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Identifying and ranking factors affecting the development of digital financial literacy in technological businesses using the fuzzy ANP technique

Navid Afshari
Department of Financial Management, Central Tehran Branch, Islamic Azad University, Tehran, Iran.
afshari.navid@gmail.com

Fereydon Rahnamay Roodposhti
Department of Accounting, Science and Research Branch, Islamic Azad University, Tehran, Iran
(Correspond author)
roodposhti.rahnama@gmail.com

Gholamreza Zomorrodian
Department of Financial Management, Central Tehran Branch, Islamic Azad University, Tehran, Iran.
gh.zomorodian@gmail.com

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ABSTRACT

This study Identifies and prioritizes the components of digital financial literacy using fuzzy network analysis. Having digital financial literacy helps individuals to step into this space with more confidence and take advantage of the financial opportunities available in the digital world, while also being aware of its risks and challenges. The statistical population of this study is managers and experts in the field of financial literacy and financial technology businesses in Tehran. The present study is a survey and applied type. The research method is a mixed method (quantitative-qualitative) in which ۱۲ experts were identified in the qualitative section and interviews were conducted to identify effective components. In the quantitative part, using the fuzzy ANP technique, the identified components were prioritized based on the experts' views in two stages using pairwise comparisons. The results indicate that the most important factor affecting digital financial literacy is financial technologies, the most important component of which was digital literacy; in second place was formal financial education, the most important component of which was financial knowledge education; in third place was financial socialization (informal education), the most important component of which was peer influence; and in last place was financial experience, the most important component of which was work experience. Suggestions were made in this regard.

Keywords: Financial literacy, digital financial literacy, technological businesses, approach ANP fuzzy

1. Introduction

Today, with the expansion of financial markets, given the increasing need for a wide range of students, scholars, and researchers from various fields, including economics, managers, investment advisors, and those interested in capital market issues, and the prevalence of this market among its vast statistical community, general and specialized education in the field of financial markets has become more important than ever. In this regard, financial engineering will play a prominent role in developing financial literacy with the aim of expanding the culture of investing in financial assets. Therefore, in today's world, many countries consider one of the main ways to deal with their country's economic problems to be improving the economic and financial literacy of their people and are trying to educate the economic and financial literacy of people from childhood to adulthood. This is while most countries are looking for the latest solutions to improve the level of financial literacy of their people by holding joint meetings and benefiting from each other's experiences and consider it one of their important priorities.

Currently, many countries in the world have actively entered the field of economic and financial literacy and have engaged in the economic and financial education and training of their people from childhood to adulthood. However, some others have only observed the developments and changes in the financial field and have not carried out any specific activities to prepare the people of their society.

Unfortunately, in our country, despite the existence of numerous economic and financial problems, this area has been neglected and neglected. No specific strategy has been designed for the growth and literacy of financial and economic. Given this weakness, financial engineering is one of the most important tools for developing investments that can be made to create inclusive and long-term economic growth.

What is now apparent is that technological advances and the growth of technologies in our daily lives have the potential to improve the overall well-being of society for those who have both access and skills (Brey, 2018). For example, a personal computer or smartphone provides us with opportunities and information to access goods and services on platforms such as Amazon and other retailers. However, imagine the lives of those who lack the knowledge or ability to properly use technology or access information. The use of financial technology (FinTech) has elevated digital financial literacy to an important topic for adult educators as a critical literacy. FinTech combines both technology and the delivery of financial services beyond traditional methods (Goldstein et al., 2019). Furthermore, FinTech is crucial for innovation in the financial services industry and is impacting our economic lives. FinTech offers users a wide range of options in terms of online banking, mobile payments, app-based investment platforms, and online shopping for a wide range of goods and services (Goyal & Kumar, 2020). And in the midst of the millennial era, digital financial literacy has a beneficial impact on investment behavior in addition to spending and saving habits. Furthermore, research conducted by (Respati et al., 2023) shows that the financial behavior of young people is significantly influenced by their level of digital financial literacy. On the other hand, access to digital financial information and investment has successfully increased the financial literacy of students (Gaol et al., 2023). According to some studies, the ability of millennials to make wise decisions and engage in consistent financial behaviors largely depends on their financial attitudes and digital financial expertise (Normawati & Rahayu, 2022). However, not a single study, even those focused-on millennials, has sought to collect and carefully examine the data provided by all of these studies. As a result, the aim of this research is to synthesize data from several studies that examine digital financial literacy among digital millennials.

The issue of financial literacy and the need to examine it is important because issues such as insufficient financial literacy severely affect the lives of individuals, their families, and their business partners due to inappropriate financial decisions. This has had inappropriate effects on society and even causes a decrease in national wealth and ultimately a decrease in the level of financial well-being in society.

