

Understanding Growth Barriers for IT Startups in Kerala: A Quantitative SEM Study

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Abstract:

The Indian startup ecosystem has witnessed significant growth, establishing itself as a global leader in entrepreneurial innovation. Kerala, recognized for its progressive policies, high literacy rates, and digital proficiency, has emerged as a prominent hub for information technology (IT) startups. This study examines the growth barriers faced by IT startups in Kerala, using Structural Equation Modelling (SEM) to analyse data collected from 288 respondents. The study identifies key factors impeding growth, such as regulatory challenges, Infrastructure challenges, and Talent shortage. By integrating literature-backed hypotheses and rigorous quantitative techniques, the research provides actionable insights for policymakers and entrepreneurs. The findings provide actionable insights into the operational realities of IT startups in Kerala and propose strategies to foster their long-term success..

Keywords: Startups , Regulatory challenges, Infrastructure challenges , Talent shortage

1. Introduction

The Indian startup context has grown tremendously over the past few years and currently, ranks amongst the most active globally. There is ample governmental encouragement, the emerging vitality of private capital, and a culture of startups that supports it. Into this larger story, Kerala has come to be recognized as a leading IT startup destination. Famously liberal and progressive, with a focus on education, digital proficiency and technology implementation, Kerala remains the perfect breeding ground for information technology startups. The state has committed resources to key propositions of growth to support the burgeoning entrepreneurial class and technological invention which includes the Kerala Startup Mission as well as technology parks, incubation and accelerator centers among others.

But, even in Kerala which has all the supporting policies and infrastructure for IT startups are plagued by several challenges that hinders their growth, expansion and sustainability. From this viewpoint, they manifest in the form of sore financial issues including lack of funds for venture capital and loans, rigid compliance requirements and unclear policies as well. Further, competitors' pressure in IT business, is another problem that requires extra effort to attract clients and to build new offers. HR issues such as talent acquisition and Maintenance of quality human capital add onto this issue.

This paper aims at examining these growth barriers so as to give analytical insight into the difficulties encountered by IT startups in Kerala. Due to the usage of a quantitative research methodology when analysing the data gathered from startup founders and key stakeholders, it is possible to point out the major factors that contribute to their stagnation. Like in many

other parts of the globe, Malayalam startups continue to face great challenges in raising enough capital to meet operational, growth, and development needs. Restricted Availability of Angel Investors, Venture Capitalists and Institutional Investors lead to resource scarcity that leads to availing alternative methods such as bootstrapping, family, and friends funding. However, it is pertinent to note that even in Kerala such policies facilitate that deed, managing complicated regulations are still a bane for startups. Sophisticated approval procedures, vague tax regulations, and bureaucratic red tape make an environment even more challenging for budding businessmen and women. The IT industry is cut-throat competitive whether on a domestic or an international platform. Challenges include gaining initial access to a market, challenging with incumbents, and general reach out to their targeted audience for startups in Kerala.

There is a high density of skilled labour migration in Kerala and a lack of local talent for niche positions is a major problem here. Small businesses have challenges of putting together teams that have the right talent and competency for business expansion. Thus, this research seeks to identify the causes of these barriers and their efficiency in preventing IT startups from achieving scalable growth within a quantitative and qualitative framework. In line with the objectives of the study, the hypotheses developed from literature and empirical literature are tested using Structural Equation Modeling (SEM). Finally, this research shows a way forward on in how these challenges can be mitigated as pushed out in the recommendations section. Consequently, it seeks to assist in designing specific policies to encourage innovative national stakeholders, improve the entrepreneur environment, and promote Kerala as a top location for IT startup firms in India. This endeavor is central to the current growth strategy of the state and also basically links up with the other paramount strategic agenda of the country, which is the support of growth of new, competitive companies.

2. Literature Review for Hypotheses Development

The four major sources of operational constraints include: access of capital that is considered to be most crucial by the IT start-ups in Kerala. Shahbaz et al. (2023) found that the constraints of little access to venture capital and seed funding were still pointed out in emerging economies as the significant challenge. Most startup companies fail to get the required capital at the initial stage, and this triggers financial vulnerability that limits growth. In general, Haider (2024) prescribed a revolutionary feature of FinTech solutions through noticing how novel financial platforms afford other sources of finance, including crowdfunding and P2P financing, among others, that might assist startups to address traditional funding obstacles. In their study done in 2022, the authors Bhagat and Singh recommended that most of the new ventures should be supported by government sponsored financial schemes with low likelihood of risks especially where such ventures are in the developmental stage in an entrepreneurial ecosystem. Likewise, Aggarwal and Pradhan (2023) examine the financial constraints as a major challenge to the growth of start-ups in India and call for formulated policies for attracting fund. Kumar et al. (2022) pointed out that the problem of high interest rates on loans and poor availability of risk capital is especially acute in Kerala, which only aggravates funding problems for startups.

