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Technological infrastructure and connectivity on startup sustainability: A study of selected fintech industries

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Abstract. Economic growth and personal well-being have been greatly affected by the spread of digital financial services, especially in emerging nations. The purpose of this study was to investigate the impact of technological infrastructure and connectivity on startup sustainability of selected fintech industries. Specifically, the study examined the effects of cybersecurity measures, 5G and beyond, and Internet of Things (IoT) on startup sustainability. A survey research design was selected, involving a population of 10,896 workers from 15 different fintech businesses. Using Krejcie and Morgan's formula, the final sample size was determined to be 386 individuals. Data collected was analysed using PLS-SEM. Findings revealed that 5G and beyond had the strongest effect on startup sustainability ($\beta = 0.363$, $t = 6.005$, $p < 0.000$), followed by cybersecurity measures ($\beta = 0.252$, $t = 4.262$, $p < 0.000$), and Internet of Things ($\beta = 0.223$, $t = 3.862$, $p = 0.000$). It was concluded that technological infrastructure and connectivity were crucial for startup sustainability of selected fintech industries. It is therefore strongly recommended that a manager of a fintech startup concentrate on ensuring that the fundamental components of the behavioural fintech ecosystem, such as the Internet of Things, 5G and beyond, and cybersecurity measures, are suitably implemented and practised within the company to increase the sustainability of fintech startups. The practical value of this study lies in providing actionable insights for fintech startup managers to prioritise investments in technological infrastructure and connectivity, such as 5G, IoT, and cybersecurity, thereby enhancing their companies' long-term sustainability and competitiveness in the rapidly evolving digital financial landscape

Keywords: cybersecurity measures; 5G; Internet of Things; digital connectivity; emerging markets; financial technology

INTRODUCTION

In the dynamic landscape of financial services, the integration of advanced technologies has become a pivotal factor in shaping the operational efficiency and growth trajectories of financial technology (fintech) companies. The infusion of digital tools and platforms has not only streamlined financial operations but also introduced innovative business models that cater to a diverse clientele. This technological evolution has been instrumental in enhancing the accessibility and quality of financial services, thereby fostering greater financial inclusion. For instance, fintech innovations enabled the development of sustainable investment platforms that empower investors to allocate capital towards environmentally friendly projects, aligning financial objectives with sustainability goals (Hadizadeh *et al.*, 2024). Additionally, fintech's use of data analytics and machine learning simplified the individualisation of financial services, which increased client engagement and satisfaction (Odegbesan *et al.*, 2023). These developments demonstrate how technology is revolutionising the financial industry by fostering innovation and improving service rendering.

Economic growth and personal well-being are greatly affected by the spread of digital financial services, especially in emerging nations. Underprivileged communities

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benefit from the virtual infrastructure created by the widespread use of mobile devices and internet connectivity. For instance, greater acceptance of digital financial services was favourably connected with the growth of mobile network coverage in sub-Saharan Africa, which led to the promotion of financial inclusion (Ndofirepi & Steyn, 2024). This pattern reflects a larger worldwide trend where digital finance platforms are expanding access to financial services, which helps to reduce poverty and promote economic growth. Fintech's potential to close financial gaps and boost economic activity is best demonstrated by its capacity to reach isolated and previously unbanked people. Additionally, fintech's contribution to green finance projects has attracted a lot of attention. Fintech companies are encouraging environmentally conscious financial practices and supporting investments in sustainable projects by utilising data-driven methodologies. For instance, the use of blockchain technology improved carbon trading and sustainable supply chains' efficiency and transparency, which helps to maintain a sustainable environment (Hajoary *et al*., 2024). Fintech's varied role in tackling global environmental issues and promoting economic growth is highlighted by this junction of finance and sustainability.

A major problem for firms striving for sustainability is cybersecurity. Because they sometimes lack the means to put strong cybersecurity measures in place, small businesses are prime targets for cybercriminals. S. Asoba & N. Mefi (2023) noted that small enterprises' lack of cybersecurity infrastructure and experience makes them particularly susceptible to cyberattacks. Data breaches, monetary losses, and reputational harm are all probable outcomes of this vulnerability, which can jeopardise a startup's long-term survival. Additionally, startups must constantly upgrade their security policies to protect against changing threats due to the quick rate of technology advancement. This can be a challenging and resource-intensive undertaking. This problem is exacerbated by the absence of standardised cybersecurity frameworks, since startups may find it cumbersome to put in place efficient security measures in the absence of defined rules (Wu *et al*., 2023). A systematic strategy to cybersecurity is needed to address these issues, one that incorporates best practices, staff training, and investments in security infrastructure (Rathi, 2023).