In general, financial knowledge refers to having knowledge about finances or money and its values, or having acquired sufficient information about finances and money; while financial literacy means having knowledge about finances and having the skills and ability to use and benefit from that money or finances.
The importance of financial literacy in developed and developing countries is increasing, and policymakers are accordingly allocating their resources to financial education programs and their promotion (Taftian and

Mirbagheri, 2017). In a study titled The Role of Economics Curriculum in the World's Formal and General Education Program: Providing an Action Plan, Paygami and Tourani (2011) concluded that financial literacy has been neglected in the country's curricula.

In this regard, Iran faces two important challenges or gaps in measuring the digital economy. These two types of gaps are: one is the methodological gap and the other is the existence gap. The methodological gap is related to what the existing statistics and information system indicators measure and how they can capture the digital economy, or to what extent they do so correctly and accurately. The Ministry of Communication and Information Technology, in cooperation with the Statistical Center of Iran, has been calculating the first layer of the digital economy for several years with its financial and moral support, but this method is still incomplete in terms of both methodology and the level of coverage of layers and variables and needs to be completed. The existence gap is closely related to the effective implementation of statistical plans and guidelines and the local conditions of the economy. In general, measuring the digital economy requires high-quality data and information and the implementation of reliable and standardized methods. Accurate and timely measurement of the digital economy is essential and needed for at least three reasons, apart from being considered key in the Seventh Development Plan. First, the development and growth of the digital economy in the world is irreversible, as the demand and use of digital technology by organizations, individuals and governments around the world is increasing.

Therefore, based on the efficient market theory, it can be argued that increasing the financial literacy of citizens is one of the prerequisites for the success of a market economy in general, and financial markets in particular. Therefore, governments that pursue a policy of developing financial markets are inevitably bound to set goals to increase the financial literacy of citizens. The more prominent the government's supportive function in ensuring the well-being and financial security of individuals, the lower the level of financialization and consequently the scope of financial literacy or, in essence, the necessity for it, the lower it becomes. Conversely, the less prominent the government's function is and the more prominent and complex the markets are, the more individuals need financial literacy for their daily lives.

In modern financial management theories, the role of financial behaviors and financial management is gaining ground and developing, strengthening the topic of financial management in management education (Ishmuhametov and Kuzmina, 2017). In order to improve the level of financial literacy in society, it is necessary to first be informed about its status and then, considering the prevailing individual, social, and cultural characteristics and for all age groups, including men and women, both as consumers of economic resources and from the perspective of producers (business owners) of economic resources at the micro and macro levels, appropriate decisions and programs should be designed and implemented (Hanifeh Zadeh, 2015). Therefore, the aim of the present research is to prioritize the components of digital financial literacy using the fuzzy ANP technique. But the main point is how to carry out the process of strengthening digital financial literacy to have the necessary effectiveness? How can financial technology businesses be managed in this regard?

2- Theoretical foundations and review of research history

Over the past decades, extensive developments in the field of information and communication technologies have brought about major changes not only in different areas of human life, but also in the organizational and social lives of individuals in society (Lukitasari et al., 2022). In this era of rapid technological change and the increasing explosion of information resources, people's ability to use modern technologies and access relevant and useful information from the vast amount of available information and services will be a vital and necessary issue (Sharp, 2018). Dealing with such complexities requires various skills, one of which is digital literacy (Tohidi Asl, 2012).

After the rapid growth of the World Wide Web in the mid-1990s, the transition from the industrial age to the information age became a major issue in national policy. Internet connectivity and access to networked information enabled business opportunities, social participation, and greater awareness and informed decision-making (Noor, 2022). The Internet was a rich source of new relationships, a facilitator of continuing education, an encourager of personal growth, a creator

of entertainment and innovation, and a creator of new professions (Cohendet, ۲۰۰۳). It also paved the way for the emergence of information and communication technology. Today, information and communication technology is ubiquitous, and the ability to use information and communication technologies is one of the most important life skills (Huang et al., ۲۰۱۰; De Jong et al., ۲۰۱۰; Tosun and Baris, ۲۰۱۱). ICT not only enhances learning, but also reduces gaps in access to learning resources (Elen et al., 2010) and plays a key role in the growth of e-commerce (Fathian et al., 2008; Hu et al., 2011), economic growth (Hanafizadeh et al., 2009; Andrianaivo and Kpodar, 2011; Papaioannou and Dimelis, 2007; Cheng et al., 2007; Seo et al., 2009) and national development (Heeks, 2008).

