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Customer Adoption of Neobank Services from a Technology Acceptance Perspective – Evidence from Hungary

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ABSTRACT

The rapid technological development of recent years has led to a transformation and digitalisation of financial services, resulting in an increasing number of neobanks. At the same time, consumer acceptance of the services offered by these branchless banks is a key success factor for their widespread adoption. The aim of our research is to understand the individual decision-making process of potential and current neobank users. This paper seeks to explore the relationships between the factors that influence customers' intention to use neobank services by extending the widely used technology acceptance model (TAM) to include trust. To answer the research questions, we conducted an online questionnaire survey in Hungary in 2022. Using structural equation modelling (SEM) on a sample of 475 respondents, we found that intention to use is directly influenced by attitude towards use, which in turn is positively influenced by trust, perceived usefulness and perceived ease of use. Based on these results, we recommend that neobanks should focus on building positive attitudes towards their services by emphasising trust, reliability, ease of use and usefulness of their services.

1. Introduction

Recent technological development has drastically changed the service sector [1]. The information society and economy can not only bring benefits in terms of value creation for companies and individuals but also increase the level of competition. It enables smaller but more flexible and responsive companies to enter a growing number of market segments, which also means that competitors are exposed to higher risk [2]

A plethora of new companies have emerged using new technologies to meet changing customer demand, suggesting that digital transformation is a key strategic priority in the financial sector [3]. The term FinTech is used to describe the technological developments emerging in the financial services sector as a result of increasing reliance on information technology [4]. Leading banks are rapidly closing gaps in the digitisation of internal processes and customer offerings to compete with FinTechs and the large technology companies that have also entered the game [5]. Banks are developing their own FinTech platforms or partnering with FinTech start-ups [6].

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In addition to the massive transformation of companies already in the market, new companies are emerging to compete ever more fiercely for consumers, who are faced with an increasingly complex choice of service providers. This is particularly true in the financial sector, where the continuous development of information technology has led to the proliferation of digital solutions [7]. In this market, consumer expectations of confidential and secure data management, credibility, convenience and cost efficiency are the measure of value and the criterion for choice [8].

The emergence of neobanks, also known as digital banks or challenger banks, has ushered in a new era in the financial landscape [9], [10]. These fully digital financial institutions operate without physical branches and use technology to offer convenient and customer-centric banking services. Neobanks have gained significant traction in recent years and are challenging the status quo of traditional banking models [11,12]. COVID-19 accelerated the global acceptance of neobanks [13]. Neobanks are disrupting traditional banking norms and offering agile, technology-driven solutions that focus on the customer experience.

Understanding consumer adoption of these new types of digital banks is critical to uncovering the factors that influence their success [14]. While there are recent studies that have investigated consumer adoption of digital banking solutions [15–19], to our best knowledge, no studies analysed consumer adoption of neobanks from a technology adoption perspective in one of the EU's emerging markets, despite the fact that neobanks are very popular in emerging countries [20] and Europe is currently the biggest neobanking market, with a transaction value of USD 1.462 trillion in 2022 [21].

By exploring the factors driving consumer adoption of neobanking services in Hungary, this study contributes to the understanding of individual decision-making in the financial sector. It also sheds light on how financial service providers should address the unmet needs of underserved consumer segments to promote financial inclusion.

The aim of this study is to analyse consumers' intention to use the innovative product portfolio of neobanks, focusing on the acceptance of technological innovations. Using the technology acceptance model (TAM) extended to include trust as a key factor in consumer choice, this study proposes an integrated theoretical framework for customer adoption of neobanking services from a technology acceptance perspective.

The theoretical positioning of this study, including our research approach, is multidisciplinary. It intends to answer questions on consumer behaviour and service management by using the theoretical background of psychology and behavioural sciences.

First, the theoretical background of the study is presented, including the emergence of neobanks and the technology acceptance model leading to the hypotheses and theoretical model of customer adoption of neobanking services. The following chapter addresses the methodology, including the research design and sample. It then presents the model tests, the structural equation modelling results and the main findings. The paper concludes with a discussion of the results, theoretical and managerial implications, limitations and a further research direction.

2. Literature Review

2.1. The Emergence of Neobanks

Previous studies [22–25] have shown that in order to increase efficiency and strengthen competitiveness, banks should give preference to smart and convenient services, especially self-service, while promoting the general use of online banking services that offer convenience or even entertainment (e.g., digital wallet, real-time interactions, video banking, ATMs integrated with smartphones, website customisation, biometric services, etc.). These features can contribute to increased use of online services.

Having investigated the trends in online banking, Chhabra *et al*., [26] identified the increase in the number of residential internet users and the growing importance of customer convenience as the key drivers for the growth of the online banking market. According to their forecasts, revenues related to online banking activities will grow by 13.6 percent on average until 2027, and by that time, the global online banking market revenue will approach USD 31.81 trillion. North America and Asia-Pacific will provide more business opportunities for online banking services in the future – the growth rate is expected to be higher in these regions.

According to Statista [21], the neobanking market is the largest segment within FinTech. Its global transaction value was USD 3.211 trillion in 2022. The global transaction value is projected to reach USD 4.74 trillion in 2023, and it is expected to show an annual growth rate (CAGR 2023-2027) of 18.15%, resulting in a projected total amount of USD 9.24 trillion by 2027. The number of neobank users is expected to reach 376.9 million users by 2027. User penetration will be 3.3% in 2023 and is expected to reach 4.7% by 2027.

Technological development significantly contributes to service development. Service delivery technologies have become a vital operational component of today's businesses, helping to reduce costs and improve overall operational efficiency [27,28]. The recent rapid development of FinTech and related areas has fundamentally changed the banking sector [22,29]. Neobanks, also referred to as digital banks, bank-like providers of financial services, or “Deposit and Lending” types of FinTechs, are financial start-ups that offer bank accounts and bank cards and are available on mobile apps. Neobank is a branchless digital bank that operates exclusively online, without a traditional physical (brick and mortar) branch network [30]. It is a fintech that relies on relationships with chartered banks that facilitate the provision of the neobank’s financial services [31]. Their popularity has been growing worldwide for years. Millions of people are using their apps, and more traditional banks are trying to emulate their distinctive, advanced digital customer experience [32].

