



Research article

Artificial intelligence, financial services knowledge, government support, and user innovativeness: Exploring the moderated-mediated path to fintech adoption

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ABSTRACT

Based upon an extended Technology Acceptance Model (TAM), this study aims to investigate the impact of financial services knowledge, familiarity with the use of artificial intelligence, government support, and user innovativeness on Fintech adoption from the perspective of university students. Furthermore, the study also aims to investigate the mediating role of user innovativeness in this relationship. A cross-sectional, survey-based method was used to collect data from 410 university students. Structural equation modeling was implied to examine the research framework of the study. The findings confirm that financial services knowledge, familiarity with artificial intelligence, government support, and user innovativeness have a direct positive impact on Fintech adoption among university students. The results also show that perceived ease of use slightly moderates the relationship between government support and user innovativeness. Meanwhile, results from the mediation analysis reveal an indirect effect of these variables on Fintech adoption through user innovativeness. The study's findings recommend practical suggestions to academic institutes and Fintech service providers to equip university students with the necessary financial knowledge and familiarity with artificial intelligence across various disciplines, which can be achieved through sufficient government support. All these can potentially revolutionize Fintech services adoption and boost economic growth, specifically in Asia-Pacific developing countries. The study identifies the key antecedents that affect the student's decision to adopt Fintech. It widens the scope of Fintech adoption by considering the university students who may serve as the future managers for the nation. It provides nuanced evidence on the role of financial services knowledge and familiarity with the use of artificial intelligence on the intention to adopt Fintech among university students in Asia-Pacific developing countries like Pakistan.

1. Introduction

Financial technology (Fintech) has gained immense importance in recent years owing to its potential to bridge the economic gap, reduce income inequality, and unlock financial opportunities for individuals [1–3]. Linking Fintech adoption with the Sustainable

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Development Goals (SDGs) for poverty reduction and a growing number of research can be traced back to the realization that access to Fintech services is no more a luxury but a basic human need and key to economic development [4,5]. Thus, access to various Fintech services is the essence of financial inclusion, as it serves as the gateway to participate in the financial system. Fintech services have gone beyond traditional financial services and their adoption has improved performance, production, and contributed towards reduced risk [6,7]. Currently, the application of quantum computing in the Fintech industry offers major applications including digital wallets, digital payments, and several payment gateways, which witnessed a profound change in financial services [8]. Interestingly, such advancements have significant implications, particularly for university students.

University students are coming of age during the internet era and are profoundly shaped by technological advancements [9]. Additionally, they grow up within the prevalence of social media, constantly exposed to well-crafted portrayals of lifestyle, affluence, and material things [10]. Furthermore, they may feel the influence of peer pressure, which can drive them to conform to societal norms and engage in obvious consumption to maintain social uprightness [11]. These influences stimulate university students' craving for digital financial services [12]. Hence, they will likely adopt mobile banking apps, online payments, and digital wallets for their financial transactions. Since, they are not as financially secure as older customers, adopting Fintech services among university students becomes crucial. These facts induced the need to conduct a comprehensive study explaining the antecedents behind Fintech adoption among university students. Thus, using the lens of the Technology Acceptance Model (TAM), the study extends the literature with four critical indicators, i.e., Financial Services Knowledge (FSK), Familiarity with the Use of Artificial Intelligence (FUAI), perceived Government Support (GS), and User Innovativeness (UI) to investigate their role in Fintech adoption among university students.

Financial services knowledge has been a silent player in adopting meaningful Fintech services [13–15]. The existing literature established that individuals with greater financial knowledge can use digital financial platforms more efficiently, manage their finances, and make guided financial decisions [16]. Consequently, these individuals are more likely to experience enhanced financial wellbeing due to their engagement with financial technologies [17,18]. Financial education is essential for university students as they take their first key financial actions during university, such as applying for loans, choosing among financial lenders, understanding interest rates, budgeting for tuition and living expenses, and choosing how much to save [19]. It also enables them to opt for banking services, contribute towards Fintech adoption and financial inclusion, and eventually contribute to society's betterment [20]. Hence, financial knowledge can be considered an important factor in determining an individual's likelihood of accessing digital financial services, like mobile apps, digital wallets, and financial services [21]. Existing literature primarily focused on financial literacy and knowledge impacts, but limited attention has been given to how an individual's level of financial services knowledge (banking, microfinance, and Fintech) impacts the Fintech adoption [14,22,23]. Thus, the study aims to fill this gap by exploring the extent to which individuals' level of financial services knowledge enhances Fintech adoption among university students. This is the first issue the study aims to address.

Artificial intelligence (AI) has gained immense importance in the finance world over the past years, specifically, with significant interaction of digital finance [24]. Further potential application of quantum computing is connected to artificial intelligence, which has the potential to revolutionize financial services [25]. Such advancements transform the concept of Fintech beyond E-banking and provide a successful introduction to innovative technology tools to fulfill individuals' financial needs [26]. Notably, for university students, artificial intelligence provides a clear opportunity to enhance the digital transformation of finance by providing them with greater value [27]. The fintech industry evolves with artificial intelligence; university students must familiarize themselves with the use of (AI)-integrated Fintech services. However, the existing literature fails to address the significance of familiarity with the use of artificial intelligence in Fintech adoption among university students. Therefore, this study attempts to fill this literature gap. This is the second issue the study aims to address.

Government support (GS) is also found one of the determinants of fintech adoption among individuals [7,28,29]. It refers to government support associated with fintech infrastructure development for easy access to financial services, legislation for secure monetary transactions, and regulations for the smooth operation of the Fintech industry [30,31]. Previous literature found that government support enhances trust among individuals, which further influences their intention to adopt Fintech services [32]. Hence, it was established that government support in any country can be a cornerstone for promoting Fintech adoption among users [29]. However, the existing literature ignores one of the important psychological factors: how individuals' perception of government support encourages them to adopt Fintech services. Therefore, the study is an attempt to address the question of whether perceived government support encourages Fintech adoption among university students. This is the third issue the study aims to address.