For startups, the introduction of 5G technology brings both possibilities and difficulties. 5G raises serious security issues despite promising improved capabilities and faster communication. A review by D. Han *et al*. (2024) claimed that startups confront a significant obstacle due to the larger attack surface in 5G networks, which is brought on by a greater number of connected devices and network complexity. Furthermore, 5G's use of network slicing may introduce vulnerabilities; security lapses in one virtual network slice could jeopardise others, therefore strong isolation measures are required to safeguard private information. Furthermore, if not appropriately handled, the intricacy of the new authentication methods in 5G networks may result in vulnerabilities. To reduce these dangers, startups must spend money on innovative security measures like end-to-end encryption and ongoing security monitoring (Zhang & Ji, 2024). Significant capital expenditure is also necessary for the quick rollout of 5G infrastructure, which might be a major hardship for businesses with little funding (Autio *et al*., 2024). As a result, even though 5G promises exciting developments, companies must carefully handle these obstacles to properly reap the rewards.

Startups can improve operations and consumer experiences in innovative ways through the Internet of Things (IoT). IoT solution integration, however, comes with a series of complications that may affect sustainability. According to V. Hernández *et al*. (2024), a significant obstacle is the absence of standards since it complicates the integration of devices from various manufacturers and prevents the development of a smooth IoT ecosystem. Privacy and data security issues are also significant; IoT devices' massive data collecting raises the possibility of cyberattacks and data breaches, which could jeopardise personal data. Furthermore, for startups with tight budgets, the prohibitive implementation costs of IoT solutions, which include the price of purchasing and deploying devices and infrastructure, can be unaffordable (Ossen *et al*., 2023). Since dependable networks are necessary for efficient operation, the implementation of IoT solutions is made more challenging by the limited infrastructure and connectivity in some areas. Startups must seek uniformity in IoT devices, engage in strong security measures, and carefully consider the cost-benefit ratio of deploying IoT solutions to overcome these obstacles (Eseigweneme *et al*., 2024).

The objectives of this study were to ascertain how cybersecurity measures affected startup sustainability, examine how 5G and beyond impacted startup sustainability, and assess how the Internet of Things (IoT) influenced startup sustainability. The purpose of this study was to provide actionable insights for fintech startup managers to prioritise investments in technological infrastructure and connectivity, such as 5G, IoT, and cybersecurity, thereby enhancing their companies' long-term sustainability and competitiveness in the rapidly evolving digital financial landscape.

LITERATURE REVIEW

Presently, technological infrastructure is crucial for organisations since it offers the framework required for smooth communication and effective operations. Together, these components hardware, software, networks, and data centres allow businesses to operate efficiently in the digital age. A crucial element of this infrastructure – connectivity – guarantees the seamless integration of these systems and makes it easier for data and information to be shared across several channels. Strong technology infrastructure and connectivity are becoming increasingly significant as firms expand and adopt innovative digital technologies (Dahri *et al*., 2024).

Connectivity and technology infrastructure are closely related, and this relationship is essential to sustainability and corporate strategy. Businesses can innovate and

strengthen their competitive edge using well-developed technology systems (Hercheui & Cornford, 2025). Additionally, data-driven decision-making is supported by high-speed internet and cloud technologies, which improve client experiences and streamline operational procedures (Chen *et al*., 2023). Businesses may be flexible and adaptable to shifting market conditions by having the ability to communicate with partners and customers easily, even when they are located on other continents (Khimani & Singhal, 2024). In this regard, the creation of effective IT infrastructure promotes long-term strategic growth in addition to ensuring daily business operations.

According to K. Sekhar (2024), startup sustainability is the idea of incorporating social, environmental, and economic factors into corporate operations to ensure the long-term viability of new endeavours. This strategy places a strong emphasis on the value of implementing eco-friendly procedures, guaranteeing decent working conditions, and giving back to the community while profiting (Li *et al*., 2017). Sustainable startups are increasingly regarded as trailblazers, establishing a model for incorporating corporate social responsibility into business strategies, as noted by U. Dzakiy (2018). Apart from increasing their brand value, these firms attract a growing number of socially conscious customers by embracing environmental goals.

For startups, obtaining sustainability is a complex process that calls for creativity and adaptation at various phases of growth. Startups prioritise creating a distinctive value proposition and achieving market fit in their early phases, often with little funding (Robertsone & Lapiņa, 2023). But when firms get older, including sustainability becomes essential to their success. This could entail developing sustainable supply chains, optimising resource usage, and implementing green technology (Tan & Miller, 2023). Partnerships with like-minded groups can also help firms enhance their sustainable practices. As a result, sustainability becomes crucial for both satisfying customer demands and building a strong basis for resilience and long-term growth (Lammers *et al*., 2022).

Beginning sustainability is significantly affected by technological infrastructure and connection, which offer the resources and tools required for expansion and environmental responsibility. Startups can lower operating costs, track environmental effects, and effectively implement sustainable practices by having access to innovative technologies like cloud computing and digital platforms (Prasetyo *et al*., 2025).

