



Alisha Maqsood¹, Muhammad Nazam², Mirza Nasir Jahan Mehdi³

¹Institute of Business Management Sciences, University of Agriculture, Faisalabad, Pakistan

²Institute of Business Management Sciences, University of Agriculture, Faisalabad, Pakistan,

Email: muhammad.nazam@uaf.edu.pk

³Department of Management Sciences, Muslim Youth University, Islamabad, Pakistan.

KEYWORDS	ABSTRACT
digital financial literacy; financial competence; women; banking sector; financial inclusion; PLS-SEM; Pakistan	Digital finance is expanding quickly in Pakistan, yet women remain far less financially included than men, and access to a smartphone or bank account does not by itself produce financial skill. This study examines how five dimensions of digital financial literacy (DFL) — Digital Financial Knowledge (DFK), Awareness of Digital Financial Services (DAW), Digital Financial Tool Usage (DTU), Online Financial Security and Risk Control (SEC), and Digital Financial Attitude and Behaviour (DAB) — relate to the financial competence (FC) of women bank employees in Faisalabad. A quantitative, cross-sectional survey was administered through purposive sampling; 344 of 360 questionnaires were valid (95.6%). The 38-item, five-point Likert instrument was adapted from validated international scales, and all six constructs showed excellent reliability (Cronbach's $\alpha = 0.932-0.952$). Data were analysed with descriptive statistics, Pearson correlation, simple and multiple regression (SPSS 26), and PLS-SEM (SmartPLS 4). Financial competence appears to depend more on attitudes, disciplined behaviour, foundational knowledge and security literacy than on awareness or tool access alone. Programmes for women should therefore be behaviour-oriented and security-embedded. Because the data are self-reported, cross-sectional and drawn from a homogeneous sample, the strength of the associations should be read with caution.
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Correspondence	Muhammad Nazam
Email:	muhammad.nazam@uaf.edu.pk
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Introduction

Background

Mobile banking applications, digital wallets, online lending and instant-payment systems have reshaped how people save, spend, borrow and pay (Panos and Wilson, 2024; Abdallah et al., 2025). These changes create new routes to financial inclusion, but they also create new forms of exclusion and exposure for people who lack the knowledge, skills and confidence to use them safely (World Bank, 2024). Women in developing economies are particularly affected because they already face gaps in education, technology access and financial participation (Lusardi and Mitchell, 2023; Hasler and Lusardi, 2017).

Pakistan illustrates the problem. It has one of the lowest rates of female account ownership in the Asia-Pacific region, and the State Bank of Pakistan's National Financial Inclusion Strategy (NFIS) 2023–2028 explicitly targets the gender gap (State Bank of Pakistan, 2021; World Bank, 2024). Whether such programmes succeed depends on whether women can use digital financial services meaningfully rather than merely open accounts (Showkat et al., 2025; Sadaf, 2025).

The city of Faisalabad, third largest city in Pakistan and a significant industrial and commercial hub is a convenient setting. It has a large number of working women, including in the banking industry (Rizvi et al., 2024). While these women might be professionally close to digital finance, being close to them does not mean they can handle money well by themselves (Kaur and Sahni, 2025). Subject to empirical investigation, this study is designed to answer whether the activities of digital finance lead to personal financial competence.

Key concepts

Digital financial literacy (DFL) is the mix of knowledge, skills, attitudes and behaviours which enable an individual to effectively and safely use digital financial services. It builds on the existing financial literacy, which only focused on budgeting, saving, and investing, and adds in digital products, digital risks and self-protection (Morgan and Trinh, 2020; Panos and Wilson, 2024; Abdallah et al., 2025). Financial competence (FC) is the capacity to use financial information when making real decisions about budgets, saving regularly, controlling spending, evaluating products and achieving financial goals (Sajid, 2024; Liu, 2025). This is important since competence is not just a cognitive state, but a behaviour. A competent person is not just aware that to budget is good sense; he makes and keeps a budget (Lusardi and Mitchell, 2023).

Problem statement

Convenience and speed come with digital platforms, and convenience can help undermine deliberation. For instance, instant credit and 'buy now pay later' options can give immediate liquidity, but promote poor long-term management if users are unaware and undisciplined (Morgan and Trinh, 2024). Having a smartphone or a bank account does not mean someone is

'financially skilled' and infrastructure increases welfare benefits only through investment in literacy (Morgan and Trinh, 2024). Digital exclusion can happen when women are excluded from formal digital channels, due to their inability to assess digital risk or evaluate digital products. (Sadaq, 2025) The rapid pace of product innovation, such as using AI for advice, decentralised finance or biometric authentication, also presents a moving-target challenge, as the skills needed today quickly become redundant (Chhillar et al., 2025).

Therefore, the question that this problem addresses is what is the link between the different aspects of digital financial literacy with financial competence among women in the digitally engaged urban workforce of Pakistan and to what extent? In the absence of such evidence, training and policy can focus on awareness building and handing out tools and miss the behavioral and security aspects that might be of greater importance.

Objectives and research questions

The study pursues three objectives: (1) to assess the level of DFL and financial competence of women employed in Faisalabad's banking sector; (2) to determine the effect of each DFL dimension on their financial competence; and (3) to derive policy and programme recommendations for strengthening DFL and women's financial inclusion. These translate into three research questions:

1. What are the current levels of digital financial literacy and financial competence among these women?
2. How are the five DFL dimensions (DFK, DAW, DTU, SEC, DAB) related to financial competence?
3. Which dimensions significantly predict financial competence?

Significance of the study

Theoretical significance. The study integrates cognitive (knowledge, awareness), applied (usage, security) and attitudinal-behavioural dimensions in one model, tests them against a behavioural outcome rather than adoption, and adds online security literacy as a distinct dimension, which is under-researched in Pakistan. **Empirical significance.** It supplies city-level evidence from Faisalabad, an industrial hub largely absent from the digital finance literature. **Methodological significance.** It offers a validated 38-item instrument and a two-method design (OLS and PLS-SEM) that allows results to be cross-checked. **Practical significance.** Findings inform bank training, the NFIS implementation agenda and curricula for finance education, showing where limited resources yield the largest gains in women's financial competence.

Scope

The study covers women employed in commercial banks in Faisalabad who use digital financial services such as mobile banking, internet banking and digital wallets. It excludes women outside

banking, rural women and male employees. Generalisation beyond this population requires replication.