Legal hurdles are one of the most cumbersome realities faced by new IT ventures in Kerala as most of the markets here come with complicated regulations and an elongated approval procedure. Mitra and Bose (2023) have discussed these regulations and it is understood how different compliance challenges can become the reasons for less growth. Kerala startups also meet extra challenges according to Varghese et al. (2022), who pointed out inefficiencies in the bureaucratic process that inhibit small businesses from benefiting from government programmes. According to Joseph et al. (2023), these challenges hit IT startups especially hard given the industry's dynamism, and that there should be flexible regulations. Singh and Kumar (2022) found the regulatory fragmentation as an issue in India through which matters including taxation or labor laws becomes ambiguous for startups. In order to address these problems, Desai et al. (2023) proposed that one of the necessary measures should involve digitalisation of regulatory approval for operation- enhancing efficiency of the technology-driven startups.

The cut throat competition that has been observed in the IT sector results in tough times which are not easy for the new comer startups in the Kerala. Ramesh and Kannan (2023) looked at how excess demand pressures the startups to look for differentiation and operate under the niche markets. This is especially true in the context of the new entrants competition which, as Gupta & Thomas demonstrated, is tough for startups who can barely get noticed by potential clients. Especially, Mohan et al. (2023) analysed only Kerala, where small startups have problems with the larger competitors with more significant budget and resources. According to Patil and Sinha (2023), these are some of the challenges that need to be addressed and emphasized that startups need to employ different ways of marketing their product, one way being what they

call as the unique selling proposition. Also, Mathew et al. (2023) revealed that the issue of escalating global players penetrating local markets, which amount to increasing hurdles for small-scale IT startups to establish themselves.

The major problem of staffing faced by IT startups in Kerala makes up a serious concern as noted by Nair and Pillai (2023) these professionals are borrowed when available, and the issue of brain drain still persists where talented employees are relocating to city based locations such as Bengaluru. This helps minimize the number of qualified talents available to startups in Kerala. D'Souza and Rao (2022) noticed that there was a lack of workers with proper expertise in the new areas of IT corresponding to synthetic intelligence and blockchain makes recruitment even more difficult. Paul et al. (2023) also noted that due to a lack of funds, most startups still cannot be able to match the big industries/multinationals in terms of remuneration occasioned by their inability to offer competitive wages and remunerations hence the problem of human resource turnover. The study by Sharma & Kalyani Iyer (2022) discusses mismatches between the coursework taught in colleges and requirements of corporate workplaces: a majority of start-ups lacks proper education and development of its employees. George et al. (2023) have suggested that there should be an increased working relationship between the startups and institutions for better talent acquisition hence a better preparation of the workforce.

The IT startup industry needs supportive infrastructure and a strong ecosystem, but unfortunately, Kerala lacks them in significant measure. Technology parks and incubators, according to Varghese et al. (2023), are beneficial when available but scarce when growth is threatened. Raj et al. (2022) also found high rental costs and absence of cheap co-working space for startups as the other challenges in other small cities of Kerala. Mohan and Joseph (2023) stressed the need for rationalising plans regarding mentorship and enhancing the funding for the startup ecosystem. The study done by Sharma et al. (2023) which discussed about Kerala's ecosystem enabler like KSUM found that it still lacks attention to the storage and communication among rural and semi urban start up entrepreneurs. Last, but not least, Nambiar et al. (2022) suggested improving digital connectivity, including broadband connectivity and devices to increase the Startup Kerala's ability to expand the exposure to foreign markets for S2K startups located in Kerala.

These detailed are essential in developing broad understanding of what make it difficult for IT startups in Kerala to thrive and set the platform for necessary interventions that can lead to sustainable IT startups.

Hypothesis

H1: Infrastructure challenges significantly impact perceived growth challenges.

H2: Talent shortage significantly influences perceived growth challenges.

H3: Regulatory barriers significantly contribute to perceived growth challenges.