Integrating cybersecurity safeguards from the beginning helps assure a startup's survival and success in a competitive market, since many lack the means to recover from such disasters (Danchuk & Danchuk, 2024). Additionally, entrepreneurs can avoid legal problems that could result from non-compliance, which could negatively affect their sustainability, by following international standards like the GDPR. Startups can improve their client experience, customise services, and streamline their business models by processing massive amounts of data in real time. 5G also facilitates smooth integration across a range of sectors, such as healthcare, banking, and logistics, which helps new businesses in these areas grow quickly (Yong *et al*., 2022). Although 5G has many advantages, there are drawbacks as well that companies must overcome to maintain their viability. Smaller companies may find it challenging to fully benefit from 5G technology due to the prohibitive cost of the equipment required to support these networks (Bigliardi *et al*., 2025). Furthermore, as 5G becomes more widely used, cybersecurity issues become more pressing since the wider network may expose companies to new security flaws (Hadizadeh *et al*., 2024). Startups face the difficulty of striking a balance between the advantages of 5G's expanded capabilities and the requirement for strong security frameworks to safeguard their business operations and client information (Odegbesan *et al*., 2023). In a fiercely competitive and rapidly changing market, startups that make cybersecurity investments in tandem with 5G adoption will be better positioned to capitalise on its potential while guaranteeing long-term resilience and growth (Ndofirepi & Steyn, 2024).

Furthermore, by providing more customised experiences like smart gadgets that adapt to consumers' preferences IoT can raise customer happiness (Hajoary *et al*., 2024). Long-term sustainability is supported by these qualities, which enable startups to scale operations effectively and offer distinctive value propositions that set them apart from rivals (Asoba & Mefi, 2023). However, privacy and security issues become more prevalent as the number of connected devices rises. Since every IoT device can become a target for cyberattacks, startups must put strict security measures in place (Wu *et al*., 2023). Furthermore, as startups install more devices, there is rising concern about the environmental impact of IoT, including the problem of electronic waste, or e-waste (Rathi, 2023). When adopting IoT, startups should prioritise sustainable methods like recycling outdated models and building gadgets with longer lifespans (Han *et al*., 2024). Startups can use IoT to stimulate growth and innovation while guaranteeing the long-term viability of their business by tackling cybersecurity and environmental issues (Zhang & Ji, 2024).

Introduced by E. Autio *et al*. (2024), the Technology-Organisation-Environment (TOE) hypothesis examines the variables affecting the adoption of technological breakthroughs in companies. It highlights the three key contexts technology, organisation, and environment that together influence a company's capacity to embrace and incorporate technology. The organisational context includes a company's resources, culture, and management; the technological context is concerned with the state and preparedness of the technology; and the environmental context includes external factors like industry trends, market competition, and regulatory pressures (Hernández *et al*., 2024). The concept is especially helpful for understanding how fintech firms use connection and technology infrastructure to secure their long-term viability in a changing market.

According to the TOE theory, companies assess their technological readiness based on both internal resources and external forces, and technology adoption is

influenced by both internal and external environmental factors (Ossen *et al*., 2023). It is criticised, meanwhile, for being unduly general and failing to address the particular subtleties of rapidly changing industries like fintech, where technical change happens at a breakneck pace. Notwithstanding these objections, the TOE theory offers insightful information about how organisational preparedness and external elements, including market demand and regulatory restrictions, influence the technological infrastructure and connectivity choices made by fintech businesses. Analogous studies demonstrated that, specifically in tech-driven businesses like fintech, matching organisational and environmental aspects with technological skills is essential for startup sustainability (Eseigweneme *et al*., 2024). Thus, the combination of organisational capabilities and external conditions is a key factor in the sustainable development of startups in the fintech sector.

MATERIALS AND METHODS

This study employed a survey research approach to collect data from a population of workers in specific fintech sectors and characterise the phenomenon pertaining to the influence of connectivity and technology infrastructure on startup sustainability. As of 2024, 10,896 workers from 15 different fintech businesses in Nigeria made up the study's population. The study focused on 15 fintech company offices in Ilorin, Kwara State, Nigeria. The companies are presented in Table 1.

Table 1. Fintech firms in Nigeria

Seq. No.	Fintech industries	Employees
1	Opay	1,542
2	PalmPay	1,330
3	Moniepoint Inc.	2,241
4	Kuda	200
5	Piggyvest	120
6	Paga	383
7	Cowrywise	555
8	Paystack	237
9	Carbon	502
10	Fairmoney	870
11	Flutterwave	930
12	Remita	90
13	Interswitch	1,614
14	Bankly	90
15	Bamboo	192
Total		10,896

Source: compiled by the author of this study

A questionnaire was used to collect the information required for this study. Overall, 357 responses, or 92.5% of the expected sample size, were collected; 29 more responses are required to achieve the expected sample size. Thus, the authentic responses comprised the data used in this study. Employees from different departments inside the fintech companies were chosen using a multi-stage sampling process including stratified sampling to select by department and simple random sampling to select respondents from each department to determine the right sample size. Using Krejcie and Morgan's formula, 386 individuals were selected as the final sample size, suitable for a moderate population. A structured questionnaire was the primary data collection instrument used in this investigation. The questionnaire was designed to cover the major aspects under study which included several items with a 5-point Likert scale options as response options.