Literature Review and Theoretical Foundations

From financial literacy to digital financial literacy

Huston (2010) separated financial *knowledge*, the stock of information a person holds, from financial *literacy*, the ability to apply that knowledge, and showed that measures based on knowledge alone are incomplete. The OECD/INFE framework likewise combines knowledge, behaviour and attitudes, and finds that behavioural scores usually trail knowledge scores across countries (Atkinson and Messy, 2015). Morgan and Trinh (2020) then showed that digital financial literacy has effects on digital service adoption that are independent of traditional financial literacy. Along with know-how of digital products (e.g., wallets, peer-to-peer platforms) and consciousness of digital dangers (e.g., phishing, identity theft), Wilson and Panos (2024) state that the digital economic system must also embody a willingness to use digital products responsibly. Lusardi and Mitchell (2023) agree, noting that “classic” financial skills are combined with a newfound ability to deal with cyber risks and digital platforms to be competent in today’s world. Morgan and Trinh (2024) state that for basic DFL (awareness and basic usage), returns diminish as the more advanced DFL (security, product evaluation, planning) keeps on improving returns. This layered view is the basis for the 5 dimension structure taken here. The financial inclusion is associated with broader economic performance, highlighting the importance of expanding meaningful participation in formal financial systems (Bajwa, 2026). However, access to digital financial services alone does not necessarily ensure effective or secure financial participation. Recent evidence from Faisalabad demonstrates that trust plays an important role in the adoption of digital financial services and their relationship with business performance (Shahzadi and Ghafoor, 2026).

Theoretical perspectives

The model is set against three related theories. As productive assets, financial knowledge and skill can be acquired at a cost that can be measured and, as a result, have economic returns that can also be measured; Jappelli and Padula (2013) provide the formal proof of this, while Lusardi and Mitchell (2017) provide empirical evidence of the economic returns of literacy. This perspective motivates the cognitive dimensions, DFK and DAW. The **Theory of Planned Behaviour** (Ajzen, 1991) holds that attitudes, subjective norms and perceived behavioural control shape behaviour. Applied to finance, women who hold favourable attitudes towards digital tools and feel able to use them are more likely to act competently; Mishra et al. (2024) confirmed the three TPB components for Indian women’s financial decisions, with attitude the strongest. This perspective motivates DAB. **Financial Socialisation Theory** emphasises that financial norms and habits are learned through family, peers and institutions (Yoshino et al., 2017). The banking workplace is such an institution, and Kaur and Sahni (2025) found that digital financial socialisation partly channels the effect of DFL on women’s financial management. Together, the theories predict that cognitive, attitudinal and behavioural

components each contribute to competence, and that the attitudinal-behavioural component is likely to be most proximal (see also Deci and Ryan, 1985, on intrinsic motivation).

Empirical evidence and hypothesis development

Women and the literacy gap. Women are less financially literate than men in virtually all countries, with wider gaps in lower-income economies, and Pakistan's female literacy rate has been estimated at roughly 26% against 36% for men (Hasler and Lusardi, 2017). Chamboko (2022) found that women use digital financial services less than men even with comparable smartphone access, implying that literacy, risk perception and norms, not access alone, drive the residual gap. Grohmann (2018) reported that literacy raises financial inclusion more for women than for men, and Vyas and Jain (2021) found DFL-well-being links to be stronger for women in India. Evidence from Pakistan links DFL to women's inclusion (Sadaf, 2025) and shows it conditions the effect of personality on inclusion among women employees (Rizvi et al., 2024).

Digital Financial Knowledge (DFK). Knowledge gives women an analytical basis for judging products and costs. Abdallah et al. (2025) found DFL, including knowledge, related to financial behaviour among bank customers in Kuwait, and Liu (2025) found that literacy was linked to all facets of financial competence in a digital environment. Meta-analytic evidence shows that financial education raises knowledge substantially and behaviour modestly, with larger effects in developing countries (Kaiser and Menkhoff, 2020). *H1: DFK has a significant positive effect on the financial competence of women.*

Awareness of Digital Financial Services (DAW). Awareness is the entry point to digital finance, but Yuneline and Rosanti (2023) found that digital-finance indicators did not independently predict financial behaviour, and Sadaf (2025) notes that Pakistani women may know of services yet not use them proficiently. *H2: DAW has a significant positive effect on financial competence.*

Digital Financial Tool Usage (DTU). Using mobile banking and wallets builds familiarity and confidence (Liu, 2025), and financial literacy raises digital payment use, which in turn supports financial management (Barus et al., 2024). Yet Simu et al. (2023) found that fintech use mattered together with literacy and social environment rather than alone. *H3: DTU has a significant positive effect on financial competence.*

Online Financial Security and Risk Control (SEC). Security literacy conditions trust and adoption. Al Doghan and Mirzaliev (2024) found that cybersecurity awareness strengthens the link between digital literacy and banking adoption, and Zheng and Hu (2025) found security awareness to be a key element of digital financial inclusion, operating through trust. Chhillar et al. (2025) tie digital literacy to healthier financial management and lower financial stress. *H4: SEC has a significant positive effect on financial competence.*

Digital Financial Attitude and Behaviour (DAB). Behaviour is more frequently understood by the confidence and attitude than the knowledge that might be shown. Danes and Haberman (2007)

have demonstrated that a self-efficacy gap contributes to the gender gap in financial behavior, Tang and Baker (2016) have found that self-esteem influences financial behaviour, beyond the impact of knowledge, and Allgood and Walstad (2016) have found that perceived literacy influences financial behaviour in addition to the actual literacy. Attitudes were not less important than product knowledge in saving as reported by Atkinson and Messy (2015). Kumar et al. (2023) also identified the factors of digital financial literacy and autonomy in shaping the quality of decisions; and Mishra et al. (2024) revealed that the attitude was the most significant determinant of women's financial decisions in India. H5: The learning of financial competence is significantly positively influenced by DAB.

Research gaps

Three gaps emerge. The first one is a contextual and geographic gap as studies on DFL and competence are primarily from China (Yang et al., 2023), Indonesia (Rahayu et al., 2024; Gosal and Nainggolan, 2023; Simu et al., 2023), India (Mishra et al., 2024; Peter et al., 2024) and Kuwait (Abdallah et al., 2025); and in the case of Pakistan the studies address the situation in Punjab at a broad level or women entrepreneurs in general but not specifically the banking women in Faisalabad. Second, a conceptual and variable gap: most models focus exclusively on cognitive knowledge and fail to include the dimension of security competency related to attitudes and behaviours, but in today's fintech era security is a key component of exclusion (Al Doghan and Mirzaliev, 2024). Third, a population gap: studies of women in Pakistan have examined women entrepreneurs (Rizvi et al., 2024; Sajid, 2024; Kaur and Sahni, 2025), and women students and general workers, but have not examined women working within the financial system, which are ideally suited to test the hypothesis that exposure leads to competence. This study takes care of all three by modelling five DFL dimensions against competence of women bankers in Faisalabad.