In the absence of a universal definition, the entirely online, low-cost neobanks can be described as market disruptors attracting customers through affordable prices, unchallengeable customer experience (CX) and modern functionality [22]. Among them are market participants with a full banking license, but also those that rely on other banks for their operations [25]. Most of them build their services around digital bank accounts and bank cards that support multiple currencies. For example, Nubank offers free of charge credit card. They also provide a wide range of digital financial services as well as unusual products from banks, e.g., insurance services and products on cryptocurrency trade by Revolut. Actually, from investments and loans to messaging windows and booking accommodation, many interesting solutions are popping up in the apps [33]. Neobanks differentiate themselves from traditional banks by offering innovative services through a strong digital platform, often tailored to specific consumer groups, including savers; unbanked, underbanked, and hourly workers; students and millennials; small business owners, entrepreneurs, and freelancers [31].

Since innovation in the services industry has a significant positive impact on the performance of organisations [34], it is also a major determinant of the success of neobanks. With the rise of open innovation, customers are now seen as a key partner in the innovation process. Customers can be involved from idea generation to the commercialization phase [35]. Open innovation is a key differentiator for banks, whether they are neobanks or traditional banks. It fuels the development of solutions that specifically serve the needs of their customers [36].

Open innovations, including crypto services, digital store financing, digital investment advice, or metaverse merchant loyalty schemes, offer an excellent opportunity to be leveraged in the metaverse. The metaverse refers to a new form of internet that uses VR headsets, blockchain

technology and avatars to blend the physical and virtual worlds [37]. This virtual world provides an excellent platform for fintech companies and neobanks to use technology solutions in the digital space that are attractive, easy to use and fun for tech-savvy customers.

Şanlısoy and Çiloğlu [38] coined a new term, Metanomics, regarding the conceptualised economic structure of the Metaverse: "the virtual needs of humans and virtual entities are met in virtual universes; production, distribution and finance processes are designed for this purpose and interact with the real universe." The Metaverse is predicted to see the emergence of new financial institutions with innovative financial instruments and a new arena for financial transactions linking the virtual and real-world economies. This will provide an ideal platform for neo-banks, especially for cryptocurrency transactions.

For many clients, managing money is a confusing and stressful activity. The metaverse creates an opportunity for neobanks to provide their customers with a more personalised way of dealing with their money. In the metaverse, savings, objectives and life goals can be visualized in ways that lead to stronger motivation and behavioural change. In this context, gamification seems to be very important, as it is one of the most effective ways to engage users with the metaverse [39]. However, neobanks seeking to implement a metaverse presence must place a high priority on trust and security because of the significant risk of fraud [40].

Banga *et al.,* [13] found five significant drivers of customer choices for neobanks in the US: the bank's popularity, services offered, ease and accessibility, fee structure, and banking experience and security. Using the UTAUT-3 model, Bhatnagr & Rajesh [41] suggested that behavioural intention to use, adoption and recommendation have a positive impact on the customer adoption of neobanking. By examining the case of the Tinkoff bank, one of the most successful neobanks in Europe, Nurbaev *et al.*, [29] identified four important business success factors of neobanks: diversity of products/services, low user burden, innovativeness and light asset. However, the emergence of neobanks raised several questions on the market, including their operation, product portfolio and customer adoption, which is the subject of our current investigations.

2.2. Technology Acceptance Model (TAM)

There are numerous theoretical models that explain the acceptance behaviour of end users. In particular, the technology acceptance model (TAM) proposed by Davis [42] has attracted considerable attention and has been extensively empirically tested. Since its introduction, TAM has been the subject of numerous empirical studies. As of July 2023, in Sciencedirect alone, under the social sciences subject area, there are more than 7400 hits for the keyword TAM. Compared to alternative models, TAM is widely considered to be particularly parsimonious, predictive and robust [43].

The main objective of TAM is to shed light on the underlying processes that drive technology adoption, thus enabling the prediction and theoretical explanation of successful technology implementation. In addition, TAM seeks to provide practitioners with valuable insights and actions to consider prior to system implementation.

The development of the technology acceptance model and associated measures has led to significant theoretical advances and practical benefits. By applying TAM to the evaluation of the usability of information systems, it became possible to assess the motivation of users to adopt a wide range of technologies [44,45]. This was previously hindered by the lack of validated subjective measures. Furthermore, the creation of constructs that have a robust and meaningful correlation with user behaviour has provided insights into the cognitive and affective factors that mediate the influence of system characteristics on technology acceptance [42].

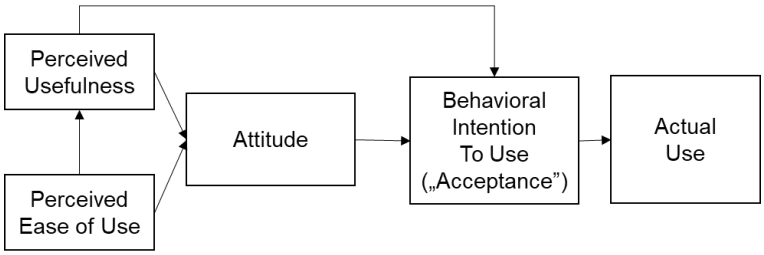

Fig. 1. The extended Technology Acceptance Model with trust

TAM (Figure 1) highlights key factors that influence the adoption of a technology. These factors provide valuable insights into users' perceptions, attitudes, intentions, and actual use. The original TAM is composed of five constructs: perceived ease of use (PEOU), perceived usefulness (PU), attitude towards use (ATT), behavioural intention to use (INT), and actual use (AU). Perceived ease of use is the individual's assessment of the effort involved in using the system, e.g., the extent to which a person believes that using a technology will be effortless [46]. Perceived usefulness is a critical factor that focuses on users' subjective assessment of how the adoption of a particular technology will improve their performance and productivity in achieving their goals [42]. Attitude towards use is the individual's overall reaction to using a system [43], which can be positive or negative. Behavioural intention to use refers to the willingness of users to adopt and use a technology, while actual use represents the actual usage behaviour of individuals after they have adopted a technology [42].

TAM proposes that perceived usefulness and ease of use are the primary determinants of users' attitudes and intentions to use a technology [46]. When users perceive a technology to be useful and easy to use, they are more likely to develop positive attitudes towards it, leading to a stronger intention to adopt and use it. Additionally, TAM proposes that the actual use of a technology is influenced by the users' intentions. Several research studies have further supported the interrelationships between these TAM variables [42,47,48].