The survey was conducted following the ethical standards for working with people (American Sociological Association…, 2018). Respondents' participation in the survey was voluntary, consent to take part and publish the results was requested directly from the respondents; confidentiality was guaranteed and maintained; there was no discrimination or pressure on the respondents. To assess the validity of the questionnaire and ascertain whether it accurately gauges the influence of connectivity and technological infrastructure on startup sustainability, construct validity was employed in this study. The internal consistency questions in the questionnaire were subjected to a Cronbach Alpha and composite reliability analysis since it helps to determine the internal consistency of the constructs of the study. Structural equation modelling (SEM) was employed to assess how the independent factors affected the dependent variable. Startup sustainability was the dependent variable in this study report, whereas technological infrastructure and connectivity was the independent variable. Since structural equation modelling (SEM) was employed in the report, the following model was used:

$$SS = f\,(\text{cybersecurity}\,[DEM + TDC + ACM] + 5G \text{ and beyond}\,[NLR + ECA + UHSC] + \text{Internet of Things (IoT)}\,[RTDA + ASI + DIS]), \quad (1)$$

where SS – Startup Sustainability; DEM – Data Encryption Methods; TDC – Threat Detection Capabilities; ACM – Access Control Measures; NLR – Network Latency Reduction; ECA – Edge Computing Adoption; UHSC – Ultra-High-Speed Connectivity; RTDA – Real-Time Data Analytics; ASI – Autonomous System Integration; DIS – Device Interoperability Standards.

RESULTS AND DISCUSSION

Strong cybersecurity measures must be put in place if startups want to remain sustainable over the long run. Cybersecurity enhances the company's overall credibility in addition to safeguarding private information and intellectual property, which is crucial for startups that mostly depend on client loyalty (Dahri *et al*., 2024). Startups can reduce the risk of data breaches and cyberattacks, which can result in large financial losses and reputational harm, by implementing a proactive cybersecurity strategy (Chen *et al*., 2023). Integrating cybersecurity safeguards from the beginning helps assure a startup's survival and success in a competitive market, since many lack the means to recover from such disasters (Hercheui & Cornford, 2025). Hence, the first hypothesis states as follows: H1: Startup sustainability is positively affected by cybersecurity measures. Startups now have more options than ever before to revolutionise their businesses because to the introduction of 5G technology. 5G makes it possible to develop applications like real-time data analytics, augmented reality (AR), and sophisticated Internet of Things (IoT) solutions that were previously impractical due to its faster data throughput and lower latency (Khimani & Singhal, 2024). This improved connectivity can induce product and service innovation, giving entrepreneurs a major competitive advantage in areas that move quickly (Sekhar, 2024). Hence, the second hypothesis states as follows: H2: Startup sustainability benefits from 5G and beyond. Startups can use the Internet of Things (IoT) to find creative methods to streamline operations, cut expenses, and enhance customer satisfaction. IoT allows companies to gather useful data for resource management, predictive analytics, and customised services by linking different systems and devices (Li *et al*., 2017). For example, real-time inventory level tracking via IoT-enabled sensors can cut waste and improve resource allocation (Dzakiy, 2018). Hence, the third hypothesis states as follows: H3: Startup sustainability benefits from the Internet of Things (IoT). All these hypotheses were tested to cumulatively determine the effects of technological infrastructure and connectivity on startup sustainability. This provided accurate details of the relationship as well as cause and effect of the various components of technological infrastructure and connectivity.

Table 2 presents the mean and standard deviation of the variables/indicators used in the study and obtained from the questionnaire used for the study. The study considered the sustainability of startups, tech infrastructure, and connectivity. A series of significant indicators were evaluated, each of which provided insight into a distinct aspect of these topics. For both academics and practitioners, the mean scores, standard deviations, and number of observations used for each indicator offer insightful information and significant consequences. The comparatively high mean score (above 3) for the questions indicated that respondents believed connectivity and tech infrastructure to be significantly related to the sustainability of startups. In each instance, the standard deviation was modest, suggesting that the replies deviated little from the mean. These descriptive findings highlighted the complex relationship between connection and digital infrastructure and the sustainability of companies. These highlighted how crucial it is for companies to be sustainable through effective tech infrastructure and connections.