Conceptual Model and Hypotheses

The model (Figure 1) treats DFL as five distinct dimensions, each hypothesised to have a direct positive effect on the financial competence of women. The estimated relationship is:

$$FC = \beta_0 + \beta_1 DFK + \beta_2 DAW + \beta_3 DTU + \beta_4 SEC + \beta_5 DAB + \varepsilon$$

The five hypotheses are H1 ($DFK \rightarrow FC$), H2 ($DAW \rightarrow FC$), H3 ($DTU \rightarrow FC$), H4 ($SEC \rightarrow FC$) and H5 ($DAB \rightarrow FC$), each stated as a significant positive effect. Based on the attitudinal-behavioural emphasis of the Theory of Planned Behaviour and of prior evidence, DAB was expected to be the strongest predictor.

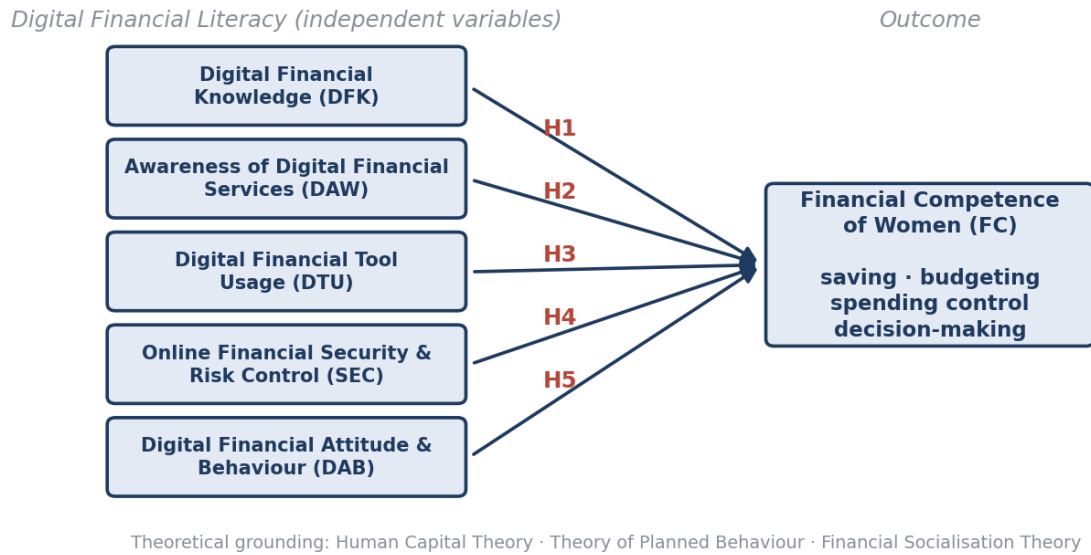


Figure 1. Conceptual framework: dimensions of digital financial literacy and the financial competence of women.

Research Methodology

Research design

The study follows a positivist, quantitative, explanatory-descriptive and cross-sectional design (Creswell, 2014). The explanatory component tests the hypothesised effects; the descriptive component profiles respondents and constructs. Primary data were collected through a structured survey, and the unit of analysis is the individual woman working in a bank in Faisalabad and using digital financial services.

Population, sampling and sample size

Their target group were women working in the banking industry in Faisalabad who access digital financial services. The non-probability sampling technique, purposive sampling, was used to select the respondents who are having relevant digital financial experience, because it is suitable for the explanatory research in a defined population (Sekaran and Bougie, 2016). The respondents were approached at various branches and areas of the city of domestic commercial banks (Habib Bank Limited, National Bank of Pakistan and United Bank Limited) and international banks. All participants needed to be female residents of Faisalabad and working in the banking sector, as well as using their smartphone for financial transactions and at least one digital financial service. Questionnaires showing more than 10% of missing answers (Hair et al., 2019), no use of any digital service, or flat-line responses were excluded.

The response rate for the 360 questionnaires that were sent out was 95.6% with 344 questionnaires being valid. This is more than the minimum of 200 typically allowed for regression and structural models (Hair et al., 2019; Kline, 2016) and 10:1 ratio of cases to predictors for a model with five predictors. The observed R^2 yielded a power of essentially 1.00 and an f^2 of approximately 3.47, which is much higher than the threshold of 0.35 for large effect size (Cohen, 1988); only about 92 cases would be needed for a medium effect ($f^2 = 0.15$).

Instrument development and measurement of variables

The questionnaire was developed in four steps: (1) review of validated DFL and financial competence scales; (2) selection and adaptation of items for Pakistan’s banking context and language; (3) content review by a panel of three academics in financial literacy, digital banking and quantitative methods, followed by a pilot with 20 banking women to check clarity and face validity; and (4) minor revisions. Section A collected demographic data (age, education, banking experience, monthly income, marital status, smartphone internet access). Section B contained 38 five-point Likert items (1 = strongly disagree to 5 = strongly agree) measuring the six constructs, written in simple English and distributed on paper, by WhatsApp and by email. A five-point scale was used to limit respondent fatigue and to match comparable studies (Abdallah et al., 2025; Rahayu et al., 2024). Table 1 summarises the measurement of each construct.

