



An Inclusive Model for Attaining SDG-9 (Industry, Innovation, & Infrastructure) Nexus through FinTech in Conventional Higher Education Institutions in Karnataka

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Abstract. SDG-9 (Industry, Innovation, and Infrastructure) signifies the FinTech quality in innovation, growth and environment. The author has collected feedback from faculty members to improve the perception of research and innovation in Conventional Higher Education Institutions. Partial Least Squares-SEM was employed to evaluate the proposed hypothesis. This analysis identifies factors such as inputs, processes, and outputs. (QOF), and (QOS) are the input factors. (QDI), (QOR), and (WE) are the process factors. Only (QIII) is represented as an output factor. This study covered three categories of HEIs including Deemed-to-be universities, public universities, and Private universities. The researcher has sent a Google Form questionnaire link to 412 respondents to collect data from the faculty members in Conventional Higher Education Institutions. The Study found satisfactory results in the structural and measurement model validations of the constructs. This study is limited to SDG-9 (Industry, Innovation, and Infrastructure) and restricted to faculty members in the Conventional Higher Education Institutions in Karnataka.

Keywords: Learning, teaching, financial tech, constructs, SDG 9.0

1 Introduction

International institutions mainly focus on quality of output-driven products through productivity improvement and new technology adoption. FinTech enhances the use of technology solutions for banking services and non-banking financial services. It is a trending fast developing eco-friendly habits in modern era. This FinTech digitization transaction is more secure for the users. It can reduce the operation costs and friendly

user. FinTech in HEIs rebuilt the structure of teaching and learning, curriculum development, fee payment systems, recruitment process, selection of students process all are differ because of technology in HEIs. Easy way to implement SDGs through FinTech in HEIs. Universities can prepare students according to demand from the markets and advanced financial trends to become visionaries of innovation in teaching and learning processes. Understanding the need of society towards young minds it can regulate the disciplines in the academia through curriculum development, internships, workshops and etc. FinTech in education system play a vital role in enhancing financial inclusion, speed up of sustainable development, long-term impact on sustainability framework. In addition sustainable FinTech applications moving towards microfinance and digital payments to blockchain-driven transparency in every aspects demand and supply chains and green finance mechanism. The adoption of digitization such as peer-to-peer lending through UPI, crowdfunding, and blockchain-based solutions, effect on decentralized, transparent, and flexible transaction instrument. Leads to increase public trust, collaboration and innovation in global markets. Financial aspects focus on sustainable finance, it can be allocation of capital decisions factor in environmental, social, and Governance (ESG) criteria. By integration of sustainability into formal and informal FinTech programs, the higher education institutions easy combined with students and professionals with a holistic measurement of financial innovation. Collaboration with experts, industry, society and policymakers are shaping towards excellent learning opportunities such as hackathons, incubators focused on entrepreneurship. (Srivastava I, 2025) Online fee payment system mechanisms for improving operational efficiency in HEIs, digital payment systems, blockchain apps, etc (Khan, 2023). According to Beeg., 2003; Dwaikat., 2020 suggest that internal consistency is developed from all stakeholders in the Higher education institutions enables the FinTech development. (Chen et al, 2014) defines teaching and learning techniques, development in curriculum, performance revising and innovations in HEIs. 2nd part of this study reveals the articles and 3rd part describes the variables, the hypothesis and the model of the conceptual framework. 4th part signifies the methodology of empirical representation. The 5th part illustrates the final outcome, eventually 6th part presents conclusions and recommendations.

2 Review of literature

Literature has discussed various models and concepts of FinTech innovations in Higher Education Institutions and author has to explore the intellectual landscape of FinTech and sustainability research through bibliographic coupling analysis and need to identify seven thematic clusters such as technological enablers, Corporate and Regulatory Practices, Emerging Market Applications, Financial Inclusion, Sustainable Business Models, Green Finance Instruments and Financial Innovation and ESG (Offiong et al., 2025). According to Anil and Laxmana, 2025 navigate FinTech innovation requires a