Today, although more than half of the world's population has access to ICT equipment, the distribution of resources is not uniform across the globe; for example, Asia, North America, and Europe have more communication devices than Africa; even within different regions of the continents, access to these devices varies. Just as ICT plays a key role in economic growth, wide inequalities in access to it disrupt social and economic balance in the world (Doong and Ho, 2012). Unequal access to these technologies in different societies is creating a digital divide (Wu et al., 2014). The new digital divide is not just about access to the Internet, but also includes the imbalance in Internet use and is a threat to a free space in which everyone has an equal opportunity to participate (Peters, 2001; Webster, 2006). Therefore, the ability to perceive and analyze the inequality of people's participation in the Internet is an important issue that needs to be addressed (Loosen, 2002). In terms of the development of information and communication technology, there is a lack of balance, heterogeneity, and a digital divide among them; to the extent that Urmia city, which ranks first in terms of the development of information and communication technology, is two and a half times more developed than Chaldran city, which ranks last (Zarabi et al., 2014). Individuals must have the necessary literacy to adapt to changes in knowledge and technology (Janks, 2010). Today, many people are engaged with digital technologies and media, using them to find information and communicate in various ways, but not everyone has the same skills, knowledge, and understanding of digital technologies, which prevents them from using them properly. They need to be prepared to live successfully in a world saturated with these technologies (Hague and Payton, 2010).

Literacy finance

Financial literacy is a component of financial capability and is often assessed jointly. Zotel (2013) acknowledged that the purpose of research on financial literacy is to consider the impact of specific socio-economic conditions and aspects of an individual's internal ability to make financial decisions, and this ability is measured through assessments of financial literacy, attitudes, and skills.

The Basic Skills Agency (BSA) published a model in 2000 called Financial Capability in Adults through Personal Finance Education. The framework includes three main areas: financial knowledge and understanding; financial skills and financial competence and responsibility, as well as three sub-levels: basic understanding and confidence development; competence development and competence development. In addition, in the model presented, each level is divided into three components as follows:

- types different money/payments;
- production in came
- use from income;
- plural gathering information finance and maintenance records;
- program tiny finance:savings to do, expense to do, Budget clause;
- risk and efficiency;
- choice Hi personal and Concepts financial;
- Rights consumption doer, responsibility I see and Resources counseling;
- Consequences affairs finance.

Based on the definitions and segmentation provided in Table 1, it is clear that this model can be used as a practical tool for developing ideas and helping to improve financial capability (FSA, 2000). In this way, this model can be effective in helping teachers, financial advisors, or those working in the field of personal finance, identify weak areas that need improvement and support financial education programs in order to increase financial capability. Commission et al. (2013) acknowledged that compared to financial literacy, measuring financial capability requires a more complex assessment due to

the broader domains it encompasses, such as knowledge, attitudes, skills, and behavior. The US Treasury (2007) also defines the concept of financial capability as the knowledge and skills of individuals to understand their own financial circumstances, along with the motivation to take action.

Table 1: Details of Basic Skills Agency's definition of financial capability

definition	Sections	A
The ability to authenticate and manipulate money in various forms, uses, and functions.	Financial understanding and knowledge	1
Ability to apply knowledge and understanding in a wide range of contexts, including predictable and unexpected situations.	Financial skills and competence	2
The ability to better understand the impact of financial decisions on individual, family, and social circumstances, and to consider social and ethical issues.	Financial responsibility	3
refer to	Levels	B
Those adults who have a low level of understanding and need the skills to make informed judgments about their finances and the ability to use appropriate financial services.	Understanding the basics and developing self-confidence	1
Those adults who have a basic understanding and competence in performing financial services and require further knowledge and skills to meet their needs.	Early growth of self-confidence and competence	2
Adults who need the skills and knowledge to understand a wider range of the ability to make informed decisions regarding their personal circumstances	Expanding self-confidence and competence	3

Financial Technological businesses (Fintech)

Fintech apps and tools are not without their problems. Ease of access may lead to harm by inciting impulsive behaviors. For example, mobile apps can lead to poor and risky decisions by creating emotional states of impulse buying or time-pressured situations (Reyna et al., 2018). Panos and Wilson (٢٠٢٠) provided evidence that mobile users are more likely to engage in impulsive buying behavior and consequently choose unfavorable financial positions. They noted that mobile loan products are often overly accessible and allow fleeting priorities to be acted upon immediately, which often leads to poor choices. However, FinTech tools and applications can also lead to improved financial behaviors. Apps can provide reminders and alerts for individuals to track their spending or record transactions (Panos and Wilson, 2020). These fintech tools create behaviors that benefit financial literacy and better financial management and stability.

Ways to strengthen financial literacy for the future

If adults are not taught the skills they need to navigate the new digital environment and make better financial decisions, there will be wider gaps in financial inclusion between the financially literate and the financially illiterate (Organization for Economic Co-operation and Development, 2018). The wide range of financial products available today and the decisions made about these financial products have implications for individual financial well-being. Educational programs need to improve the financial and digital literacy of individuals and families, ultimately improving their overall financial decision-making. Adult educators can create more effective curriculum and experiences by understanding learners' needs, utilizing adult learning strategies, and developing online competencies.

