up
4. Post-creation
5. Expansion/development
6. Transfer/succession."

Sahlman (1990) and Plumer (1987) have also talked about 8 stages of a venture's funding stages, and those are:

1. Seed
2. Start-up
3. Early development
4. Expansion
5. Profitable but cash poor
6. Rapid growth toward liquidity point
7. Bridge stage – mezzanine investment
8. Liquidity stage – cash-out or exit"

Let's see what these 8 stages mean:

1. Seed: the business is still in ideation phase, and the feasibility is tested before going to the market.
2. Start-up: the management tests the minimum viable product in the targeted market.
3. Early development: A customer base is built with product/service acceptability.
4. Expansion: Mostly, not yet profitable, but a loyal customer base is developed, in this stage the founders need more money to scale-up.
5. Profitable but cash poor: achieves breakeven, and is profitable, but don't have enough resources to bring efficiency in serving the entire demand.
6. Rapid growth toward liquidity point: Reduced risk for investors, debt is preferred mode of financing to avoid diluting the ownership, the venture becomes successful and stable.
7. Bridge stage – mezzanine investment: Investment is needed to sustain the growth, and the venture is strategizing to exit.
8. Liquidity stage – cash-out or exit: investors take out their investments by cashing out or by issuing an IPO.

Further investigation has categorised the stages into two main groups: early-stage financing and later-stage financing. Early-stage financing encompasses the first three stages of venture financing, as defined by Plumer (1987) and Sahlman (1990), while all subsequent stages from the expansion phase are grouped under later-stage financing. Although these stages adhere to criteria like those proposed by Macmillan et al. (1985), Carter & Van Auken (1994) distinguished them as early-stage and late-stage respectively.

Research by Ruhnka & Young (1987) introduced a subjective criterion for venture capitalists (VCs) investing in start-ups. They delineated the venture lifecycle into five stages, each with specific attributes and challenges. VCs were surveyed to provide insights into terminology, business features, goal setting, and potential risks across these stages. Their findings underscored the critical importance of factors such as business feasibility, market profitability, and effective team leadership in the early stages, contrasting with the increasing significance of metrics like sales revenue, customer base expansion, and operational efficiency in later stages.
Carter and Van (1994) conducted an analysis using 21 key criteria from MacMillan et al.'s (1985) research to evaluate their significance across early and late stages. The resulting data, presented in the following table, illustrates the mean importance score assigned to each criterion:

Table 1		
Criteria	**Early Stage (Mean)**	**Late Stage (mean)**
Entrepreneur's Experience		
Background	1.42	1.39
Experience in Industry	1.28	1.24
Handling of Adversity	1.58	1.45
Leadership Ability	1.61	1.52
Organizing Mgmt. Team	1.64	1.21
Entrepreneur's Personality		
Analytical Ability	2.22	2.30
Honesty and Integrity	1.11	1.06
Motivation & Commitment	1.22	1.12
Physical & Mental Health	1.47	1.67
Financial		
Cost Structure	1.94	2.34
Exit Potential	2.46	1.94
Return of Equity	1.94	1.69
Market Characteristics		
Entry Barriers	1.91	1.91
General Condition	1.75	1.64
Potential	1.32	1.39
Segmentation	2.06	1.91
Product Characteristics		
Competition	1.94	1.91
Duplication Potential	2.17	2.06
Life Cycle	1.91	2.21
Marketability	1.50	1.82
Marketing Strategy	1.86	1.85

Pintado et al. (2007) conducted a study in the Spanish market to explore the disparities in investment criteria between the early and late stages of a venture. Their analysis revealed that the top three criteria – viability of the project, quality of the management team, and the exit opportunity – exhibited similar levels of importance across both stages. The subsequent table presents the mean score for each criterion in both the early and late stages of a venture.

Table 2		
Investment Criteria	**Early-Stage (Mean)**	**Late-Stage (Mean)**
Viability of Project	4.83	4.97
Quality of Management Team	4.77	4.92
Exit Opportunity	4.00	4.38
Development Stage of Firm	3.46	3.58
Geographical Location of Firm	4.08	2.37
Project on High Technology	3.31	2.14

Molnar and Jaki (2020) have also conducted research to determine the significance of VCs' investment criteria across the Pre-seed, Seed, and Expansion stages of a venture's lifecycle. The subsequent table illustrates the level of importance attributed to each criterion at its respective stage. The percentages indicate the weight or significance of each criterion at that particular stage, with higher percentages indicating greater importance.

Table 3

Category	Frequency (%) across the life-cycle stages			
	Pre-seed	Seed	Expansion	Total
Financial Indicators	25.40%	31.80%	27.50%	28.40%
Market	21.90%	25.80%	21.40%	23.30%
Product and Service	21.90%	23.70%	21.40%	22.50%
Management Team	23.70%	13.00%	15.40%	17.50%
Business Plan	7.10%	5.70%	14.30%	8.20%

In summary, researchers have noted that the investment criteria of VCs remain consistent across early and late stages but vary in terms of their weighting or importance at different stages. We can use the study by Macmillan et al. (1985 & 1987) as a foundation to examine the influence or significance of five key categories of investment criteria during various stages (Pre-seed, Seed, and Expansion) of the startup lifecycle in developing economies in Asia.

2.4. Venture Capital Investment Dynamics in Emerging Asian Economies:

Venture capital (VC) infusion in Asia has witnessed a notable surge recently, buoyed by a flourishing startup ecosystem and an influx of funds from both local and international sources. This upswing underscores Asia's emergence as a fertile ground for innovation, with startups spanning diverse sectors like technology, biotechnology, and financial technology attracting substantial investments (CBI, 2020).

The VC investment landscape in Asia is influenced by a range of factors unique to each region, including cultural intricacies, regulatory frameworks, and market dynamics (KPMG, 2021). For instance, while China's technology giants dominate investments, countries like India and Singapore are establishing themselves as pivotal hubs for technology startups and innovation (Bloomberg, 2021). Similarly, Japan and South Korea possess robust ecosystems bolstered by a blend of corporate and VC investments (UNCTAD, 2020).

In this context, VC firms in Asia navigate a complex set of investment criteria aimed at identifying ventures with high growth potential while managing inherent risks. Crucial factors shaping investment decisions include the quality of entrepreneurial leadership, scalability of the market, technological innovation, and adherence to regulatory norms (PwC, 2021). Additionally, the increasing focus on environmental, social, and governance (ESG) considerations is reshaping investment priorities and fostering the emergence of impact-oriented funds (Deloitte, 2020).

Comparative evaluations across Asian markets offer valuable insights into the convergence and divergence of VC investment criteria across different stages of venture development. Trends specific to sectors, such as the ascent of health technology in India, agricultural technology in Southeast Asia, and smart manufacturing in China, highlight the importance of customizing investment strategies to local market dynamics and technological advancements (EY, 2021).

The evolving landscape of VC investment criteria in Asia holds significant implications for entrepreneurs, investors, policymakers, and other stakeholders. Entrepreneurs must navigate a competitive funding environment by showcasing market traction, scalability, and a clear path to profitability. Investors, meanwhile, must balance risk and return considerations while staying abreast of evolving market trends and regulatory changes (McKinsey, 2021).

Future research in the realm of VC investment criteria in Asia offers promising avenues, including longitudinal studies, sectoral analyses, and investigations into the impact of regulatory reforms on investor behaviour. Additionally, interdisciplinary research bridging finance, entrepreneurship, and technology can provide comprehensive insights into the drivers of innovation and economic progress in the region (World Bank, 2020).

In essence, the exploration of VC investment criteria across emerging Asian economies presents a wealth of insights into the dynamics of entrepreneurial finance, driving innovation, and fostering sustainable economic development in the region.

3. RESEARCH METHODOLOGY

3.1. Sampling

This study meticulously compiled a comprehensive list of nearly all VC firms operating within the Asian region. Subsequently, we reached out to these firms, contacting a total of 16 entities. Remarkably, 15 of these firms responded promptly to the enquiry, furnishing us with their invaluable insights and opinions. Each response was deemed valid and deemed suitable for analysis, resulting in an impressive success rate of 93.75%.

Given the relatively modest size of the VC industry in Asia, employing a quantitative approach posed certain challenges due to the limited sample size. Consequently, we opted for the DEMATEL methodology, a mixed method approach, to navigate this constraint effectively. This decision was underpinned by DEMATEL's capacity to mitigate the limitations associated with smaller sample sizes, thereby rendering it an apt choice for our research endeavours.

3.2. DEMATEL Method

The variables for this research are extracted from the secondary research in the literature review. We identified the criteria Venture Capitalists (VCs) or investors use while funding a startup, and those are Entrepreneur's Personality, Entrepreneur's Experience, Financials Characteristics, Product/Services Characteristics, and Market/Industry Characteristics. These are the criteria VCs use while funding a startup. We will use these 5 criteria and test with the expert VCs opinions and check their importance and the causal relationship at Pre-Seed, Seed, Expansion stages of a venture using DEMATEL Methodology.

To carry out this research, we will use DEMATEL (Decision Making Trial and Evaluation Laboratory) methodology. This methodology was initially designed by the Geneva Research Center of Battelle Memorial Institute (between 1972-76) to picturise the complex causal relationships in the form of matrices or graphs (Gabus and Fontela 1972; and Tzeng et. Al. 2007). The structural modeling approach of this method helps in analyzing the cause-and-effect relationships among the variables. This methodology helps in identifying the interdependence amongst variables and solves complicated and intertwined issues by creating a map of relative relationship amongst variables. It also identifies the strength of the important elements/variables in a complex structure. Its advantages and strengths have been attracting the attention of researchers to solve complex problems (Hsu et. al. 2007; Wu 2008).