significant path towards social entrepreneurship, environment friendly and technological knowledge providing towards pupil development through FinTech. Parasuraman et al., 1991 investigates the problems faced by HEIs to achieve better quality regarding ethical aspects, collaboration and policy frameworks for full potential sustainable development. According Arner et al., 2015 FinTech is a nexus between finance and technology, enhancing innovative software, platforms and digital broadcasting delivery of financial services more accurately and inclusively. According to Ricartii 2025 defines ennegram model highlights quality of education and output leads increase the efficiency of leadership in HEIs. The TQM approach thoroughly emphasised the effective analysis in higher education (Jenicke et al., 2008). The SQM-HEI model focuses on the service area of enhancing the quality of teaching methods, environmental factors, and quality education in HEIs (Senthilkumar & Arulraj, 2011). According to (Ricartti et al., 2025) reveals the model ENNEAGRAM model is an association between education quality and academic outcomes with excellent personality traits for the improvement in leadership in HEIs. (Antony jiju., & et al., 2012) highlight Lean Six Sigma (LSS) basic barriers and success depends on efficiency and effectiveness of HEIs, along with the SIPOC model which reveals the supplier's viewpoint: input of material must be unique and qualitative to get quality output, and customers will satisfy through products and services. Therefore, it is difficult to navigate the quality of institutional innovations and infrastructure from these models; this research study fills the gap.

3 Objectives

- a. To evaluate an inclusive architecture for attaining the QIII
- b. To determine how input, process, and output factors interact through FinTech for SDG 9 achievement.

4 Hypothesis

- H1: Association between Quality of Digital Infrastructure (QDI) & Quality of Institutional Innovations and Infrastructure (QIII)
- H2: There is a significant relationship between Quality of Faculty (QOF) & Quality of Institutional Innovations and Infrastructure (QIII)
- H3: There is a significant association between Quality of Research (QOR) & Quality of Institutional Innovations and Infrastructure (QIII)
- H4: There is a significant association between Quality of Students (QOS) & Quality of Institutional Innovations and Infrastructure (QIII)
- H5: There is relations of Working Environment (WE) & Quality of Institutional Innovations and Infrastructure (QIII)

5 Research methodology

The study concentrated on gathering first-hand information from the field. A systematic, structured questionnaire was used. The questionnaire asked questions about stakeholders' experience. To navigate the proposal and predict the holistic model for assessing the QIII at CHEIs using the PLS-SEM model (Dwaikat et al., 2020).

5.1 Sample size and population

The study population covered within Karnataka State. The data for the study of conventional HEIs in Karnataka through an online survey from faculties. Therefore, the author took decision to collect data from the faculty members to navigating the concept of Industry, Innovation, and Infrastructure in using FinTech in CHEIs. Therefore, the author has sent structured questionnaires to a total of 412 respondents through Google Form, and due to time constraints restricted to three weeks and got 76 responses. However, due to insufficient information, 27 has been deleted and the remaining 49 responses were taken for study. The questionnaire consisted of a total of 24 direct questions, including 6 demographic and 18 questions based on indicators.

Sampling. Stakeholders such as faculty members from Deemed-to-be University, Private and Public Universities through an online survey.

Determination of sample size. Compared to CB-SEM (Co-variance based), PLS-SEM for prediction and theory development (N. Y. Dwaikat., 2020 & Hair et al., 2011)

5.2 Data analysis

Through the measurement model (outer model) and the structural model (inner model). The first model computes route estimates and parameters using the consistent PLS-SEM technique (reflection model). The bootstrapping method is considered for parameter relevance. This model is analyzed using Smart PLS v.4.1.1.4 (Sarstedt et al., 2024) software package with the default settings included.

6 Model development and discussions



Fig. 1. Study variables

6.1 Overview of the Model Variables

Through an overview of the literature review, six variables were taken to propose a research model indicating Figure 1. These variables show the quality indicators measured through a five-point Likert scale.

Quality of Institutional Innovations and Infrastructure (QIII). It shows that this variable is considered a dependent variable that can be measured through indicators: projects and placements, startups/Innovation hub, sustainable campus initiatives and innovations in curriculum design (Shange et al., 2025; Coulson et al., 2014)

Quality of Students (QOS). Based on student perspectives in HEIs, it is an independent variable; every educational institution used to select students through user-friendly technology of intelligent students use digital learning. In addition, there are 3 other dimensions such as admission entry requirement, language entry requirement, and student engagement (Dwaikat, 2020; Skolnik, 2016).