3. Research Methodology

The study collected a total of 288 responses from IT startup founders and key stakeholders in Kerala using purposive sampling, a method chosen to specifically target individuals with relevant insights into the challenges faced by startups. A structured questionnaire served as the primary tool for data collection, carefully designed based on validated scales from previous studies to ensure reliability and relevance. The instrument included comprehensive items targeting key dimensions such as financial constraints, regulatory challenges, market competition, human resource issues, and infrastructure support. Each item was measured using a 5-point Likert scale, where responses ranged from 1 (strongly disagree) to 5 (strongly agree), allowing for nuanced feedback on the perceived severity of these challenges.

Following data collection, the dataset underwent rigorous screening to address missing values and identify outliers.

Confirmatory Factor Analysis (CFA) was conducted to validate the measurement model, assessing the reliability and validity of the constructs. This step involved verifying factor loadings, composite reliability, and average variance extracted (AVE) to confirm that the constructs were well-defined and could be effectively used in structural modeling.

The final analysis employed Structural Equation Modeling (SEM), a robust statistical technique used to test the hypothesized relationships between identified growth barriers and the performance of IT startups. SEM enabled the study to model complex interdependencies between variables, providing insights into how financial constraints, regulatory

challenges, market competition, human resource issues, and infrastructure limitations collectively influence the growth trajectory of startups in Kerala.

4. Data Analysis and Results

4.1 Demographic Information

Demographic Variable	Category	Frequency	Percentage
Gender	Male	192	66.7%
	Female	96	33.3%
Age	Below 30	104	36.1%
	30–40	134	46.5%
	Above 40	50	17.4%
Experience in IT Industry	Less than 5 years	132	45.8%
	5–10 years	96	33.3%
	Above 10 years	60	20.9%
Company Size (Employees)	Less than 10	120	41.7%
	10–50	108	37.5%
	More than 50	60	20.8%

The demographic data reveals important insights about the participants in the study. Regarding gender, a majority of the respondents were male, comprising 66.7% (192 individuals) of the sample, while females represented 33.3% (96 individuals). In terms of age distribution, the largest group falls within the 30–40 years category, accounting for 46.5% (134 respondents), followed by 36.1% (104 individuals) who are below 30 years of age, and 17.4% (50 participants) who are above 40 years. The experience level in the IT industry shows that 45.8% (132 respondents) have less than 5 years of experience, 33.3% (96 individuals) have between 5 to 10 years of experience, and 20.9% (60 participants) have more than 10 years of experience. When looking at the company size, 41.7% (120 respondents) work in companies with fewer than 10 employees, 37.5% (108 individuals) belong to companies with 10 to 50 employees, and 20.8% (60 respondents) are employed in companies with more than 50 employees. This demographic breakdown provides a clear view of the sample's composition in terms of gender, age, experience, and company size, offering a foundation for understanding the context of the study's findings.

4.2 Data Screening

4.2.1 Missing values: From 300 questionnaire, the researcher got 290 returned responses, the missing for two or three constructs were replaced using mean of the series. After removing incomplete responses 288 was finalized for data analysis.

4.2.2 Normality: The analysis of the collected data for outliers and normality was performed using kurtosis and skewness. The research referenced the work by Hair et al. (2010) for the interpretation of normality values. Table 2 indicates that the skewness and kurtosis values fall under the cutoff threshold of +2 to -2. Moreover, the standard deviations for all items exceeded 0.5, so confirming that the data is normally distributed.

4.2.3 Linearity and Multicollinearity: The relationships between the observed variables were tested for linearity, as SEM assumes linear relationships between constructs. Scatterplots were inspected, and correlation matrices were analyzed to confirm the linear nature of relationships. Multicollinearity was assessed using the Variance Inflation Factor (VIF), and no values exceeded the threshold of 5, indicating that multicollinearity was not a concern.

4.3 Exploratory Factor Analysis

Prior to performing the analysis, sample adequacy was assessed using the Kaiser-Meyer-Olkin (KMO) test. The KMO statistic yielded a value of 0.900, which is above the recommended cutoff of 0.60, confirming that the sample was sufficient for factor analysis. Additionally, the Bartlett's test of sphericity was significant at the 1% level, further supporting the appropriateness of running the EFA. The EFA was performed using principal component analysis with varimax rotation.

Based on the criterion of Eigenvalues greater than 1, four factors were extracted, explaining a total variance of 77.99%, indicating a good level of explanation.

