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Research Article

Quantifying the Dynamic Factors Influencing New-Age Users' Adoption of 5G Using TAM and UTAUT Models in Emerging Country: A Multistage PLS-SEM Approach

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Objectives. The 5G has ushered in a new age of life-changing breakthroughs and advancements due to faster speeds, greater bandwidth, and ultra-high expectancy. The study proposes a multistage approach for quantifying the dynamic factors affecting users' adoption of 5G in emerging countries. *Method*. This study integrated the technology acceptance model (TAM) and unified theory of acceptance and use of technology (UTAUT) to recommend a comprehensive model that the industry–academia can adopt. In the proposed model, various core hypotheses and subhypotheses were tested by employing 510 5G users of the metro cities of India. An online questionnaire was used to collect the facts, and the data were framed in the conceptual model to test the validation using partial least squares structural equation modeling (PLS-SEM). *Results*. The findings suggest that users' perceptions of adopting 5G are overwhelming in that perceived trust was discovered as a mediating enabler between behavioral intention (BI) and selected manifest. Performance expectancy (PE), effort expectancy (EE), social factors (SF), facilitating factors (FF), hedonic motivation (HM), perceived benefits (PB), price value (PV), and habit (HB). *Contribution*. By identifying key enablers in the suggested model, service providers may better evaluate these aspects, particularly in ensuring reliable infrastructure for 5G service stands. The study is undoubtedly a novel attempt to assist the telecom industry and policymakers in accelerating the adoption of 5G in emerging economies of Asian continents.

1. Introduction

In the present chaotic scenario, society is at a crossroads where cellular modems and the internet have evolved into prosperity and economic progress [1]. According to a study by Bauer and Bohlin [2] and Hoeschele et al. [3], these instruments have become integral to our daily lives. Similarly, technology disruption is stifling the output of the telecom industry as the world's population grows. Thus, the industry will have to accomplish more tasks with less balance of resources [4]. The fifth-generation (5G) wireless networks are now being installed worldwide. By linking heterogeneous devices and machines, 5G technologies aim to serve a wide range of vertical applications by substantially enhancing high-quality service delivery, greater network capacity, and increased system throughput [5]. The new-age mobile communication standard, 5G, is being pushed out internationally. 5G denotes the fifth generation of communication channels, a significant upgrade over today's 4G/3G rise in data [6]. Agility in today's digital world and the Internet of Things (IoT) connected things and future technologies. Before creating fully standalone networks in previous releases and coverage extensions, 5G would work in tandem with existing 4G networks [7]. Flaherty et al. [8] and Fourati et al. [9] delineated that the industrial sector necessitates extensive planning, coordination, tracking, and shipment efforts, among other things. 5G can support current efforts while opening new possibilities. Some related work [10, 11] relevant to 5G found certain factors contributing to the advancement of 5G technology, including smart mobile devices and sophisticated communication technologies. So, it can function as a technological facilitator for an entirely new set of economic development and industrial uses. 5G cellular networks would likely advance global industries in the future, with significant implications for both enterprises and customers in the short and long term [12].

Mobile network providers (MNOs) in the UK, USA, and China currently offer 5G services. 5G enables a new generation of programs, applications, and company growth that have never been seen before due to its speed, reduced latency, and interconnectivity [13]. As the operators know the significance and promise of 5G, the number of operators developing and investing in the technology. Moreover, one-fifth, or 154 operators across 66 countries, of the 681 LTE commercial networks worldwide are already performing field trials and evaluating 5G technology [14]. According to industry estimates, it is also projected that 3% of network-based mobile service providers will be able to build a commercial 5G network by the year 2024 [15]. Further, Norway, Netherlands, and Hungary provide the fastest internet speed globally. South Korea, Japan, Hong Kong, and Sweden are also a few countries that offer internet speeds above 14.6 Mbps [16]. AT&T began offering mobile 5G service to customers in select capitals across the United States before the end of 2021 through a portable hotspot [13]. Chinese companies are expected to begin commercial use of 5G by the end of 2021, with 10,000 5G base stations nationwide [17]. South Korea Telecommunication has organized a task group of 200 fellows to expedite the commercial introduction of 5G facilities. The company has also purchased spectrum in the 3.5 and 28 GHz bands to cover hotspot capacity [18, 19]. In Australia, Telstra has completed a 5G link information call experiment with Ericsson and Intel as part of its Telstra 2022 approach. The company plans to install its 5G network, with commercial-scale deployment scheduled in 2022 in high-demand areas [20, 21].

According to a study by Longo et al. [22], internet admittance, data approval, and government focus on digitalization rising technology usage across industries that have endorsed a digital revolution in India. This revolution can produce new growth channels, upsurge industrial productivity, and change the country's socioeconomic fabric. The country also has a new feather in its cap, as 5G has become its first-ever contribution to the world for mobile radio interface technology. However, telcos and residents are preparing for 5G differently. In the words by Ma et al. [23] and Manish et al. [24], 5G is expected to provide widely deployed performance improvements over previous generations. It should also increase service dimensions far above traditional data services by enabling technologies such as IoT, AI-ML-DL, AR, robotics, etc. Recently, studies on quantifying the enablers of 5G adoption have gained lukewarm attention from information and communications technology (ICT) providers, academicians, and the research community. For example, Madi et al. [25] investigated the 5G value chain, new business models and concluded that IT mediators are emerging to meet the demand for bandwidth and different services among emerging market segments and customers.

In a scholarly review by Maksimović and Forcan [26] and Maqableh et al. [27], India is currently experimenting with 5G technology in several major cities and provinces. According to current estimates, 28% of India's mobile networks will be on 5G systems by 2025, accounting for almost one-fourth of the world's total 5G mass. 5G can be the key to realizing the industry's and society's digital ambitions. However, given the telecom sector's underlying infrastructural and business hurdles, a coordinated plan between the public and private sectors can go a long way toward establishing the ideal ecosystem for effectively deploying 5G in India [28]. Innovations can flourish and dramatically alter our day-to-day lives due to 5G. As a result, telecom companies invest billions of dollars in current networks and new technologies to prepare for the next-generation wireless service, which will rely on dense networks of small cells [29, 30]. By 2025, India's digital economy is expected to grow to USD 1 trillion due to the growing proliferation of smartphones, greater internet penetration, mobile broadband expansion, data growth, and social media spread platforms. Jio, Airtel, and Vi have already made a network connecting everyone and everything in the country, including machines, objects, and gadgets. 5G offers higher multigigabit per second speeds, lower latency, and more stability than previous-generation mobile networks [31, 32]. Users can also see use cases for AR/VR, AI, and high-speed broadband on the web. With the advent of 5G, many sectors of India may grow exponentially. According to recent research [33, 34], the first and foremost sections are energy, smart city, healthcare 4.0, industry 5.0, media and entertainment, automotive, agriculture, SCM, smart vehicle, surveillance, retail, IoT, blockchain, etc. (see Figure 1).