Digital financial literacy

Technological advances and the growth of technologies in our daily lives have the potential to improve the overall well-being of society for those who have both access and skills (Berry, 2018). For example, a personal computer or smartphone provides us with opportunities and information to access goods and services on platforms like Amazon and other retailers. However, imagine the lives of those who lack the knowledge or ability to properly use technology or access information. The use of financial technology (FinTech) has elevated digital financial literacy to an important topic for adult educators as a critical literacy. FinTech combines both technology and the delivery of financial services beyond traditional methods (Goldstein et al., 2019). Furthermore, FinTech is crucial for innovation in the financial services industry and is impacting our economic lives. FinTech offers users a wide range of options in terms

of online banking, mobile payments, app-based investment platforms, and online shopping for a wide range of goods and services (Goyal and Kumar, 2020). Educators and professionals must deliver digital skills and sound financial principles to meet the needs of the 21st century learner—one who can demonstrate financial literacy not only in a face-to-face customer service environment but, more importantly, in an online or virtual environment. This move toward fintech presents opportunities for adult educators to equip individuals and families with the tools to make better financial decisions and meet their financial obligations. Therefore, expanding the use of technology in financial literacy education and practices is as critical as reading, writing, and arithmetic in today's digital economy.

Digital financial literacy is a combination of the two concepts of financial literacy and digital platform. Financial literacy itself is an attitude and behavior as well as the level of understanding that an individual has towards financial products and services and also relates to how an individual manages their personal finances (Tony & Desai, 2020). Meanwhile, digital platforms are everything (which is a combination of hardware and software) using computer technology and the Internet. Based on the above definition, digital financial literacy can be defined as: An individual's knowledge and understanding of financial products and services related to digital technology. This is in line with the definition provided by Prasad et al. (2018), where digital financial literacy is the level of understanding of an individual related to online purchases, online payments with various payment methods, and online banking systems.

Digital capability with digital financial literacy

Recently, almost all countries in the world have committed to eliminating poverty by enabling businesses to achieve and support relative prosperity through digital financial capability (Sha ban et al., 2020) for sustainable development goals. In Asian countries (Tay et al., 2022), Indonesia, as a developing country, should focus on its policy to reduce poverty rates and reduce the gap in society between low- and high-income levels. Sangmi (2013) emphasized that financial capability is a condition to ensure that all elements of society have access to and use the legitimate financial system. Financial capability and empowerment are considered as an important aspect required to promote rapid national economic growth (Mbutor & Uba, 2013).

Previous research on financial capability and its dimensions, including financial access (Demirguc-Kunt et al., 2018; gammage et al., 2017; Widyastuti et al., 2019) and its barriers (Vidyastoty et al., 2019), has identified one indicator of access as bank account ownership. Solo (2008) explained that people with lower incomes and less education were often identified as unbanked because they did not have any bank accounts. The community classified as unbanked often included fishermen, farmers, women, informal sector workers, and migrants from the bottom of the pyramid. Along with technological advancements and COVID-19 disruptions, access to financial services using technology has shifted towards financial digitization (Tay et al., 2022). Today, the emergence of digital financial services has encouraged people to adopt many digital platforms to meet their needs. This situation is driving financial institutions to enhance their services by providing digital financial inclusion. Using mobile phones as a financial technology tool makes the financial system more accessible to support financial transactions, including digital payments, digital investment platforms, and internet-based money transfer systems. Daily financial transactions can be influenced by the adoption and use of digital financial services and contribute to the economic growth of countries (Vidyastotia et al., 2024).

Research background

Table 2 shows a summary of internal and external research related to digital financial literacy.

Table 2: Summary regarding digital financial literacy

Research title and results	year	Researcher
"The Impact of Financial Literacy, Financial Technology, and Intellectual Capital on Performance in Saveh Municipality" The results show that financial performance can be improved in municipalities by increasing and improving intellectual capital.	**2022**	Moradi and Ahmadiyya
"Risk-Based Investment Portfolio Optimization and the Impact of Investment Efficiency on Investors' Investment Decisions" Investment portfolio optimization, investors' accuracy	**2022**	Baik Jani and colleagues