Table 2: Descriptives, Scale Items and Factor Loadings

		Loadings	Mean	Standard deviation	Skewness	Kurtosis	VIF
Infrastructure Challenges	Q1	.866	3.35	.808	-.114	.161	1.419
	Q2	.766	3.20	.755	-.101	1.582	
	Q3	.845	3.40	.794	-.086	.347	
	Q4	.742	3.28	.739	.013	1.317	
Talent shortage	Q5	.842	3.28	.859	-.469	-.677	1.358
	Q6	.788	3.46	1.015	-.439	-.283	
	Q7	.862	3.34	.989	-.116	-.656	
	Q8	.817	3.35	.917	-.371	-.416	
Regulatory barriers	Q9	.888	3.35	.973	.313	-.010	1.401
	Q10	.780	3.21	.769	.181	1.107	
	Q11	.769	3.15	.757	-.062	1.744	
	Q12	.870	3.32	.928	.238	.262	
Perceived growth challenges	Q13	.729	3.10	.747	.239	1.060	-
	Q14	.827	3.25	.705	.320	1.132	
	Q15	.810	3.20	.758	-.119	1.269	
	Q16	.794	3.13	.716	.203	1.111	

Source: Primary survey

4.4 Confirmatory factor analysis

The validity and reliability tests of the constructs were determined using Confirmatory Factor Analysis (CFA). The reliability of the constructs was confirmed by CR values, AVE was used to examine the convergent validity of the constructs, while the discriminant validity was tested by using MSV. Hair et al. (2010) noted that for a construct to be reliable and valid its CR values should be higher than 0.7, the AVE should be greater than 0.5 while the MSV for a construct should be less the AVE.

As shown in Table 3, all constructs achieve these thresholds, which suggest adequate reliability and validity. The CR values for all the constructs are above 0.7, AVE values are greater than 0.5 and the MSV values are lower than AVE and therefore the scales used in this study are appropriate for further analysis with SEM. Also, the diagonal values in the table if the square root of the AVE for every construct is present. These diagonal values exceed the correlations between each of the two constructs and demonstrate discriminant validity of the constructs (Fornell, & Larcker, 1981). The inter-construct correlation is given below the diagonal elements to point to the relationship of the constructs. Moreover, the standard errors and the estimated loadings and correlations of the model are good and the fit statistics of the CFA model show that the nomological validity of the model is acceptable as NFI>0.90, CFI>0.90 and RMSEA<0.08.