5G adoption is a complex phenomenon [22]; therefore, implementing these web structures concerns service providers and researchers. In a similar context, organizations need to quantify the enablers that can promote the successful adoption of this new-age internet system. Research on adopting 5G in emerging economies is still in its infancy. In the recent past, few types of research identified the behavior intention of 5G [8, 9]. However, these works were based on systematic literature review (SLR) and small case studies using the viewpoints of regional experts of technopreneurs [6, 35]. Certain works on 5G explored the new adoption dimension but are limited to a small sample size and the absence of a theoretical framework [28, 36, 37]. Therefore, this study uses the following research design to explore the 5G phenomenon and its potential implications from various theoretical and practical perspectives (Figure 2). It would exclusively aid in responding to the following broad research questions.

RQ: How to comprehend and quantify the effect of factors influencing users' adoption of the 5G in India?

The proposed frame is analyzed using the information collected from 4G and 5G users of metro cities in India. SmartPLS has been employed to test the validity and reliability of collected data using structural equation modeling (SEM). TRAI releases White Paper on "Enabling 5G in

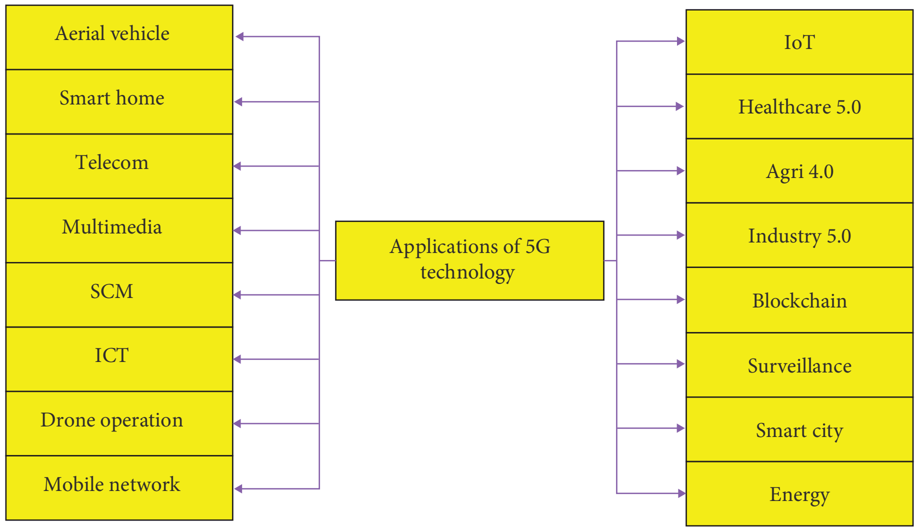

Figure 1: Applications of 5G.

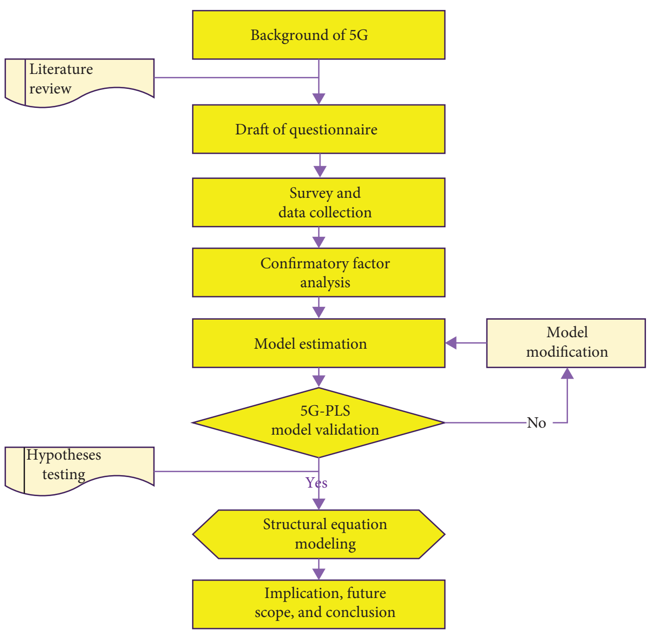

Figure 2: Research design.

India," which is creating a purpose-built network tailored 13 million consumer needs by 2027 (https://www.trai.gov.in/notifications/press-release/trai-releases-white-paper-enabling-5g-india). The government of India has commenced several initiatives, which can boost the nation's growth, and 5G is one of them (https://www.weforum.org/agenda/2019/10/5g-technology-in-india). However, the dissemination of such a network is nascent, and there is still a long way to go in this disruptive era. Thus, it is pertinent to enumerate the factors influencing users' adoption of 5G in a developing country. The proposed model is tested in the context of the Indian 5G market. The outcomes will bring new insights for the internet services providers who have recently introduced the transformation to 5G and the services providers still in this evolution's planning phase.

Furthermore, the following is the order of this study: Section 2 reviews the relevant literature. The conceptual model and hypotheses are presented in Section 3. Section 4 describes the data analysis and statistical methods applied in the study. Section 5 summarizes managerial implications, limitations, future directions, and conclusion.

2. Theoretical Background and Hypotheses Development

This section examines the previous research on high-technology (5G) adoption, consumer behavior, enablers, approaches, and predictions. Rana et al. [38] discovered that 5G offered better speeds, network stability, availability and accessibility, high-quality pictures, pleasure, and enjoyment. Robles-Carrillo [16] compared 4G technology and 5G technology and concluded that 5G delivers high-quality material to users through a new rapid transmission method that improves their viewing experience. Rogalski [39] elucidated that 5G is intended to improve corporate operations and work performance. Online gaming, social networking, online music, and videos of high quality are just a few of the leisure activities available to customers through technology. Several studies [28, 36, 37] have discovered that high-quality service, time-saving features, enjoyment, and amusement benefit people's attitudes about specific technologies. Rathore et al. [40] employed the expectation–confirmation model (ECM) to test the users' intention to adopt the new technology. In their opinion, contentment, approval, and customer postadoption behavior are vital and can be evaluated by perceived usefulness, which is essential in determining whether consumers would continue to use IT. A significant feature of the ECM allows users to compare their impressions before and after adoption. Customers' intentions to call green hotels were predicted by Zhu et al. [41], who examined the favorable effect of understanding attitudes, subjective standards, and perceived behavioral of consumer intentions to visit green hotels. Tai et al. [42] also demonstrated that improving service awareness could boost customers' willingness to purchase telecom products. Earlier research has also investigated various aspects of techno knowledge that influence purchase intention.

In this regard, Huseien and Shah [12] assessed that 5G technology would considerably influence Singapore's building development, operation, and management organization. This paper addresses global trends in 5G applications for smart constructions, R&D, and test-bedding work. Tang et al. [43] provided a comprehensive investigation of 5G in the agricultural segment by discussing the necessity of nifty and precision farming. There is a significant role of 5G in agribusiness for monitoring real-time growth of plants, virtual consultation, preventative analysis, data analytics, and prospects. Nikolopoulou et al. [28] used the unified theory of acceptance and use of technology-2 (UTAUT-2) technique in conjunction with the technological pedagogical knowledge concept to investigate behavioral intention of teachers to use 5G mobile internet in teaching. Zhu et al. [41] investigated the quality and safety of agricultural e-commerce items using 5G-IoT technologies. Experiments demonstrate that 5G-IoT can provide agricultural producers, sellers, and ordinary users with more effective, convenient, and accurate information about the quality and safety of agricultural commodities. It also increases agrarian product circulation efficiency and effectively reduces the cost.