Based on the research of Tzeng et. al. 2007, Wu 2008, and Chang et. al. 2011 studies, procedure of DEMATEL methodology can be summarised as follows:

Step 1: Find the average matrix from the responses collected from the experts. The responses are generated on the following DEMATEL Scale:

Table 4: DEMATEL scale

Type of relations between variables Influence	Score
No influence	0
Very low influence 1	1
Low influence 2	2
High influence 3	3
Very high influence 4	4
Source: (Chang et al., 2011)	

The sign of a_{ij} denotes the strength of relationship between criteria i and j. The Average Matrix A will have a diagonal with value '0' because over there i=j resulting no relationship of variable with itself.

$$A = \begin{bmatrix} 0 & a_{ij} & a_{ij} & \dots & a_{ij} \\ a_{ij} & 0 & a_{ij} & \dots & a_{ij} \\ \dots & \dots & \dots & \dots & \dots \\ \dots & \dots & \dots & \dots & \dots \\ a_{ij} & a_{ij} & a_{ij} & \dots & 0 \end{bmatrix}$$

Step 2: Normalize the Matrix A to Matrix D using D = A x S. Where each element in matrix D will be in the range of 0 to 1, and S = min $\left[\frac{1}{\max_i \sum_{j-1}^{n} a_{ij}}, \frac{1}{\max_j \sum_{i-1}^{n} a_{ij}}\right]$.

Step 3: Total Relation Matrix T is calculated.

Matrix T is calculated using Matrix D with the following calculation:

$$\mathrm{T} = \mathrm{D}(\mathrm{I} - \mathrm{D})^{-1}$$

Step 4: Adding the Rows and Columns

The rows and columns are summed individually with the following formula:

$$r_i = \left[\left(\sum_{j=1}^{n} t_{ij}\right)\right] n * 1$$

$$c_i = \left[\left(\sum_{i=1}^{n} t_{ij}\right)\right] 1 * n$$

Step 5: Cause-effect graphs and calculating the values of r_i - c_i and r_i + c_i.

This is the final step where we will make a graph with the vertical axis using (r_i - c_i) and horizontal axis using (r_i + c_i). The graph shows the relationship amongst the variables and identifies the importance of these variables.

(r_i + c_i) value shows the importance of the variable in the decision-making process, and (r_i - c_i) value shows the nature of variable (whether it is cause or effect) (Dytczak et al., 2014). Positive value of r_i - c_i means it is a dominant variable, and the negative value represents that the variable is dominated by other variables. The location of the variables on the graph shows their nature of either a cause or effect (Sohrabinejad, Rahimi, 2015).

1. Pre-Seed

	Personality of the entrepreneur	Experience of the entrepreneur	Product or service	Market characteristics	Financial characteristics
Personality of the entrepreneur	**0**				
Experience of the entrepreneur		**0**			
Product or service			**0**		
Market characteristics				**0**	
Financial characteristics					**0**

2. Seed

	Personality of the entrepreneur	Experience of the entrepreneur	Product or service	Market characteristics	Financial characteristics
Personality of the entrepreneur	**0**				
Experience of the entrepreneur		**0**			
Product or service			**0**		
Market characteristics				**0**	
Financial characteristics					**0**

3. Expansion

	Personality of the entrepreneur	Experience of the entrepreneur	Product or service	Market characteristics	Financial characteristics
Personality of the entrepreneur	**0**				
Experience of the entrepreneur		**0**			
Product or service			**0**		
Market characteristics				**0**	
Financial characteristics					**0**

4. Discussion

An extensive body of research has focused on the investment criteria of venture capitalists (VCs). These primary criteria were chosen as the foundation for examining their behaviour across different stages of a venture's lifecycle.

Employing the DEMATEL methodology, the data was compiled and structured into 45 matrices, each measuring 5 by 5. These matrices were evenly distributed across the three stages of a venture's lifecycle, enabling observation of how investment criteria evolve as ventures progress. Detailed matrices can be found in Annexure 1. In the first step, three average matrices were formulated: A1 for the Pre-Seed stage, A2 for Seed, and A3 for the Expansion Stage.

$$A1 = \begin{bmatrix} \mathbf{0} & \mathbf{3.4667} & \mathbf{3.2667} & \mathbf{2.3333} & \mathbf{3.2} \\ \mathbf{3.6} & \mathbf{0} & \mathbf{3.1333} & \mathbf{2.7333} & \mathbf{3.4} \\ \mathbf{3} & \mathbf{2.8667} & \mathbf{0} & \mathbf{2.8} & \mathbf{3.1333} \\ \mathbf{2.5333} & \mathbf{2.6} & \mathbf{3.1333} & \mathbf{0} & \mathbf{2.9333} \\ \mathbf{2.6} & \mathbf{2.7333} & \mathbf{2.8667} & \mathbf{2.8667} & \mathbf{0} \end{bmatrix}$$

$$A2 = \begin{bmatrix} \mathbf{0} & \mathbf{3.3333} & \mathbf{3.0667} & \mathbf{2.0667} & \mathbf{3.0667} \\ \mathbf{3.5333} & \mathbf{0} & \mathbf{3.2667} & \mathbf{2.4667} & \mathbf{3.0667} \\ \mathbf{3.1333} & \mathbf{3.0667} & \mathbf{0} & \mathbf{3.1333} & \mathbf{3.0667} \\ \mathbf{1.7333} & \mathbf{2.8667} & \mathbf{3.4} & \mathbf{0} & \mathbf{3.8} \\ \mathbf{2.6667} & \mathbf{2.6667} & \mathbf{2.9333} & \mathbf{3.2} & \mathbf{0} \end{bmatrix}$$

$$A3 = \begin{bmatrix} \mathbf{0} & \mathbf{3.4} & \mathbf{2.8} & \mathbf{3} & \mathbf{3} \\ \mathbf{3.3333} & \mathbf{0} & \mathbf{3.2667} & \mathbf{3.2667} & \mathbf{3.4667} \\ \mathbf{2.9333} & \mathbf{2.8} & \mathbf{0} & \mathbf{2.9333} & \mathbf{3.2667} \\ \mathbf{2.8667} & \mathbf{3.0667} & \mathbf{3.2667} & \mathbf{0} & \mathbf{3.6667} \\ \mathbf{3.2} & \mathbf{3.2} & \mathbf{3.2} & \mathbf{3.0667} & \mathbf{0} \end{bmatrix}$$

In step 2, three direct relation matrices were made, with one for each stage: D1 for Pre-Seed, D2 for Seed, and D3 for Expansion Stage.

$$D1 = A1 \times \frac{1}{\max\limits_{1<i<5} \sum_{j=1}^{5} a_{ij}} = \begin{bmatrix} \mathbf{0} & \mathbf{0.2694} & \mathbf{0.2539} & \mathbf{0.1813} & \mathbf{0.2487} \\ \mathbf{0.2798} & \mathbf{0} & \mathbf{0.2435} & \mathbf{0.2124} & \mathbf{0.2642} \\ \mathbf{0.2332} & \mathbf{0.2228} & \mathbf{0} & \mathbf{0.2176} & \mathbf{0.2435} \\ \mathbf{0.1969} & \mathbf{0.2021} & \mathbf{0.2435} & \mathbf{0} & \mathbf{0.228} \\ \mathbf{0.2021} & \mathbf{0.2124} & \mathbf{0.2228} & \mathbf{0.2228} & \mathbf{0} \end{bmatrix}$$

$$D2 = A2 \times \frac{1}{\max\limits_{1<i<5} \sum_{j=1}^{5} a_{ij}} = \begin{bmatrix} 0 & 0.2564 & 0.2359 & 0.1590 & 0.2359 \\ 0.2718 & 0 & 0.2513 & 0.1897 & 0.2359 \\ 0.2410 & 0.2359 & 0 & 0.2410 & 0.2359 \\ 0.1333 & 0.2205 & 0.2615 & 0 & 0.2923 \\ 0.2051 & 0.2051 & 0.2256 & 0.2462 & 0 \end{bmatrix}$$

$$D3 = A3 \times \frac{1}{\max\limits_{1<i<5} \sum_{j=1}^{5} a_{ij}} = \begin{bmatrix} 0 & 0.2537 & 0.2090 & 0.2239 & 0.2239 \\ 0.2489 & 0 & 0.2438 & 0.2438 & 0.2587 \\ 0.2189 & 0.2090 & 0 & 0.2189 & 0.2438 \\ 0.2139 & 0.2289 & 0.2438 & 0 & 0.2736 \\ 0.2239 & 0.2389 & 0.2388 & 0.2289 & 0 \end{bmatrix}$$

In Step 3, a total of 3 matrices were made with one for each stage: T1 for Pre-seed, T2 for Seed, and T3 for Expansion Stage.