Figure 1: CFA model for the proposed scale

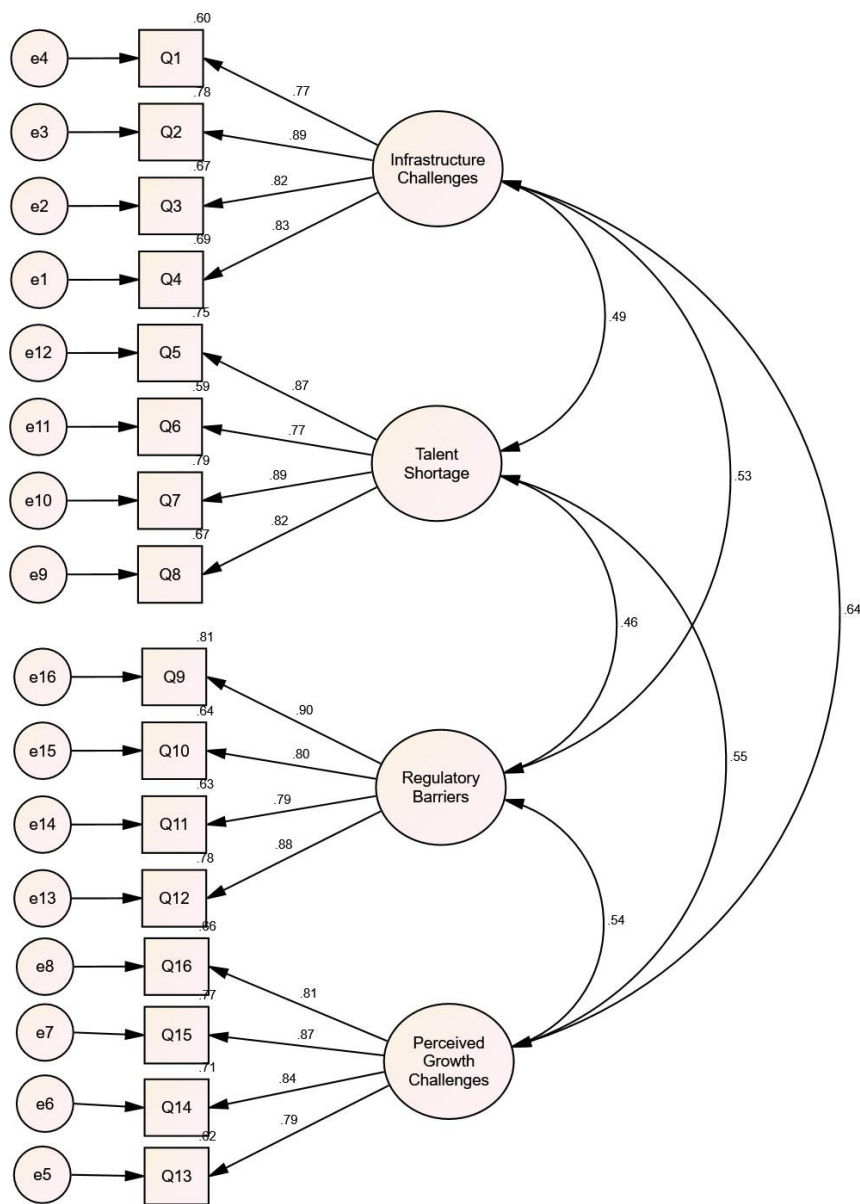


Table 3: Reliability, validity and correlation

	Correlation						
	CR	AVE	MSV	IC	TS	RB	PGC
Infrastructure Challenges (IC)	0.897	0.686	0.403	1	.446**	.473**	.562**
Talent Shortages (TS)	0.903	0.700	0.304		1	.435**	.514**
Regulatory Barriers (RB)	0.910	0.717	0.293			1	.512**

Perceived growth challenges (PCG)	0.898	0.687	0.403				1
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Correlation is significant at the 0.01 level (2-tailed).

Table 4: Model fit indices

Indices	Abbreviation	Observed values	Recommended criteria
Normed chi square	χ^2/DF	2.991	$1 < \chi^2/df < 3$
Goodness-of-fit index	GFI	0.897	>0.90
Normed fit index	NFI	0.916	>0.90
Comparative fit index	CFI	0.942	>0.90
Tucker-Lewis index	TLI	0.929	$0 < TLI < 1$
Root mean square error of approximation	RMSEA	0.063	<0.05 good fit <0.08 acceptable fit

4.5 Hypotheses testing using SEM model

Purposely the Structural Equation Modeling (SEM) was used based on maximum likelihood estimation method, which is considered as one of the most efficacious methods of structural analysis based on its high accuracy and flexibility (Hair et al., 2019; Kline, 2020). The path analysis co-efficients measuring the strength of the hypothesized relationships include standardized regression weights (β), standard errors (SE), critical ratios (CR), and their corresponding p-values and are presented in table 5. All the research hypotheses that postulated the correlations between the independent variables and perceived growth challenges as presented in Table 5 and Figure 2 were affirmed meaning they have significant positive values. These results further point out the strategic significance of infrastructure constraints, human capital deficiencies, and overly stringent or inadequate and cumbersome regulations in the evaluation of the perceived growth impediments confronting IT start-ups in Kerala.

Impact of Infrastructure Challenges on Perceived Growth Challenges

Infrastructure challenges had a significant positive impact on perceived growth challenges, with a standardized regression weight (β) of 0.396, a CR of 5.817, and a p-value of 0.000, supporting H1. This result highlights the foundational role of robust infrastructure in supporting the growth trajectory of IT startups. In line with previous studies, inadequate infrastructure, including unreliable internet connectivity, insufficient co-working spaces, and power supply issues, creates significant bottlenecks for startups (Goswami et al., 2020). Addressing these challenges could improve the operational efficiency and scalability of IT startups in Kerala, fostering a more conducive ecosystem for growth.

Impact of Talent Shortages on Perceived Growth Challenges

Talent shortages were also found to have a notable positive influence on perceived growth challenges, with a β of 0.261, a CR of 4.206, and a p-value of 0.000, thus supporting H2. These findings align with earlier research indicating that the scarcity of skilled professionals in specialized areas, such as artificial intelligence, blockchain, and software development, hampers the ability of startups to innovate and expand (Kumar et al., 2021). For Kerala, often termed as a knowledge-driven state, bridging this talent gap through targeted education and training programs is crucial for reducing growth barriers in the IT sector.