Technology acceptance model (TAM) is commonly regarded as the most persuasive and extensively utilized theoretical frame for information systems [44]. It has been used in various fields, including virtual learning, e-commerce, shared human–automation technology, agricultural systems, marketing, behavior finance, adoption theory, and telecommunication and automobile expertise, to name a few. The TAM framework [45] was suggested in recent research for elucidating the user acceptability of new and advancing technologies. Several academicians employed the TAM background to describe user acceptance, adding new constructs and interactions [46, 47]. Chang [44] studied the UTAUT-2, a theoretical framework formed from the TAM and the UTAUT-1. It is a vigorous forecasting framework for technological adoption. People's technology adoption behaviors for novel IT solutions can be efficiently explained using the UTAUT-2. As a result, the UTAUT-2 was introduced as an analytic model. Thus, the present study integrated the structure and the content of TAM and UTAUT-2 to elucidate better predictive capabilities when compared to its predecessors. This means that it can more accurately forecast how individuals and organizations might adopt and use new technologies.

Furthermore, because the features of innovative smart 5G devices are often complex for ordinary customers to comprehend, market research approaches on consumer opinion surveys are not possible for such novel items. This section provides an analytic background based on integrating TAM and UTAUT (see section Abbreviations). Performance expectancy (PE), effort expectancy (EE), social factors (SF), facilitating factors (FF), hedonic motivation (HM), perceived benefits (PB), price value (PV), habit (HB), perceived trust (PT), and behavioral intention (BI) can be explored using the conceptual framework below (see Figure 3).

2.1. Performance Expectancy. PE is defined as the degree to which a person is confident that a technological product would benefit them in doing certain tasks [28]. According to several prior studies, PE has four enablers: perceived utility, extrinsic impetus, job fit, and relative gain. (a) The perceived usefulness of novel technology refers to how people think it may expand their job performance [24, 36], (b) extrinsic impetus discusses people's opinions of whether they want to do something to assist them and achieve valued results that are not directly associated with the activity [1], (c) according to a study by Knieps and Bauer [14], the work fit is how a novel technology's capabilities would enhance an individual's job concert, and (d) according to Rogers [48], the relative advantage is conducive to adopting a new technology versus the costs. As a result, it is vital to acknowledge all the parameters of PE that may significantly impact adopting new-age technology. Thus, it is posited as:

H1: Performance expectancy has an impact on the perceived trust of users.

2.2. Effort Expectancies. It is a scale that indicates how simple a technology product is to use [4]. EE is linked to the effort required to use technology products and the ease or difficulty they can be operated [49]. The degree of ease is linked with innovative technology engagement, referred to as EE [6]. The effort and performance expectations are essential to knowing technology usage and behavioral in technology adoption. The EE consists of three norms: perceived ease of application, ease of interaction, and effortless deed; (a) perceived ease of application refers to individuals' perceptions of how relaxed it will be to use a piece of knowledge [46], (b) ease of interaction is defined as how new products are used and implemented in various sectors to cope with changes [50], and (c) according to Chen et al. [51], easy to interact refers to how innovative technology is supposed to respond and comprehend. Lack of new technology access will negatively influence its acceptance rate [7]. Thus, the technology should be so users can use it without extra effort. According to prior empirical investigations, customers' attitudes toward directed and voluntary usage are influenced by EE.

H2: EEs have a positive and notable impact on the perceived trust of 5G users.

2.3. Social Factors. It is a term used to describe the influence of a group of people on another group of people. SF are defined as a scale that indicates how important someone believes they should use a technology product [8]. Researchers have investigated social influence and found that it impacts people's behavior [9]. A social idea independent of one's decision making influences one's behavior. The principles of social influence have been thoroughly investigated, and the effects of social influence on molding users' behavior have been demonstrated. Persons acquire awareness from other individuals, denoted as an informational influence [3]. Mani et al. [52] outlined social impact as the degree to which a person uses new technology by endorsing the surrounding society. The social image, social factor, and subjective norms are vital social influence constructs; (a) an individual's image is the degree to which they trust that

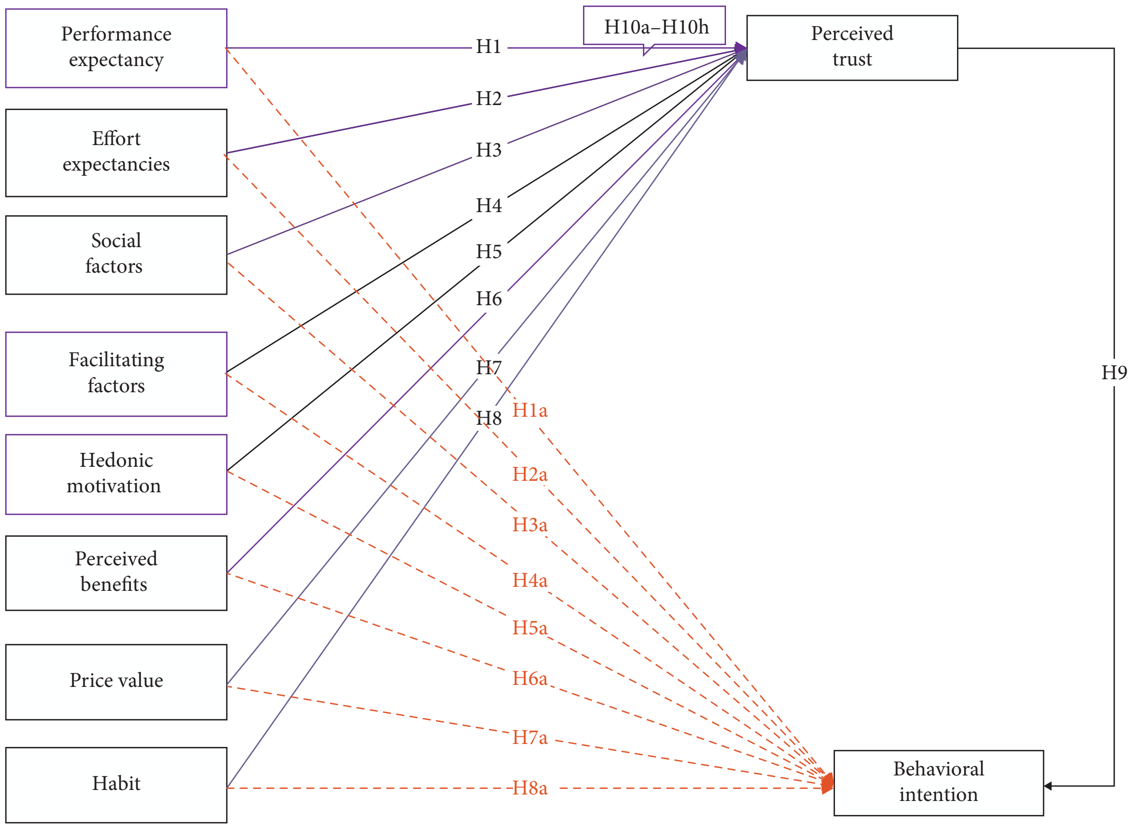

Figure 3: Conceptual framework and hypotheses.

employing new technology might advance their social organization status [14], (b) the SF is an individual's acceptance of the subjective norms and relational accords that the person has recognized with others in social circumstances [13], and (c) the subjective norm refers to the social burden to accomplish or not accomplish an action [53]. The subjective norm in this study is the perceived social pressure to use new technology in any field. Based on the literature research findings, SF can influence innovative product and technology.