User innovativeness (UI) means readiness to adapt relatively faster than others [33]. This study uses the same as user innovativeness about Fintech adoption and it correlates openness, leadership, creativity, and risk-taking [34]. *Individual innovativeness theory* has commonly been applied in education research and posts that user innovativeness is correlated with the willingness to opt for new technology [35]. Literature has also integrated user innovativeness with Fintech adoption in the financial sector [36]. This study provides evidence of the impact of user innovativeness whether direct or indirect on Fintech adoption among university students. Thus, the fourth objective of the study would be achieved by providing empirical evidence regarding the mediating impact of user innovativeness between financial services knowledge, familiarity with artificial intelligence, and government support. This is the fourth issue the study aims to address.

The present study diverges from the previous literature by focusing on university students in Asia-Pacific (APEC) developing countries. The university students who grow up in the (APEC) region are facing unique economic, technological, and cultural challenges. In these regions, they have limited access to smartphones, reliable internet connection, and financial services. Students also lack perceived security in Fintech avenues because of limited government and institutional support. Further, the COVID-19 pandemic has driven a focus on sustainable development, particularly in the context of Fintech [37]. Therefore, amid the COVID-19 pandemic and economic challenges in Asia-Pacific developing countries, financial institutions and policymakers need more understanding of

Fintech adoption among university students. This study makes a significant contribution to the existing literature in several ways. First, this study provides empirical evidence of the role of a self-assessed level of financial services knowledge on university students' Fintech adoption. Though there is abundant research investigating the positive impact of financial knowledge on Fintech adoption, However, a dance of literature is present considering the financial services knowledge in the domain of university students. Second, the study reconnoitered one of the important psychological indicators, i.e., university students' perception of government support in Fintech adoption. This is particularly important in Asia-Pacific developing countries like Pakistan, where family, peers, and media significantly influence university students' decision-making and choices. Third, the study enriches the literature by providing evidence on the role of university students' familiarity with the use of artificial intelligence in Fintech adoption. This provides a nuanced dimension to the existing literature in exploring the role of artificial intelligence in Fintech adoption. Last, the study provides noteworthy evidence on bridging the role of user innovativeness in the relationship between financial services knowledge, familiarity with the use of artificial intelligence, government support, and Fintech adoption.

The remaining paper has been divided into four sections. The first section covers the literature review which is followed by the research methodology. The third section entails data and findings. Detailed discussion followed by theoretical and practical implications has been covered in the last section.

2. Literature review

2.1. Financial services knowledge and fintech adoption

In today's rapidly evolving digital landscape, financial technology has emerged as a game-changer in the financial services industry [38]. Previous studies highlight financial knowledge as a key indicator in exploring the antecedents of Fintech adoption [15]. Different definitions of "Fintech" have been put forth over the years for various situations and across national boundaries, but have never been settled [39]. The impact of financial services knowledge on the adoption of Fintech highlights its significance in navigating the digital realm [21]. Besides the fact that Fintech provides convenience, efficient, and easily accessible financial services, its adoption is greatly influenced by financial knowledge [21]. It equipped individuals to understand the basic features of Fintech services, which reduces the learning curve and ultimately boosts the overall Fintech experience [15]. Specifically, financial services knowledge becomes more particular as individuals adapt to new technologies, or transform into digital services [38]. In addition, with enhanced financial services knowledge, individuals can leverage Fintech solutions to access banking services, make digital payments, and manage emerging dynamic financial inclusions [15,21]. Individuals with high levels of financial services understanding are better equipped to make learned decisions while adopting Fintech services [40]. Moreover, individuals with high financial services knowledge can assess the Fintech services' benefits, risks, and suitability, which helps them choose the right solutions that align with their financial needs. Furthermore, previous studies explored that financial services knowledge plays a pivotal role in building trust, and confidence, accompanied with Fintech services' creditability and security of Fintech services users [38,41]. Thus, financial services knowledge plays a pivotal role in adopting and effectively utilizing Fintech solutions. It empowers individuals to make informed decisions, build trust, navigate the digital landscape, and embrace financial inclusion [15,21,38]. Therefore, acquiring and enhancing financial services knowledge becomes increasingly important to leverage the benefits of these transformative technologies. Therefore, the study hypothesizes that.

H1. Financial services knowledge has a positive impact on the intention to adopt Fintech.

H2. Financial services knowledge has a positive impact on user innovativeness.

H3. User innovativeness mediates the impact of financial services knowledge on the intention to adopt Fintech.

2.2. Artificial intelligence and fintech adoption

Artificial intelligence is a breakthrough element encouraging adoption in Fintech [42]. It gained importance during the industrial revolution and is indispensable for Fintech adoption. Fintech is providing several new technology-centric products and solutions for consumers [42]. Fintech companies are revolutionizing the conventional financial industry [43], and digital innovations aim to increase productivity, which is a crucial competitive edge in today's worldwide marketplaces. Institutions, such as technology companies, banks, non-bank financial institutions, etc., are the entities that employ Fintech [43]. Numerous factors that influence the adoption of Fintech are discussed in the literature, and the majority of these studies look for statistical connections between the factors and Fintech. A single component, such as government support, familiarity with the use of artificial intelligence, and financial services knowledge, is the focus of certain studies on the relationship between Fintech and these variables. These observations are in accordance with financial services knowledge, familiarity with artificial intelligence, and government support for quick, error-free, and economical activities [44]. The customer's desire to try out something new or explore the latest innovations, the greater the probability of Fintech adoption [45]. Some focus on an amalgam of these elements along with user innovativeness and perceived usefulness of artificial intelligence and Fintech adoption. The technological issue encourages existing users to log back in and draws non-users to begin online financial operations, documents that a potential buyer carries certain preceding notions about artificial intelligence and associated technologies [42,43]. Therefore, the study hypothesizes that.