Impact of Regulatory Barriers on Perceived Growth Challenges

Regulatory barriers exerted a significant positive effect on perceived growth challenges, with a β of 0.210, a CR of 3.333, and a p-value of 0.000, supporting H3. This is consistent with findings in literature, which emphasize that complex

compliance requirements, lengthy approval processes, and inconsistent policies discourage startups from scaling up effectively (Sharma & Shukla, 2022). Simplifying regulatory frameworks and offering single-window clearances can mitigate these challenges, creating a more startup-friendly business environment in Kerala.

Explained Variance in Perceived Growth Challenges

The combined impact of infrastructure challenges, talent shortages, and regulatory barriers explains 41% of the variation in perceived growth challenges ($R^2 = 0.410$). This indicates that nearly half of the growth challenges perceived by IT startups can be attributed to these factors. These findings highlight the critical areas where interventions are needed to build a supportive startup ecosystem in Kerala.

Figure 3: Structural model

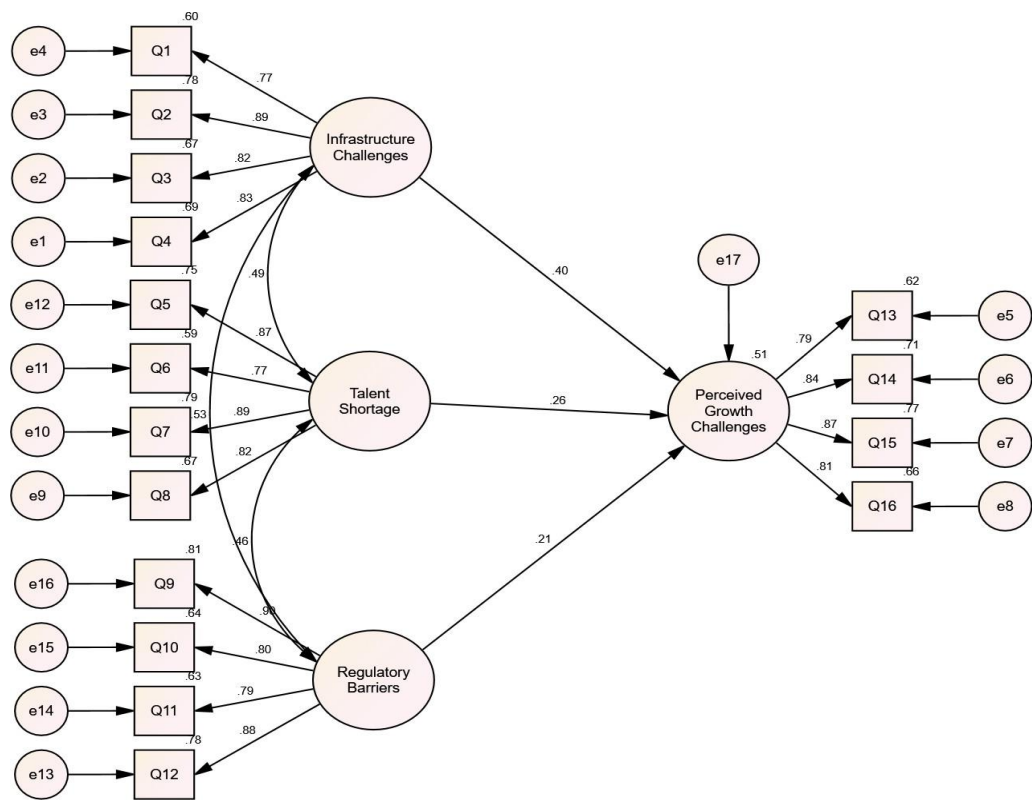


Table 5: Path coefficients of the Structural model

Outcome variables		Causal Variables	Standardized regression weights	Standard error	Critical ratio (CR)	P	Result
Perceived Growth Challenges	<---	Infrastructure Challenges	0.396	.065	5.817	0.000	H1 supported
Perceived Growth Challenges	<---	Talent Shortage	0.261	.049	4.206	0.000	H2 supported
Perceived Growth Challenges	<---	Regulatory Barriers	0.210	.045	3.333	0.000	H3 supported