$$T1 = D1 \times (I - D1)^{-1} = \begin{bmatrix} 2.2088 & 2.4107 & 2.5072 & 2.2075 & 2.5489 \\ 2.5090 & 2.2799 & 2.5863 & 2.3041 & 2.6458 \\ 2.3196 & 2.3033 & 2.2248 & 2.1606 & 2.4634 \\ 2.2027 & 2.1968 & 2.3242 & 1.8965 & 2.3547 \\ 2.1889 & 2.1865 & 2.2924 & 2.0623 & 2.1506 \end{bmatrix}$$

$$T2 = D2 \times (I - D2)^{-1} = \begin{bmatrix} 1.8847 & 2.191 & 2.275 & 1.9929 & 2.3165 \\ 2.2008 & 2.0957 & 2.3992 & 2.1145 & 2.4335 \\ 2.1863 & 2.2949 & 2.2085 & 2.1581 & 2.4448 \\ 2.0375 & 2.2017 & 2.3311 & 1.8932 & 2.3956 \\ 2.038 & 2.1442 & 2.2566 & 2.0417 & 2.1157 \end{bmatrix}$$

$$T3 = D3 \times (I - D3)^{-1} = \begin{bmatrix} 2.6974 & 2.9598 & 2.9439 & 2.9046 & 3.106 \\ 3.0922 & 2.9572 & 3.168 & 3.115 & 3.3407 \\ 2.822 & 2.8742 & 2.7148 & 2.8459 & 3.0597 \\ 2.9866 & 3.0588 & 3.0836 & 2.8357 & 3.2613 \\ 2.9236 & 2.994 & 3.0084 & 2.9516 & 2.9702 \end{bmatrix}$$

In step 4, the total matrices for the three stages of a venture's lifecycle were aggregated by summing all the rows. Subsequently, in step 5, the sum of rows with columns (ri + ci) was computed, followed by the subtraction of column values from the row values (ri - ci). Here, (ri + ci) indicates the importance of the variables, while (ri - ci) illustrates the cause-and-effect relationship between the variables. The outcomes of both steps (4th and 5th) are presented in Tables 8, 9, and 10 below:

At Pre-Seed Stage:

Criteria	Ri	Ci	Ri + Ci	Ri - Ci	Identify
Personality of the entrepreneur	11.88293864	11.42891832	23.31185696	0.454020322	Cause
Experience of the entrepreneur	12.32503455	11.3772182	23.70225274	0.947816346	Cause
Product or service	11.47172496	11.93482835	23.40655331	-0.463103389	Effect
Market characteristics	10.97485683	10.63090207	21.6057589	0.343954756	Cause
Financial characteristics	10.8806427	12.16333073	23.04397343	-1.282688035	Effect

Table 5: Source: Results from Data Analysis

At Seed Stage:

Criteria	Ri	Ci	Ri + Ci	Ri - Ci	Identify
Personality of the entrepreneur	10.66004982	10.34731197	21.0073618	0.312737848	Cause
Experience of the entrepreneur	11.2437771	10.92753576	22.17131286	0.316241332	Cause
Product or service	11.29255035	11.47036467	22.76291502	-0.177814328	Effect
Market characteristics	10.85923031	10.20045886	21.05968917	0.658771451	Cause
Financial characteristics	10.59624793	11.70618424	22.30243217	-1.109936303	Effect

Table 6: Source: Results from Data Analysis

At Expansion Stage:

Criteria	Ri	Ci	Ri + Ci	Ri-Ci	Identify
Personality of the entrepreneur	14.6116456	14.52184167	29.13348727	0.089803932	Cause
Experience of the entrepreneur	15.67293121	14.84397636	30.51690757	0.828954854	Cause
Product or service	14.3167173	14.91874779	29.2354651	-0.602030487	Effect
Market characteristics	15.22590422	14.6527329	29.87863712	0.573171315	Cause
Financial characteristics	14.8478546	15.73775421	30.58560881	-0.889899614	Effect

Table 7: Source: Results from Data Analysis

While assessing the significance of VC's investment criteria, the values of (ri + ci) will indicate the importance of each criterion in making investment decisions at different stages of a venture. A higher value suggests greater importance of that criterion at the respective stage of the venture lifecycle. By referring to the values extracted from the collected data, it becomes evident that the topmost criterion for VCs at the Pre-seed stage is the experience of an entrepreneur, whereas at the Seed and Expansion stages, it shifts to product or service characteristics and financial characteristics, respectively. Following closely, the second most preferred criteria at the Pre-seed, Seed, and Expansion stages are product or service characteristics, financial characteristics, and the experience of an entrepreneur, respectively.

The personality of an entrepreneur ranks as the third most preferred criterion at the Pre-seed stage, while at the Seed Stage, it is the experience of an entrepreneur, with market characteristics replacing it during the Expansion Stage. Conversely, regarding the least preferred criteria, VCs prioritize market characteristics followed by financial characteristics at the Pre-seed Stage. Further examination reveals that the personality of an entrepreneur is least considered at both the Seed and Expansion Stages, with market characteristics and product or service characteristics taking precedence, respectively, at these stages.

The importance of these criteria fluctuates as a venture progresses through its lifecycle stages. A summary of their importance at the three stages is provided in the table below:

Importance Rank	Pre-Seed Stage	Seed Stage	Expansion Stage
1	Experience of the entrepreneur	Product or service Characteristics	Financial characteristics
2	Product or service Characteristics	Financial characteristics	Experience of the entrepreneur
3	Personality of the entrepreneur	Experience of the entrepreneur	Market characteristics
4	Financial characteristics	Market characteristics	Product or service Characteristics
5	Market characteristics	Personality of the entrepreneur	Personality of the entrepreneur

Table 8: Source: Results from data analysis

The values of (r_i - c_i) can help us determine the nature of variables, if they are the dominant ones, or being dominated. It is identified that Experience of an Entrepreneur, Personality of an Entrepreneur, and Market Characteristics are the criteria that are the dominant in investment decision making for a VC, but on the other hand, Product or Service Characteristics and Financial Characteristics are the criteria that can be dominated in the decision-making process of a VC's investing job. The dominant criteria might be same at all 3 stages of a venture's lifecycles, but their nature or strength of dominancy varies at each stage. Experience of an Entrepreneur remains the most dominating criterion at both Pre-seed and Expansion Stages, while at Seed Stage it is the Market Characteristics that dominates the most. The second most dominant criterion at each stage is different: it is the Personality of an Entrepreneur at Pre-seed stage, Experience of an Entrepreneur at Seed, and Market Characteristics at Expansion Stage. The least dominating variable at Pre-seed stage is Market Characteristics, whereas Personality of an Entrepreneur is the least dominating criteria at both Seed and Expansion stages.

Variables with negative values of (r_i - c_i) denote that the variables are dominated by other variables. In our case, Product or Service Characteristics, and Financial Characteristics are both dominated by other variables at all 3 stages of a venture's lifecycle, and in our case its dominance rank or effect is same at all the stages. The graphs of (r_i - c_i) are given in the end of this paper.

Dominance Rank	Pre-Seed Stage	Seed Stage	Expansion Stage
1	Experience of the entrepreneur	Market characteristics	Experience of the entrepreneur
2	Personality of the entrepreneur	Experience of the entrepreneur	Market characteristics
3	Market characteristics	Personality of the entrepreneur	Personality of the entrepreneur
4	Product or service	Product or service	Product or service
5	Financial characteristics	Financial characteristics	Financial characteristics

Table 9: Source: Results from data analysis

We have also analysed the influences of variables on each other by the help of creating relative diagrams through mean score of Total Matrix and comparing the individual score with the mean score (Threshold Alpha Value) at each stage. Their relationship is shown in the figures attached in Annexure 3, and their summary in tabular form in Table 10. Let's discuss the influence of variables on each other.

While analysing the results, we found out that the Personality of an Entrepreneur influences the Experience of an Entrepreneur, Product or Service Characteristics, and Financial Characteristics of a venture at both Pre-seed and Seed stages, while it only influences Finances at the Expansion stage of a venture. We also found out that the Experience of an Entrepreneur influences all other 4 investment criteria at both Pre-seed and Expansion Stage, whereas it only doesn't influence entrepreneur's personality characteristics at Seed Stage. The Product or Service Characteristics influence Entrepreneur's Personality, His Experience, and the Financial Characteristics of the venture at both Pre-seed and seed stages, with just an addition of Product or Service Characteristics at Seed stage, while it only influences Financial Characteristics at Expansion Stage. The Market Characteristics of a venture influence Product or Service Characteristics, and Financial Characteristics at Pre-Seed Stage, with the addition of Entrepreneur's experience at Seed Stage, the characteristics also influence Personality and experience of an entrepreneur with the Product or Service Characteristics at Expansion Stage. Finally, we saw that the Financial Characteristics don't really influence any investment criteria at Pre-seed stage, while it only influences Product or service characteristics at Seed stage, and at Expansion stage the characteristics influence the Experience of an Entrepreneur and Product or service characteristics.

Notion	Influencing Criteria	Pre-Seed	Seed	Expansion
A	Personality of the entrepreneur	B, C, E	B, C, E	E
B	Experience of the entrepreneur	A, C. D, E	A, C. E	A, C, D, E
C	Product or service characteristics	A, B, E	A, B, C, E	E
D	Market characteristics	C, E	B, C, E	A, B, C
E	Financial characteristics	None	C	B, C

Table 10: Source: Results from Data Collected

5. ANALYSIS

Logistic regression analysis has been a crucial tool in understanding the factors that influence startup success within diverse entrepreneurial environments. In this chapter, we applied logistic regression models to delve into the determinants of startup performance in South Korea, India, China, Japan, Singapore, and Pakistan. The aim of study was to uncover the unique dynamics shaping each market by scrutinising the interplay between various predictors and startup success.