Table 2. Descriptive analysis of responses and normality test

	Mean	Standard deviation	Excess kurtosis	Skewness	Number of observations used
5G and beyond 1	2.941	1.259	-1.047	0.035	357.000
5G and beyond 2	3.555	1.333	-1.061	-0.471	357.000
Cybersecurity measures 1	3.092	1.309	-1.134	-0.262	357.000
Cybersecurity measures 2	3.361	1.207	-0.742	-0.406	357.000
Internet of Things 1	2.689	1.235	-0.960	0.206	357.000
Internet of Things 2	3.235	1.281	-1.111	-0.158	357.000
Startups' sustainability 1	3.639	1.327	-0.741	-0.681	357.000
Startups' sustainability 2	3.639	1.255	-0.891	-0.521	357.000
Startups' sustainability 3	3.050	1.295	-1.075	-0.071	357.000

Source: developed by the author of this study using SmartPLS Output

According to the distribution's normality results, the sample size was greater than 100, meaning that an absolute skewness value of + 1.0 or less was required for the data to be considered normal. Additionally, for kurtosis, a normal peak must have an absolute value of ± 3.0 because any result below that threshold could be serious and cause concern. All variables were under the absolute value criterion of ± 1.0, according to the normality results, while the kurtosis values were within the value of ± 3.0 in absolute terms. The results of the normality test indicated that all the data entered for the study were normally distributed and suitable for further analysis and deductions. This suggested that all the variables

used to measure the regulatory framework had a moderate mean with little deviation from the mean, and that they were all normally distributed. Therefore, the variables were useful for establishing the causal relationship between the sustainability of startups and tech infrastructure and connectivity.

Cybersecurity measures, 5G and beyond, and the Internet of Things against startups' sustainability were the variables used to quantify digital infrastructure and connectivity to evaluate their influence on sustainability. These variables were crucial for understanding how technological advancements and security practices influenced the long-term sustainability of fintech startups in the digital age. Analysing their effects can help identify key strategies to enhance the resilience and growth potential of these innovative enterprises.

Figure 1 presents the impact of connection and technology infrastructure on the sustainability of startups as evaluated by the structural route model.

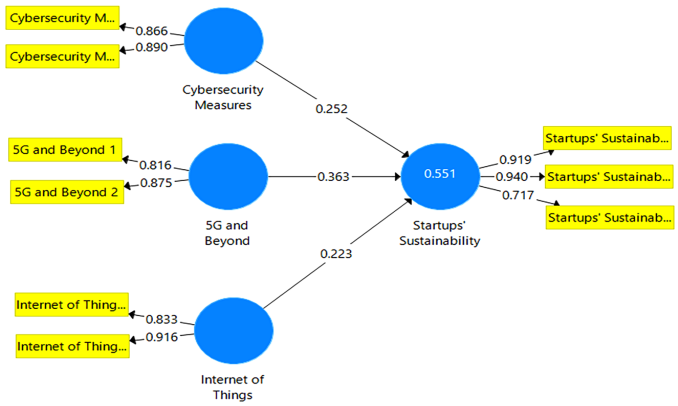

Figure 1. Path model of tech infrastructure and connectivity and startups' sustainability

Source: developed by the author of this study using SmartPLS Output

The model had one dependent variable – the sustainability of startups, and three independent variables – cybersecurity measures, 5G and beyond, and the Internet of Things. The model's findings demonstrated that the sustainability of startups was significantly and positively affected by all three independent variables. This indicated that connectivity and digital infrastructure were critical for businesses since they could improve the sustainability of startups. The specific effects demonstrated that every independent variable significantly affected the viability of startups. This suggests that to improve the sustainability of startups, companies must concentrate on digital infrastructure and connection. Table 3 presents significant statistical indicators pertaining to the validity and construct reliability of the study's four latent variables.

Table 3. Construct reliability and validity

	Cronbach's alpha	Composite reliability	Average variance extracted (AVE)
5G and beyond	0.706	0.834	0.716
Cybersecurity measures	0.703	0.871	0.771
Internet of Things	0.701	0.867	0.766
Startups' sustainability	0.827	0.897	0.747

Source: developed by the author of this study (SmartPLS 3.2.9 Output)

These metrics helped to evaluate how well these variables quantified the fundamental ideas they were meant to reflect. Cronbach's Alpha and Composite dependability were the two key measurements used to assess construct dependability. Cronbach's Alpha assesses a latent variable's internal consistency by determining the extent to which each item is related to every other item. Decent quality was shown by the internal consistency scores of the four latent variables, which were above 0.7. Since these values were much greater than the widely accepted threshold of 0.7, they suggested that the items within each variable were reliable markers of the related structures. Composite reliability is another construct reliability statistic that accounts for both internal consistency and the relationships between the items and the latent variable. All the variables in this study showed strong composite dependability, providing a more trustworthy measure of reliability, with all values above 0.7. The latent variables' high values suggested that they were trustworthy predictors of the constructs they represented. The table also presents the Average Variance Extracted (AVE), which evaluated each latent variable's convergent validity. The degree to which items in a variable measure the same underlying notion and are related to one another is known as convergent validity. All the AVE values in the table were greater than the suggested threshold of 0.5. This indicates that the items for each latent variable were effectively converging and measuring their respective constructs as a whole. The findings suggest that the latent variables under study had

high construct validity and reliability. The choice of these variables as valid and dependable measures in the study was supported by their strong composite reliability, high internal consistency, and adequate convergent validity.