TAM has evolved from its original model and is continuously adapted to different research goals and contexts, enabling its progress and development [47,49]. It has been used to study user acceptance and adoption behaviours, identify factors affecting technology adoption, and guide the design and implementation of user-friendly technologies [50,51]. TAM has been applied extensively in various contexts and technologies, including software systems, e-commerce, mobile applications, and online services. For example, Munoz-Leiva *et al*., [52] investigated the user acceptance of mobile banking applications in Spain using TAM, extended with the innovation diffusion theory, perceived risk and trust. Using the extended UTAUT2 with security, privacy and trust, Merhi *et al*., [53] identified the factors influencing intention to use mobile banking services in Lebanon and the UK. Susilo *et al.*, [54] analysed the acceptance rate in the technology of digital payment systems in Indonesia. Hu *et al.*, [55] used an improved TAM that integrates user innovativeness, government support, brand image, and perceived risk as determinants of trust to investigate user adoption of FinTech services in China. The study of Komalasari and Ramadhani [56] revealed the factors of Indonesian online banking usage. Singh and Srivastava [57] investigated online banking users' behavioural intention to use similar services such as mobile banking in India. Albort-Morant *et al.,* [58] studied the different levels of adoption of online banking services in Spanish cities and towns using TAM. Alnemer [59] analysed the factors of digital banking adoption in Saudi Arabia using TAM extended by with trust. Applying the unified theory of acceptance and use of technology extended by privacy enablers and privacy

inhibitors, Bajunaied *et al.,* [60] examined the consumers' behavioural intention towards FinTech services in Saudi Arabia.

2.2.1. Perceived usefulness (PU)

In line with the original TAM framework, our theoretical model incorporates perceived usefulness as a direct factor influencing attitude and as an antecedent to the intention to use.

2.2.1.1. Perceived usefulness and attitude towards use (PU-ATT)

The influence of perceived usefulness on intention to use occurs both directly and indirectly through its effects on attitudes related to self-efficacy and technical needs [61]. When customers perceive the service as useful, they have positive attitudes towards the service, which directly increases their intention to use the service [16,62]. However, if services are not perceived as useful, customers may not use the platform or application, even if they find it easy to use [63]. In addition, several other studies have found that attitudes towards technology use are positively influenced by perceived usefulness [16,52,54–56,64,65]. Therefore, we developed the following hypothesis:

H1a: Perceived usefulness has a positive effect on the attitude towards the use of neobank services.

2.2.1.2. Perceived usefulness and behavioural intention to use (PU-INT)

Extensive research has provided ample evidence of the significant impact of perceived usefulness on consumers' intention to adopt a product or service [16,57,59,66–68]. The findings of the study of Pikkarainen *et al.*, [69] indicated that perceived usefulness and information on online banking on the website are the key factors of online-banking acceptance. Fortes and Rita [62] found that perceived usefulness positively affects online purchasing intention. Recently, Ananda *et al.,* [15] revealed that awareness, web features and perceived usefulness have a significant positive influence on the adoption of digital banking. Albort-Morant *et al*., [58] found that perceived usefulness and online banking use behaviour are positively and directly associated. According to Alnemer [59], perceived usefulness shows a significant and positive marginal effect on the adoption of digital banking. Meijer *et al*., [19] found that perceived usefulness has a significant positive weak direct effect on acceptance of neobank services. However, it must be noted that Munoz-Leiva *et al.,* [52] and Komalasari and Ramadhani [56] found no significant relationship between perceived usefulness and behavioural intention to use. Therefore, the above discussion leads to the development of the following hypotheses:

H1b: Perceived usefulness has a positive effect on the intention to use neobank services.

2.2.2. Perceived ease of use (PEOU)

Perceived ease of use refers to the extent to which customers have confidence in a particular service and feel comfortable using it, which gives them a sense of freedom and comfort [70]. Digital banking services offer customers more convenience and accessibility compared to traditional services.

2.2.2.1. Perceived ease of use and perceived usefulness (PEOU-PU)

Numerous studies have shown that the usability of a service has a significant impact on customers' perception of its usefulness [16,43,46,52,55,58]. Komalasari and Ramadhani [56] found that perceived ease of use significantly influences perceived usefulness. Nguyen [16] found that perceived ease of use has a positive impact on perceived usefulness. Meijer *et al*., [19] found that perceived ease of use has a significant positive weak direct effect on acceptance of neobank services

and a significant positive strong effect on perceived usefulness and trust. Based on those results, we developed the following hypothesis:

H2a: Perceived ease of use has a positive effect on the perceived usefulness of neobank services.

2.2.2.2. Perceived ease of use and attitude towards use (PEOU-ATT)

Perceived ease of use has positive influence on the overall attitude towards the service [46,52,54,70]. According to Fortes and Rita [62], perceived ease of use has a positive effect on attitudes towards online purchasing. Marakarkandy *et al.,* [65] found that attitude towards internet banking is positively affected by the perception of ease of use. Susilo *et al.,* [54] found that the perceived ease of use of digital payment systems positively affects attitudes towards use. Komalasari and Ramadhani [56] found that perceived ease of use significantly influences attitudes towards the use of online banking. Albort-Morant *et al.*, [58] found that perceived ease of use positively influences online banking use behaviour. However, Hu *et al.,* [55] found no significant relations between perceived ease of use of and attitudes towards Fintech services in China. In the light of these, the following hypothesis was developed:

H2b: Perceived ease of use has a positive impact on attitudes towards the use of neobank services.

2.2.3. Attitude towards use (ATT)

Stoel and Hye Lee [71] define attitude as the emotional disposition of an individual towards the use of technology. Another definition states that attitude is the evaluation or judgment of a person regarding the use of technology, indicating whether they like it or not [48]. Therefore, in this study, attitude is defined as an individual's reactions towards the use of neobank services, encompassing their acceptance and preference for it. Attitude refers to an individual's inclination to respond positively or negatively towards various entities, such as something, someone, an organization or distinguishable things [65]. In the context of internet banking service usage, a person's positive or negative reaction can also explain the concept of attitude [64].