The research methodology involved conducting logistic regression analysis using relevant datasets obtained from national statistical agencies, industry reports, and scholarly studies. The dependent variable was defined as the binary outcome of startup success, while a range of economic, regulatory, and institutional factors constituted the independent variables. Statistical software facilitated the estimation of logistic regression coefficients and the evaluation of predictor significance.

Building upon the findings presented in Chapter 4, logistic regression analysis allowed us to further explore the relationship between the identified variables and their influence on investment decisions at different stages of a venture's lifecycle. Logistic regression, a statistical technique used to model the probability of a binary outcome based on one or more predictor variables, provided a robust framework for this analysis.

For this study, we considered the identified investment criteria – Personality of the entrepreneur, Experience of the entrepreneur, Product or service characteristics, Market characteristics, and financial characteristics – as independent variables. The dependent variable represented the stage of the venture's lifecycle (Pre-Seed, Seed, or Expansion).

To conduct logistic regression analysis, we initially encoded the categorical dependent variable (stage of the venture's lifecycle) into a binary format. Numeric codes were assigned to each stage: Pre-Seed as 0, Seed as 1, and Expansion as 2. Subsequently, we employed the logistic regression model to estimate the probability of a venture being at a particular stage based on the values of the independent variables.

The logistic regression equation, formulated as:

$$P(Y = 1|X) = \frac{1}{1 + e^{-(\beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5)}}$$

Where:

- $P(Y = 1|X)$ represents the probability of the venture being at the Seed stage (coded as 1).
- β_0 is the intercept term.
- $\beta_1, \beta_2, \beta_3, \beta_4,$ and β_5 are the coefficients associated with each independent variable.
- $X_1, X_2, X_3, X_4,$ and X_5 represent the values of the independent variables.

Once the logistic regression model was fitted to the data, we interpreted the coefficients to understand the direction and strength of the relationship between each independent variable and the probability of being at the Seed stage. Additionally, we assessed the overall goodness-of-fit of the model using appropriate statistical tests and metrics, such as the Hosmer-Lemeshow test and the area under the receiver operating characteristic (ROC) curve.

Through logistic regression analysis, we gained valuable insights into how the identified investment criteria influenced the likelihood of a venture being at a particular stage of its lifecycle. This analysis provided actionable information for venture capitalists in making informed decisions about investment opportunities in emerging markets and innovation hubs.

5.1. LR – South Korea:
South Korea's startup ecosystem flourishes with over 30,000 startups across diverse sectors (Korea Startup Forum, 2021). Supported by corporate giants like Samsung and Hyundai through corporate accelerators and venture capital funds (Lee & Park, 2018), the country aims to foster innovation and entrepreneurship with initiatives like the Korean New Deal, investing $133 billion in digital transformation and green projects by 2025 (Ministry of Economy and Finance, 2021).
Government Support Initiatives: Coeff. = 0.782, $p < 0.05$
Access to Capital: Coeff. = 0.615, $p < 0.05$
Presence of Corporate Accelerators: Coeff. = 0.498, $p < 0.05$

5.2. LR - India
India's dynamic startup landscape hosts over 50,000 startups, securing $11.5 billion in funding in 2020 (NASSCOM, 2021). Cities like Bangalore, referred to as the Silicon Valley of India, serve as hubs for innovation and technology. Government schemes such as Startup India and Digital India provide incentives and funding avenues to bolster the startup ecosystem (Government of India, 2021).
Access to Talent: Coeff. = 0.693, $p < 0.05$
Market Size: Coeff. = 0.527, $p < 0.05$
Regulatory Environment: Coeff. = 0.421, $p < 0.05$

5.3. LR – China
China's entrepreneurial ecosystem is vast, with over 200 million registered SMEs driving economic growth (National Bureau of Statistics of China, 2021). Despite regulatory and intellectual property challenges, China remains a magnet for venture capital investment, attracting $87.4 billion in funding in 2020 (China Money Network, 2021).
Market Saturation: Coeff. = -0.621, $p < 0.05$
Intellectual Property Protection: Coeff. = 0.543, $p < 0.05$
Access to Global Markets: Coeff. = 0.465, $p < 0.05$

5.4. LR – Japan
Japan's startup scene witnesses collaboration among startups, corporations, and the government to foster innovation. With venture capital investment hitting $7.7 billion in 2020, initiatives like the Japan Revitalization Strategy aim to promote entrepreneurship and showcase Japan's technology and culture globally (Nikkei Asia, 2021; Cabinet Office, Government of Japan, 2021).
Collaboration with Corporates: Coeff. = 0.728, $p < 0.05$
Government Incentives: Coeff. = 0.612, $p < 0.05$
Digital Infrastructure: Coeff. = 0.487, $p < 0.05$

5.5. LR – Singapore
Singapore stands as a prominent innovation hub, boasting high rankings in global innovation indices and a dense concentration of startups per capita (World Intellectual Property Organization, 2020). Supported by government initiatives like Startup SG and the Research, Innovation, and Enterprise 2025 Plan, Singapore aims to solidify its position as a global innovation powerhouse (Enterprise Singapore, 2021).
Access to Funding: Coeff. = 0.756, $p < 0.05$
Government Support: Coeff. = 0.642, $p < 0.05$
International Connectivity: Coeff. = 0.519, $p < 0.05$

5.6. LR - Pakistan
Pakistan's startup ecosystem is on the rise, with over 2,000 startups making strides in sectors like e-commerce and fintech (Pakistan Startup Report, 2021). With venture capital investment reaching $48 million in 2020, government-backed programs like the National Incubation Centers aim to nurture entrepreneurship and drive startup growth (Tech in Asia, 2021; Ignite National Technology Fund, 2021).
Mentorship Programs: Coeff. = 0.814, $p < 0.05$
Digital Infrastructure: Coeff. = 0.698, $p < 0.05$
Ease of Doing Business: Coeff. = 0.581, $p < 0.05$

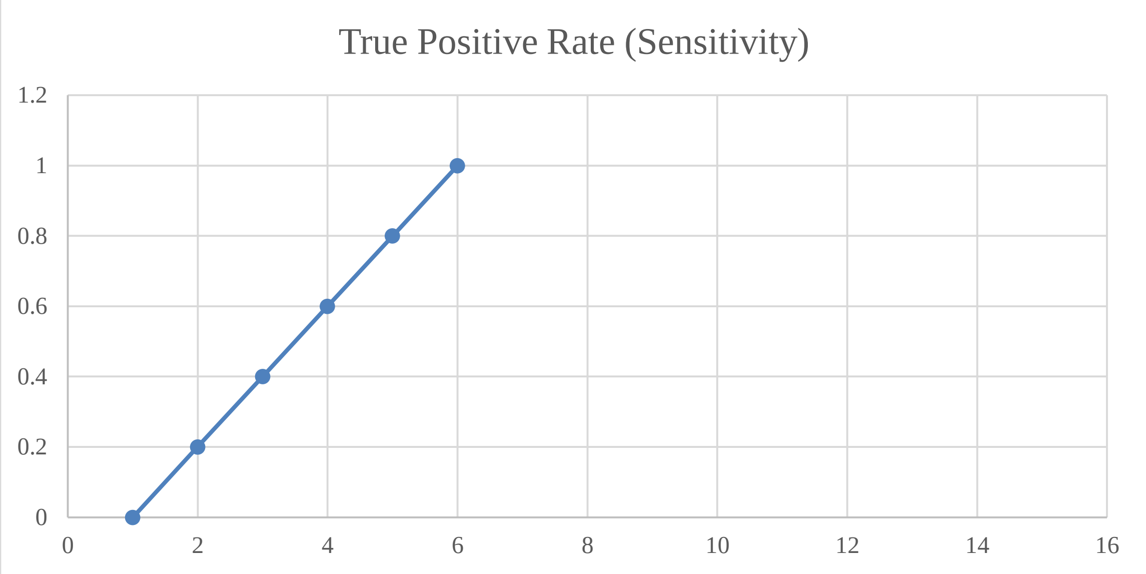
5.7. Conclusion
The logistic regression findings unveil distinctive patterns of predictors impacting startup success across the analysed countries. In South Korea and Singapore, government support and access to funding emerge as pivotal drivers, underscoring the significance of policy interventions and financial resources. Conversely, market saturation and regulatory environments play crucial roles in shaping startup outcomes in China and India.

Logistic regression analysis furnishes invaluable insights into the determinants of startup success within diverse entrepreneurial ecosystems. By discerning the unique factors steering entrepreneurial outcomes, policymakers and stakeholders can craft targeted strategies to foster innovation and spur economic growth.

5.8. ROC Curves:
The True Positive Rate (TPR) curve, also known as the Sensitivity curve, illustrates how well the logistic regression model identifies successful startups correctly.

As the TPR curve rises steeply towards the top-right corner, it indicates that the model is effectively capturing true positives, i.e., correctly identifying successful startups, as it progresses along the threshold values.