Research title and results	year	Researcher
in optimizing investment portfolio, investment efficiency, increasing investment efficiency perceived by investors		
"Investigating the impact of past behavior and financial literacy on investors' investment decisions within the framework of the theory of planned behavior in the stock market." The results are that by creating an education structure from childhood and paying attention to this issue in educational systems, in addition to teaching students reading and writing, they should also learn financial literacy so that not only individuals but also the entire society can benefit from the benefits of this issue.	**2022**	Khushnood and Mutawalian
"Investigating the Effect of Past Behavior and Financial Literacy on Investors' Investment Decisions within the Framework of the Theory of Planned Behavior in the Stock Exchange" concluded that an individual's attitude towards investment decisions has a positive effect on an individual's intention to invest in the stock market. Past behavior also has a positive effect on an individual's intention to invest in the stock market and on an individual's attitude towards investing in the stock market. Past behavior affects an individual's intention to invest in the stock market through an individual's attitude. On the other hand, financial literacy has a positive effect on people's attitudes towards investing in the stock market and on perceived behavioral control towards investing in the stock market.	**2022**	Nazem Manbari and colleagues
"Investigating and measuring the financial literacy of retail investors in Iran, determining the factors affecting the level of financial literacy and measuring, evaluating the financial literacy of retail investors in the capital market in Iran." The conclusion is that environmental and demographic characteristics have an effect on the financial literacy of retail investors in the capital market.	**1401**	Chirani and Colleagues
"Challenges and Interactions of Digital Financial Literacy in Portugal" Results: Digital financial education; Development of a strategy for digital financial literacy; Roadmap for implementation; Organization of an event to disseminate the digital financial literacy strategy	**2023**	The Organisation for Economic Co-operation and Developmen
"The interaction of skills, digital financial literacy, financial decision-making ability and independence and well-being to examine the determinants of increased financial decision-making and an individual's perceived financial well-being" concluded that financial intelligence and analytical skills in an individual lead to better digital financial literacy. Skilled individuals with greater financial independence make fewer impulsive decisions, and digital financial literacy improves financial ability and, consequently, increases financial decision-making power	**2023**	Kumar et al
"Digital Financial Literacy: Dimensions and Effective Components of Digital Financial Literacy" The conclusion is that the emergence of FinTech has led to the expansion of the use of financial technologies in financial education, which is crucial for the development of an economy.	**2022**	Golden and Kurdi
"A Coherent Framework for Developing Digital Financial Literacy for Nepal Bank" will result in awareness of the availability of digital financial services, their benefits as well as the inherent risks of digital services, managing personal finances and planning for old age through budgeting and savings, imparting various financial literacy skills to others that will make you act more rationally, and...	**2022**	maskai

Research methodology

In this research, due to the novelty of the subject, the fuzzy ANP method was used, using the opinions of 12 experts, in order to achieve reliable results using this method. Since experts have different characteristics, they also have different mindsets, and if the options are answered based on different mindsets, the analysis of variables will be worthless. In this way, by defining the scope of qualitative variables, experts will answer questions with the same mindset. Therefore, in this section, qualitative variables are defined as trapezoidal fuzzy numbers: In measuring and ranking the main indicators affecting the components affecting digital financial literacy, considering the ۱۲ stages of distributing the questionnaire among the experts and selecting ۱۲ healthy questionnaires from among the questionnaires distributed among the expert members, the results obtained are displayed in the following tables.

According to the results obtained from the qualitative fuzzy Delphi analysis in the above table, in measuring and evaluating the averages obtained from calculating the fuzzy values resulting from the distribution of the questionnaire among the experts in the 2 stages under study, the components with a final mean difference less than or equal to 0.2 will be confirmed. Thus,

according to the measurement of the final mean difference column, it is clear that only the first subcomponent of the main financial technology index among the components studied did not have sufficient fit and validity from the experts' point of view. Therefore, in conclusion, we have reached a good and appropriate consensus on the remaining research components that were derived from the results of the qualitative analysis.

Table 3: The average difference between the experts' opinions in the first and second stages of completing the questionnaire

Final mean difference		Fuzzy average of expert opinion (second questionnaire)		Fuzzy average of experts' opinions (first questionnaire)		component
2	1	2	1	2	1	Financial technologies
0.2	0.35	6,8,10,10	4/8.6/3,7/8,8/2	5/5, 7/3, 9/3, 9/5	5/5, 7/3, 9/3, 9/5	
4	3	4	3	4	3	
0.1	0	3/5, 7, 9, 9/3	6,8,10,10	4/8.6/3,7/8,8/2	6,8,10,10	
2	1	2	1	2	1	Formal financial education
0	0.14	6,8,10,10	5/8, 7/7, 9/7, 9/8	6,8,10,10	4/8.6/3,7/8,8/2	
4	3	4	3	4	3	
-	0.1	-	3/5, 7, 9, 9/3	-	4/8.6/3,7/8,8/2	
2	1	2	1	2	1	Financial socialization (non-formal education)
0	0	5/5, 7/3, 9/3, 9/5	5/8, 7/7, 9/7, 9/8	5/5, 7/3, 9/3, 9/5	5/8, 7/7, 9/7, 9/8	
4	3	4	3	4	3	
-	0.2	-	6,8,10,10	-	5/5, 7/3, 9/3, 9/5	
2	1	2	1	2	1	Financial experience
0	0.2	5/8, 7/7, 9/7, 9/8	6,8,10,10	5/8, 7/7, 9/7, 9/8	5/5, 7/3, 9/3, 9/5	
4	3	4	3	4	3	
-	0.2	-	6,8,10,10	-	(5/5, 3/7, 3/9, 5/9)	

Research findings and data analysis:

The fundamentals of quantitative analysis in this article are based on the interpretation and analysis of data collected from the expert community under study, in the form of analytical statistics in a combined quantitative and qualitative manner. So that the data related to each of these variables, which were obtained from the experts' responses to the researcher-designed questionnaires using a qualitative fuzzy ANP method in two stages, are analyzed based on the principles of quantitative research methods and the fuzzy network analysis (ANP) method.