Table 1. Constructs, operational definitions and measurement

Construct (items)	Operational definition and sample content	Adapted from
DFK (6)	Knowledge of digital financial products and concepts: interpreting digital statements, distinguishing savings products, calculating loan interest, evaluating terms and conditions, long-term planning impact	Abdallah et al. (2025); Liu (2025)
DAW (6)	Awareness of digital services and programmes: services available in Pakistan, new products, government programmes, best-rate platforms, microfinance and non-bank services	Sadaf (2025); Kaur and Sahni (2025)
DTU (6)	Everyday use of digital tools: mobile and internet banking, wallets, utility bill payment, tracking transactions, preference for digital over in-branch banking	Barus et al. (2024); Yang et al. (2023)
SEC (6)	Knowledge and practice of online security: fraud techniques, account protection, spotting suspicious messages, response to compromise, privacy policies, confidence in protecting data	Al Doghan and Mirzaliev (2024); Zheng and Hu (2025)
DAB (6)	Attitudes and habits: belief in benefits, positive disposition, information seeking, self-discipline, encouraging others, perceived effect on behaviour	Gosal and Nainggolan (2023); Mishra et al. (2024)

FC (8)	Managing money effectively and making informed decisions: regular saving, budgeting, spending control, independent decisions, digital monitoring, understanding product risks, goal achievement, evaluating options	Rahayu et al. (2024); Peter et al. (2024); Abdallah et al. (2025)
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Note. DFK = Digital Financial Knowledge; DAW = Awareness of Digital Financial Services; DTU = Digital Financial Tool Usage; SEC = Online Financial Security and Risk Control; DAB = Digital Financial Attitude and Behaviour; FC = Financial Competence.

Validity, reliability and ethics

Content validity rested on the literature review and the expert panel; face validity on the pilot. Reliability was judged by Cronbach’s alpha (minimum 0.70; Nunnally, 1978) and corrected item-total correlations. Convergent validity was examined through average variance extracted (AVE > 0.50) and composite reliability (CR > 0.70) and discriminant validity through the heterotrait-monotrait (HTMT) ratio below 0.85 (Fornell and Larcker, 1981; Henseler et al., 2015). Participation was voluntary with informed consent, anonymity and confidentiality; banks granted permission before data collection, and no procedure posed physical, psychological or social risk.

Data analysis

Data were cleaned in Microsoft Excel 2019 and analysed in IBM SPSS Statistics 26 and SmartPLS 4 (Ringle et al., 2022). Analysis proceeded in stages: descriptive statistics; normality tests (Shapiro-Wilk, Kolmogorov-Smirnov); reliability; Pearson correlations; simple regressions for each predictor; and multiple regression with all five predictors (Enter method). Diagnostics comprised variance inflation factors (VIF), the Breusch-Pagan test, the Durbin-Watson statistic and Jarque-Bera test. Because heteroscedasticity was detected, HC3 heteroscedasticity-consistent standard errors (MacKinnon and White, 1985) were also reported. PLS-SEM with 5,000 bootstrap samples then served as a cross-check on measurement quality and structural paths. The significance level was $\alpha = 0.05$ throughout.

Results

Respondent profile

Table 2 shows the profile of the 344 valid respondents. The sample is young (78.2% aged 20–30), well educated (58.4% hold a bachelor’s degree and 26.7% a master’s degree or higher), early-career (72.7% with under one year in banking) and mostly on modest incomes (58.4% earn below PKR 30,000 per month). Smartphone-with-internet ownership is almost universal (94.5%). This is a digitally connected, junior workforce, consistent with the generational shift towards younger women in Pakistani banking.

Table 2. Demographic profile of valid respondents (N = 344)

Variable	Category	n	%
Age	20–30 years	269	78.2
	31–40 years	32	9.3
	41–50 years	38	11.0
	Above 50 years	5	1.5
Education	Intermediate	51	14.8
	Bachelor's	201	58.4
	Master's	54	15.7
	MPhil/PhD	38	11.0
Banking experience	< 1 year	250	72.7
	1–3 years	27	7.8
	4–6 years	32	9.3
	7–10 years	32	9.3
	> 10 years	3	0.9
Monthly income (PKR)	< 30,000	201	58.4
	30,001–50,000	38	11.0
	50,001–70,000	44	12.8
	70,001–100,000	50	14.5
	> 100,000	11	3.2
Marital status	Single	181	52.6
	Married	151	43.9
	Divorced/Widowed	12	3.5
Smartphone with internet	Yes	325	94.5
	No	19	5.5

Note. Percentages are based on N = 344 and may not sum to exactly 100 because of rounding.

Descriptive statistics

Table 3 reports item-level results. Every item mean lies above the scale midpoint of 3, with the modal response “Agree” (4) on all 38 items. Skewness (–0.47 to –0.90) and excess kurtosis (–0.41 to 0.90) are well inside the |2| and |7| guidelines (Hair et al., 2019). Item means range from 3.619 (DFK4, calculating interest on digital loans; 58.7% agreement) to 4.012 (DAB4, disciplining oneself to use digital tools responsibly; 75.0%), with SEC2, taking precautions to secure accounts (M = 4.006; 77.0%), close behind. The weakest area is therefore computational knowledge, and the strongest are disciplined use and account security.

Table 3. Item-level descriptive statistics (N = 344; 5-point scale)

Code	Item (abbreviated)	% A + SA	Mean	SD	Skew.	Kurt.
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Digital Financial Knowledge (DFK)						
DFK1	Understand basic concepts of digital finance	65.1	3.701	0.984	−0.770	0.435
DFK2	Correctly interpret digital banking statements	65.4	3.776	0.975	−0.656	0.172
DFK3	Understand differences in digital savings products	66.6	3.744	0.983	−0.778	0.441
DFK4	Calculate interest rates on digital loans	58.7	3.619	1.040	−0.466	−0.409
DFK5	Understand the digital products' long-term planning impact	63.4	3.741	0.954	−0.574	0.112
DFK6	Evaluate the terms and conditions of digital services	66.9	3.776	0.919	−0.625	0.226
Awareness of Digital Financial Services (DAW)						
DAW1	Aware of digital financial services in Pakistan	73.5	3.924	0.904	−0.846	0.846
DAW2	Keep updated on new digital financial products	67.2	3.773	0.951	−0.754	0.523
DAW3	Aware of government digital financial programs	67.4	3.741	1.007	−0.886	0.647
DAW4	Know platforms offering the best savings rates	64.8	3.759	0.997	−0.634	0.001
DAW5	Aware of digital microfinance and lending services	64.8	3.733	0.974	−0.564	−0.181
DAW6	Access digital services from non-banking institutions	62.5	3.706	0.947	−0.499	−0.109
Digital Financial Tool Usage (DTU)						
DTU1	Regularly use mobile banking applications	69.8	3.799	1.003	−0.803	0.257
DTU2	Use internet banking to manage accounts	70.3	3.820	0.967	−0.699	−0.023
DTU3	Use digital wallets for daily transactions	75.9	3.942	0.905	−0.901	0.841
DTU4	Use digital platforms for utility bill payments	73.0	3.890	0.941	−0.746	0.122
DTU5	Use digital tools to track transaction history	73.3	3.869	0.928	−0.856	0.654
DTU6	Prefer digital over traditional in-branch banking	69.8	3.875	0.916	−0.617	0.055
Online Financial Security and Risk Control (SEC)						
SEC1	Aware of digital fraud and scam techniques	71.5	3.872	0.923	−0.722	0.280
SEC2	Take precautions to secure financial accounts	77.0	4.006	0.857	−0.817	0.782