2.2.3.1. Attitude towards use and behavioural intention to use (ATT-INT)

Previous studies in e-business have consistently demonstrated that an individual's attitude plays a significant and direct role in shaping their intention to use a specific e-business application [16,52,54,55,62,65,72]. For instance, George [73] found a positive correlation between individuals' attitudes towards online shopping and their intention to engage in such behaviour. Furthermore, Püschel *et al.*, [74] conducted a study that highlighted the significant impact of attitude on the intention to use mobile banking. They concluded that there exists a strong relationship between individuals' perspectives on adopting mobile banking and their behavioural intention. The result of Komalasari and Ramadhani [56] also confirmed that attitude towards use significantly influences behavioural intention to use. Accordingly, the following hypothesis was developed:

H3: The attitude towards using neobank services has a positive effect on the intention to use.

2.2.4 Trust (TRU)

Trust is a subjective disposition to believe in the likelihood of positive actions or outcomes [75]. It is established when a specific system demonstrates a sufficient level of ability, benevolence, and integrity [76]. Trust is one of the cardinal elements of the digital economy. Without trust, few transactions would take place.

The concept of trust encompasses utilitarian and affective aspects to varying degrees, which is essential for comprehending its influence on relational behaviours. Utilitarian elements pertain to the consumer's perception that the trusted entity will fulfil functional objectives, such as meeting performance expectations. On the other hand, affective elements refer to the perception that the trusted entity is suitable for satisfying relational goals, such as exhibiting honesty, altruism, or other desirable qualities [77,78]. While integrity primarily relates to affective or emotional evaluations, rather than utilitarian considerations, the ability or competence dimension focuses on utilitarian assessments of the provider's capabilities [79,80].

In the context of mobile banking adoption, institutional trust and trust in the technology or channel can be identified [75]. Institutional trust refers to the trust between users and financial service providers, which can be based on past experiences or a good reputation [81]. However, this concept may not apply when introducing new financial technology. In such cases, users' trust in the technology is influenced by perceptions, emotions, and other non-rational factors [82].

2.2.4.1. Trust and attitude towards use (TRU-ATT)

In their study of consumer acceptance of virtual shops in Korea, Oh *et al.*, [83] identified perceived playfulness, perceived trust, perceived usefulness and perceived ease of use as the four most important factors directly affecting virtual shop users' attitudes. The research conducted by Alsajjan and Dennis [84] in the UK and Saudi-Arabia revealed that trust has a positive effect on users' attitudinal intentions towards Internet banking adoption. Fortes and Rita [62] found that trust has a positive effect on the consumer's intention to make online purchases. Munoz-Leiva *et al.,* [52] found that trust positively influences attitude. The results of Hu *et al.*, [55] uncovered that users' trust in Fintech services has a very significant influence on users' attitudes towards acceptance. However, Nguyen [16] found that trust has no effect on the attitude towards the service. These findings suggested the development of the following hypothesis:

H4a: Trust has a positive effect on the attitude towards the use of neobank services.

2.2.4.2. Trust and behavioural intention to use (TRU-INT)

Several studies [53,85–87] have found that trust is a key influencer of behavioural intention to adopt technology in mobile and online banking, and online shopping. Trust plays a vital role in shaping individuals' behavioural intention to adopt a technology, as it is inversely associated with perceived risk [88]. Consequently, a higher level of trust in a technology reduces perceived risk and positively influences behavioural intention. Furthermore, prior trust has been found to have a significant positive impact on the adoption of mobile banking [81,82]. Keskar and Pandey [89] reviewed the literature on digital banking and found that trust has been used as an important variable for digital banking adoption and usage in many studies. Merhi *et al.,* [53] found that perceived trust is a key influencer of behavioural intention to adopt mobile banking in both Lebanon and England and suggested that the undeniable impact of trust on mobile banking usage and adoption may be due to the sensitive nature of electronic financial transactions. Kaur *et al.*, [17] found that a key factor in improving the adoption of digital banking in India is the need for integrated cultural and organizational changes at the bank level to gain customer trust and confidence in digital banking. Meijer *et al.,* [19] found that trust has a significant positive weak effect on both the perceived usefulness of, and the behavioural intention to use neobanks. When investigating the adoption of neobanking, the factor of trust appears to be an important decision-making factor for consumers when using banking and online services. According to Alnemer [59], trust drives customers to adopt digital banking. Bajunaied *et al.,* [60] found that trust and information richness as privacy enablers

positively influence behavioural intention. Therefore, we extended the original TAM with trust (Figure 2) and developed the following hypotheses:

H4b: Trust has a positive effect on the intention to use neobank services.

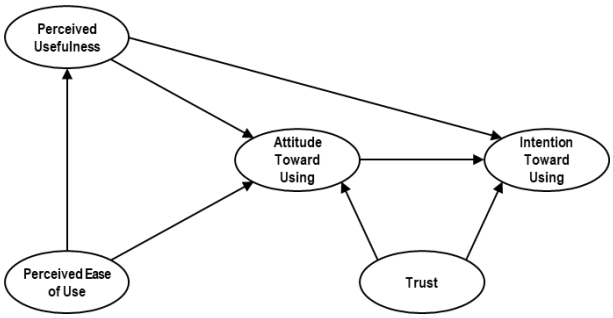

Fig. 2. The extended Technology Acceptance Model with trust

Table 1 summarises the research findings concerning the relationship between the factors of TAM, which we used to build the theoretical model and develop the hypotheses.