Fuzzy Network Analysis (ANP):

In the fuzzy ANP method, first the geometric mean of the experts' evaluation will be calculated. Then, using the Googos and Boucher method, the consistency matrices at the level of each relationship between each component and the subcomponents related to that component will be calculated. For this purpose, according to the standard of the network analysis method, in order to achieve the goal of the present quantitative method, paired comparison questionnaires based on the proposed and approved model in the mentioned qualitative method were designed and distributed among the experts. Considering the fuzzy approach in this research, the verbal expressions and fuzzy numbers listed in the table below have been used.

According to Table 5, which was obtained through interviews and expert opinions and is based on the confirmed components and subcomponents resulting from the qualitative fuzzy Delphi method and expert opinions, in the first step of obtaining FANP results, the average of pairwise comparisons of the studied criteria is displayed in the following table.

In the table below, in the first step, the main components affecting digital financial literacy have been examined and analyzed, and the fuzzy geometric mean of these components has been calculated in accordance with the standard of the fuzzy network analysis method.

Table 4: Qualitative words and their corresponding fuzzy numbers in the fuzzy network analysis method (FANP)

numberFary	PhrasesVerbal
(1,1,1)	Equal importance
(1,1.5,1.5)	Equal to weak importance
(1,2,2)	Weak importance
(3,3.5,4)	Weak to strong importance
(3,4,4.5)	Strong importance
(3,4,5,5)	Strong to very strong importance
(5,5,5,6)	Very strong importance
(5,6,7)	Very strong to absolute importance
(5,7,9)	Absolute importance

Table 5: Components and subcomponents studied (Objective: Identify and prioritize factors affecting digital financial literacy)

symbol	*Subcomponent*		*component*	*row*
a1	financial literacy	A	Financial technologies	*1*
a2	Financial innovation			*2*
a3	Digital literacy			*3*
a4	Accessibility			*4*
b1	planning level	B	Formal financial education	*5*
b2	Teaching financial knowledge			*6*
b3	Corporate training			*7*
c1	Social media influence	c	Financial socialization (non-formal education)	*8*
c2	upstream influence (parents)			*9*
c3	Colleague influence			*10*
d1	Gender and age	d	Financial experience	*11*
d2	Work experience			*12*
d3	Educational qualifications and literacy			*13*

Table6: Average of pairwise comparisons of the main measures affecting digital financial literacy

Criteria	*A*			*B*			*c*			*d*			*E*			*average geometric*		
	l	**m**	**u**	**l**	**m**	**u**	**L**	**m**	**u**	**l**	**m**	**u**	**L**	**m**	**u**	**l**	**m**	**u**
A	1	1	1	0.9	1.1	1.1	0.5	0.5	0.6	2.3	0.68	3.32	3.4	4.24	3.4	1.2672	1.08848	1.477
B	0.9	1	1.09	1	1	1	0.4	0.4	2.2	2.3	0.87	3.22	2.1	1.54	3.2	1.0921	0.87322	1.907
c	1.85	2.1	2.2	2.2	2.6	2.8	1	1	1	3.2	0.57	4.66	3.4	5.65	0.8	2.1497	1.77259	1.902
d	0.3	0.3	0.44	0.3	0.3	0.4	0.2	0.2	3.3	1	1	1	2	3.33	2.5	0.5261	0.61507	1.104
total																5.0351	4.34936	6.39
	CRm =0.025 CRg =0.069compatible																	

Now, in the following, in the form of Table 7, we will examine the average of comparisons in measuring the identified sub-criteria:

In the third step, the geometric means calculated in the previous step are normalized. In this step, the values obtained from the second step are normalized. The values $\tilde{Z}_i$ for each matrix are normalized by the sum of $\tilde{Z}_i$.

$$\tilde{r}_{ij} = \tilde{w}_i = \frac{\tilde{z}_i}{\sum_{i=1}^{n} \tilde{z}_i}$$

If these normalized weights are related to comparisons of options, they are called $\tilde{r}_{ij}$ (weight of the i-th option in relation to the j-th criterion) and if they are related to comparisons of criteria, they are called $\tilde{w}_i$. Table 8 shows these normalized values in the measurement of the four principal components.