SEC3	Identify suspicious messages asking for banking info	75.6	3.953	0.899	−0.846	0.671
SEC4	Know the steps if account is hacked or compromised	67.7	3.788	0.944	−0.650	0.113
SEC5	Understand privacy policies of digital platforms	73.5	3.910	0.907	−0.854	0.827
SEC6	Confident protecting financial information online	71.5	3.913	0.899	−0.695	0.384
Digital Financial Attitude and Behaviour (DAB)						
DAB1	Believe digital services lead to better financial outcomes	70.6	3.846	0.852	−0.721	0.896
DAB2	Feel positive about incorporating digital tools	70.6	3.849	0.868	−0.642	0.395
DAB3	Actively seek information on new digital services	70.9	3.846	0.914	−0.744	0.459
DAB4	Discipline myself to use digital tools responsibly	75.0	4.012	0.907	−0.752	0.171
DAB5	Encourage others to use digital financial services	70.3	3.828	0.852	−0.683	0.693
DAB6	Digital tools positively shape my financial behaviour	71.5	3.875	0.906	−0.716	0.378
Financial Competence of Women (FC) — dependent variable						
FC1	Regularly save a fixed portion of monthly income	68.0	3.785	0.900	−0.596	0.104
FC2	Prepare and follow a monthly budget	68.9	3.849	0.897	−0.620	0.280
FC3	Track and control spending to avoid unnecessary expenditures	71.2	3.875	0.941	−0.842	0.721
FC4	Feel confident making independent financial decisions	72.7	3.898	0.903	−0.821	0.800
FC5	Use digital tools to monitor financial activities	69.2	3.808	0.906	−0.697	0.428
FC6	Understand risks and benefits of different financial products	70.9	3.869	0.886	−0.724	0.641
FC7	Achieve short-term and long-term financial goals	71.8	3.863	0.868	−0.721	0.648
FC8	Evaluate and choose most suitable financial option	71.8	3.881	0.847	−0.693	0.767

Note. % A + SA = share of respondents answering Agree or Strongly Agree. Median = 4 for all items. Min = 1, Max = 5. Full frequency distributions for each response category are available from the authors.

At construct level (Table 4; Figure 2a), means range from 3.726 (DFK, the lowest) to 3.907 (SEC, the highest), and financial competence is moderately high ($M = 3.854$, $SD = 0.773$). All constructs are negatively skewed (-0.690 to -0.825), the typical pattern for self-reported Likert data from a professional sample. Shapiro-Wilk and Kolmogorov-Smirnov tests rejected strict normality for all constructs ($p < 0.001$), but with $N = 344$, mild skewness and no extreme outliers, parametric procedures are considered robust (Field, 2018; Hair et al., 2019).

Table 4. Construct-level descriptive statistics ($N = 344$)

Construct	Mean	SD	Median	Min	Max	Skewness
DFK – Digital Financial Knowledge	3.726	0.855	3.833	1.000	5.000	–0.704
DAW – Awareness of Digital Fin. Services	3.773	0.833	4.000	1.000	5.000	–0.720
DTU – Digital Financial Tool Usage	3.866	0.815	4.000	1.000	5.000	–0.825
SEC – Online Financial Security & Risk Control	3.907	0.804	4.000	1.000	5.000	–0.770
DAB – Digital Financial Attitude & Behaviour	3.876	0.774	4.000	1.000	5.000	–0.697
FC – Financial Competence (DV)	3.854	0.773	4.000	1.000	5.000	–0.690

Note. Construct scores are the mean of the constituent items.

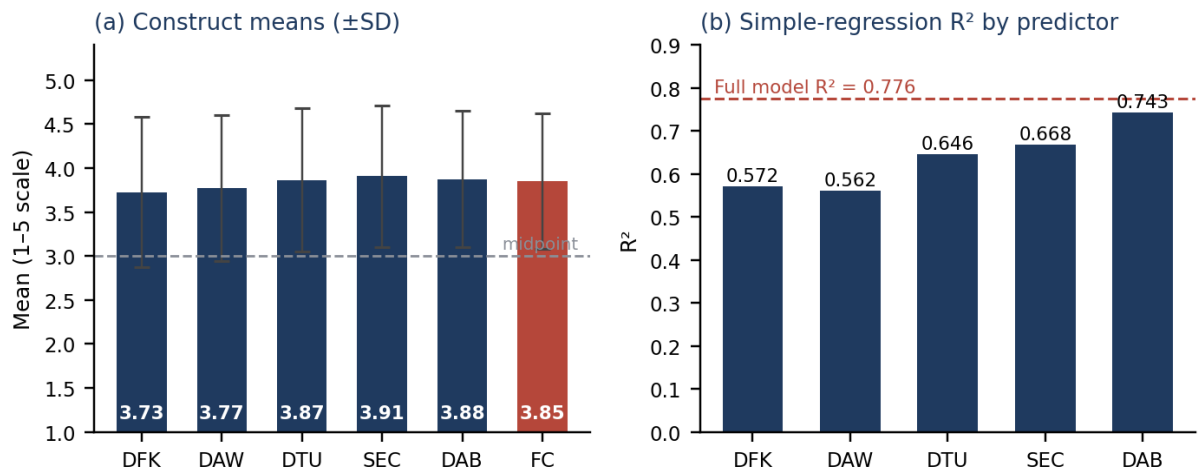


Figure 2. (a) Construct means with standard deviations; (b) variance in financial competence explained by each predictor in simple regression, compared with the full model.

Reliability

All constructs show excellent internal consistency (Table 5): alphas run from 0.932 (DTU) to 0.952 (FC), and the lowest corrected item-total correlation is 0.720, far above 0.30 (Field, 2018). No deletion of any item would raise alpha. These values match or exceed those in comparable studies

(Abdallah et al., 2025; Kaur and Sahni, 2025; Rahayu et al., 2024). Alphas above 0.90 can also indicate item redundancy, a point taken up in the limitations.