Compelling evidence of discriminant validity among the latent variables Internet of Things, cybersecurity measures, startups' sustainability, and 5G and beyond is supported by the findings of the discriminant validity study in Table 4.

Table 4. Discriminant validity

	5G and beyond	Cybersecurity measures	Internet of Things	Startups' sustainability
5G and beyond	0.846			
Cybersecurity measures	0.703	0.878		
Internet of Things	0.677	0.595	0.875	
Startups' sustainability	0.692	0.641	0.619	0.864

Note: the table is presented with empty cells, as it displays only the square roots of the Average Variance Extracted (AVE) on the diagonal and the intercorrelations of the latent variables in the lower triangle, consistent with the standard output format generated by SmartPLS software

Source: developed by the author of this study using SmartPLS 3.2.9 Output

Whether these constructs were separate and not strongly associated with each other was determined by discriminant validity. Examining the correlations showed that off-diagonal values, representing correlations between different variables, were significantly lower than diagonal values, which represented each variable's correlation with itself. This supported the idea that each latent variable was unique and measured a separate feature of the overall construct by indicating that each latent variable had a stronger relationship with itself than with the other constructs. The Internet of Things was highly correlated with itself, more so than it was correlated with cybersecurity, the sustainability of startups, 5G and beyond. Analogously, the sustainability of startups was strongly correlated with itself as opposed to the other characteristics. However, this was also true for other variables in their respective contexts. These findings demonstrated that rather than being merely various expressions of the same underlying construct, the latent variables under study were measuring unique concepts. Considering that it successfully distinguished between these crucial elements – the Internet of Things, cybersecurity precautions, the viability of startups, and 5G and beyond – it appears that the measurement approach was suitable for the objectives of the present study.

The study evaluated the independent variable's correlation. The purpose was to determine whether two independent variables were associated and yielded the same results. In this study, the expected association between the independent variables was evaluated using the variance inflation factor (VIF). The VIF of the construct of the study is presented in Table 5.

Table 5. Inner VIF values

	5G and beyond	Cybersecurity measures	Internet of Things	Startups' sustainability
5G and beyond				2.490
Cybersecurity measures				2.087
Internet of Things				1.948
Startups' sustainability				

Note: the table is presented with empty cells, as it displays only the square roots of the Average Variance Extracted (AVE) on the diagonal and the intercorrelations of the latent variables in the lower triangle, consistent with the standard output format generated by SmartPLS software

Source: developed by the author of this study using SmartPLS 3.2.9 Output

Table 5 presents the VIF values for the latent factors pertaining to the sustainability of startups. It was encouraging that the VIF values for cybersecurity, the Internet of Things, and 5G and later were all far below the 10-point threshold. This implies that these latent variables did not exhibit significant multicollinearity. In other words, these variables were not significantly associated with each other, hence multicollinearity was not a major concern when they were included in this study. This subsection provided the coefficient of determination score. The subsection also included the effect size score, as well as the path coefficient result.

Table 6 presents the quality of fit of a model as measured by the coefficient of determination, or R-squared.

Table 6. Coefficient of determination score

	R-squared	R-squared adjusted
Startups' sustainability	0.551	0.547

Source: developed by the author of this study using SmartPLS 3.2.9 Output

The independent or latent factors included in the startups' sustainability model explained approximately 55.1% of the variability in the dependent variable (startups' sustainability), according to the model's R-squared value of 0.551. This suggests that the model captured and explained the observed variations in the purchasing experience. The adjusted R-squared value was 0.547. This resulted in a more careful evaluation of the model's quality of fit. The adjusted R-squared value was almost the same as the standard R-squared value, suggesting that the inclusion of the independent variables in the model was unlikely to cause overfitting or excessive complexity. This implied that even when accounting for probable problems associated with model complexity, the explanatory power of the model was still robust. The model's performance did not appear to be negatively affected by the inclusion of numerous latent variables, and the R-squared and adjusted R-squared values indicated that the startups' sustainability model was reasonably sound in explaining startups' sustainability variability.