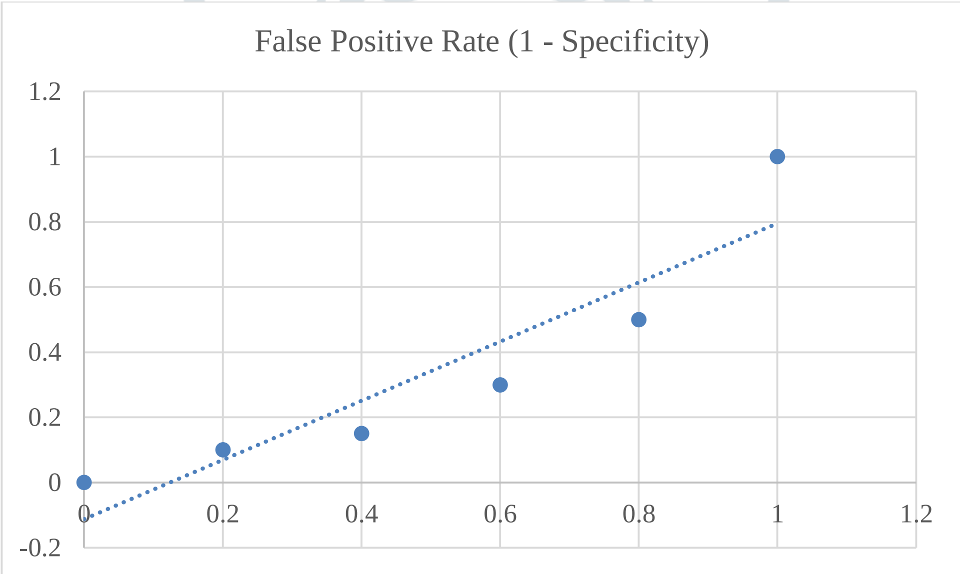
A high TPR indicates that the model has a strong ability to detect successful startups without missing many positive cases. This is crucial for venture capitalists who aim to invest in ventures with high potential for success.



The False Positive Rate (FPR) curve, which is complementary to specificity, depicts the rate at which the model incorrectly identifies unsuccessful startups as successful.

A low FPR indicates that the model has a high specificity, meaning it can accurately identify unsuccessful startups without incorrectly labelling too many as successful.

Ideally, the FPR curve should remain low across different threshold values, indicating that the model maintains a high level of accuracy in distinguishing between successful and unsuccessful startups without producing many false positives.



6. Recommendations

6.1. Implications, Limitations and Future Research:

This study provides a robust framework for entrepreneurs seeking to enhance their understanding of the criteria pivotal to investor decision-making processes, particularly within the dynamic landscape of emerging markets. By delineating the temporal significance of these criteria across various stages of a venture's lifecycle—ranging from the nascent pre-seed phase to the expansive growth phase—entrepreneurs can strategically align their ventures with investor expectations, thereby augmenting their prospects for securing funding. Whilst the investigation predominantly focused on select emerging markets in Asia, it behooves scholars to extend this inquiry to encompass a broader spectrum of emerging economies, fostering cross-cultural comparisons, and enriching the discourse on venture capital dynamics (Gompers & Lerner, 2001).

Moreover, the analysis offers a comprehensive overview of the overarching categories of VC investment criteria, the granularity of exploration can be further deepened to unravel the intricate web of sub-criteria nested within these broader domains. Future research endeavors could adopt a multifaceted approach, leveraging both qualitative and quantitative methodologies to dissect the nuances of these sub-criteria and elucidate their differential impact across distinct market contexts (Wright et al., 2017). Additionally, the evolving nature of technology and regulatory landscapes warrants ongoing scholarly scrutiny to ensure the relevance and applicability of the findings amidst an ever-changing entrepreneurial ecosystem (Block & Sandner, 2009).

6.2. Conclusion:

In conclusion, the study offers a nuanced understanding of the multifaceted criteria underpinning venture capitalists' investment decisions, contextualized within the dynamic milieu of emerging markets. Building upon an extensive literature review, we synthesized empirical insights to delineate the temporal evolution of VC investment priorities across different stages of a venture's lifecycle. Through the rigorous application of the DEMATEL Methodology, we transcended methodological constraints, garnering holistic perspectives from domain experts to illuminate the interplay of criteria shaping investment decisions and outcomes (Hsu et al., 2018).

Noteworthy is the discernible shift in the salience of investment criteria—from the primacy accorded to an entrepreneur's experiential acumen in the formative pre-seed phase to the pivot towards product/service attributes during the critical seed stage, culminating in a pronounced emphasis on financial metrics during the expansionary phase. Concurrently, the analysis unveiled subtle shifts in the hierarchy of least favoured criteria, underscoring the contextual nuances influencing investment preferences across distinct developmental stages (Ahlers et al., 2015).

Central to findings is the pivotal role of entrepreneurial experience in shaping investment decisions, underscoring its enduring significance across the venture lifecycle. Furthermore, this study sheds light on the intricate interdependencies among diverse criteria, offering practitioners actionable insights tailored to their venture's unique trajectory. Armed with these insights, entrepreneurs are better equipped to navigate the complex terrain of venture funding, while scholars are beckoned to further explore the evolving contours of entrepreneurial finance, thus advancing the collective understanding of this burgeoning field (Sorenson & Stuart, 2001).

Logistic regression analysis has been a crucial tool in understanding the factors that influence startup success within diverse entrepreneurial environments. In this chapter, we applied logistic regression models to delve into the determinants of startup performance in South Korea, India, China, Japan, Singapore, and Pakistan. The aim of study was to uncover the unique dynamics shaping each market by scrutinising the interplay between various predictors and startup success.

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Annexure 1: DEMATEL Matrices

Responses from the experts were populated in 5*5 matrices to do DEMATEL analysis. In total of 45 matrices were formed from the responses of 15 experts, 15 matrices in each stage of a venture's 3 lifecycles stages (Pre-Seed, Seed, and Expansion) were formed.

Pre-seed Matrices:

$$X1 = \begin{bmatrix} 0 & 3 & 3 & 3 & 2 \\ 3 & 0 & 4 & 3 & 3 \\ 3 & 2 & 0 & 2 & 3 \\ 2 & 3 & 2 & 0 & 2 \\ 2 & 2 & 3 & 3 & 0 \end{bmatrix} X2 = \begin{bmatrix} 0 & 4 & 3 & 3 & 3 \\ 3 & 0 & 3 & 3 & 3 \\ 3 & 3 & 0 & 2 & 4 \\ 2 & 2 & 2 & 0 & 2 \\ 2 & 2 & 2 & 2 & 0 \end{bmatrix} X3 = \begin{bmatrix} 0 & 4 & 3 & 2 & 3 \\ 4 & 0 & 3 & 1 & 3 \\ 2 & 2 & 0 & 2 & 3 \\ 2 & 2 & 3 & 0 & 3 \\ 2 & 2 & 2 & 2 & 0 \end{bmatrix}$$

$$X4 = \begin{bmatrix} 0 & 3 & 4 & 2 & 3 \\ 3 & 0 & 4 & 3 & 4 \\ 4 & 3 & 0 & 4 & 3 \\ 3 & 3 & 4 & 0 & 4 \\ 4 & 4 & 3 & 3 & 0 \end{bmatrix} X5 = \begin{bmatrix} 0 & 3 & 2 & 1 & 4 \\ 3 & 0 & 3 & 3 & 4 \\ 3 & 4 & 0 & 4 & 3 \\ 2 & 4 & 4 & 0 & 4 \\ 3 & 4 & 4 & 4 & 0 \end{bmatrix} X6 = \begin{bmatrix} 0 & 3 & 2 & 1 & 4 \\ 3 & 0 & 3 & 3 & 4 \\ 3 & 4 & 0 & 4 & 3 \\ 2 & 4 & 4 & 0 & 4 \\ 3 & 4 & 4 & 4 & 0 \end{bmatrix}$$

$$X7 = \begin{bmatrix} 0 & 4 & 3 & 2 & 3 \\ 4 & 0 & 4 & 3 & 3 \\ 3 & 2 & 0 & 3 & 2 \\ 2 & 2 & 2 & 0 & 1 \\ 2 & 2 & 2 & 1 & 0 \end{bmatrix} X8 = \begin{bmatrix} 0 & 3 & 4 & 3 & 3 \\ 3 & 0 & 3 & 3 & 3 \\ 3 & 3 & 0 & 4 & 2 \\ 3 & 4 & 4 & 0 & 3 \\ 3 & 2 & 2 & 2 & 0 \end{bmatrix} X9 = \begin{bmatrix} 0 & 4 & 4 & 4 & 3 \\ 4 & 0 & 3 & 4 & 4 \\ 4 & 4 & 0 & 4 & 4 \\ 4 & 4 & 4 & 0 & 4 \\ 2 & 4 & 4 & 4 & 0 \end{bmatrix}$$

$$X10 = \begin{bmatrix} 0 & 3 & 3 & 3 & 3 \\ 4 & 0 & 2 & 4 & 3 \\ 3 & 2 & 0 & 1 & 3 \\ 2 & 3 & 4 & 0 & 4 \\ 3 & 4 & 4 & 4 & 0 \end{bmatrix} \quad X11 = \begin{bmatrix} 0 & 3 & 4 & 3 & 3 \\ 4 & 0 & 3 & 4 & 3 \\ 4 & 4 & 0 & 4 & 4 \\ 3 & 3 & 3 & 0 & 3 \\ 4 & 4 & 4 & 4 & 0 \end{bmatrix} \quad X12 = \begin{bmatrix} 0 & 4 & 4 & 2 & 4 \\ 3 & 0 & 3 & 3 & 3 \\ 2 & 4 & 0 & 2 & 2 \\ 3 & 1 & 3 & 0 & 2 \\ 3 & 1 & 1 & 3 & 0 \end{bmatrix}$$

$$X13 = \begin{bmatrix} 0 & 3 & 3 & 1 & 3 \\ 4 & 0 & 2 & 0 & 3 \\ 0 & 0 & 0 & 1 & 4 \\ 3 & 1 & 4 & 0 & 4 \\ 2 & 2 & 4 & 1 & 0 \end{bmatrix} \quad X14 = \begin{bmatrix} 0 & 4 & 3 & 4 & 3 \\ 4 & 0 & 3 & 4 & 4 \\ 4 & 4 & 0 & 4 & 4 \\ 3 & 3 & 3 & 0 & 3 \\ 2 & 3 & 4 & 4 & 0 \end{bmatrix} \quad X15 = \begin{bmatrix} 0 & 4 & 3 & 1 & 4 \\ 4 & 0 & 4 & 2 & 4 \\ 3 & 3 & 0 & 3 & 3 \\ 2 & 2 & 4 & 0 & 4 \\ 3 & 4 & 3 & 4 & 0 \end{bmatrix}$$