H4. Familiarity with the use of AI has a positive impact on the intention to adopt Fintech.

H5. Familiarity with the use of AI has a positive impact on user innovativeness.

H6. User innovativeness mediates the impact of familiarity with the use of AI on intention to adopt Fintech.

2.3. Government support and fintech adoption

In the development of the Fintech industry government support plays an important role, by making regulations that facilitate the growth of the Fintech industry [29]. Government support removes uncertainties and positively contributes towards Fintech. In this study government support is linked with the introduction of favorable legislation, and regulations and its activeness in setting up all infrastructure such as telecom networks to promote Fintech services. Technologies are promising change agents for sustainability and sustainable development due to their efficiency-driven properties and digital structure [46]. Fintech involves substantial resources and infrastructure and has been widely implemented in industrialized countries, showing that government support is an essential part of promoting Fintech adoption [29,41]. Specifically, to ensure access to affordable and quick financing, particularly for people with limited incomes and minority groups, to help boost their economic potential [46]. The legitimacy and dependability of goods and services could be improved by increasing consumer awareness of the use of modern technologies in economic development and investing in infrastructure with government backing [32]. Users have a sense of security when the government comes into play positively leading an increased population to use financial technologies. The UN promotes financial inclusion in partnership with the Special Advocate for Inclusive Finance for Development (UNSGSA), and Fintech is essential in achieving financial inclusion [43]. Thus, the study hypothesizes that.

H7. Perceived government support has a positive impact on the intention to adopt Fintech.

H8. Perceived government support has a positive impact on user innovativeness.

H9. User innovativeness mediates the impact of perceived government support on intention to adopt Fintech.

3. Methodology

3.1. The research settings

A quantitative, cross-sectional, survey-based methodology was used to collect the data from university students. The rationale for considering university students as a target population was their unique characteristics towards technology adoption. They are open to adopting new technology, often creative, and more tech-savvy. Therefore, they can provide valuable insights into how financial services knowledge (AI), familiarity, and government support are being integrated to enhance financial technology (Fintech) adoption in their lives. In addition, studying how university students' financial service knowledge and their familiarity with (AI), along with government support, can enhance their Fintech adoption. Which can help financial institutions and policymakers to formulate the policy to enhance Fintech adoption among university students.

3.2. Sample and sample selection

An online survey was used to collect the data from potential university students who were willing to participate and with at least

Table 1
Sample characteristics.

		%	Mean	SD
<i>Gender</i>	Male	60.20	1.40	0.49
	Female	39.80		
<i>Area</i>	Urban	85.60	1.14	0.35
	Rural	14.40		
<i>Marital Status</i>	Married	3.90	1.96	0.19
	Unmarried	96.10		
<i>Education</i>	Matric/O' Level	2.40	2.62	0.69
	College/A' Level	40.70		
	Bachelor's	55.34		
	Master/Higher	2.20		
<i>Working Experience</i>	0–1 years	87.80	1.20	0.65
	2–3 years	9.30		
	4–5 years	1.50		
	Over 5 years	1.50		
<i>Age</i>	15–17 years	2.00	2.23	0.57
	18–21 years	77.10		
	22–24 years	18.00		
	25–27 years	1.70		
	Over 27 years	1.20		

*N = 410.

some experience with Fintech services. A total of 410 university students participated in the survey. To develop the online survey, the study followed recommendations by Ref. [47], such as guaranteeing the secrecy of participants and keeping it short. A ‘*purposive convenience sampling*’ was implied to obtain a diverse sample in terms of demographic characteristics such as gender (39.80 percent of participants were female), age (18–21 years 77.10 percent, 22–24 years 18 percent), area of origin (85.60 percent from urban, 14.40 percent from rural). The university students who are working along with getting a university education have working experience (<1 year 87.80 percent), education level (Bachelor’s 55.34 percent, college/O’ level 40.7 percent), and most were unmarried (96.10 percent) as can be seen in Table 1.

3.3. Measurement and validation

The measures were adapted from previous scales assessing financial service knowledge [14,48], familiarity with the use of AI [49, 50], government support [28], user innovation [29,41], perceived ease of use of Fintech [51–53], perceived ease of use of AI [54,55], and Fintech adoption [14,54]. To test the face validity, content validity was established in consensus discussions by the expert panel members, ensuring that the measurements comprehensively captured the intended concepts of the variables [56]. Additionally, pilot testing was conducted, sending the first draft to 20 testers, to assess the suitability of the measures, ensuring that they were clear, comprehensible, and relevant to the constructs of the study. Hence, it is crucial to acknowledge that by addressing these steps during the initial stage of the study, confidence in the reliability of these measurements is reinforced, providing a solid justification for subsequent data analysis. All scales were based on self-reported measures and used a 5-point Likert scale response format (see Table ‘A1’ in the appendix).

A confirmatory factor analysis was used to confirm the dimensional structure of the scales. The factor loadings estimate (i.e., 0.61–0.90), exceeded the cutoff value of 0.5, which reveals that no item is needed to be eliminated [57]. Likewise, to assess the construct reliability, the composite reliability (CR) of these dimensions was estimated which were above the cutoff value of 0.6 [58]. To further ensure convergent validity, the Average Variance Extracted (AVE) was estimated above the cutoff value of 0.5 [59], as can be seen in Table 2.

Finally, Table 3 shows the discriminant validity results, which reveal that each construct shared more variance with its own measures than with the other constructs in the model.