H3: SF have a substantial and prominent impact on the perceived trust of 5G users.

2.4. Facilitating Factors. The facilitating construct specifies the extent to which a person considers that an organization and technical setup facilitate using a system [11, 54]. Earlier research on the elements that impact technology acceptance has found that conducive environments greatly influence the usage behaviors of an individual [17, 55]. These studies concluded that the facilitating factors are strong predictors of technology acceptance usage and can forecast technology acceptance and utilization. Rogers [48] defined compatibility is the degree to which future users' beliefs, past experiences, and desires are met by technology. Madi et al. [25] and Dadhich et al. [31] shared this viewpoint, stating that e-learning systems should be compatible with learners' beliefs and expectations. As a result, compatibility and FF would be highly valued. Besides, past research [26, 28] has discovered that perceived compatibility significantly impacts BI.

H4: Facilitating enablers have a substantial and dynamic influence on the perceived trust of 5G users.

2.5. Hedonic Motivation. When utilizing a technology product, people's joy or fun is HM [29]. It is essential in deciding how a technology product is used and accepted. The hedonic viewpoint is associated with an individual's psychological and poignant understandings, which may be generated by individual traits and cognitive conditions [16]. Sun et al. [56] investigated the interactions between customers and technology items by assessing customers' intentions. Tang et al. [43] set a frame to measure the outcome of HM on consumer buying behavior.

According to Sharma and Dadhich [54], hedonic enablers are enjoyment, interest, and curiosity toward new technology. To put it another way, an individual's hedonic practice of utilizing a technology product makes them more willing to engage in an experimental and enjoyable activity. Moreover, several earlier pragmatic investigations have confirmed that hedonic involvement would impact technology acceptance in organizational and individual contexts.

H5: HM has a considerable and positive influence on the perceived trust of consumers.

2.6. Perceived Benefits. Technology, products, or services paybacks are PB [57]. According to current technology adoption research, higher speed, accessibility, network stability, convenience, and pleasure are optimal advantages [28, 58]. Compared to 4G technology, 5G delivers high-quality material via new rapid broadcast to improve consumers' viewing experiences. 5G isn't merely for improving business or productivity. It is also a kind of entertainment for consumers, with various activities like social links, conferences, online videos, and virtual learning. Researchers discovered that superior service quality, time savings, and enjoyment positively impacted people's attitudes toward utilizing certain technologies [38, 59, 60]. These reasons are vital indicators of 5G adoption. Thus, we posit:

H6: PB have a considerable and positive influence on the perceived trust of 5G users.

2.7. Price Value. It is an individual's cognitive balance between the perceived advantages of a technological product and the financial cost of employing it [33]. If consumers perceive a technology product's benefits to be greater than its economic cost, it has a favorable PV, influencing users' behavioral intentions [39]. The pricing value is traditionally defined as a trade-off between advantages and sacrifices [21]. Users of IT sectors and vendors of consumer electronics gadgets have recently emphasized the pricing value. Users' acceptance of developing technologies or smart devices was studied using this approach. According to the findings, the PV idea is critical in enticing customers [1]. When the paybacks of adopting technology are greater than the monetary expenses, the PV is positive. The influence of such a pricing value on intentions is beneficial. Venkatesh et al. [45] defined pricing value as two marketing viewpoints: monetary costs and nonmonetary expenses.

In contrast to the price paid, monetary prices refer to the value that has been determined. The nonmonetary costs refer to the worth identified in exchange for nonmonetary expenditures such as time and effort. The PV in this study includes monetary and nonmonetary elements to investigate factors influencing users' adoption of 5G.

H7: PV substantially and positively influences consumers' perceived trust and intentions.

2.8. Habit. It is defined as the degree to which an individual automatically behaves due to prior learning [34]. There have been empirical findings that using technology relates to different basic activities that affect technology use [55]. The HB construct has received much attention in various fields, including psychology, consumer purchasing behavior, education, health science, and management. Nikolopoulou et al. [28] discovered that HB strength reduces the amount of information gathered before deciding. The HB was defined by Venkatesh et al. [45] as the degree to which customers automatically perform behaviors due to learning. The HB construct comprises past behavior, reflex behavior, and personal involvement. Users' former activities are defined as past behaviors. Users' behavior sequences or conventions that are standard components of daily life are referred to as reflex behaviors [22]. Individual experience denotes users' understandings derived from routines, benchmarks, and habits when utilizing technology. Discussions, cooperation, and effortful decision making become less necessary due to these experiences [27]. According to studies on habitual intentions and actions, HB is a powerful predictor of behavioral changes.

H8: HB has a substantial and positive influence on the perceived trust of consumers.

2.9. Behavioral Intention. It is demarcated as the degree to which someone has made definite preparations to engage in certain future behaviors or not to behave in certain future behaviors [61]. The frequency of a user's actual use of a technological product is used to compute use behavior [28, 62]. It significantly influences someone's use behavior when utilizing a technology product. Social psychologists have extensively studied BI and its links to future conduct [4]. Predicting actual buying behaviors is always tricky. Despite this, several previous studies have shown that BI considerably impacts trust and other individual traits [8]. The interaction and communication, developing cost, accessible operations, and service quality were chosen for analyzing the consumers' BI in this study to evaluate the elements impacting their acceptance of 5G.

H9: BI is influenced by the perceived trust of 5G users.

2.10. Perceived Trust. It is defined as the degree to which people believe system characteristics are predictable and purposeful [63]. Several studies have found that users' trust positively impacts their desire to adopt new technology. 5G technology, which is dependable, expedient, and simple to use, would aid in developing trust. According to Dadhich et al. [58], perceived utility and ease of usage improve customers' trust in cellphone technologies. Respondents in this research responded differently because they did not have a real-world experience with 5G instead of existing technology like 3G or 4G. According to Hoeschele et al. [3], compatibility, confidence, particular innovativeness, and intention to use are linked. However, no research has shown a link between PE, EE, SF, HM, FF, PB, PV, HB, and PT. The study builds on previous work by examining trust as a moderator in the interaction between enablers that impact technological acceptance and behavioral intent. Jeon et al. [53] discovered that trust partially mediated perceived usefulness and mobile wallet acceptability. Users have hardly any trust in technology due to many glitches. Aligned with this notion, no research in emerging economies has examined the mediating role of confidence between apparent compatibility, social impact, and individual innovativeness with BI in the 5G adoption model setting. As a result, the following subhypotheses are proposed:

H1a: Perceived trust mediates the consequences of perceived expectancy on behavior intention of individuals to use 5G.