Table 5. Reliability analysis (N = 344)

Construct	Items	Cronbach's α	Min. item-total r	Reliability level
DFK	6	0.9391	0.7647	Excellent
DAW	6	0.9324	0.7198	Excellent
DTU	6	0.9316	0.7722	Excellent
SEC	6	0.9465	0.8219	Excellent
DAB	6	0.9395	0.7822	Excellent
FC (DV)	8	0.9516	0.8016	Excellent

Note. Excellent: $\alpha \geq 0.90$ (George and Mallery, 2003). Threshold for acceptability: 0.70 (Nunnally, 1978).

Correlation analysis

All constructs correlate positively and significantly ($p < 0.001$; Table 6). DAB has the strongest association with FC ($r = 0.862$), followed by SEC (0.817), DTU (0.804), DFK (0.756) and DAW (0.750); all are large by Cohen's (1988) standard. Correlations among the predictors are also high (0.724–0.895), especially DAB–SEC (0.895), DTU–DAB (0.880) and DFK–DAW (0.875). This is expected for dimensions of one broader construct, but it signals possible multicollinearity in the joint model.

Table 6. Pearson correlation matrix (N = 344)

	DFK	DAW	DTU	SEC	DAB	FC
DFK	1					
DAW	0.875***	1				
DTU	0.749***	0.775***	1			
SEC	0.724***	0.750***	0.854***	1		
DAB	0.753***	0.782***	0.880***	0.895***	1	
FC	0.756***	0.750***	0.804***	0.817***	0.862***	1

Note. *** $p < 0.001$ (two-tailed).

Regression analysis

Simple regressions

Each predictor alone significantly predicts FC (all $p < 0.001$; Table 7). Explanatory power rises from DAW ($R^2 = 0.562$) through DFK (0.572), DTU (0.647) and SEC (0.668) to DAB (0.743), which alone accounts for 74.3% of the variance in competence (Figure 2b).

Table 7. Simple linear regressions of FC on each predictor (N = 344)

Predictor	B	SE	β	t	R ²	Adj. R ²	F(1, 342)
DFK	0.6833	0.0320	0.756	21.365	0.5717	0.5704	456.46
DAW	0.6949	0.0332	0.750	20.942	0.5618	0.5606	438.55
DTU	0.7624	0.0305	0.804	25.010	0.6465	0.6455	625.52
SEC	0.7852	0.0299	0.817	26.233	0.6680	0.6670	688.17
DAB	0.8601	0.0274	0.862	31.424	0.7428	0.7420	987.49

Note. All $p < 0.001$. In simple regression the standardised β equals Pearson r .

Multiple regression

The joint model is highly significant, $F(5, 338) = 234.51$, $p < 0.001$, with $R^2 = 0.776$, adjusted $R^2 = 0.773$ and $RMSE = 0.368$ (Table 8). Three predictors are significant under conventional standard errors: DAB ($B = 0.496$, $\beta = 0.497$, $p < 0.001$), DFK ($B = 0.194$, $\beta = 0.215$, $p < 0.001$) and SEC ($B = 0.147$, $\beta = 0.153$, $p = 0.013$). DAW ($\beta = -0.001$, $p = 0.982$) and DTU ($\beta = 0.077$, $p = 0.196$) are not. With HC3 robust errors, DAB ($p < 0.001$) and DFK ($p = 0.009$) remain significant, whereas SEC becomes marginal ($p = 0.058$) and DAW and DTU remain non-significant. The dominant role of DAB is thus robust, while the SEC result should be treated as tentative. A one-standard-deviation rise in DAB is associated with a 0.50 standard-deviation rise in competence, holding the others constant.

Table 8. Multiple regression: dependent variable FC (N = 344)

Predictor	B	SE	β	t	p (OLS)	HC3 SE	HC3 p
Constant	0.3579	0.1045	—	3.426	0.001	0.1414	0.012
DFK	0.1944	0.0497	0.215	3.915	< 0.001	0.0739	0.009
DAW	-0.0012	0.0541	-0.001	-0.022	0.982	0.0867	0.989
DTU	0.0727	0.0561	0.077	1.297	0.196	0.0791	0.358
SEC	0.1468	0.0586	0.153	2.506	0.013	0.0774	0.058
DAB	0.4957	0.0682	0.497	7.263	< 0.001	0.1052	< 0.001

Note. $R^2 = 0.776$; adjusted $R^2 = 0.773$; $F(5, 338) = 234.513$, $p < 0.001$; $RMSE = 0.368$. HC3 = heteroscedasticity-consistent standard errors (MacKinnon and White, 1985).

Assumption diagnostics

Table 9 shows that all VIFs are below the conventional limit of 10 (4.56–7.06; tolerance 0.142–0.219), and the Durbin-Watson statistic (2.028) indicates no autocorrelation. The Breusch-Pagan test detected heteroscedasticity ($LM = 19.03$, $p = 0.002$), which is why robust errors were reported. Residuals depart from normality (Jarque-Bera = 987.7; Shapiro-Wilk $W = 0.864$), which is tolerable at $N = 344$ through the central limit theorem (Field, 2018). Note that four VIFs exceed 5, the stricter cut-off some authors apply, so multicollinearity remains a real interpretive concern.

Table 9. Collinearity and regression diagnostics

Predictor / test	Tolerance	VIF	Decision
DFK	0.2193	4.561	Acceptable
DAW	0.1942	5.150	Acceptable
DTU	0.1893	5.283	Acceptable
SEC	0.1781	5.615	Acceptable
DAB	0.1416	7.063	Moderate–high; below 10
Breusch–Pagan	LM = 19.032	p = 0.002	Heteroscedasticity: HC3 errors applied
Durbin–Watson	2.028	—	No autocorrelation
Jarque–Bera (residuals)	987.73	—	Non-normal; CLT applies at N = 344

Note. $VIF > 10$ or tolerance < 0.10 indicates problematic collinearity (Hair et al., 2019).

Hypothesis testing

Table 10. Summary of hypothesis tests

Hypothesis	β (OLS)	t	p (OLS)	p (HC3)	PLS path	Decision
H1: DFK $\rightarrow$ FC	0.215	3.915	< 0.001	0.009	0.199***	Supported
H2: DAW $\rightarrow$ FC	−0.001	−0.022	0.982	0.989	0.003 ns	Not supported
H3: DTU $\rightarrow$ FC	0.077	1.297	0.196	0.358	0.071 ns	Not supported
H4: SEC $\rightarrow$ FC	0.153	2.506	0.013	0.058	0.151*	Supported (tentative)
H5: DAB $\rightarrow$ FC	0.497	7.263	< 0.001	< 0.001	0.487***	Strongly supported

Note. *** p < 0.001; * p < 0.05; ns = not significant. Decisions are based on OLS at $\alpha = 0.05$; H4 is flagged because it is marginal under HC3 errors.