3.3.1. Multicollinearity analysis

In addition, to assess the multicollinearity among the variables, *Variance Inflation Factors* (VIF) were implied. The values, as shown in Table 4, suggest that for the most part, multicollinearity is not a major concern (VIF <5).

Table 2
Measurement model.

		loadings	Cronbach’s alpha	CR	AVE
Financial Services Knowledge	BK	0.90	0.76	0.86	0.68
	MK	0.85			
	FUK	0.71			
Fintech Adoption	FA1	0.78	0.90	0.92	0.60
	FA2	0.61			
	FA3	0.75			
	FA4	0.78			
	FA5	0.80			
	FA6	0.76			
	FA7	0.86			
	FA8	0.82			
Familiarity with the use of AI	FUAI1	0.78	0.72	0.84	0.64
	FUAI2	0.87			
	FUAI3	0.78			
Government Support	GS1	0.85	0.74	0.85	0.66
	GS2	0.89			
	GS3	0.84			
Perceived Ease of Use of AI	PEUAI1	0.87	0.873	0.913	0.725
	PEUAI2	0.82			
	PEUAI3	0.87			
	PEUAI4	0.85			
Perceived Ease of Use of Fintech	PEUF1	0.83	0.84	0.91	0.76
	PEUF2	0.89			
	PEUF3	0.82			
	PEUF4	0.85			
User Innovation	UI1	0.76	0.87	0.91	0.72
	UI2	0.83			
	UI3	0.82			

Table 3
Discriminant validity.

	1	2	3	4	5	6	7
1. Financial Services Knowledge	1.00						
2. Fintech Adoption	0.52						
3. Familiarity with the use of AI	0.52	0.49					
4. Government Support	0.47	0.45	0.44				
5. Perceived Ease of Use of AI	0.48	0.53	0.70	0.37			
6. Perceived Ease of Use of Fintech	0.53	0.84	0.55	0.46	0.55		
7. User Innovation	0.59	0.53	0.50	0.48	1.48	1.56	

3.3.2. *Common method bias*

The study used a common bias analysis to check if our sample size got too big or if our estimates got too high because of a pattern in how people answered, instead of real connections between things. The results found a common method factor accounts for less than 50 %, which indicates that common method bias is not a significant issue [60].

3.3.3. *Non-response biased analysis*

The study also used the non-response bias analysis to provide significant evidence for the generalization of the results. The generalizability of the findings was ensured by employing a non-response bias analysis using 100 early and late responses of each variable, as shown in Table 5. Furthermore, Table 6 presents summary statistics, indicating that all variables have values within the acceptable ranges, confirming the normality of the data.

3.4. *Analytic plan*

The study implied Partial Least Squares-Structural Equation Modeling (PLS-SEM) to investigate the antecedents of Fintech adoption among university students by utilizing the Technology Adoption Model (TAM) as a theoretical background, as this is a useful and flexible tool for statistical model building [61]. The conceptual framework of the study comprises three research models (see Figs. 1–3), each consisting of three hypotheses with variables including financial services knowledge (FSK), Familiarity with the use of AI, (FUAI), Government support (GS), User innovation (UI), and Fintech adoption (FA). Thus, the study implied 10,000 bootstrapping sub-sample techniques to analyze the significance of hypotheses testing.

Model-1. Impact of financial service knowledge on Fintech adoption: the moderating role of perceived ease of use of Fintech and the mediating role of user innovativeness.

Model-2. Impact of familiarity with AI on Fintech adoption: the moderating role of perceived ease of use of AI and the mediating role of user innovativeness.

Model-3. Impact of Government support on Fintech adoption: the moderating role of perceived ease of use of Fintech and mediating role of user innovativeness.

4. Results and analysis

4.1. *Results and analysis of Model-1*

The results of the research model – I (Figure-1), as shown in Table 7, reveal that between the two predictors of Fintech adoption (FA), Financial Service Knowledge (FSK), and User Innovativeness (UI), user innovativeness had a greater positive significant impact ($\beta = 0.45$, [0.38, 0.53], 95 % CI) on Fintech adoption among university students, followed by (FSK) -> (FA) ($\beta = 0.14$, [0.09, 0.19] 95 % CI). In addition, at a 95 % confidence interval, “0” didn’t lie between the lower and upper limits, indicating significant relationships. Furthermore, exploring the Fintech adoption among university students, the direct path of Perceived Ease of Use of Fintech (PEUF) was also examined. The results indicate that PEUF had a greater influence on UI ($\beta = 0.33$, [0.24, 0.43] 95 % CI) than Fintech adoption ($\beta = 0.15$, [0.1, 0.21] 95 % CI). However, lower and upper limits didn’t contain ‘0’, signposting positive relationships.

The study also explored the moderating role of perceived ease of use of artificial intelligence, with the mediation role of user innovativeness on the path relationship of the research model-1. Tables 8–9 shows that (PEUF) didn’t strengthen the relationship between (FSK) and (FA). Similarly, exploring the mediating path relationship (PEUF x FSK -> UI), a partial mediation of (UI) was

Table 4
Single source-bias.

	FSK	FA	FUAI	GS	PEUAI	PEUF	UI
VIF	1.41	1.59	1.35	1.67	1.55	1.00	1.52

Where FSK = Financial Services Knowledge; FA = Fintech Adoption; FUAI = Familiarity with the use of AI; GS = Government Support; PEUAI = Perceived Ease of Use of AI; PEUF = Perceived Ease of Use of Fintech; UI = User Innovation.

Table 5
Non-response biased analysis.