Quality of Faculty (QOF). Teachers are achieving quality in service through FinTech and SDG 9 in HEIs, teachers' knowledge and skills for creating quality innovations. Which consists of three indicators: that is staff qualification, staff performance, and continuous development of staff (Dwaikar, 2020; Skolnik, 2016)

Quality of Digital Infrastructure (QDI). This is an independent variable; it measures online banking payments, FinTech platforms, e-payment opportunities, mobile banking, AI-based financial services, and offering digital financial services, offering strong

encryption and transparent security policies are the major facilities to achieve institutional innovation and infrastructure (Moroz et al., 2025) which are necessary to achieve SDG 9 in the HEIs.

Quality of Research (QOR). This independent variable is promoting innovations in HEIs through Financial technology, article publication payment through digital payments, collaboration with FinTech companies, develop digital transfer of funds. This is the processing technique to achieve FinTech in HEIs. It has 3 indicators, such as digital repositories and open access resources, data analysis tools and a collaboration and establishment platform (Aga, 2025). Research in FinTech contributes to developing FinTech labs, digital financial initiatives, FinTech startups, blockchain and easy-to-use e-payment systems through research.

Work Environment (WE). Within the campus, the faculties face many problems, but they need a proper work environment to achieve Quality of Institutional Innovation and Infrastructure (QIII) in the HEIs using FinTech. In this regard (Dwaikar, 2020; Mohammed et al., 2019) used various levels of work environment-related stress, motivation, and satisfaction in HEIs faculty members. This independent variable consists of three indicators, such as good health and well-being, good remuneration and management decision involvement (Dwaikar, 2020; Srikanthan & Dalrymple., 2002).

7 Measurement model

To evaluate the factor loadings through this model for the identification of T-values. It exceeds the threshold value 0.7 must be acceptable.

7.1 Factor loading

Using a consistent PLS-SEM to determine the main component correlates with the correlation. The larger the values vary from -1.0 to +1.0, indicate a strong association between factors. There is not a single item in the research that has a factor loading below the suggested value of .50 (Hair et al., 2017)

Table 1. Factor-loadings

Model Variables	Outer load-ings
QDI1 <- Quality of Digital Infrastructure	0.953
QDI2 <- Quality of Digital Infrastructure	0.965
QDI3 <- Quality of Digital Infrastructure	0.952

QIII_1 <- Quality of Institutional Innovations and Infrastructure	0.938
QIII_2 <- Quality of Institutional Innovations and Infrastructure	0.897
QIII_3 <- Quality of Institutional Innovations and Infrastructure	0.911
QIII_4 <- Quality of Institutional Innovations and Infrastructure	0.896
QOF1 <- Quality of Faculty	0.963
QOF2 <- Quality of Faculty	0.965
QOR1 <- Quality of Research	0.867
QOR2 <- Quality of Research	0.921
QOR3 <- Quality of Research	0.925
QOS1 <- Quality of Students	0.942
QOS2 <- Quality of Students	0.937
QOS3 <- Quality of Students	0.914
WE1 <- Work Environment	0.977
WE2 <- Work Environment	0.955
WE3 <- Work Environment	0.942

7.2 Construct reliability and validity analysis

According to the construct and indications of Cronbach's alpha of measurement results. The rule of thumb values have to be equal > 0.7 for alpha and 0.7 for rho_a (Hair et al., 2009). According to the rule, the rule of thumb AVE is $\Rightarrow 0.5$, convergent validity is established (Bagozzi, 1988).

Table 2. Construction of reliability and validity analysis

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance ex- tracted (AVE)
QIII	0.932	0.933	0.951	0.830
QDI	0.954	0.954	0.970	0.916
QOF	0.924	0.925	0.963	0.929
QOR	0.890	0.897	0.931	0.818
QOS	0.923	0.925	0.951	0.867
WE	0.955	0.964	0.971	0.918

Tables 1 & 2 present the construction of factor loadings, reliability and validity analysis of the SDG 9 nexus of FinTech through CHEIs in Karnataka. The model consists of six constructs: Quality of Institutional Innovation and Infrastructure, Quality of Digital Infrastructure, Quality of Faculty, Quality of Research, Quality of Students and Work Environment. Every construct was measured 0.896 to 0.977 ranges demonstrating strong individual item reliability. CA range from 0.890 to 0.955, shows internal high consistency, Composite Reliability (rho_a and rho_c) scores 0.897 to 0.964 and 0.931 to 0.971, validating the strength. AVE values exceed 0.50, range from 0.818 to 0.918, ensures adequate convergent validity (Hair et al., 2017). High R & V constructs and indicators show hypothesis testing.