The effect size, often denoted as f-square, is presented in Table 7. In statistical analysis, this quantifies the strength of the correlation or influence of independent variables on a dependent variable. This study evaluated the effect sizes of several latent variables on "startups' sustainability". Every independent variable had a value over 0.02, which was regarded as a minor effect size. This implied that every variable had a moderate effect size, i.e., they all significantly affected the sustainability of startups. In other words, variations in any of the variables can account for a moderate amount of the variation in the sustainability of startups.

The study tested the hypothesis that tech infrastructure and connectivity do not affect startups' viability using bootstrap route coefficient analysis, as presented in Table 8.

Table 7. Assessment of the effect size (f^2)

	5G and beyond	Cybersecurity measures	Internet of Things	Startups' sustainability
5G and beyond				0.118
Cybersecurity measures				0.068
Internet of Things				0.057
Startups' sustainability				

Note: the table is presented with empty cells, as it displays only the square roots of the Average Variance Extracted (AVE) on the diagonal and the intercorrelations of the latent variables in the lower triangle, consistent with the standard output format generated by SmartPLS software

Source: developed by the author of this study using SmartPLS 3.2.9 Output

Table 8. Bootstrapping results showing path coefficient for structural model

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
5G and beyond → Startups' sustainability	0.363	0.371	0.061	6.005	0.000
Cybersecurity measures → Startups' sustainability	0.252	0.247	0.059	4.262	0.000
Internet of Things → Startups' sustainability	0.223	0.222	0.058	3.862	0.000

Source: developed by the author of this study using SmartPLS 3.2.9 Output

The findings showed that the viability of startups was significantly affected by the Internet of Things, cybersecurity measures, and 5G and beyond as components of digital infrastructure and connectivity. A thorough analysis of the relationship between cybersecurity measures, the Internet of Things, and advancements in 5G technology with the sustainability of startups demonstrated a statistically significant correlation among these variables. Compelling evidence to reject the null hypothesis was suggested by the T statistics being over 1.96 and the P-values being less than the conventional significance level of 0.05. As a result, the sustainability of startups was greatly affected by factors related to tech infrastructure and connectivity, such as the Internet of Things, cybersecurity, and 5G and beyond.

The findings of the study revealed that the sustainability of startups was statistically affected by all three factors: cybersecurity, the Internet of Things, and 5G and beyond. Specifically, the results indicated that cybersecurity measures significantly affected startups' sustainability ($\beta = 0.252$, $t = 4.262$, $p < 0.000$), supporting the H1 hypothesis. This underscored the critical role of robust cybersecurity practices in protecting startups from potential cyberthreats, thereby enhancing their operational resilience and long-term viability.

Furthermore, the Internet of Things was found to substantially influence the startups' sustainability ($\beta = 0.223$, $t = 3.862$, $p < 0.000$), thereby supporting the H2 hypothesis. The IoT enables startups to optimise their operations, reduce waste, and enhance resource utilisation, which are essential for achieving environmental sustainability and operational efficiency. This aligns with the findings of G. Robertsone & I. Lapiņa (2023), who demonstrated that IoT technology not only increased operational efficiency but also promoted environmental sustainability by

reducing energy usage. Additionally, the study found that 5G and beyond had the strongest effect on startups' sustainability ($\beta = 0.363$, $t = 6.005$, $p < 0.000$), thereby supporting the H3 hypothesis. Advanced connectivity through 5G and beyond enhanced operational efficiency, fostered transparency, and built credibility with partners and customers. This was consistent with the findings of Z. Tan & N. Miller (2023), who noted that improved connectivity was essential to establish trust and maintain a competitive edge in the market. The findings of the present study were corroborated by several other studies that highlighted the significance of technological infrastructure and cybersecurity in enhancing the sustainability of startups. For instance, T. Lammers *et al*. (2022) demonstrated that technical improvements enable startups to monitor their environmental impact and identify areas for waste reduction and resource optimisation. This aligns with the role of the Internet of Things in promoting sustainability by increasing operational efficiency and reducing energy usage, as found in the study by M. Prasetyo *et al*. (2025). Both studies support the idea that technological advancements are crucial for startups to achieve sustainability goals.

C. Yong *et al*. (2022) emphasised that data-driven insights enabled by strong IT infrastructure enable startups to make more accurate decisions about sustainability initiatives, such as reducing carbon emissions and increasing energy efficiency. This aligned with the findings of the current study, which highlighted the significant impact of 5G and beyond on startups' sustainability. Enhanced connectivity through advanced technologies like 5G not only improves operational efficiency but also fosters transparency and credibility with partners and customers, as noted by A. Chinedu *et al*. (2024).

The significance of cybersecurity in ensuring the sustainability of startups is also underscored by several studies. B. Bigliardi *et al*. (2025) and M. Hadizadeh *et al*. (2024) highlighted that establishing an organisational culture that prioritises security is crucial for reducing vulnerabilities and enhancing resilience against cyber threats. This was supported by the findings of the present study, which showed that cybersecurity measures significantly affected the startups' sustainability. O. Odegbesan *et al*. (2023) further emphasised the human element in cybersecurity, noting that investing in employee training and fostering a strong security culture can markedly improve startup sustainability.