		Mean	N	SD	t-value	Sig.
Fintech Adoption	Early	3.27	100	0.91	-1.410	0.162
	Late	3.45	100	0.93		
User Innovation	Early	3.05	100	0.95	0.667	0.507
	Late	2.96	100	0.97		
Perceived Ease of Use of Fintech	Early	3.56	100	0.92	0.492	0.624
	Late	3.50	100	0.89		
Government Support	Early	3.05	100	0.97	0.840	0.403
	Late	2.93	100	0.89		
Perceived Ease of Use of AI	Early	3.56	100	0.92	0.492	0.624
	Late	3.50	100	0.89		
Familiarity with the use of AI	Early	3.04	100	1.04	-2.213	0.029
	Late	3.34	100	0.92		
Banking Knowledge	Early	2.93	100	0.82	1.022	0.309
	Late	2.81	100	0.89		
Microfinance Knowledge	Early	2.78	100	1.02	0.920	0.360
	Late	2.66	100	0.93		
Fintech-Usage Knowledge	Early	3.36	100	0.91	-1.771	0.080
	Late	3.58	100	1.03		

Table 6
Summary statistics.

	M	SD
Financial Services Knowledge	3.46	0.93
Fintech Adoption	3.08	0.96
Familiarity with the use of AI	3.55	0.91
Government Support	3.09	0.93
Perceived Ease of Use of AI	3.55	0.91
Perceived Ease of Use of Fintech	3.22	0.99
User Innovation	3.13	0.78

Note(s): Results show the normality of the data as all the values of the kurtosis and skewness lie within the range (-1 to +1).

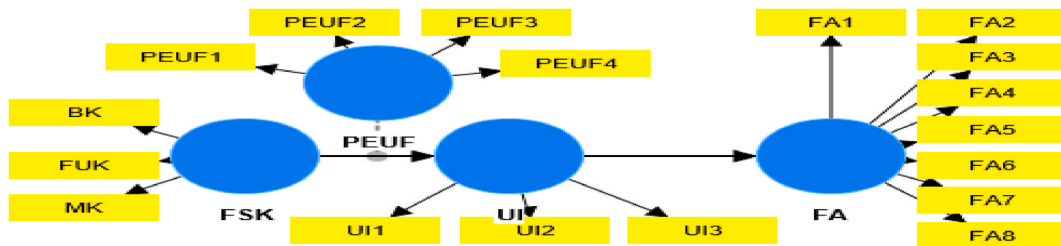


Fig. 1. Showing SEM for Model - 1.

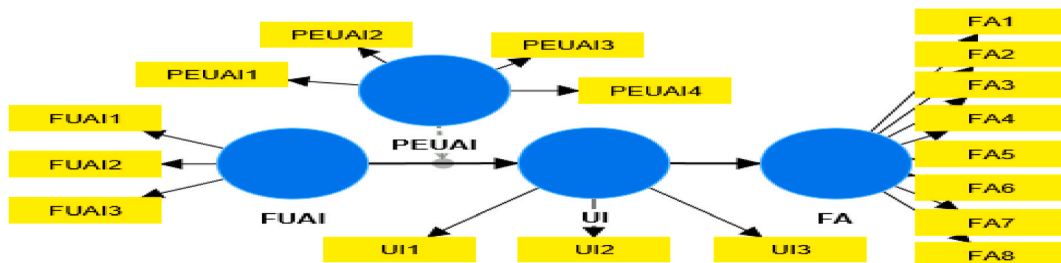


Fig. 2. Showing SEM for Model - II.

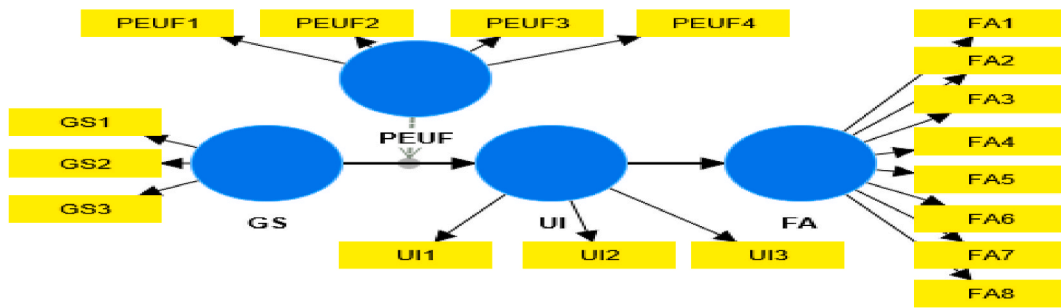


Fig. 3. Showing SEM for Model – III.

Table 7

Regression analysis results for Model-I.

Direct paths	B	t-value	p-value	f2	Decisions
FSK - > FA	0.14	4.98	p < 0.05		Supported
FSK - > UI	0.3	5.97	p < 0.05	0.11	Supported
PEUF - > FA	0.15	5.19	p < 0.05		Supported
PEUF - > UI	0.33	7.24	p < 0.05	0.12	Supported
UI - > FA	0.45	12.1	p < 0.05	0.26	Supported

Note(s): Where FSK = Financial Services Knowledge; FA = Fintech Adoption; PEUF = Perceived Ease of Use of Fintech; UI = User Innovativeness.

Table 8

Moderation analysis results for interaction between FSK and PEUF on FA.

	B	t-value	p-value	f2	Decisions
PEUF x FSK - > FA	0	0.26	0.79		Not supported
PEUF x FSK - > UI	0.01	0.27	0.79	0	Not supported

Note(s): Where FSK = Financial Services Knowledge; FA = Fintech Adoption; PEUF = Perceived Ease of Use of Fintech; UI = User Innovativeness.

Table 9

A path analysis of FSK on FA through UI.