7.3 Discriminant Validity- F & L criterion

To know the different concepts of two or more variables, measure the correlations are too high (Bagozzi et al., 1991). If the AVE is > correlation with other structures, the result will be proven. It represents the construct meet the FL criterion for validity. Hence, the constructs are satisfied from one another, and there is no overlapping conceptual dimensions. (Fornell and Larcker, 1981). This model satisfies the requirement of discriminant validity. As the (AVE) extracted values for all constructs exceeds the construct correlation coefficients. Based on this shows it is free from multicollinearity issues.

Table 3. Discriminant validity results by using the Fornell and Larcker criterion

	QIII	QDI	QOF	QOR	QOS	WE
QIII	0.911					
QDI	0.774	0.957				
QOF	0.823	0.912	0.964			
QOR	0.786	0.876	0.847	0.905		
QOS	0.852	0.860	0.892	0.904	0.931	
WE	0.742	0.876	0.887	0.781	0.804	0.958

7.4 Discriminant Validity- Hetero Trait Mono Trait ratio of correlations (HTMTs) criterion

(Henseler et al., 2015) shows HTMT value ranges 0 & 1, and a value lower than 1 indicates better Discriminant validity. HTMT values are below the threshold value of 0.90, demonstrating adequate discriminant validity, as Table 4 illustrates, clearly indicating that the constructs are connected. Therefore, it confirms satisfactory discriminant validity among the constructs.

Table 4. Discriminant Validity-Hetero Trait Mono Trait ratio of correlations (HTMTs) criterion

	QIII	QDI	QOF	QOR	QOS	WE
QIII						
QDI	0.817					
QOF	0.882	0.871				
QOR	0.849	0.842	0.829			
QOS	0.815	0.814	0.862	0.888		
WE	0.779	0.898	0.842	0.840	0.852	

7.5 SRMR for test goodness-of-fit index

To measure variable quality, when using PLS-SEM (Henseler & Sarstedt, 2013). To test SRMR indicates the values doesn't exceed 0.1. From this study 0.068 was obtained, showing the model is properly adopted.

Table 5. SRMR For test goodness-of-fit

	SM	EM
SRMR	0.068	0.068

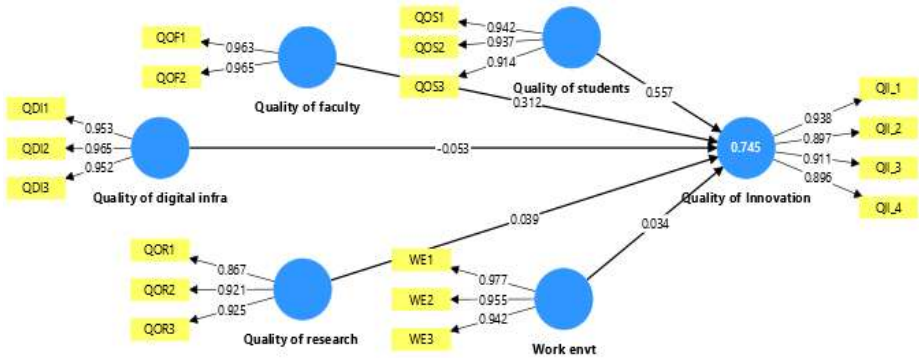


Fig. 2. Path modeling estimation using Consistent PLS algorithm

8 Structure model

It determines values shows strong values for the construct, as seen in Table 6, the coefficient of determination R² for Quality of Innovation and Infrastructure (QIII) is 0.745. R² values near 0.75 indicate that the structural model is considered significant.(Hair et al., 2011). This model demonstrates a strong explanatory power, as the

variation in Quality of Innovation and Infrastructure is explains all independent variables.

Adjusted R-square value is 0.716, after the adjustment for the number of this model, 71.6% of the variance in Quality of Innovation and Infrastructure (QIII) is measured. There is a small variation between R-square and Adjusted R-square, which shows that the model is more stable and does not cause over fitting. Overall, shows accurate and explanatory capability.