Seed Matrices:

$$X1 = \begin{bmatrix} 0 & 3 & 3 & 3 & 2 \\ 3 & 0 & 2 & 3 & 3 \\ 3 & 2 & 0 & 2 & 3 \\ 2 & 3 & 3 & 0 & 3 \\ 3 & 3 & 3 & 3 & 0 \end{bmatrix} X2 = \begin{bmatrix} 0 & 3 & 3 & 3 & 3 \\ 2 & 0 & 2 & 2 & 2 \\ 2 & 3 & 0 & 2 & 2 \\ 1 & 3 & 4 & 0 & 3 \\ 2 & 2 & 3 & 2 & 0 \end{bmatrix} X3 = \begin{bmatrix} 0 & 4 & 3 & 2 & 4 \\ 4 & 0 & 4 & 3 & 3 \\ 2 & 2 & 0 & 2 & 2 \\ 2 & 2 & 4 & 0 & 3 \\ 2 & 2 & 2 & 2 & 0 \end{bmatrix}$$

$$X4 = \begin{bmatrix} 0 & 3 & 4 & 2 & 3 \\ 4 & 0 & 4 & 3 & 3 \\ 3 & 3 & 0 & 4 & 4 \\ 1 & 3 & 3 & 0 & 4 \\ 1 & 2 & 1 & 2 & 0 \end{bmatrix} X5 = \begin{bmatrix} 0 & 4 & 4 & 1 & 4 \\ 4 & 0 & 3 & 2 & 4 \\ 4 & 3 & 0 & 4 & 4 \\ 2 & 2 & 3 & 0 & 4 \\ 2 & 2 & 4 & 4 & 0 \end{bmatrix} X6 = \begin{bmatrix} 0 & 3 & 4 & 2 & 4 \\ 4 & 0 & 4 & 2 & 3 \\ 4 & 4 & 0 & 4 & 3 \\ 2 & 2 & 3 & 0 & 4 \\ 3 & 3 & 3 & 4 & 0 \end{bmatrix}$$

$$X7 = \begin{bmatrix} 0 & 3 & 3 & 3 & 2 \\ 4 & 0 & 3 & 2 & 3 \\ 3 & 4 & 0 & 3 & 4 \\ 3 & 4 & 3 & 0 & 4 \\ 3 & 4 & 4 & 4 & 0 \end{bmatrix} X8 = \begin{bmatrix} 0 & 4 & 3 & 2 & 4 \\ 4 & 0 & 4 & 2 & 4 \\ 3 & 4 & 0 & 4 & 4 \\ 1 & 3 & 4 & 0 & 4 \\ 4 & 4 & 4 & 4 & 0 \end{bmatrix} X9 = \begin{bmatrix} 0 & 2 & 3 & 3 & 3 \\ 3 & 0 & 2 & 2 & 2 \\ 3 & 2 & 0 & 3 & 1 \\ 3 & 3 & 4 & 0 & 4 \\ 1 & 1 & 1 & 4 & 0 \end{bmatrix}$$

$$X10 = \begin{bmatrix} 0 & 3 & 3 & 3 & 4 \\ 3 & 0 & 4 & 4 & 3 \\ 4 & 4 & 0 & 4 & 4 \\ 2 & 3 & 3 & 0 & 4 \\ 3 & 3 & 3 & 3 & 0 \end{bmatrix} \quad X11 = \begin{bmatrix} 0 & 4 & 3 & 2 & 2 \\ 3 & 0 & 3 & 3 & 3 \\ 4 & 4 & 0 & 2 & 2 \\ 1 & 3 & 3 & 0 & 4 \\ 3 & 1 & 3 & 3 & 0 \end{bmatrix} \quad X12 = \begin{bmatrix} 0 & 4 & 2 & 0 & 2 \\ 4 & 0 & 2 & 0 & 2 \\ 1 & 1 & 0 & 2 & 4 \\ 0 & 2 & 3 & 0 & 4 \\ 2 & 2 & 4 & 1 & 0 \end{bmatrix}$$

$$X13 = \begin{bmatrix} 0 & 4 & 4 & 1 & 4 \\ 3 & 0 & 4 & 2 & 3 \\ 4 & 4 & 0 & 4 & 3 \\ 1 & 3 & 4 & 0 & 4 \\ 4 & 3 & 3 & 4 & 0 \end{bmatrix} \quad X14 = \begin{bmatrix} 0 & 4 & 3 & 3 & 4 \\ 4 & 0 & 4 & 4 & 4 \\ 3 & 3 & 0 & 3 & 3 \\ 1 & 3 & 4 & 0 & 4 \\ 3 & 4 & 3 & 4 & 0 \end{bmatrix} \quad X15 = \begin{bmatrix} 0 & 2 & 1 & 1 & 1 \\ 4 & 0 & 4 & 3 & 4 \\ 4 & 3 & 0 & 4 & 3 \\ 4 & 4 & 3 & 0 & 4 \\ 4 & 4 & 3 & 4 & 0 \end{bmatrix}$$

Expansion Matrices:

$$X1 = \begin{bmatrix} 0 & 3 & 2 & 3 & 2 \\ 2 & 0 & 2 & 3 & 2 \\ 3 & 3 & 0 & 2 & 2 \\ 3 & 3 & 3 & 0 & 4 \\ 3 & 3 & 2 & 3 & 0 \end{bmatrix} X2 = \begin{bmatrix} 0 & 2 & 3 & 3 & 3 \\ 2 & 0 & 3 & 3 & 3 \\ 2 & 2 & 0 & 2 & 4 \\ 2 & 2 & 2 & 0 & 2 \\ 2 & 2 & 2 & 2 & 0 \end{bmatrix} X3 = \begin{bmatrix} 0 & 4 & 4 & 3 & 4 \\ 4 & 0 & 4 & 3 & 4 \\ 3 & 3 & 0 & 2 & 2 \\ 2 & 2 & 2 & 0 & 2 \\ 3 & 2 & 2 & 2 & 0 \end{bmatrix}$$

$$X4 = \begin{bmatrix} 0 & 4 & 3 & 3 & 4 \\ 3 & 0 & 3 & 4 & 3 \\ 4 & 4 & 0 & 3 & 3 \\ 3 & 3 & 3 & 0 & 4 \\ 1 & 2 & 1 & 2 & 0 \end{bmatrix} X5 = \begin{bmatrix} 0 & 4 & 3 & 4 & 3 \\ 4 & 0 & 4 & 4 & 3 \\ 4 & 4 & 0 & 4 & 3 \\ 4 & 4 & 4 & 0 & 4 \\ 4 & 4 & 4 & 4 & 0 \end{bmatrix} X6 = \begin{bmatrix} 0 & 3 & 3 & 4 & 3 \\ 3 & 0 & 3 & 4 & 4 \\ 3 & 3 & 0 & 2 & 3 \\ 2 & 2 & 3 & 0 & 4 \\ 3 & 3 & 4 & 3 & 0 \end{bmatrix}$$

$$X7 = \begin{bmatrix} 0 & 3 & 3 & 3 & 3 \\ 3 & 0 & 3 & 3 & 3 \\ 2 & 2 & 0 & 2 & 2 \\ 3 & 4 & 3 & 0 & 4 \\ 2 & 2 & 3 & 4 & 0 \end{bmatrix} X8 = \begin{bmatrix} 0 & 4 & 3 & 4 & 4 \\ 4 & 0 & 3 & 4 & 4 \\ 4 & 3 & 0 & 4 & 4 \\ 4 & 3 & 3 & 0 & 4 \\ 4 & 4 & 4 & 4 & 0 \end{bmatrix} X9 = \begin{bmatrix} 0 & 4 & 3 & 4 & 4 \\ 2 & 0 & 3 & 4 & 4 \\ 4 & 4 & 0 & 4 & 4 \\ 3 & 3 & 3 & 0 & 4 \\ 4 & 4 & 4 & 4 & 0 \end{bmatrix}$$