Mediation paths	Direct path				Indirect path			
	β	t-value	p-value	Decision	β	LLCI	ULCI	Decision
FSK - > UI - > FA	0.35	6.23	P < 0.05	Supported	0.16	0.1	0.23	Partial Mediation

Note(s): Where FSK = Financial Services Knowledge; FA = Fintech Adoption; PEUF = Perceived Ease of Use of Fintech; UI = User Innovativeness.

found in the relationship between (FSK) and (FA).

4.2. Results and analysis of Model-II

Likewise, results for research model – II (Figure-2), exploring the familiarity with the use of artificial intelligence (FUAI), as an antecedent of Fintech adoption (FA), among university students, are shown in Table 10. Results show that (FUAI) had a weak but positive significant impact ($\beta = 0.09$, [0.04, 0.15], 95 % CI) on Fintech adoption among university students. As, lower and upper limits didn't include '0', indicating a significant relationship. In addition, amongst the two the direct path of perceived ease of use of (AI)

Table 10

Regression analysis results for Model-II.

Direct path	β	t-value	p-value	f2	Decision
FUAI - > FA	0.09	3.26	p < 0.05		Supported
FUAI - > UI	0.21	3.52	p < 0.05	0.036	Supported
PEUAI - > FA	0.12	3.95	p < 0.05		Supported
PEUAI - > UI	0.26	4.63	p < 0.05	0.055	Supported
UI - > FA	0.45	11.87	p < 0.05	0.253	Supported

Note(s): Where FUAI = Familiarity with the use of AI; FA = Fintech Adoption; PEUAI = Perceived Ease of Use of AI; UI = User Innovativeness.

(PEUAI), and user innovativeness (UI), was also investigated. The results disclose that (UI) had a greater effect ($\beta = 0.45$, [0.38, 0.53], 95 % CI) on Fintech adoption among university students than (PEUAI) ($\beta = 0.12$, [0.07, 0.18], 95 % CI). As “0” didn’t lie between upper and lower limits, marking significant relationships (see Table 10).

Furthermore, the study also examines the moderating effect of (PEUAI) and the mediation role of (UI) on the path relationships of the research model – II. The results, as shown in Tables 11 and 12, reveal that (PEUAI) didn’t strengthen the relationship between (FUAI) and (FA). Likewise, the mediating path relationship (PEUAI x FUAI - > UI), revealed a partial mediation of UI in between familiarity with the use of (AI) and Fintech adoption among university students.

4.3. Results and analysis of Model-III

Lastly, the research model – III (Figure-3) of the study, investigates the role of government support (GS) on Fintech adoption (FA) among university students. The findings in Table 13, show that (GS) had a predictor ($\beta = 0.10$, [0.05, 0.15], 95 % CI) of (FA) among university students. In addition, the effect of (GS) in (FA), (PEUF), and (UI) was also explored. Amongst the two direct paths, (UI) had a strong significant impact on (FA) ($\beta = 0.45$, [0.39, 0.53], 95 % CI).

Furthermore, the study also explored the moderating role of (PEUF). The findings in Table 14 show that the interaction term was significant at 95 % CI ($\beta = 0.04$, [0.00, 0.15], as “0” lies between the upper and lower limits. The study also investigated the significance of (UI) as a mediator on the path relationship of the research model – III. The findings in Table 15 represent that (UI) is a significant [ULCI 0.17, LLCI 0.01], 95 % CI) but partial mediation ($\beta = 0.09$) between (GS) and (FA) among university students.

In summary, exploring the antecedents of Fintech adoption among university students, (FSK), (FUAI), (GS), (PEUF), and (PEUAI) were examined (see Fig. 4). Amongst the five direct path relationships, the effect of (UI) on (FA) was the highest and positively significant ($\beta = 0.45$), followed by (PEUF) -> (FA) ($\beta = 0.15$), (FSK) -> (FA) ($\beta = 0.14$), (GS) -> (FA) ($\beta = 0.10$), (FUAI) -> (FA) ($\beta = 0.09$).

Likewise, the study investigated the six indirect paths to examine the significant influence of the interaction terms (see Fig. 5). A perceived ease of use (PEUF and PEUAI) was implied as moderators while UI was examined as a mediator in the conceptual framework of the research study. Amongst these interaction terms, only (PEUF x GS) -> (UI) was found significant ($\beta = 0.09$).

5. Discussion

As global digital finance continues to evolve, it becomes crucial to explore the key factors contributing to the Fintech adoption among university students. This study enhances existing literature by employing the theoretical lenses of the Technology Acceptance Model (TAM). It investigated the significant impact of financial services knowledge, familiarity with the use of, and perceived government support on Fintech adoption among university students. Moreover, the study also employs moderated-mediation path analysis to explore the mediating effect of user innovativeness and the moderating role of perceived ease of use of AI and Fintech in this domain. The empirical findings of the study confirmed that financial services knowledge, familiarity with the use of artificial intelligence, perceived government support, and financial services knowledge were found direct antecedents of Fintech adoption among university students in developing countries. Align with previous studies [7,62]. The relationship between financial services knowledge was positively related to emerging adults’ Fintech adoption [19,29,62]. However, this is the first study that took these findings one step further and tied the self-assessed level of financial services knowledge to university students’ Fintech adoption. The finding may support the fact that a higher level of financial services knowledge facilitates an individual to adopt Fintech. It refers to the fact that having high subjective financial services knowledge, makes them confident and aware of the benefits of Fintech adoption. That is why the study results were found significant between financial services knowledge and Fintech adoption. Hence, university students must equip themselves with financial services knowledge through various socialization agents like family, peers, and media. This would help them in using advanced Fintech services including mobile payment apps, digital wallets, and Fintech services in their financial transactions.