Table 6. R-square

	R-square	R-square adjusted
Quality of Innovation	0.745	0.716

9 Findings and results

9.1 Hypotheses testing results

By analyzing the standardized path coefficients to see if the threshold value is equal to or more than 0.1 (Eggert & Serdaroglu, 2011). The hypothesis shows a structural model, exhibits strength and significance of the relationships between constructs, through bootstrapping with 5000 samples. The results show that Quality of Digital Infrastructure ($\beta=0.053$, $p=0.865$), Quality of Faculty ($\beta=0.312$, $p=0.446$), Quality of research ($\beta=0.039$, $p=0.847$), and work environment ($\beta=0.034$, $p=0.863$) statements hypothesis are rejected due to p value is >0.05 , and Quality of students is directly influence on Quality of innovation and infrastructure (QII) ($\beta=0.557$, $P=0.040$), therefore, alternative hypothesis accepted

Table 7. Hypotheses testing results

	(O)	(M)	(STDEV)	(O/STD EV)	P values	Conclusion
QDI -> QIII	-0.053	-0.057	0.314	0.170	0.865	Rejected
QOF -> QIII	0.312	0.307	0.409	0.763	0.446	Rejected
QOR -> QIII	0.039	0.056	0.205	0.193	0.847	Rejected
QOS -> QIII	0.557	0.506	0.271	2.051	0.040	Accepted
WE -> QIII	0.034	0.075	0.196	0.172	0.863	Rejected

10 Limitations

- This study limited to 49 sample only.
- Only used exploratory studies, which can handle relatively small sample sizes.
- Restricted to only faculties in the universities in Karnataka
- This study focused only on SDG-9 (Industry, Innovations and Infrastructure)
- This study is restricted to only conventional higher education institutions in Karnataka
- Restricted to single-context analysis and does not examine comparative perspectives

11 Suggestions

- Every universities must provide facilities to faculty members regarding salary hike, fair performance evaluation and etc.
- Provide proper training facilities or FDP programs to the faculty members working in the universities
- Faculties must use digital infrastructure to learn and earn
- Every education institutions must provide research funding to the faculty members to their research work to attain quality of innovation and infrastructure
- Need to provide an isolated or comfortable working environment to the faculty
- Every university must have access to online research databases such as Elsevier and Web of Science.

12 Recommendations

- Larger the sample larger the accuracy is needed to get more accuracy in results and model stability.
- Future studies may include stakeholders like students, administrators and policy-makers to obtain a more significant understanding of the implementation of SDGs in HEIs.
- Further studies may extend to other SDGs apart from SDG-9, namely SDG-4 (Quality Education), SDG-5 (Gender equality) towards sustainable development.
- Further studies may focus on comparative studies to conventional, technical or professional HEIs to know innovation practices, digital infrastructure, and research.
- Further research focuses beyond Karnataka state to other states in India to evaluate the quality of institutions, innovations and infrastructure.
- Further recommended to examine the longitudinal studies to know the impact of FinTech innovations in HEIs.

13 Conclusions

This holistic PLS-SEM modelling for quality evaluation relationships between factors for achieving SDG 9 (industry, innovation, and infrastructure) through FinTech in traditional higher education institutions in Karnataka. The model offers input, process, and output-based characteristics substantial infrastructure & innovation quality of traditional higher education institutions. According to this factor, inputs are QOS and QOF, and the output-based factor QIII is significantly impacted by the process-based factors QDI, QOR, and WE. While most publications concentrate on output-based factors, input and process factors influence output-based results. Therefore, evaluate quality in CHEIs, HEI stakeholders, including senior academics, professors, associate professors, and assistant professors, must adopt an inclusive, creative, industry-related, research-oriented approach. These PLS-SEM reflective models for evaluating the latent and observed variables thoroughly measure relationships between factors and analysis for measuring quality in HEIs such as Public university, private university, and Deemed-to-be university faculty members from Karnataka.

From a practical viewpoint, these findings imply the development of FinTech adoption in Conventional Higher Education Institutions. This FinTech helps users such as students and faculty members at the university. To pay fees using FinTech, issue marks cards and certificates through digital payments. Institutions should incorporate financial literacy into the curriculum for all streams in the universities. Develop a practical way of teaching lessons using digital boards and writing exams through digital tablets. Answer scrutiny should be used of technology in every public, private and deemed to be universities in Karnataka.

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