T. Ndofirepi & R. Steyn (2024) conducted a mixed-methods study and found that startups with robust cybersecurity procedures and reliable infrastructure were better equipped to withstand disruptions, leading to improved financial performance and customer retention. This supports the current study's conclusion that the behavioural fintech ecosystem, including cybersecurity measures, is essential for startups' long-term sustainability. The findings of the present study were supported by several other studies that highlighted the critical role of technological infrastructure and cybersecurity in enhancing the sustainability of startups. The behavioural fintech ecosystem, encompassing cybersecurity measures, the Internet of Things, and 5G and beyond, is essential for startups to achieve operational resilience, environmental sustainability, and long-term viability. These studies collectively emphasise the need for startups to invest in advanced technologies and robust cybersecurity practices to ensure their sustainability in a rapidly evolving digital landscape. Integrating these elements into core operations will help startups to better navigate the challenges of the digital age and achieve long-term success.

CONCLUSIONS

The purpose of this study was to investigate the effects of technological infrastructure and connectivity on the sustainability of selected fintech startups, focusing on cybersecurity measures, the Internet of Things, and 5G and beyond. The findings confirmed that all three factors significantly influenced startup sustainability, thereby rejecting the null hypothesis that the behavioural fintech ecosystem had no discernible impact. Specifically, 5G and beyond had the strongest effect, followed by cybersecurity measures, and the Internet of Things. These findings aligned with the objective of this study to quantify the role of digital infrastructure in startup sustainability. The findings underscored the necessity of robust technological infrastructure for startups to thrive in a competitive and rapidly evolving digital landscape. Future research should explore the specific mechanisms through which these technologies enhance sustainability and investigate the potential of emerging technologies like artificial intelligence and blockchain in this context. Additionally, further studies could focus on the role of regulatory frameworks and policy interventions in fostering a supportive environment for fintech startups.

Considering the significant impact of cybersecurity on startup sustainability, it is crucial for fintech startups to invest in robust security protocols and employee training programmes. This will not only protect against cyberthreats but also build trust with customers and partners. Startups must leverage IoT technologies to optimise operations and enhance resource management. By doing so, they can achieve greater efficiency and sustainability, ultimately improving their market position and competitiveness. To fully capitalise on the benefits of advanced connectivity, startups must prioritise the adoption of 5G and beyond technologies. This will enable them to deliver faster, more reliable services and foster innovation, which is essential for long-term success in the fintech industry.

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Технологічна інфраструктура та підключення як чинники сталості стартапів: дослідження обраних фінтех-галузей

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Анотація. Економічне зростання та особисте благополуччя значною мірою зазнали впливу поширення цифрових фінансових послуг, особливо в країнах, що розвиваються. Метою цього дослідження було вивчення впливу технологічної інфраструктури та підключення на сталість стартапів в окремих фінтех-індустріях. Зокрема, дослідження розглядало вплив заходів з кібербезпеки, технологій 5G та новітніх рішень, а також Інтернету речей (IP) на сталість стартапів. Було обрано дизайн опитувального дослідження, яке охопило сукупність із 10 896 працівників із 15 різних фінтех-компаній. Відповідно до формули Крейчі та Моргана, остаточний розмір вибірки склав 386 осіб. Зібрані дані були проаналізовані за допомогою PLS-SEM. Результати показали, що найбільший вплив на сталість стартапів мав фактор 5G і новітніх технологій ($\beta = 0{,}363$, $t = 6{,}005$, $p < 0{,}000$), далі йшли заходи з кібербезпеки ($\beta = 0{,}252$, $t = 4{,}262$, $p < 0{,}000$) та Інтернет речей ($\beta = 0{,}223$, $t = 3{,}862$, $p = 0{,}000$). Зроблено висновок, що технологічна інфраструктура та підключення стали вирішальними для сталого розвитку фінтех-стартапів. У зв'язку з цим настійно рекомендується, щоб менеджери фінтех-стартапів зосередили увагу на впровадженні ключових елементів поведінкової фінтех-екосистеми, таких як Інтернет речей, 5G і новітні технології, а також кібербезпека. Практична цінність дослідження полягає в наданні прикладних рекомендацій для менеджерів фінтех-стартапів щодо пріоритетного інвестування в технологічну інфраструктуру та підключення, що дозволить посилити довгострокову сталість і конкурентоспроможність компаній в умовах стрімкої цифрової трансформації фінансового сектору

Ключові слова: заходи кібербезпеки; 5G; Інтернет речей; цифрове підключення; ринки, що розвиваються; фінансові технології