Supplementary PLS-SEM validation

PLS-SEM provided a second test of measurement quality and structure. All AVE values (0.673–0.742) exceed 0.50 and all composite reliabilities (0.941–0.957) exceed 0.70, with standardised loadings between 0.802 and 0.876 (Table 11), supporting convergent validity. HTMT ratios range from 0.731 to 0.840, all below 0.85 (Table 12), supporting discriminant validity even though the raw correlations are high.

Table 11. PLS-SEM measurement model: convergent validity (N = 344)

Construct	Cronbach's α	AVE	CR	Min. loading	Max. loading
DFK	0.9391	0.673	0.941	0.802	0.842
DAW	0.9324	0.681	0.943	0.808	0.844
DTU	0.9316	0.698	0.945	0.826	0.852

SEC	0.9465	0.726	0.951	0.842	0.875
DAB	0.9395	0.719	0.950	0.839	0.862
FC	0.9516	0.742	0.957	0.853	0.876
Threshold	≥ 0.70	≥ 0.50	≥ 0.70	≥ 0.70	—

Table 12. Heterotrait monotrait (HTMT) ratios (N = 344)

	DFK	DAW	DTU	SEC	DAB	FC
DFK	—					
DAW	0.741	—				
DTU	0.752	0.731	—			
SEC	0.738	0.769	0.784	—		
DAB	0.795	0.782	0.801	0.812	—	
FC	0.823	0.810	0.818	0.831	0.840	—

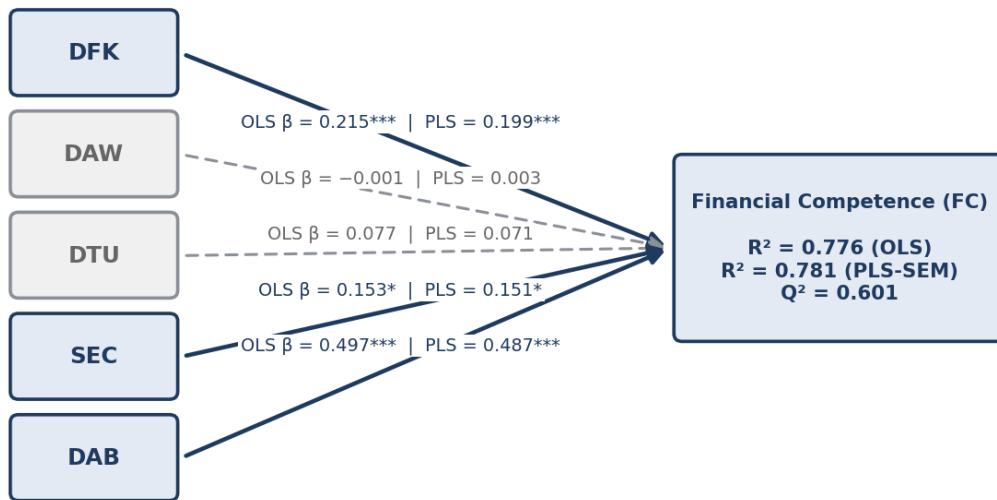
Note. All values are below the conservative 0.85 threshold (Henseler et al., 2015).

Bootstrapping (5,000 samples) produced structural results that mirror the regression (Table 13; Figure 3). DAB (path = 0.487, $t = 7.11$), DFK (0.199, $t = 3.87$) and SEC (0.151, $t = 2.49$) are significant, while DAW (0.003) and DTU (0.071) are not. The model explains 78.1% of the variance in FC (OLS: 77.6%), with strong predictive relevance ($Q^2 = 0.601$). Effect sizes are large for DAB ($f^2 = 0.521$) and small-to-medium for DFK (0.147) and SEC (0.089).

Table 13. PLS-SEM structural model (bootstrap, 5,000 samples)

Path	Coefficient	SE	t	p	Decision
DFK → FC	0.199	0.051	3.872	< 0.001	Supported
DAW → FC	0.003	0.063	0.048	0.962	Not supported
DTU → FC	0.071	0.055	1.283	0.200	Not supported
SEC → FC	0.151	0.061	2.489	0.013	Supported
DAB → FC	0.487	0.068	7.108	< 0.001	Supported

Note. R^2 (FC) = 0.781; Q^2 (FC) = 0.601.



Solid arrows: significant (OLS, $p < .05$); dashed: not significant. *** $p < .001$, * $p < .05$.

Figure 3. Structural model: standardised OLS coefficients and PLS-SEM path coefficients.

Discussion

Hypothesis-by-hypothesis interpretation

H1 (DFK) supported. Knowledge of digital products contributes to competence independently of attitudes, usage and security ($\beta = 0.215$). Women who can read digital statements, compare savings products and evaluate terms tend to budget, save and decide better. This agrees with Abdallah et al. (2025) and Liu (2025) and with the human capital view that cognitive investment pays off (Lusardi and Mitchell, 2017). DFK also had the lowest mean, and item DFK4 (interest on digital loans) the lowest of all items, so it marks an obvious and productive training target.

H2 (DAW) not supported in the joint model. Awareness correlates strongly with FC ($r = 0.750$; $R^2 = 0.562$ alone) but contributes nothing unique once the other dimensions are controlled ($\beta = -0.001$). It overlaps heavily with knowledge ($r = 0.875$). Awareness appears to be a necessary gateway rather than a sufficient cause: knowing that Easypaisa, Raast or Ehsaas exist does not by itself produce competent use (Sadaf, 2025; Yuneline and Rosanti, 2023).

H3 (DTU) not supported in the joint model. Frequent use of mobile banking and wallets is closely tied to attitude ($r = 0.880$), and once attitude is controlled, usage adds little ($\beta = 0.077$). Using a tool because it is required at work differs from using it deliberately for financial goals. This parallels Barus et al. (2024), who found that disciplined behaviour, not usage frequency, carried the effect, and Simu et al. (2023), where fintech use mattered alongside literacy and social context. It also suggests that the digital divide is partly a divide of disposition rather than of access.