H2a: Perceived trust facilitates the impact of EEs on behavior intention of individuals to use 5G.

H3c: Perceived trust mediates the effects of social constructs on behavior intention of individuals to use 5G.

H4a: Perceived trust facilitates the impact of facilitating enablers on behavior intention of individuals to use 5G.

H5a: Perceived trust mediates the effects of HM on behavior intention of individuals to use 5G.

H6a: Perceived trust facilitates the impact of PB on behavior intention of individuals to use 5G.

H7a: Perceived trust mediates the effects of PV on behavior intention of individuals to use 5G.

H8a: Perceived trust facilitates the effects of HB on behavior intention of individuals to use 5G.

2.11. Novelty and Gap. 5G technologies aim to serve a wide range of vertical applications by linking heterogeneous devices and machines, significantly improving service quality, network capacity, speed, and system throughput [64]. Geng and Maimaituerxun [65] did bibliometric analysis of certain keywords, viz., green marketing in sustainable consumption in the modern era. Similarly, Jeon et al. [53] studied the effect of government 5G policies on telecommunication operators' firm value. Most prominent studies were conducted on 5G and factors influencing emerging countries. For instance, Akawuku et al. [66] studied 5G technology and its health impact in Africa but with limited sample size. Parcu et al. [33] emphasized ubiquitous technologies and 5G development, but this study limited to geographical area, and there is no precise model to be followed. Jorquera Valero et al. [17] did a comprehensive study on the prestandardization of reputation-based trust models beyond 5G. Flaherty et al. [8] assessed 5G with spatial analysis fallacies in the age of data democratization, but this study was not statistically and empirically validated. Shah et al. [37] and Javaid et al. [67] studied consumer's intention to purchase 5G and elucidated the role of environmental awareness, environmental knowledge, and health consciousness attitude. This work was conducted with a limited sample size and few variables. Tang [68] outlined digitalization-based image edge detection algorithm in intelligent recognition of 5G smart grid. Ramli et al. [69] did scheduling mechanisms for a mixture of 5G multimedia use cases, but the findings of this study were unable to address the current challenges of emerging nations. Cheng et al. [6] conduced interesting work to gauge attitude toward 5G in which the regulatory frame acted as moderating factors, but the absence of a concrete model failed to justify the outcomes. Considering the above extensive work, the researchers found a clear gap to quantifying the dynamic factors influencing new-age users' adoption of 5G using TAM and UTAUT models. Thus, reckoning the dynamic effect of implementing 5G is a new vista to study. This research issue is still relevant, although other academics have investigated it from various angles. The study is the first attempt to examine 5G uptake in India. The model described in this work has not been employed in earlier literature. The significant contribution of this work is to elucidate users' adoption intentions for 5G services by adding and integrating the factors from TAM and UTAUT theories. Earlier researchers have measured the effect of the individual associations of factors on users' adoption of new technology without considering the comprehensive and contemporary dependencies. The issue confines the practicality and applicability of the earlier work for 5G adoption in developed nations. The research provides a robust approach that integrates the direct and indirect effects of the enablers of 5G adoption in underdeveloped countries to bridge this knowledge gap.

3. Research Methodology

3.1. Designing Questionnaire. It is possible to collect information on technology usage in various ways, depending on the research purpose. Different strategies are utilized to increase the validity of the data to obtain high-quality information. We adapted each tool from a previous study, making minor adjustments to fit our research environment. When doing this kind of study, the cross-sectional study is the most frequently utilized technique, in which questionnaires are sent to different respondents. A perceived benefit, sacrifice, value, and adoption intention were modified by Nikolopoulou et al. [28] and used in this study. Some of the phrasings of these items were altered slightly to anticipate better purchasing intentions. All factors were scaled on a 5-point Likert scale (1—strongly disagreed and 5—strongly agreed). The initial flow of the questionnaire was written considering the available works on the subject. Further, revisions were made in response to criticism obtained from actual users. Initially, all manifests were designed in English. However, they were reviewed and modified for translation into the local language to grab the respondents' real-time responses. Further, Table 1 portrays constructs, manifests, and their respective codes and factor loading.

3.2. Sampling and Data Collection. The researchers conducted a survey of 4G and 5G users to test the hypotheses that had been offered. As part of the questionnaire survey's announcement, all users were informed that their responses would stay unnamed and only be used for academic drives. This was done to maintain anonymity. It was separated into two sections: demographic evidence and a collection of measuring manifest intended to frame the creation of the research framework, which were both included in the questionnaire. First, we performed a test poll to gauge interest. Based on the responses to the pilot review, we amended the questionnaire. A formal investigation was conducted, and data were collected from May to August, 2022. A total of 510 complete and upfront questionnaires were chosen for further consideration. Four metro cities of India have been considered for collecting the data. TAM and UTAUT contributed to the methodology by providing structured frameworks, measurement tools, and a foundation for hypothesis testing. These contributions enhanced the quality and rigor of research in this area and made it easier for researchers to design and conduct technology adoption and innovation studies. Further, preprocessing of data prepared the raw data for PLS-SEM. Missing values replace the average frequency. Convenience sampling is used to frame the data in logical analysis. The researchers review the general approach to EFA and then elucidate the detailed SEM strategy, i.e., PLS iterative algorithm.

3.3. Common Method Bias. It is a fretting problem that frequently affects researchers who undertake studies using self-report, single-source, and cross-sectional studies. It describes the level of illegitimate covariance that manifests share. It occurs because of using a consistent method to gather data from the same field of study [70]. In accordance with the recommendations by Aguirre-Urreta and Hu [71] and Dadhich and Hiran [72], an investigation of Harman's single factor was undertaken using 35 items from the scale and 10 constructs (PE, EE, SF, FF, HM, PB, PV, HB, PT, and BI). However, no one factor emerged as the initial construct

Table 1: Manifests of the questionnaire and factor loadings.

Latent constructs	Manifests and codes	Loading
Performance expectancy	PE_1: Expending 5G products would help me perform better.	0.791
	PE_2: I would try to perceive the usefulness of 5G.	0.854
	PE_3: 5G would improve my job performance.	0.844
	PE_4: 5G is a valuable addition to my tech life.	0.723
Effort expectancies	EE_1: It's easy to learn how to use 5G devices.	0.842
	EE_2: 5G is easy to use and apply.	0.862
	EE_3: Easily interact with other gadgets.	0.594
	EE_4: 5G is an effortless deed.	0.808
Social factors	SF_1: I consider the recommendation of friends for adopting new technology.	0.756
	SF_2: I accept social pressure to adopt technology.	0.813
	SF_3: Subjective culture and social system are conducive to technology adoption.	0.783
	SF_4: Huge acceptance of new-age technology motivates me to accept.	0.734
Facilitating factors	FF_1: My physical environment encourages me to use 5G.	0.865
	FF_2: The workplace encourages me to use 5G.	0.875
	FF_3: Using 5G is a good fit for my lifestyle.	0.923
Hedonic motivation	HM_1: Using 5G service would be fun and knowledge.	0.453
	HM_2: 5G would be enjoyable and more interactive.	0.491
	HM_3: 5G enables induce curiosity and interest.	0.859
Perceived benefits	PB_1: I'm aware, 5G can deliver high-speed services.	0.383
	PB_2: I'm aware, 5G can deliver high-quality services.	0.398
	PB_3: I'm aware, 5G can provide entertainment.	0.760
	PB_4: 5G services are beneficial as far as I'm aware.	0.875
Price value	PV_1: 5G should be reasonably priced.	0.607
	PV_2: 5G would be a good value for the money.	0.801
	PV_3: 5G would provide a decent value than 4G at the current price.	0.484
Habit	HB_1: The use of 5G may become a habit for me.	0.220
	HB_2: 5G facilitates and intends me to use internet continuously	0.979
Perceived trust	PT_1: 5G maintains privacy and confidence.	0.402
	PT_2: 5G transactions are likely to be reliable.	0.540
	PT_3: My transactions with 5G are likely to be safer than previous technology.	0.500
	PT_4: Confident that my transactions with 5G are transparent.	0.849
Behavioral intention	BI_1: 5G reduces the surfing cost.	0.691
	BI_2: 5G is easy to interact with and communicate.	0.782
	BI_3: I will continue to use 5G after I use 5G.	0.841
	BI_4: 5G is accessible to manage operations and signals.	0.342