Table 1
Summary table of the relationships between extended TAM constructs

Relations and hypotheses	Positive effect	No significant effect
Perceived Usefulness → Attitude H1a	Davis *et al.,* [61]; Bashir and Madhavaiah [64]; Fortes and Rita [62]; Marakarkandy *et al.,* [65]; Munoz-Leiva *et al.,* [52]; Susilo et al. [54]; *Hu et al.,* [55]; Banu *et al.,* [63]; Komalasari and Ramadhani [56]; Nguyen [16]	
Perceived Usefulness →Intention to use H1b	Khalifa and Ning Shen [66]; Kim and Garrison [67]; Tsu Wei *et al.,* [68]; Pikkarainen *et al.,* [69]; Fortes and Rita [62]; Ananda *et al.,* [15]; Nguyen [16]; Singh and Srivastava [57]; Albort-Morant *et al.,* [58]; Alnemer [59]; Meijer *et al.,* [19]	Munoz-Leiva *et al.,* [52]; Komalasari and Ramadhani [56]
Perceived Ease of Use → Perceived Usefulness H2a	Venkatesh [46]; Venkatesh *et al.,* [43]; Munoz-Leiva *et al*., [52]; Hu *et al.*, [55]; Nguyen *et al.,* [90]; Komalasari and Ramadhani [56]; Nguyen [16]; Albort-Morant *et al.,* [58]; Meijer *et al.,* [19]	
Perceived Ease of Use→Attitude H2b	Davis [70]; Venkatesh [46]; Fortes and Rita [62]; Marakarkandy *et al.,* [65]; Munoz-Leiva *et al.,* [52]; Susilo *et al.*, [54]; Komalasari and Ramadhani [56]; Albort-Morant *et al.* [58]	Hu *et al.,* [55]
Attitude Towards Use → Intention H3	George [73]; Püschel *et al.,* [74]; Cudjoe *et al.,* [72]; Fortes and Rita [62]; Marakarkandy *et al.,* (2017); Munoz-Leiva *et al.,* [52]; Hu *et al.,* [55]; Susilo *et al.,* (2019); Komalasari and Ramadhani [56]; Nguyen [16]	
Trust → Attitude H4a	Oh *et al.,* [83]; Alsajjan and Dennis [84]; Fortes and Rita [62]; Munoz-Leiva *et al.,* [52]; Hu *et al.,* [55]	Nguyen [16]
Trust → Intention to Use H4b	Kim *et al.,* [82]; Alalwan *et al.,* [85]; Chiu *et al.,* [81]; Yadav *et al.,* [86]; Keskar and Pandey [89]; Tarhini *et al.,* [87] ; Merhi *et al.,* [53]; Sharma and Sharma [88]; Kaur *et al.,* [17]; Alnemer [59] ; Bajunaied *et al.,* [60]; Meijer *et al.,* [19]	

3. Research Methodology and Sample

3.1. Research Methodology

Based on the result of the extensive literature review presented in the previous chapter, we hypothesized the relationship between variables and proposed the research framework shown in Figure 3 to investigate customer adoption of neobank services from a technology acceptance perspective. This theoretical model is based on the original Technology Acceptance Model (TAM), which we extended with trust.

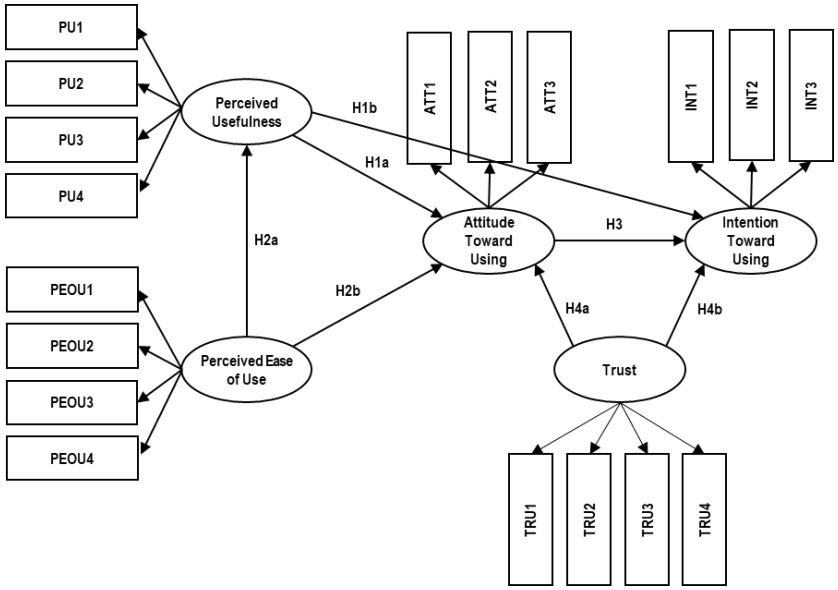

Fig. 3. Theoretical model of customer adoption of neobank services

The measurement constructs and items are listed in Table 2. The measurement items were developed by the authors. We used the original items of the TAM scale developed by Davis [42] and modified them to make them suitable for measuring consumer acceptance of neobank services. We collected data using a questionnaire that included 19 items on the use of neobank services and four demographic variables: gender, age, education and place of living. All items in Table 2 were measured on a seven-point Likert scale ranging from "strongly disagree" (1) to "strongly agree" (7).

Table 2
Constructs and measurement instruments

Construct	Measurement items	Code
Perceived Usefulness (PU)	I can save time by using neobanks.	PU1
	I can manage my finances efficiently by using the services of neobanks.	PU2
	By using the services of neobanks, I can lower bank fees.	PU3
	Neobanks provide the cheapest solution to exchange currency.	PU4
Perceived Ease of Use (PEOU)	I can easily use neobank apps.	PEOU1
	I can quickly learn how to use neobank apps.	PEOU2
	Neobank apps make it easy for me to manage my finances.	PEOU3
	I can make payments/money transactions quickly by using neobank apps.	PEOU4
Trust (TRU)	Neobank apps are reliable.	TRU1
	I can trust that my money is in good hands.	TRU2
	The information shared with me is credible.	TRU3
	I can trust that my data is safe.	TRU4
	I consider neobanks' services a good solution.	ATT1

Attitude Towards Using (ATT)	Those who use the services of neobanks are making a wise choice.	ATT2
	I am happy to use neobank apps.	ATT3
Intention Towards Using (INT)	I plan to use neobank services.	INT1
	I think I will use neobank services regularly in the future.	INT2
	I intend to recommend neobank services to my friends and acquaintances.	INT3

3.2. Data Collection and Sample

We collected the data in Hungary in November and December 2022 using an online survey (Google Forms). The only eligibility criterion for participation in the survey was that the respondent had to be over 18 years old.

In the questionnaire, we first asked whether the respondent had ever heard the term "neobank" and knew what it meant. Then, for those respondents who said they had never heard of neobanks or had heard of them but were not familiar with them, we clarified the concept of neobanks by sharing the following information: “The word "neo" means new. These 21st-century banks have no branches and are exclusively available online. They offer digital, mobile-based financial solutions for payments, money transfers, lending and other services." Only after reading and understanding this information were respondents allowed to continue filling in the questionnaire.