Table7: Average pairwise comparisons of components and subcomponents affecting digital financial literacy

compatibility status	Compatibility rate	Geometric mean			symbol	Subcomponents	component (indexI see)
		U	m	l			
compatible	CRm = 0.010 CRg = 0.019	1.56086	1.42655	1.24187	a1	Financial Literacy	Financial technologies (A)
		2.13092	1.61835	1.29986	a2	Financial Innovation	
		2.52291	2.37278	1.16818	a3	Digital Literacy	
		1.89823	1.97692	1.31125	a4	Accessibility	
		12.4858	11.1790	11.4635	A	total	
compatible	CRm =0.012 CRg =0.033	1.44802	0.93140	1.12065	b1	planning level	Formal financial education (B)
		2.02821	1.01912	1.20235	b2	Teaching financial knowledge	
		2.36785	1.47530	1.98606	b3	Corporate training	
		10.5177	8.05480	8.69328	B	total	
compatible	CRm = 0.001 CRg = 0.017	1.44802	0.93140	1.12065	c1	Social media influence	Financial socialization (non-formal education) (c)
		2.02821	1.01912	1.20235	c2	upstream influence (parents)	
		2.36785	1.47530	1.98606	c3	Colleague influence	
		10.5177	8.05480	8.69328	c	total	
compatible	CRm =0.008 CRg =0.055	1.53438	2.21316	2.14759	d1	Gender and age	Financial experience (D)
		2.16871	2.07718	2.35967	d2	Work experience	
		2.52786	2.14740	1.89013	d3	Educational qualifications and literacy	
		13.3889	15.3835	12.7796	d	total	

Table8: Normalized geometric mean of the main criteria

Criteria	Symbol	Normalized geometric mean		
		l	M	u
Financial technologies	A	0.187835	0.18089	0.164538
Formal financial education	B	0.161872	0.145117	0.212523
Financial socialization (non-formal education)	C	0.318631	0.294578	0.211967
Financial experience	D	0.077979	0.102216	0.12309

Fourth stage: Defuzzification: In this stage, the obtained fuzzy weights will be defuzzified according to the following equation.

$$\boldsymbol{Crisp(\widetilde{U}) = \frac{(u_l + 2 \times u_m + u_r)}{4}}$$

In this regard$\widetilde{U} = (u_l, u_m, u_r)$ and $Crisp(\widetilde{U})$ D-Fuzzy$\widetilde{U}$is

By performing these calculations, the final weights will be obtained in order.

Accordingly, according to the results of defuzzifying the output of the third stage in the calculation of the fuzzy network analysis method (FANP), we can prioritize the main components and related subcomponents as shown in the following table:

Prioritizing the criteria and sub-criteria of the research model:

According to the results of fuzzy network analysis calculations and the output obtained in most of the aforementioned sections, the overall prioritization of the components in their main criterion group and at the level of the entire criteria can be shown as follows (in order from highest priority to lowest):

Table9: Final criteria weight matrix

rank	weightFinal determination of components	component	
2	0.178538	A	Formal financial education
3	0.166157	B	Financial socialization (non-formal education)
1	0.279939	c	Financial technologies
4	0.101375	d	Financial experience

Table 9 shows the final weight matrix of the main criteria. According to the results, the order and prioritization of these criteria in influencing the

components affecting digital financial literacy can be shown as follows (in order from highest priority to lowest):

1) Financial technologies
2) Formal financial education
3) Financial socialization (non-formal education)
4) Financial experience

Now that the final weights of the main research criteria have been determined, we will begin to measure and evaluate the final weights of the sub-criteria associated with each of these four main components and criteria (Table 10):

It is important to note that the technique used in this study is the fuzzy ANP method, and since the priority of these factors has already been examined and identified, digital financial literacy should be able to create this capability in society so that individuals, policymakers, and stakeholders in the field of financial literacy can overcome their inability and helplessness in the digital context and, with sufficient ability and literacy, can handle commercial economic issues in their technological businesses without stress and with security. Also, considering the comprehensive impact of the components in this model and this method, the accuracy of the identified dimensions and components is reliable and can be optimal solutions for digital financial literacy in the future.

Table 10: Final weight under the four principal components criteria

Final rank	Final Defuzzified Weights	Subcomponents	Abbreviation	Criteria
4	0.122141	financial literacy	A1	Financial technologies
3	0.143398	Financial innovation	A2	
1	0.182118	Digital literacy	A3	
2	0.155025	Accessibility	A4	
2	0.124463	planning level	B1	Formal financial education
1	0.146048	Teaching financial knowledge	B2	
3	0.204977	Corporate training	B3	
3	0.124463	Social media influence	C1	Financial socialization (non-formal education)
2	0.146048	upstream influence (parents)	C2	
1	0.204977	Colleague influence	C3	
3	0.142595	Gender and age	D1	Financial experience
1	0.154169	Work experience	D2	
2	0.153972	Educational qualifications and literacy	D3	

Discussion and Conclusion

In the current study, it is important to prioritize effective components for digital financial literacy with regard to the approach of strengthening social financial literacy and technological businesses and in order to create a learning culture for investment and entrepreneurship in new contexts. In this regard, digital financial literacy is a set of knowledge and skills that help individuals make informed and effective decisions in the complex world of digital finance. Therefore, in today's world, financial technologies are rapidly expanding, and with the emergence of concepts such as cryptocurrencies, electronic payments, and digital banking, having digital financial literacy has become very important. This type of literacy allows individuals to become familiar with digital tools such as e-wallets, financial management apps, and investing in digital assets, and use these capabilities to increase income, manage expenses, and reduce financial risks. In addition, familiarity with the concepts of cybersecurity and privacy in the digital space is another important part of digital financial literacy that protects individuals' information and financial assets from threats. Having digital financial literacy helps individuals to step into this space with more confidence and take advantage of the financial opportunities available in the digital world, while also being aware of its risks and challenges.