that could account for 26.85% of the variance, which is less than the 40% limit criterion advised by Aguirre-Urreta and Hu [71]. Common method bias (CMB) relates to whether the relationship between the underlying constructs caused any variance between two variables to overlap. As a result, the study performed Harman's single-factor analysis and discovered that the common variance is below the suggested limit [73]. The researchers also tried to ensure that the assertions in the items were clear, short, and unambiguous. The CMV single-factor method has been called into question by Baron and Kenny [74]. The common latent factor (CLF) was used in the SEM model to test CMB. The researcher also figured out the values of standardized regression weights with and without a common least factor and found no indication of a CMB.

Table 2: Demographics of respondents ($N = 510$).

Measures	Categories	Frequency	Percentage (%)
Gender	Male	275	53.90
	female	235	46.10
Age	20–30 years	245	48.00
	31–40 years	155	30.40
	>40 years	110	21.60
Location	Delhi	125	24.50
	Mumbai	130	25.50
	Chennai	135	26.60
	Kolkata	120	23.40
Education	Undergraduate	205	40.20
	Graduate	189	37.00
	Masters/others	116	22.80
Occupation	Private	256	49.80
	Government	159	32.10
	Professionals	095	18.10
Income per annum	<5 lakhs	315	61.80
	>5 lakhs	195	38.20

4. Data Analysis and Discussion

The demographic information provided by these respondents is shown in Table 2. Both male (53.90%) and female

Table 3: Execution of convergent validity and reliability.

Manifests	Cronbach's alpha	RhoA	CR	AVE
Performance expectancy	0.715	0.822	0.748	0.622
Effort expectancies	0.825	0.816	0.812	0.564
Social factors	0.815	0.714	0.722	0.425
Facilitating factors	0.830	0.853	0.731	0.714
Hedonic motivation	0.925	0.759	0658	0.526
Perceived benefits	0.789	0.713	0.795	0.594
Price value	0.775	0.665	0.658	0.724
Habit	0.675	0.701	0.586	0.525
Perceived trust	0.703	0.713	0.625	0.516
Behavioral intention	0.913	0.665	0.758	0.586

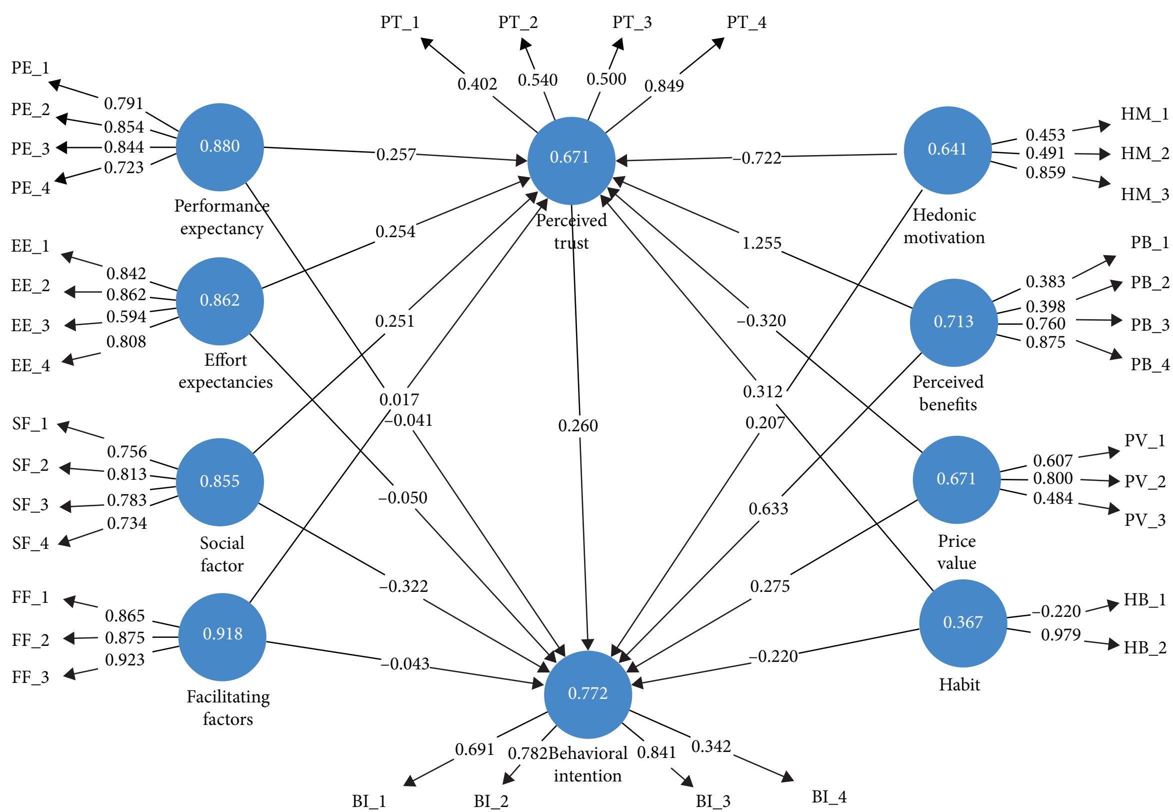

Figure 4: 5G-PLS structural model.

(46.10%) participants were almost evenly represented. More than 48% of respondents were between 20% and 30%, 30.40% were between 31% and 40%, and 21.60% were above 40 years. Similarly, location represented the equal distribution among India's four major metro cities. Approximately 40.20% of respondents were undergraduates, 37% were graduates, and 22.80% had just completed their master's education. 49.80% of users were from the private sector, 32.10% held the government sector, and the rest were professionals. Annual income less than 5 lakhs scored 61.80%, whereas only 38.20% earned above 5 lakhs.

4.1. Measurement Model. This technique connects the measured manifests that are standard to their latent manifests. In the first step, SmartPLS 4 with bootstrapping of 5,000 convenient samples and no significant change setting was used to test the hypotheses. A one-tailed test was done with a level of significance of 0.05. The study's outcome checks how reliable and valid the constructs were based on the results of the PLS algorithm.