The analysis demonstrates significant relationships between the causal variables and perceived growth challenges, supporting all three hypotheses. Infrastructure challenges had the strongest impact, with a standardized regression weight of 0.396, a standard error of 0.065, and a critical ratio (CR) of 5.817, indicating a highly significant effect ($p = 0.000$). Talent shortage was also a significant predictor, with a standardized regression weight of 0.261, a standard error of 0.049, and a CR of 4.206, further confirming its influence on perceived growth challenges ($p = 0.000$). Similarly, regulatory barriers had a standardized regression weight of 0.210, a standard error of 0.045, and a CR of 3.333, indicating a significant impact ($p = 0.000$). These results confirm that infrastructure challenges (H1), talent shortage (H2), and regulatory barriers (H3) all significantly contribute to the perceived growth challenges, emphasizing their critical role in shaping organizational growth dynamics.

5. Managerial implications

This study provides invaluable recommendations for policymakers, budding entrepreneurs, and the ecosystem players on how to overcome the challenges IT startups in Kerala experience and how best to boost their sustainability and growth.

Infrastructure Development: The formulated relationships show the importance of infrastructure issues for perceiving growth issues, proving the need for increased investment in infrastructure, both material and digital. Therefore, it is recommended that the government pays special attention to the establishment of technology parks as well as the improvement of technology access through efficient broadband connection. Moreover, the creation of cheap co-working possibilities helps those startups that have just started their journey to obtain equipment to work effectively and scale up the business. These interventions are important with regards to minimizing operational inefficiencies and improving productivity among startup organizations as the study showed.

Addressing Talent Shortages: Skills gaps were seen as a significant challenge to startup scaling and by extension needed collective partnerships between educational institutions industry and government. It will of course be the case that more detailed and specific skills training consonant with industry needs, in conjunction with strong internship schemes, may go some way towards filling the current skills deficit. These measures are aimed to improve the employment rates of local professionals and guarantee the further availability of skilled workforce, I still have to note this problem as one of the major limitations of growth among the companies participating in the study.

Regulatory Reforms: These conclusions explain that regulative constraints have become one of the major inhibitors of startups' development, thus underlining the necessity of simplifying procedural and policy conditions. It is imperative to free up access, generate streamlined taxation mechanisms, improve the ease of business, and develop forward-looking policies for startup corporations. Other government simulated efforts such as consistency and non-corruptible transparency and establishment of mentorship programs can also add on more power to startups by ensuring that the kind regulatory support offered is in harmony with the dynamic nature of the ecosystem.

6. Conclusion and Future research scope

As it has been illustrated in this research, issues related to IT startups in Kerala reflect fundamental difficulties associated with infrastructure constraints, lack of skilled human capital, and compliance issues. Meeting these challenges demands a dual process of investing in the general enhancement of the technological infrastructure of the economy and developing a range of skill-building programs that will correspond to the needs and demands of new start-ups, as well as a range of measures to demystifying the existing legal frameworks. Thus, if above mentioned measures are to be taken then the State of Kerala can further improve its position on the Map of IT Based Start-ups and can facilitate new measurements for facilitating the growth of economy. The findings extend the knowledge about startup ecosystems, more specifically in the emerging countries with specific socio-economic and political environments.

Future research can extend to analyse the detailed issues of different sectors of IT industry altogether to offer further enhancements. Cross-sectional comparisons of various states or regions regarding startup ecosystems could also help in pointing out the best practices as well as good strategies. Also, it would have presented cultural and societal analysis of entrepreneurial performance in Kerala and the evaluation of the effects of governmental support programs on the sustainability of start-ups. These directions will contribute to the knowledge enhancement of the startup ecosystem and improve policy and managerial initiatives.

Annexure:

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.686	48.035	48.035	7.686	48.035	48.035	3.205	20.034	20.034
2	1.799	11.243	59.278	1.799	11.243	59.278	3.173	19.832	39.865
3	1.672	10.452	69.730	1.672	10.452	69.730	3.057	19.103	58.969
4	1.322	8.260	77.991	1.322	8.260	77.991	3.044	19.022	77.991
5	.500	3.126	81.117						
6	.442	2.763	83.880						
7	.407	2.542	86.422						
8	.360	2.249	88.671						
9	.317	1.981	90.652						
10	.312	1.950	92.602						
11	.253	1.579	94.181						
12	.232	1.453	95.634						
13	.202	1.265	96.899						
14	.186	1.163	98.062						
15	.156	.976	99.038						
16	.154	.962	100.000						

Extraction Method: Principal Component Analysis.

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