In addition, the study also explores the impact of familiarity with the use of Fintech adoption among university students. Artificial intelligence has revolutionized financial services in recent years and provides awareness of Fintech services that were previously inaccessible [63,64]. Specifically, for university students in developing countries, familiarity with the use of artificial intelligence holds significant implications in Fintech adoption. Therefore, the findings of the study highlight the importance of familiarity with the use of artificial intelligence for getting guidance and information in adopting Fintech for better financial decisions. Similarly, coherent with the previous studies [29,32,65,66], the findings of the study confirmed that government support has a positive significant impact on Fintech adoption. The findings of the study show that governments must create an enabling environment for financial innovation and Fintech adoption. More explicitly, for university students, this support has the potential to enhance financial knowledge and awareness, addressing the security risk attached to Fintech services, and ensuring that Fintech services are backed with legal cover. All this will influence the Fintech adoption among university students which ultimately contributes to the growth of the industry.

Table 11
Moderation analysis results for interaction between FUAI and PEUAI on FA and UI.

	β	t-value	p-value	f2	Decision
PEUAI x FUAI - > FA	-0.02	0.88	0.38		Not supported
PEUAI x FUAI - > UI	-0.04	0.89	0.37	0.003	Not supported

Note(s): Where FUAI = Familiarity with the use of AI; FA = Fintech Adoption; PEUAI = Perceived Ease of Use of AI; UI = User Innovativeness.

Table 12
A path analysis of FUAJ on FA through UI.

Mediation paths	Direct path				Indirect path			
	B	t-value	p-value	Decision	β	LLCI	ULCI	Decision
FUAJ -> UI -> FA	0.26	5.94	P < 0.05	Supported	0.11	0.07	0.16	Partial Mediation

Note(s): Where FUAJ = Familiarity with the use of AI; FA = Fintech Adoption; PEUAI = Perceived Ease of Use of AI; UI = User Innovativeness.

Table 13
Regression analysis results for Model-III.

	B	t-value	p-value	f2	Decisions
GS -> FA	0.1	3.95	P < 0.05		Supported
GS -> UI	0.22	4.32	P < 0.05	0.05	Supported
PEUF -> FA	0.19	5.84	P < 0.05		Supported
PEUF -> UI	0.41	8.87	P < 0.05	0.17	Supported
UI -> FA	0.45	12.32	P < 0.05	0.26	Supported

Note(s): Where GS = Government support; FA = Fintech Adoption; PEUF = Perceived Ease of Use of Fintech; UI = User Innovativeness.

Table 14
Moderation analysis results for interaction between GS and PEUF on FA and UI.

	Beta	t-value	p-value	f2	Decisions
PEUF x GS -> FA	0.04	2.04	P < 0.05		Supported
PEUF x GS -> UI	0.09	2.08	P < 0.05	0.02	Supported

Note(s): Where GS = Government support; FA = Fintech Adoption; PEUF = Perceived Ease of Use of Fintech; UI = User Innovativeness.

Table 15
A path analysis of GS on FA through UI.

Mediation paths	Direct path				Indirect path			
	β	t-value	p-value	Decision	β	LLCI	ULCI	Decision
GS -> UI -> FA	0.26	5.67	P < 0.05	Supported	0.12	0.08	0.18	Partial Mediation

Note(s): Where GS = Government support; FA = Fintech Adoption; PEUF = Perceived Ease of Use of Fintech; UI = User Innovativeness.

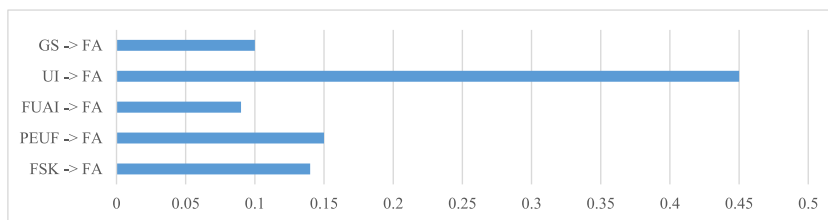


Fig. 4. Showing the overview of direct path relationships. **Note(s):** Where FSK = Financial Services Knowledge; UI = User Innovativeness; FUAJ = Familiarity with the use of AI; GS = Government support; PEUF = Perceived Ease of Use of Fintech; PEUAI = Perceived Ease of Use of AI.

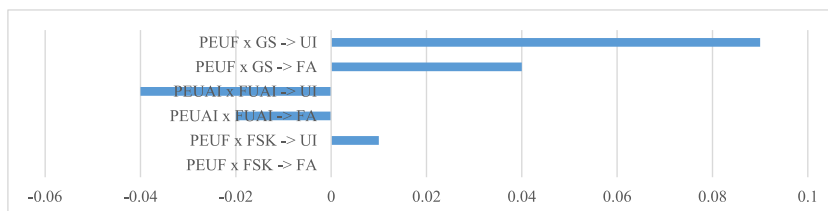


Fig. 5. Showing the overview of indirect path relationships **Note(s):** Where FSK = Financial Services Knowledge; UI = User Innovativeness; FUAJ = Familiarity with the use of AI; GS = Government support; PEUF = Perceived Ease of Use of Fintech; PEUAI = Perceived Ease of Use of AI.

Furthermore, the study also explored a significant positive impact of perceived ease of use and user innovativeness on Fintech adoption, in line with previous studies [67,68]. However, the findings of the study reveal an insignificant moderation-mediation effect of perceived ease of use (PEUF, PEUAI) and user innovativeness (UI) on the relationship between predictors (FSK, FUAI, GS), and the outcome (Fintech adoption). These findings explain that the direct-path relationships between predictors and outcomes might be strong enough that the influence of perceived ease of use as a moderator is negligible. Likewise, the insignificant mediating impact of user innovativeness posits that university students are highly innovativeness, and already have a strong inclination to Fintech adoption, regardless of perceived ease of use.