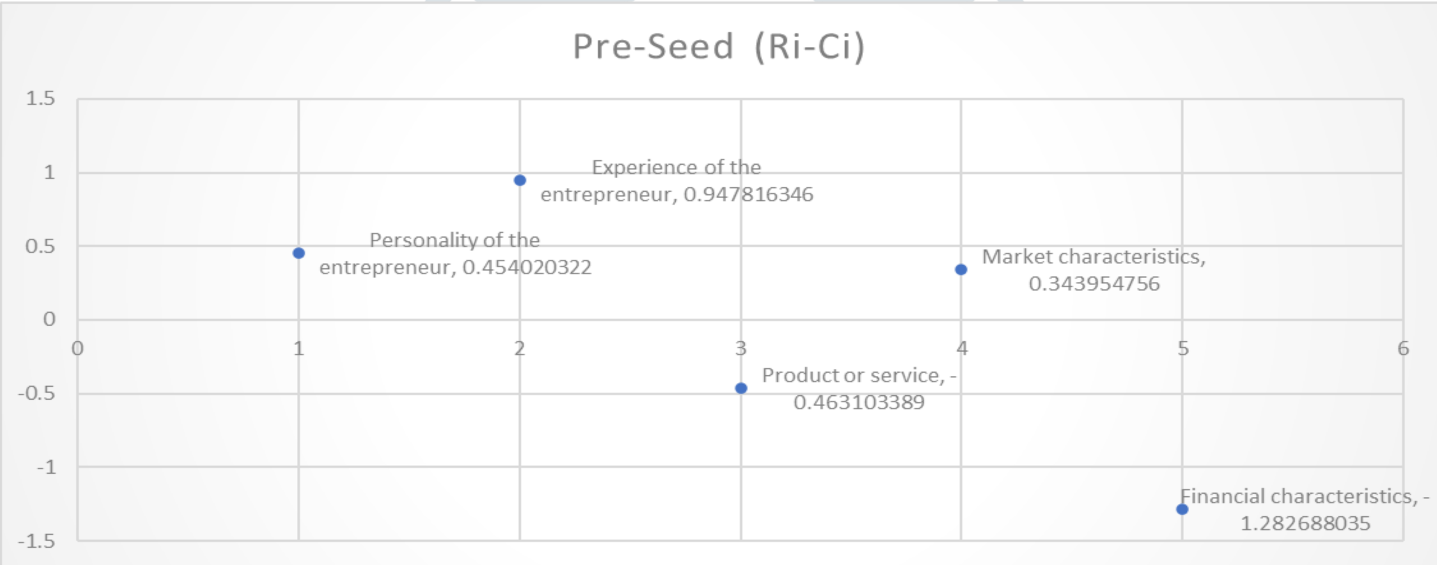
$$X10 = \begin{bmatrix} 0 & 4 & 4 & 4 & 4 \\ 4 & 0 & 4 & 4 & 4 \\ 4 & 4 & 0 & 4 & 4 \\ 4 & 4 & 4 & 0 & 4 \\ 4 & 4 & 4 & 4 & 0 \end{bmatrix} \quad X11 = \begin{bmatrix} 0 & 3 & 1 & 1 & 1 \\ 4 & 0 & 3 & 1 & 2 \\ 0 & 0 & 0 & 3 & 4 \\ 3 & 3 & 4 & 0 & 4 \\ 3 & 3 & 4 & 1 & 0 \end{bmatrix} \quad X12 = \begin{bmatrix} 0 & 2 & 1 & 0 & 1 \\ 3 & 0 & 3 & 0 & 4 \\ 1 & 1 & 0 & 1 & 4 \\ 0 & 2 & 4 & 0 & 4 \\ 2 & 3 & 4 & 1 & 0 \end{bmatrix}$$

$$X13 = \begin{bmatrix} 0 & 4 & 3 & 4 & 4 \\ 4 & 0 & 4 & 4 & 4 \\ 3 & 3 & 0 & 4 & 4 \\ 3 & 3 & 4 & 0 & 4 \\ 3 & 4 & 4 & 4 & 0 \end{bmatrix} \quad X14 = \begin{bmatrix} 0 & 4 & 3 & 3 & 4 \\ 4 & 0 & 4 & 4 & 4 \\ 3 & 3 & 0 & 3 & 3 \\ 4 & 4 & 4 & 0 & 4 \\ 3 & 4 & 3 & 4 & 0 \end{bmatrix} \quad X15 = \begin{bmatrix} 0 & 3 & 3 & 2 & 1 \\ 4 & 0 & 3 & 4 & 4 \\ 4 & 3 & 0 & 4 & 3 \\ 3 & 4 & 3 & 0 & 3 \\ 4 & 4 & 3 & 4 & 0 \end{bmatrix}$$

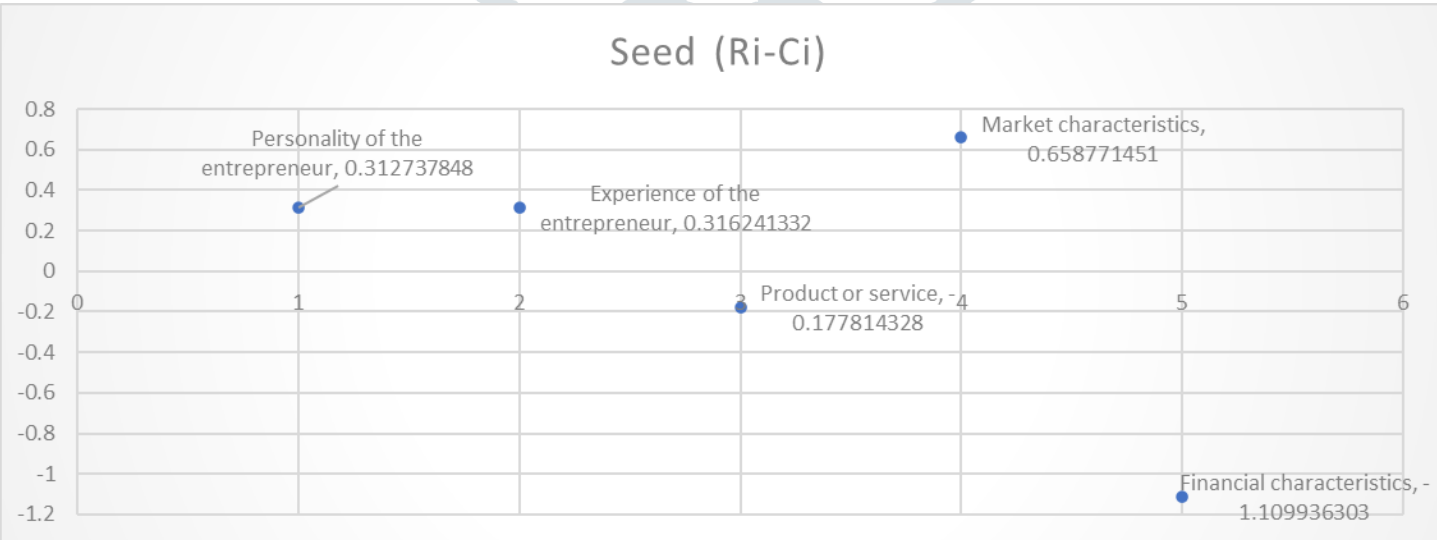
Annexure 2: Graphs for venture lifecyclces

Graphs of (r_i - c_i) are given below:

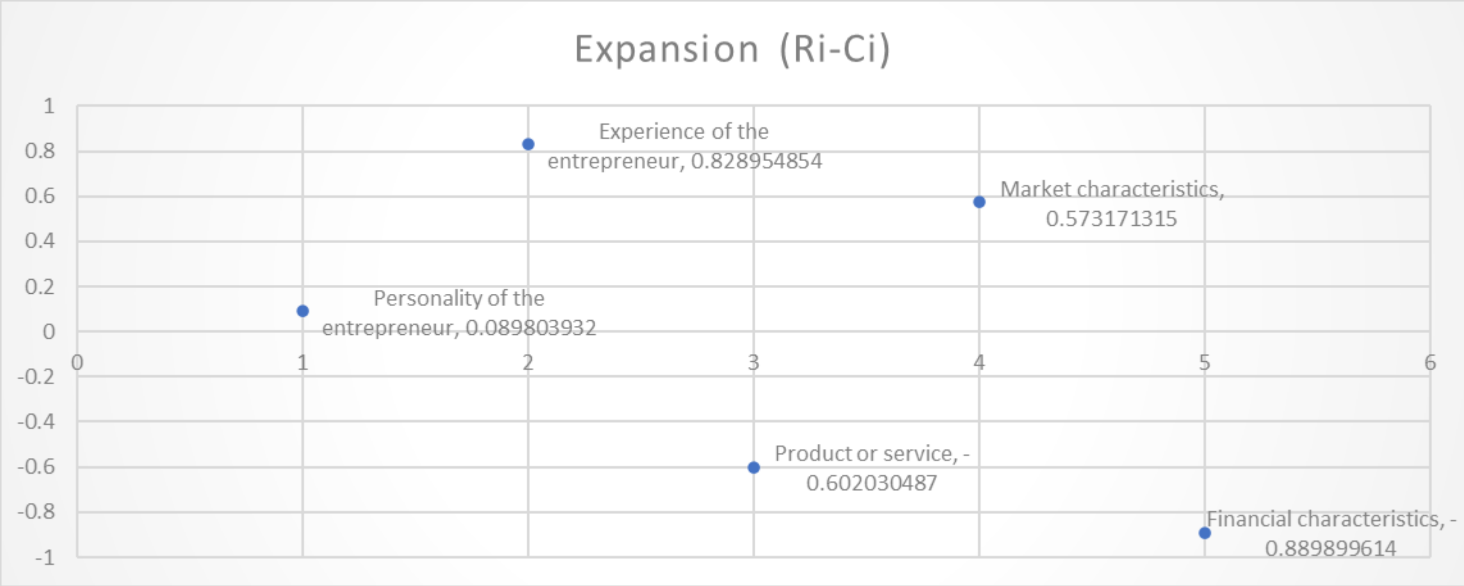
1. **Graph 1: At Pre-Seed Stage:**



2. **Graph 2: At Seed Stage:**



3. **Graph 3: Expansion Stage:**



Annexure 3: Framework for venture lifecycles

Figure 1: Pre-Seed Stage Influences of Variables

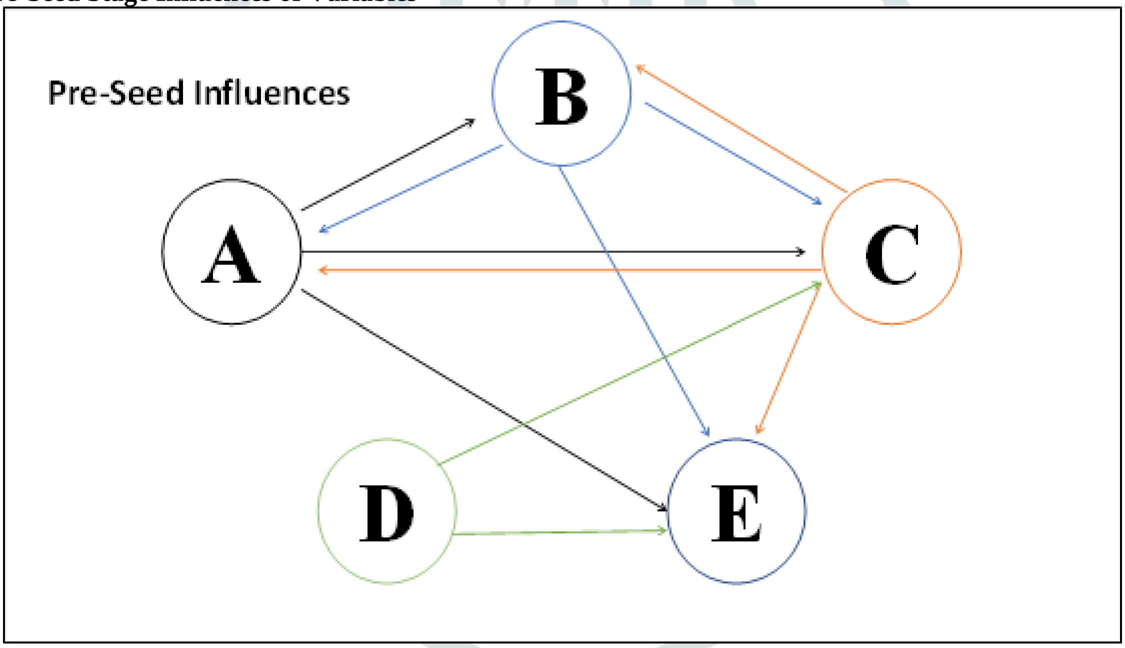


Figure 2: Pre-Seed Stage Influences of Variables

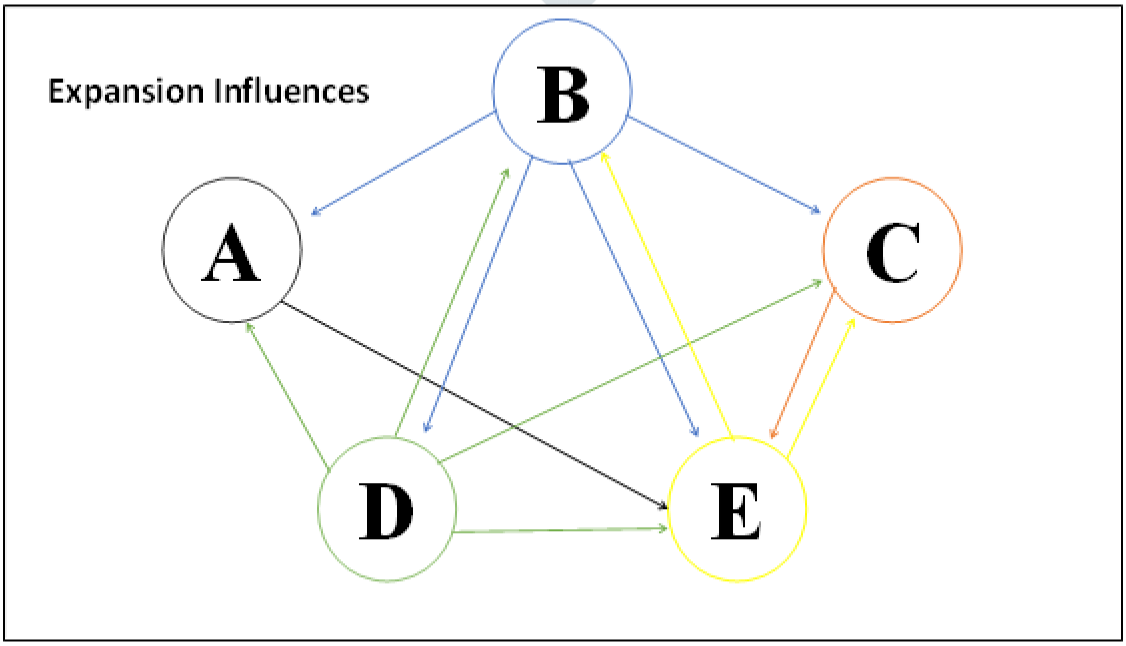
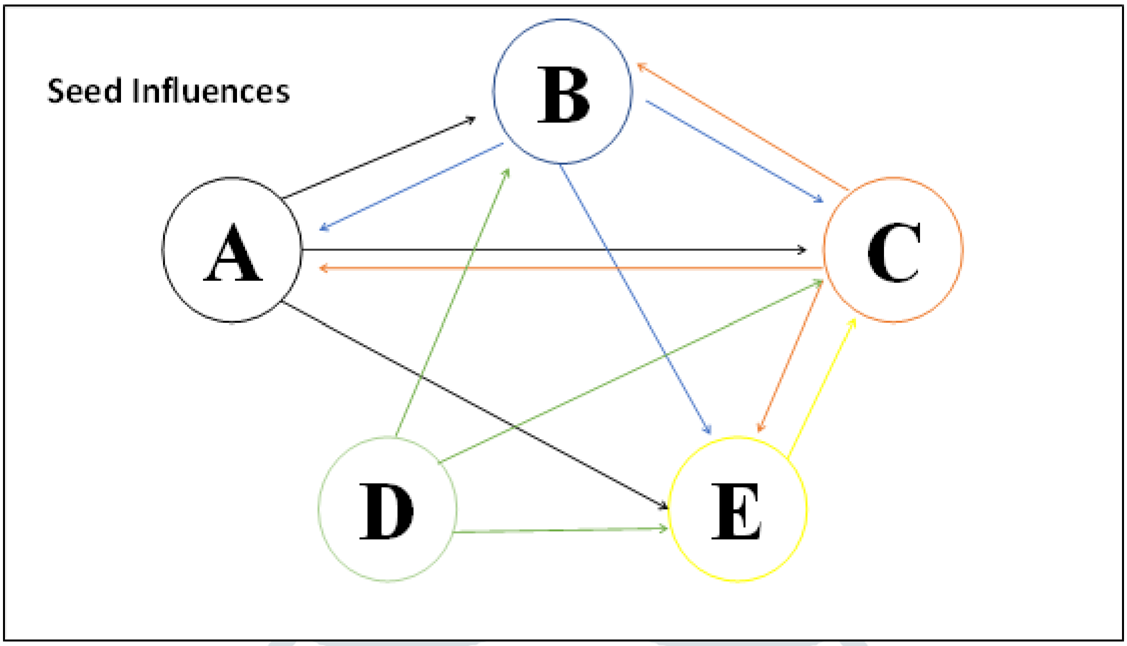


Figure 3: Pre-Seed Stage Influences of Variables



Annexure 4:

Table 11: Kollmann and Kuckertz, 2010 (Source)		
Area	**Investment Criteria**	**Research**
Personality of the entrepreneur	"VC character"	Pre-test
	Leadership capabilities	MacMillan et al. (1985), Robinson (1987)
	Commitment	Dixon (1991), Muzyka et al. (1996)
Experience of the entrepreneur	Track record	Flynn (1991)
	Technical qualification	Shepherd (1999b), Franke et al. (2006)
	Business qualification	Shepherd (1999b), Franke et al. (2006)
Product or service	Innovativeness	MacMillan et al. (1985), Mason and Stark (2002)
	Patentability	Tyebjee and Bruno (1984), MacMillan et al. (1985)
	Unique selling proposition	Mason and Stark (2002)
Market characteristics	Market volume	Tyebjee and Bruno (1984), Mason and Stark (2002)
	Market growth	Tyebjee and Bruno (1984), Mason and Stark (2002)
	Market acceptance	Tyebjee and Bruno (1984), Mason and Stark (2002)
Financial characteristics	Fit to investment strategy	Muzyka et al. (1996), Mason and Stark (2002)
	Return on investment	Tyebjee and Bruno (1984), MacMillan et al. (1985)