A measurement scale analysis was carried out to determine the validity and reliability of the research framework's items. The limit of Cronbach's alpha and composite reliability values is greater than 0.650, indicating that all the manifests exhibit an extreme level of core consistency reliability (see Table 3). Those indicators (HB_3) had loadings less than 0.5, and we chose to eliminate them from the analysis because the remaining items in these constructs met the content validity criteria. As shown in Figure 4, 5G-PLS structural frame

Table 4: Discriminant matrix of the factors.

Variables	PE	EE	SF	FF	HM	PB	PV	HB	PT	BI
PE	0.652									
EE	0.342	0.754								
SF	0.619	0.433	0.896							
FF	0.404	0.299	0.419	0.615						
HM	0.467	0.347	0.537	0.462	0.791					
PB	0.619	0.433	0.896	0.619	0.433	0.896				
PV	0.404	0.299	0.419	0.404	0.299	0.419	0.525			
HB	0.467	0.347	0.537	0.467	0.347	0.537	0.425	0.520		
PT	0.578	0.598	0.533	0.462	0.537	0.472	0.626	0.415	0.625	
BI	0.658	0.758	0.859	0.759	0.705	0.625	0.595	0.629	0.655	0.452

Table 5: Path coefficient and hypotheses testing.

SN	Structural pathway	Standardized beta coefficient	t-statistic	p-value
H1	PE → PT	0.178	5.346	0.537
H2	EE → PT	0.215	2.167	0.501
H3	SF → PT	0.451	5.301	0.201
H4	FF → PT	0.058	1.137	0.093
H5	HM → PT	0.109	4.351	0.104
H6	PB → PT	0.294	5.662	0.020
H7	PV → PT	−0.118	2.568	0.003*
H8	HB → PT	0.215	3.214	0.005*
H9	PT → BI	0.109	1.956	0.075
H1a	PE → BI	0.352	2.956	0.096
H2a	EE → BI	0.102	2.359	0.086
H3a	SF → BI	−0.255	3.254	0.569
H4a	FF → BI	0.109	5.021	0.388
H5a	HM → BI	0.356	3.029	0.605
H6a	PB → BI	0.258	2.027	0.009 *
H7a	PV → BI	−0.296	3.025	0.258
H8a	HB → BI	−0.089	3.098	0.925

validated a measurement model determining its convergent and discriminant validity (DV). Convergent validity is proven when all indicator items for each construct have factor loadings greater than 0.70, the composite reliability (CR) is greater than 0.70, and the average variance extracted (AVE) is larger than 0.50 [75].

Additionally, Fornell and Larcker [76] demonstrated acceptable DV. DV is established when a construct is unique and distinct from other constructs in a model. Table 4 demonstrates that the square root of each construct AVE is greater than the sum of all construct correlations. If each construct's AVE square root values are greater than the correlation coefficients between the latent components in the model, DV exists [77, 78]. The results indicated that the square root of the AVE was greater than the correlation coefficient between the two relevant constructs. Thus, the measuring model developed in this investigation possessed sufficient DV and found no multicollinearity issues as suggested by Hair et al. [79]. The heterotrait–monotrait (HTMT) assessment was also employed to outline the DV of all the enablers. The cutoff point for all HTMT standards must be less than 0.80 [75]. DV was recognized in this study because all the HTMT figures are less than the concerned figure.

4.2. Structural Model. Figure 4 outlines bootstrapping of the 5G structural model, and Table 5 outlines path analysis and testing hypotheses, which delineated that 14 paths are insignificant. The researchers used the t-statistics and the 95% confidence intervals to determine the relationship's importance. A relationship is important if neither the bottom nor the top of the 95% confidence interval has a zero in it. Using the two-stage SEM method, the measurement frame was used to assess the structural model, comprising routes indicating the projected relationships among chosen variables. Moreover, it is necessary to analyze the statistical worth of the standardized regression weights, including t-value, beta, and significant p-value for testing chosen hypotheses and the coefficient of determination (R^2) for the endogenous manifests [80]. An algorithm was utilized to estimate the nicks of factors, path coefficients, and R^2 standards while evaluating the structural equation. Further, to identify the t-values and to assess the stated hypotheses, PLS-SEM bootstrapping was

Table 6: Mediation effects of PT on BI.

SN	Structural pathway	Standardized beta coefficient	t-statistic	p-value
H10a	PE → PT → BI	0.262	4.247	0.037*
H10b	EE → PT → BI	0.466	2.363	0.021*
H10c	SF → PT → BI	0.351	3.405	0.001*
H10d	FF → PT → BI	0.098	1.955	0.013*
H10e	HM → PT → BI	0.199	3.253	0.029*
H10f	PB → PT → BI	0.396	6.362	0.030*
H10g	PV → PT → BI	−0.215	13.441	0.523
H10h	HB → PT → BI	−0.301	9.221	0.993

used. The R^2 value for BI was 0.727, while the value for trust was 0.859. This suggests that PE, EE, SF, FF, HM, PB, PV, HB, and PT might account for approximately 72% of the variance in BI and approximately 85% in PT.

A path coefficient's p-value is normally considered the best tool that elucidate the statistical implication of hypothesis assessment [75]. Table 5 presents the results of the hypotheses tests. The relationships between PE to PT ($\beta = 0.178$, $p > 0.005$), EE to PT ($\beta = 0.215$, $p > 0.005$), SF to PT ($\beta = 0.451$, $p > 0.005$), FF to PT ($\beta = 0.058$, $p > 0.005$), HM to PT ($\beta = 0.109$, $p > 0.005$), and PB to PT ($\beta = 0.178$, $p > 0.005$) were not statistically noteworthy. Thus, the null hypothesis cannot be rejected. Similarly, the association between PV to PT ($\beta =$ -0.118, $p < 0.005$) and HB to PT ($\beta = 0.215$, $p < 0.005$) were quite momentous, and null hypotheses were supported. Further, to analyze the direct effects of selected enablers and subhypotheses, i.e., H1a–H8a, the researchers found insignificant results except for the H6a, PB to BI ($\beta = 0.258$, $p < 0.005$). These findings contradict past researchers [9, 20, 55, 81], where the selected manifests directly affect BI of the users, but when it comes to studying the adoption of new technology (5G). It is vital to traverse the mediation influence of perceived trust on BI. Therefore, the researchers analyzed the mediation effect before declaring the model fit. Moreover, this finding is in agreement with previous findings by Li et al. [82], Moudgil et al. [83], and Patil et al. [84], who emphasized on encouraging the continued advancement of technology; the full potential of 5G is yet to be realized, and its benefits will continue to expand as the technology matures and new use cases emerge.