H4 (SEC) tentatively supported. Security literacy adds a small unique contribution ($\beta = 0.153$), consistent with Al Doghan and Mirzaliev (2024), Zheng and Hu (2025) and Chhillar et al. (2025). The present result extends their work from adoption and trust to a broader competence outcome. However, significance disappears at the 5% level under HC3 errors ($p = 0.058$), and the PLS estimate ($p = 0.013$) is based on one-tailed bootstrapping, so replication is warranted before firm conclusions are drawn.

H5 (DAB) strongly supported. DAB is the strongest predictor in every analysis ($r = 0.862$; $R^2 = 0.743$ alone; $\beta = 0.497$ jointly; PLS path = 0.487), roughly twice the size of the next predictor. This fits the Theory of Planned Behaviour and behavioural-finance reasoning that dispositions and habits are closer to actual behaviour than knowledge is. It echoes Mishra et al. (2024), Kumar et al. (2023), Gosal and Nainggolan (2023) and Atkinson and Messy (2015), and it explains why knowledge-only interventions show small behavioural effects in meta-analyses (Kaiser and Menkhoff, 2020). Two cautions apply. DAB combines attitudes and behaviours, and several DAB items (for example, DAB6 “digital tools positively shape my financial behaviour”) are conceptually close to the competence items, which may inflate the association. Also, because the design is cross-sectional, competent women may simply hold more positive attitudes, so the direction of influence cannot be settled here.

Comparison with earlier studies

The joint R^2 of 0.776 is higher than the values reported in comparable DFL studies, which are typically 0.30–0.60 (for example, 0.612 for Abdallah et al., 2025; 0.534 for Rahayu et al., 2024; and 0.488 for Gosal and Nainggolan, 2023, as summarised in the source thesis). Two explanations are plausible. The sample is homogeneous, made up of women who share a workplace with heavy exposure to digital finance, which lifts inter-construct correlations. In addition, all constructs were self-reported in one sitting, and Harman’s single-factor test found that one factor explained 63.6% of total variance, above the 50% guideline (Podsakoff et al., 2003). Although Harman’s test is a weak diagnostic (Richardson et al., 2009), and OLS and PLS-SEM agree closely, common method variance probably inflates the effect sizes. The *ranking* of predictors, with DAB first, is consistent with the literature and is more credible than the magnitudes. That attitudes and behaviours dominate across Kuwait, India, Indonesia and now Pakistan suggests a cross-context regularity.

Theoretical contributions

The results support the three-theory framing: knowledge (Human Capital Theory) and attitude-behaviour (Theory of Planned Behaviour) both contribute independently, and the workplace-based sample is a plausible socialisation context. The study also contributes by (i) showing that security literacy adds explanatory value beyond adoption models, (ii) demonstrating that awareness and usage, often the targets of inclusion campaigns, are largely absorbed by deeper dimensions, and (iii) validating a six-construct instrument with strong measurement properties in Pakistan. A plausible refinement for future testing is that DAW and DTU operate *through* DAB

and DFK rather than directly, which is a mediation structure that these data cannot test but that the high overlaps suggest.

Implications

For banks. Because DAB carries most weight, staff programmes should move beyond information delivery to behaviour change: goal-setting and savings workshops, peer groups in which senior women model financial discipline, and practice-based digital tools. Since SEC contributes independently and 72.7% of respondents have under a year of experience, cybersecurity training should occur early in a woman banker's career. Computational content (loan interest, product comparison) should be added to address the weakest knowledge item.

For policymakers and regulators. Nearly all respondents (94.5%) have internet-enabled smartphones, yet competence tracks attitudes and behaviour rather than tool use. The State Bank of Pakistan and the Ministry of Finance could therefore embed (i) behaviour-change communication, (ii) mandatory security literacy and (iii) knowledge enrichment on digital credit and products into NFIS 2023–2028 women's programmes, and track competence outcomes, not only account ownership or app downloads. Community-based workshops that use existing bank networks may be a cost-effective delivery channel (Sadaq, 2025).

For educators. Finance, economics and business curricula in Faisalabad's universities and colleges should integrate digital product analysis, consumer cybersecurity, digital goal-setting and ethical digital decision-making.

Design principles for gender-sensitive DFL programmes. (1) Differentiate by level: awareness and basic usage for beginners, knowledge and security for intermediate learners, attitude and habit formation for advanced learners. (2) Deliver through trusted channels: employer-led training and peer networks for working women, community and religious groups for others, with WhatsApp or app-based follow-up as a supplement. (3) Use behavioural tools such as commitment devices, social proof and loss framing. (4) Evaluate success by behavioural competence indicators.

Limitations and Future Research

Four limitations qualify the findings. First, the cross-sectional design prevents causal inference, and reverse causation is plausible. Second, purposive sampling of young, educated bank employees in one city limits generalisation to rural women, non-bank workers or other cities. Third, self-report measures collected together create common method variance (Harman's factor = 63.6%), and the very high alphas (up to 0.95) and inter-construct correlations point to overlapping items and inflated effects. Fourth, only formal digital services were measured, excluding informal practices such as rotating savings committees (ROSCAs) and family mobile-money transfers that are significant in Pakistani women's finances. Marital status, income and experience were described but not tested as moderators.

Future studies could (1) follow new female recruits over 12–24 months; (2) replicate in Lahore, Karachi, Peshawar and in other professions such as health and education; (3) reduce method bias with time-separated measurement, marker variables or objective decision tasks; (4) test moderation by income, experience and marital status; (5) test mediation through financial self-efficacy, anxiety and social norms, including whether DAW and DTU act through DAB; and (6) evaluate a behaviour-focused, security-integrated DFL programme through a randomised controlled trial.

Conclusion

This study asked which parts of digital financial literacy translate into financial competence for women working in Faisalabad's banks. Five dimensions jointly explained about 78% of the variance in competence. Digital financial attitude and behaviour was by far the strongest predictor, followed by digital financial knowledge and, more tentatively, online security literacy. Awareness and tool usage correlated strongly with competence but added little once other dimensions were considered, indicating that they are entry points rather than engines of competence. The message for practitioners is that access and awareness are not enough: programmes should build knowledge, secure practice and, above all, the attitudes and habits that turn digital tools into disciplined financial behaviour. Given the study's self-report, cross-sectional and single-city design, the direction and ranking of effects are more dependable than their exact size, and longitudinal and experimental work is needed to confirm them.

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