We transferred the data from Google Forms into SPSS 28 and AMOS and then checked the coding accuracy to ensure that the database was complete, and no data was missing. We conducted statistical analyses in SPSS and performed structural equation modelling (SEM) in AMOS to test the research hypotheses.

Marsh *et al.,* [91] suggest that a minimum sample size of 200 is appropriate for SEM in AMOS. Schumacker and Lomax (2010) recommend having 10-20 subjects per parameter estimate in the model. Given the 50 parameter estimates in our initial model, our ideal sample size would be between 380 and 760. The actual sample size of 475 respondents is within this range.

Out of the 475 respondents, 42.1% are females and 57.9% are males, with an average age of 22.9 years. In terms of education, 43.6% have completed tertiary education, 53.2% have completed secondary education, and 3.2% have completed primary education. The majority of respondents reside in county seats (38.7%), while the rest live in other cities and towns (33.9%), villages (24.2%), or the capital (3.2%). This suggests that our conclusions apply primarily to young men with above-average education, who live in urban areas.

The demographics of the population of neobank users are not known, which made it impossible to construct a representative sample. However, according to Polych [92], target customers of neobanks are men (58%) and women (42%), aged between 25 and 44. Moreover, Ernst & Young’s consumer banking survey [93] revealed that 27% of global consumers have relationships with neobanks, and 37% of neobank users are aged between 18 and 34. Therefore, the sample we used is similar to the population of neobank users in terms of gender and age.

4. Results, Discussion

Our initial model (Figure 3) did not fit the data well (CMIN/DF=1.904; p=.00; GFI=.698; CFI =.860; RMSEA=.122; HOELTER 0.5=39), so we did not interpret any parameter estimates and rejected the model. To achieve a better fit, we re-specified the model using the alternative modelling approach proposed by Byrne [94] and developed a nested model. Following the suggestion of Osborne [95], we developed several modified models and selected the best-fitting, theoretically justifiable model (Figure 4). In addition, as recommended by Byrne [94], we omitted variables with factor loadings below |0.7| in the Principal Component Analysis (PCA). In the nested model shown in Figure 4,

perceived usefulness is measured by two variables (PU1, PU2), perceived ease of use by three variables (PEOU1, PEOU2, PEOU3), attitude towards use by two items (ATT1, ATT2) and trust by three items (TRU1, TRU2, TRU4). Intention to use is composed of two variables (INT1, INT2).

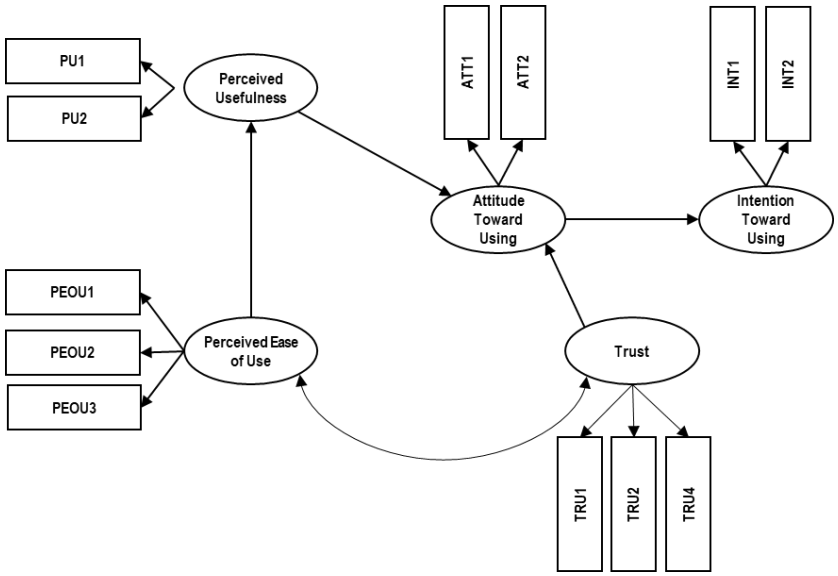

Fig. 4. The nested model

4.1. Validity

We assessed the convergent and discriminant validity of our nested model. According to the Fornell-Larcker criterion [96], Average Variance Extracted (AVE) should exceed 0.5 for convergent validity. Hair *et al.,* [97] also suggest that AVE should be above 0.5, standardized factor loadings of all items should be above 0.5, and composite reliability (CR) should be above 0.7. Our nested model met all these criteria (Table 3). AVE scores were well above the threshold level (AVE (PU)=0.76; AVE (PEOU)=0.75, AVE (TRU)=0.82; AVE (ATT)=0.73 and AVE (INT)=0.73), and all CR scores were above 0.7 (CR (PU)=0.87; CR (PEOU)=0.86, CR (TRU)=0.90; CR (ATT)=0.85 and CR (INT)=0.86)

Table 3
Summary table of means, standard deviations, validity and reliability measures

		M	SD	Loading	Alpha	AVE	CR
Perceived Usefulness (PU)	PU2. I can manage my finances efficiently by using the services of neobanks.	5.02	1.49	0.94	0.85	0.76	0.87
	PU1. I can save time by using neobanks.	4.85	1.42	0.79			
Perceived Ease of Use (PEOU)	PEOU3. Neobank apps make it easy for me to manage my finances.	5.34	1.57	0.91	0.89	0.75	0.86
	PEOU2. I can quickly learn how to use neobank apps.	5.24	1.71	0.90			
	PEOU1. I can easily use neobank apps.	5.23	1.80	0.77			
Trust (TRU)	TRU4. I can trust that my data is safe.	4.65	1.62	0.87	0.93	0.82	0.90
	TRU2. I can trust that my money is in good hands.	4.50	1.49	0.96			

	TRU1. Neobank apps are reliable.	4.84	1.48	0.88			
Attitude Towards Using (ATT)	ATT2. Those who use the services of neobanks are making a wise choice.	4.74	1.42	0.86	0.84	0.73	0.85
	ATT1. I consider neobanks' services a good solution.	5.06	1.53	0.85			
Intention Towards Using (INT)	INT2. I think I will use neobank services regularly in the future.	4.94	1.51	0.83	0.84	0.73	0.86
	INT1. I plan to use neobank services.	5.29	1.57	0.89			

Our nested model has adequate discriminant validity, as none of the correlations exceeded the threshold limit of 0.85 for poor discriminant validity. The correlations were as follows: PU*PEOU=0.70; PU*TRU=0.29; PU*ATT=0.76; PU*INT=0.77; PEOU*TRU=0.64; PEOU*ATT=0.84; PEOU*INT=0.80; TRU*ATT=0.71; TRU*INT=0.53; ATT*INT=0.84

4.2. Reliability

We investigated the accuracy and consistency of the nested model using three reliability tests: Cronbach's alpha (α), the Average Variance Extracted index (AVE), and Composite Reliability (CR). The measurement model is considered acceptable if all estimates are significant, α is greater than 0.5 or 0.7 (optimal), AVEs for all constructs are above 0.5 [96], and CRs for all constructs are above 0.7 [98]. As shown in Table 2, all constructs had Cronbach's alphas of 0.84 or higher, AVE scores higher than 0.73, and CRs above 0.85, indicating that the reliability of the measurement model is optimal.