The theorized associations to analyze and measure the mediating role of perceived trust are shown in Table 6. The necessity and relevance of the mediation trailed the actions recommended by Hair et al. [77]. The table divulges the partial mediating effect of trust is supported in H10a–H10f. Significant indirect properties were specified by path coefficients of PE → PT → BI ($\beta = 0.262$, $p < 0.005$, $t = 4.24$), EE → PT → BI ($\beta = 0.466$, $p < 0.005$, $t = 2.36$), SF → PT → BI ($\beta = 0.351$, $p < 0.005$, $t = 3.40$), FF → PT → BI ($\beta = 0.098$,$p < 0.005$, $t = 1.95$), HM → PT → BI ($\beta = 0.199$, $p < 0.005$, $t = 3.25$), and PB → PT → BI ($\beta = 0.396$, $p < 0.005$, $t = 6.36$). Ramanujam et al. [34] reportedly observed that PT partially mediates the relationship between EE, PE, HM, FF, and BI. On the flip side, the work found no mediation effect for the path PV → PT → BI ($\beta =$ -0.215, $p > 0.005$, $t = 13.44$) and HB → PT → BI ($\beta =$ -0.301, $p > 0.005$, $t = 9.22$). Hence, hypotheses H10g and H10h were not supported. A conceivable motive can be that users suppose the 5G technology to be valuable for the price, which is easy to navigate. In a somewhat similar sense, Zhu et al. [41], Sun et al. [56], and Singh [85] suggested that HB and price affect BI positively. The research extends its literature to embrace PT to find the mediating role to achieve BI. The projected frame in this research was validated by integrating acceptable performance principles to quantify how the chosen enabler, viz., PE, EE, SF, FF, HM, PB, PV, and HB, performs toward behavioral intention of 5G adoption. Most of the constructs were steady and relevant to the previous studies [16, 33, 38].

The study's results are further consistent with the findings of Kumar and Dadhich [80], Arpaci and Bahari [86], and Mukherjee et al. [87], who advocated that the deployment of 5G networks has the potential to drive economic growth and spur innovation. It allows businesses, entrepreneurs, and developers to create new products, services, and industries. Industries like autonomous vehicles, telemedicine, smart infrastructure, and immersive entertainment can leverage 5G to revolutionize their fields, creating jobs and driving economic prosperity. Hence, it corroborates the proposed model's good fit.

5. Managerial Implications

This study enhances the body of knowledge by demonstrating that, in the context of 5G technology, PE, EE, SF, FF, HM, PB, PV, HB, and PT have a noteworthy impact on BI. Additionally, trust has had a substantial mediator in technology acceptance. Limited information elucidates the link between these variables and BI in the context of independent knowledge. Policymakers, technicians, and service providers can create a plan for 5G adoption in India by integrating TAM and UTAUT models. Additionally, by highlighting these enablers in the suggested model, service providers will be better able to take into account the issues raised by these variables, particularly in terms of supplying robust infrastructure for a stronger 5G service position. As a result, it might significantly alter civilian society, increasing technological knowledge and elevating the general quality of life. The investigation's conclusions could be used to create a unique approach for winning the trust and business acumen of 5G users in India.

6. Limitations and Future Scope

Despite notable unidirectional links and promising outcomes, the present work can be upgraded by incorporating multidimensional clusters and adoption enablers. The study's methodology was prone to the inherent limits of measurement errors [88]. At the outset, the limitations are associated explicitly with the sorts of questionnaires used to collect the data from metro cities of India. Keep track of the remarks and views of a subset of the metro population of India at a predetermined time, which means that only the causal association between 5G service users can be determined rather than proven. Research conducted in just four metro cities may not represent the entire population of emerging countries or regions. Findings may not be applicable to rural areas, smaller towns, or other demographic groups. Further, the statistical facility to measure a broader range of qualified probabilities for the Indian customers' acceptance of 5G is limited. Second, this work surveyed a convenient sample of clients who agreed to contribute and provided information about their attitudes. The academic study described here could be applied to other groups or clients in other nations in the region. Third, while the response amount was satisfactory for statistical analysis purposes, the fraction of individuals who did not answer was apparent. As a result, descriptive statistics, CFA, and convergent and DV must be explored and confirmed by further researchers. Last, the results of this survey were restricted to India and specifically to the adoption of 5G technology. Possible cultural constraints may exist, and future studies in diverse cultures may shed additional light on whether we can generalize or need to adapt the research paradigm. As a result, it may be prudent to take the findings of this study with caution.

Future research can be undertaken longitudinally, resulting in a more definitive conclusion. Although this study has discovered numerous significant elements that influence 5G adoption, more factors (individuals, societal, and technological factors) must be investigated to understand consumer purchase intentions. Future studies are advised to take these considerations into account. It is also possible to develop new dimensions that may yield a more in-depth understanding of the interrelationships among the variables. This research emphasizes the features of users as represented by the model. Other constructs, such as the qualities and personal specifications, may be incorporated and tested. TAM and UTAUT cannot correctly explain users' intentions since 5G adopters should be viewed as technology users and service consumers instead of just technology users. The study still yields an evocative base for future research on a similar domain. The adoption and development of numerous developing technologies are accelerated by 5G. The study recommends laying the groundwork for the mainstream adoption of edge computing, virtual reality, augmented reality, and artificial intelligence (AI). These technologies can use the 5G network's enhanced capacity, quicker speeds, and low latency to provide novel applications and revolutionary user experiences. By following these recommendations, 5G vendors can ensure a smooth transition to 5G and fully embrace the technology's benefits and potential.

7. Conclusion

This study integrated the TAM and UTAUT models with specific manifests collected from recent studies to examine constructs associated with consumers' behavioral intention to adopt 5G internet in their daily lives. This is a relatively unexplored topic of inquiry globally and locally. The findings indicate that customers seek to establish trust and are concerned with factors influencing the adoption of 5G. The possible factors and dimensions impacting consumer technology adoption were analyzed and summarized. The study offers untried statistical evidence that policymakers and service providers can adopt to understand the users better, as 5G will change the internet matrix globally. An acquaintance of the proposed model would induce a positive market reaction in telecommunication companies. It also provides new insights that impact every sphere of a human–techno walk. Although 5G is a significant technology for society, its adoption is now riddled with debate. Besides the technological components, 5G has become a matter of users' interest. This research responds to a need made by Hoeschele et al. [3] and Nikolopoulou et al. [28], who stated that empirical evidence is urgently needed to supplement the existing 5G research in the field of ICT. This study aims to increase the literature on 5G adoption and extend value addition to the literature on technological innovation adoption. Besides, the work produces a tangible indication of supporting the prior research decisions that focused on the conceptual association between PT and PE, EE, SF, FF, HM, PB, PV, and HB. The study also confirmed the partial mediation of perceived trust to elucidate the BI of the users. The results reinforce such direct and indirect influences of constructs on 5G adoption with empirical evidence. This study also delineates a novel step in putting together research questions, constructs, and conceptual models that demand 5G research and adoption in academia–industry.

Abbreviations

TAM: Technology acceptance model
UTAUT: Unified theory of acceptance and use of technology
BI: Behavior intention
PLS: Partial least squares
SEM: Structural equation modeling
DV: Discriminant validity
CR: Construct reliability
AVE: Average variance extracted
MSV: Mean square variance
PT: Perceived trust
HM: Hedonic motivation
PE: Performance expectancy
PV: Price value
CFA: Confirmatory factor analysis.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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