5.1. Conclusion

The study confirms the positive impact of financial services knowledge, artificial intelligence, and government support on Fintech adoption among university students. Financial services knowledge and familiarity with the use of artificial intelligence enhances Fintech adoption. Government support further strengthens this relationship by providing supportive environment. The findings support the notion that university students regularly encounter various digital payments to meet their academic needs. Therefore, Fintech adoption is now the need for every individual to fit into the growing digital financial environment. Moreover, the government support in this domain cannot be ignored. Though the study provides valuable insights, however, future research can use longitudinal designs to examine the causal relationships between the variables. Further, the impact of various socialization agents (family, peers, and media) on Fintech adoption would be an addition to the body of knowledge. The findings of the study emphasize the need to equip university students with the necessary financial knowledge and familiarity with the use of artificial intelligence across various disciplines which will boost economic growth, specifically in Asia-Pacific developing countries.

CRedit authorship contribution statement

Muhammad Akhtar: Writing – original draft, Methodology, Data curation, Conceptualization. **Asma Salman:** Resources, Project administration, Methodology, Conceptualization. **Khalid Abdul Ghafoor:** Software, Methodology, Investigation, Formal analysis, Conceptualization. **Mahnoor Kamran:** Validation, Software, Data curation.

Informed consent

Informed consent was obtained from all participants. To reduce any potential concerns, participants were given written informed consent forms that explained the aim of the study and its significance. All participants were asked whether they consented voluntarily to be a participant in this study. From the received document analysis, it was impossible to determine how each individual participated as the commenters' names and information are completely anonymous.

Ethical approval

Approval to conduct the study was given by the ethical committee, research center of the contributing author's institution, Shaheed Zulfikar Ali Bhutto Institute of Science and Technology University, Islamabad, Pakistan.

Submission declaration

The article is not under consideration for publication elsewhere.

Data availability

The data sets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author(s) did not use AI in order to develop manuscript. Authors take full responsibility for the content of the published article.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A1

Measurement models

Fintech adoption		loadings	Cronbach's alpha	CR	AVE	
FA1	We tend to use Fintech Services frequently	0.78	0.90	0.92	0.60	
FA2	We spend a lot of time analyzing Fintech Services.	0.61				
FA3	I get involved with Fintech Services.	0.75				
FA4	I will recommend using Fintech Services.	0.78				
FA5	I prefer to use the Fintech payment service as compared to a cash basis while performing transactions.	0.80				
FA6	I intend to use the Fintech payment service very soon.	0.76				
FA7	As an existing user, I will continue using the Fintech payment system.	0.86				
FA8	I rely on Fintech payment service for my future transactions.	0.82				
<i>User Innovation</i>		loadings	Cronbach's alpha	CR	AVE	
UI1	When I hear about a new tech product, I look for ways to try it.	0.76	0.87	0.91	0.72	
UI2	Among my peers, I am usually the first one to try a new tech product.	0.83				
UI3	I am experimenting with the latest Fintech services.	0.82				
<i>Financial Services Knowledge</i>		loadings	Cronbach's alpha	CR	AVE	
Banking knowledge	BK1	The knowledge level of respondents on bank deposits or savings.	0.836	0.879	0.92	0.74
	BK2	The knowledge level of respondents on saving interest rate.	0.865			
	BK3	The knowledge level of respondents on bank security money.	0.892			
	BK4	The knowledge level of respondents on bank installments.	0.836			
Microfinance knowledge	MFK1	The knowledge level of respondents on deposits or savings to micro-finance.	0.884	0.92	0.94	0.81
	MFK2	The knowledge level of respondents on the microfinance saving interest rate.	0.901			
	MFK3	The knowledge level of respondents on micro-finance security money.	0.906			
	MFK4	The knowledge level of respondents on micro-finance installments.	0.903			
Fintech-usage knowledge	FUK1	The ability to pay different bills of government services such as electricity bills, gas bills, and other government services bills.	0.878	0.82	0.89	0.74
	FUK2	The knowledge level of respondents on how to operate the fintech software.	0.891			
	FUK3	The knowledge level of respondents to deal in online shopping with their mobile banking account.	0.801			
<i>Familiarity with the use of AI</i>		loadings	Cronbach's alpha	CR	AVE	
FUAI1	I have worked with or studied artificial intelligence	0.78	0.72	0.84	0.64	
FUAI2	Throughout my life, I have had experience interacting with AI	0.87				
FUAI3	I am familiar with AI or AI content (texts, audiovisuals, etc.)	0.78				
<i>Government Support</i>		loadings	Cronbach's alpha	CR	AVE	
GS1	I believe the government supports and improves the use of Fintech services.	0.85	0.74	0.85	0.66	
GS2	I believe the government has introduced favorable legislation and regulations for Fintech services.	0.89				
GS3	I believe the government is active in setting up all kinds of infrastructure, such as the infrastructure telecom network, which has a positive role in promoting Fintech services.	0.84				
<i>Perceived ease of use of fintech</i>		loadings	Cronbach's alpha	CR	AVE	
PEUF1	I think it is easy to download application programs from the internet using Fintech Service.	0.83	0.84	0.91	0.76	
PEUF2	I think it is very easy to complete transactions using Fintech Service.	0.89				
PEUF3	I think it is easy to get started using Fintech Service without reading the service manual.	0.82				
PEUF4	I think it is easy to learn Fintech Service without spending too much time.	0.85				
<i>Perceived ease of use of AI</i>		loadings	Cronbach's alpha	CR	AVE	
PEUAI1	Learning to use AI would be easy for me	0.868	0.87	0.91	0.73	
PEUAI2	I would find it easy to manage investments using AI	0.823				
PEUAI3	It would be easy for me to become skillful at using AI	0.868				
PEUAI4	I would find AI easy to use Perceived usefulness	0.846				

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