4.3. Model fit

We evaluated both absolute and relative model fits. All absolute measures were significant and indicated a good fit, with a Chi square of 88.85 (DF=60), a probability level of 0.009, CMIN/DF of 1.48, GFI of 0.84, AGFI of 0.76, RMSEA of 0.08, and SRMR of 0.07. To test relative model fit, we used TLI/NNFI, GFI, AGFI, NFI, IFI, and CFI, which were all acceptable or good (TLI/NNFI=0.94; GFI=0.84; AGFI=0.76; NFI=0.87; IFI=0.96 and CFI=0.95). According to Bentler and Bonnet [99], values above 0.9 represent an acceptable fit, while values above 0.95 indicate a good fit. The results of both the absolute and relative model fit tests confirmed that the structural nested model is suitable for analysing and interpreting the parameter estimates.

4.4. Hypothesis testing and estimates

We used the nested structural model to test hypotheses and gain insights into neobank service adoption. The results of the hypothesis tests, including the direct, indirect and total effects measured in the model, are summarised in Table 4.

Table 4
Direct, indirect, total effects and hypothesis testing

Hypothesis	Relationship	P	St. direct eff.	St. indirect eff.	St. total eff.	Result
H1a	PU → ATT	<0.001	0.663	0.000	0.663	accepted
H1b	PU → INT	rejected				
H2a	PEOU → PU	<0.001	0.722	0.000	0.722	accepted
H2b	PEOU → ATT	rejected				
H3	ATT → INT	<0.001	0.896	0.000	0.896	accepted
H4a	TRU →ATT	<0.001	0.446	0.000	0.446	accepted
H4b	TRU → INT	rejected				

We calculated gamma estimates between exogenous and endogenous constructs and beta estimates between two endogenous constructs. Figure 5 shows the standardised estimates, loadings and residuals for the relationships between the constructs and the observed indicators. If a statistically significant relationship was confirmed in the predicted direction, we accepted the corresponding hypothesis.

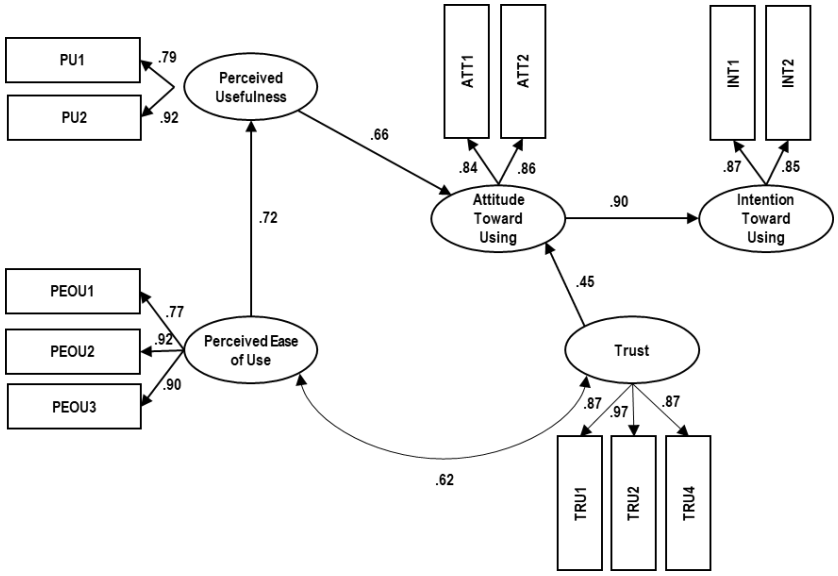

Fig. 5. Parameter estimates of the nested model

We hypothesised that perceived usefulness has a direct, positive effect on the intention to use neobank services (H1a) and also a direct, positive effect on attitudes towards use (H1b). Based on the results, we rejected H1a (p=0,353) and accepted H1b (β=0.663, p<0. 001).

This means that the more useful consumers perceive the services offered by the neobanks, i.e., if they can save time and/or manage their finances more efficiently by using neobank apps, the more positive attitudes they will develop towards the use of neobank services. This finding corroborates the result of Davis *et al*., [42]; Bashir and Madhavaiah [64]; Fortes and Rita [62]; Marakarkandy *et al*., [65]; Munoz-Leiva *et al.*, [52]; Susilo *et al*., [54]; Hu *et al*., [55]; Banu *et al*., [63]; Komalasari and Ramadhani [56] and Nguyen [16].

The rejection of H1b suggests that perceived usefulness does not have a significant direct impact on consumers' intention to use neobank services. This is consistent with the findings of Munoz-Leiva

et al., [52], who studied user adoption of mobile banking applications in Spain, and Komalasari and Ramadhani [56] , who studied the use of online banking in Indonesia.

The next two hypotheses were formulated on the effect of perceived ease of use, one describing the direct positive effect on perceived usefulness (H2a) and the other on attitude towards use (H2b). Based on the results of the model test, H2a was confirmed (β=0.722, p < 0.001), while H2b was rejected (p=0,279).

Accepting H2a means that there is a direct positive effect of perceived ease of use on perceived usefulness. Accordingly, if consumers perceive neobank apps as simple, easy to use and quick to learn, they will also consider them more useful. This finding is consistent with previous research results (Venkatesh [46]; Venkatesh *et al.,* [43]; Munoz-Leiva *et al.,* [52]; Hu *et al.,* [55]; Nguyen *et al.,* [90]; Komalasari and Ramadhani [56]; Nguyen [16]; Albort-Morant *et al.,* [58]; Meijer *et al.,* [19]).

One unexpected finding was the insignificant relationship between perceived ease of use and attitude towards use, which differs from the results of numerous previously published studies (Davis [70]; Venkatesh [46]; Fortes and Rita [62]; Marakarkandy *et al.,* [65]; Munoz-Leiva *et al.,* [52]; Susilo *et al.,* [54] ; Komalasari and Ramadhani, [56]; Albort-Morant *et al.,* [58]). However, our result agrees with the findings of Hu *et al.,* [55] , who investigates user adoption of FinTech services in China. Consequently, the ease of use of neobank services has no direct, but only indirect positive effect on attitudes towards such systems and service providers via perceived usefulness.

As for the next hypothesis (H3), the positive relationship between consumers' attitude and intention to use neobank services was confirmed by our research results (β=0.896, p < 0.001). It should be noted that the effect of attitude on behavioural intention is very strong; therefore, attitude towards neobanking is an important determinant of customers' bank choice. In the model, this was the strongest effect we found among the latent structures. This result accords with previous findings by George [73]; Püschel *et al.,* [74] ; Cudjoe *et al.,* [72]; Fortes and Rita [62]; Marakarkandy *et al.,* [65]; Munoz-Leiva *et al.,* [52]; Hu *et al.,* [55]; Susilo *et al.,* [54]; Komalasari and Ramadhani [56]; Nguyen [16]. Those who believe that the services offered by neobanks are a good solution for managing their finances and who believe that they have made a wise decision to use these novel services will develop a stronger intention to use them regularly in the future.

The fourth hypothesis of our study was also divided into two sub-hypotheses. The first related to the effect of trust on attitude (H4a) and the second to the effect of trust on intention to use (H4b). Hypothesis H4a was confirmed (β=0.446, p < 0.001), while H4b was rejected based on the results of the statistical tests (p=0,253).

Trust in neobank services, including the reliability of these brand-new services and the belief that our money is safe with them and that our data is not being misused, is a major determinant of attitudes towards using them. The more consumers trust neobanks, the better they think their services are and the more they think it is a smart choice to be their customer. Our research findings are consistent with previous studies of Oh *et al.,* [83]; Alsajjan and Dennis [84]; Fortes and Rita [62]; Munoz-Leiva *et al.,* [52]; Hu *et al.*, [55].

This is an interesting finding that trust has no significant direct effect on the intention to use neobank services, which is in contradiction with the results of several previous studies: Kim *et al.*, [82]; Alalwan *et al.,* [85]; Chiu *et al.,* [81]; Yadav *et al.,* [86]; Keskar and Pandey [89]; Tarhini *et al.,* [87]; Merhi *et al.,* [53]; Sharma and Sharma [88]; Kaur *et al*., [17]; Alnemer [59]; Bajunaied *et al.,* [60]; Meijer *et al.,* [19], and requires further investigation. However, not surprisingly, perceived trust indirectly influences the behavioural intention to use via attitudes towards neobanking.

Overall, we can conclude that the easier we can use neobank applications, the more useful we find them. The higher sense of perceived usefulness and stronger trust in neobanks lead to a more

positive attitude towards them, which in turn leads to a stronger willingness to use neobanking services.

4.5. Implications, Limitations and Further Research Directions

From a theoretical perspective, this paper extends the knowledge of individual decision making by investigating the customer adoption of neobank services. The extension of TAM to include trust proved to be an appropriate theoretical model to understand the drivers of individual behavioural intentions to use this disruptive technology offered by neobanks.

As expected, our research results confirmed that the most important factor influencing behavioural intentions to use neobank services is the attitude towards neobanking. Interestingly, attitude plays such an important role in neobanking that even trust and perceived usefulness do not have a direct impact on individuals' intentions to use neobank services. However, both trust and perceived usefulness strongly influence customers' willingness indirectly through attitude. Attitude, on the other hand, has a strong, almost deterministic relationship with behavioural intention and is a powerful driver of individual behaviour. This suggests that the inclusion of trust in the original TAM has partially changed its structure, making the role of attitude more dominant in the adaptation of neobanking as a disruptive technology. However, further research is needed to reconfirm this by extending the sample to include other countries or industries (e.g., FinTech).

Moreover, this article contributes to the development of knowledge on individual decision-making by providing new insights into the decision-making process of Eastern European, more specifically Hungarian, potential and current neobank customers. The novelty of this research lies in the fact that while several studies have investigated consumer adoption of various technologies such as e-commerce, online banking, mobile banking, etc. in different emerging markets, there are no studies on customer adoption of neobanking services in an emerging market in the EU.

From a managerial perspective, the paper contributes to the customer insights in the neobanking industry. Understanding the critical factors for choosing a bank is extremely important for neobank marketing managers to formulate strategies to attract more customers. Our research findings suggest that marketers should develop and execute campaigns to improve attitudes towards neobanking. In this campaign, marketers should change attitudes by emphasising that neobanking is a smart choice and an excellent, easy and secure solution to save time and manage one's finances efficiently. Trust also plays a key role in this campaign, as customers need to be convinced that neobanks are reliable and that their data and money are protected.

The inevitable role of trust in the adoption of neobanking services is also very important for policy makers. They should regulate this industry in such a way that customer trust is enhanced, which can lead to further growth of the neobanking industry.

Amongst the limitations of the study, we can pinpoint that we conducted the survey only in one of the EU countries, Hungary. As for future research directions, it would be advisable to broaden research and repeat this study in other countries of the European Union so that we can compare them to find out the country-specific and culture-bound characteristics of individual decision-makers, for example, by using other theories such as Hofstede's 6D model.

Author Contributions

Conceptualization, S.N. L.M. and A.P.; methodology, S.N. and L.M.; software, L.M. and S.N.; validation, S.N.; formal analysis, L.M.; investigation, L.M. and S.N.; resources, S.N. and A.P.; data curation, L.M.; writing—original draft preparation, A.P., L.M and S.N.; writing—review and editing, S.N. and L.M; visualization, L.M.; supervision, S.N.; project administration, L.M.; funding acquisition, S.N. All authors have read and agreed to the published version of the manuscript.

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Data sharing is not applicable to this article.

Conflicts of 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.

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