The main objective of this study is to investigate and identify the factors affecting digital financial literacy, to prioritize the components in groups and main criteria, and finally to present a model of digital financial literacy in technological businesses.

According to the results, the order and prioritization of these criteria in influencing digital financial literacy can be shown as follows (in order from highest to lowest priority: (1) Financial technologies; (2) Formal financial education; (3) Financial socialization (informal education); and (4) Financial experience. Based on the results of the analysis mentioned in the previous section, the model of digital financial literacy in technological businesses can be defined as Figure 1.

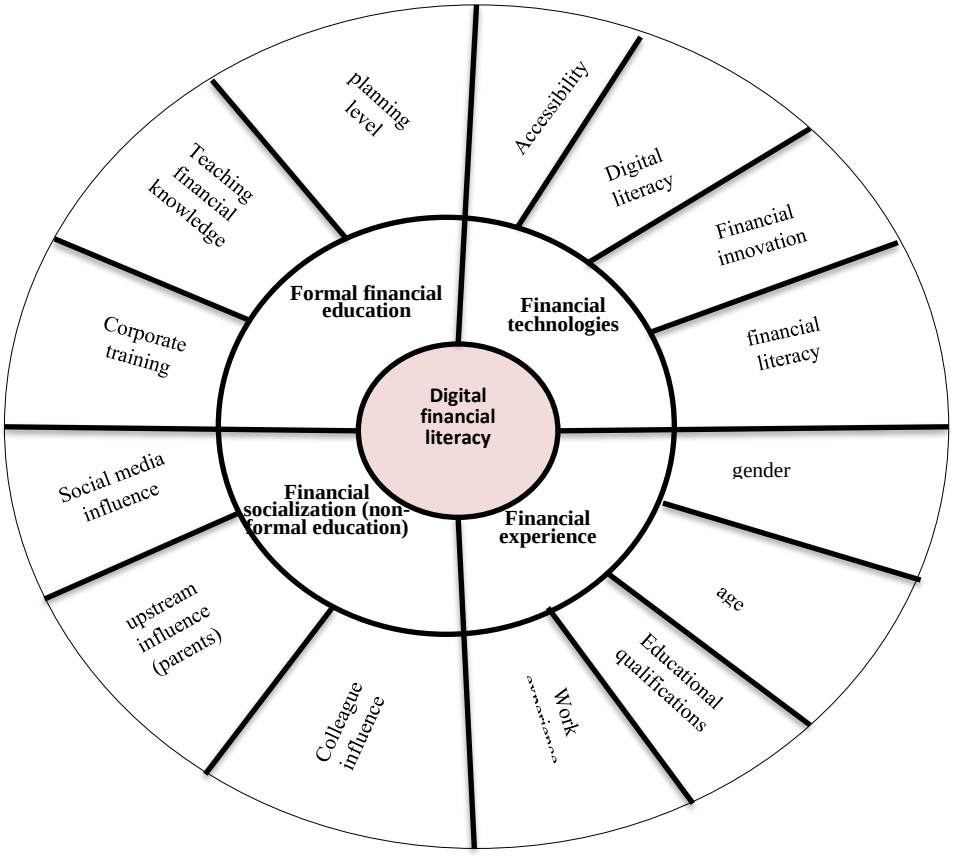

Figure No. 1: Research model

As is clear from the research model, four components were identified from the perspective of the research experts in line with digital financial literacy, including: 1) financial technologies; 2) formal financial education; 3) financial socialization (informal education); and 4) financial experience; which, from the perspective of the experts selected in this study, each of these factors also includes several sub-components, the extent of their influence has also been determined in previous discussions.

In the field of financial technologies, it is necessary and essential to seek help from investment companies in line with financial innovation strategies, and by strengthening digital financial literacy, we can use these technologies, tools, and services to help individuals improve their financial knowledge and skills using new technologies. As a result, financial technologies can be used by simplifying complex processes, providing transparent information, and interactive tools, which play an important role in increasing digital financial literacy. These tools should help people manage their finances with greater confidence and more complete awareness.

In the field of formal financial education in digital financial literacy, formal financial education in the field of digital financial literacy should be designed in a way that teaches individuals the basic concepts and skills related to financial management in a digital context. This type of training is usually provided in the form of curricula, courses, or online workshops and covers various aspects of financial management and digital technologies. Formal digital financial education is designed to increase individuals' awareness and enhance their skills in facing the challenges and opportunities of the digital economy. This type of education plays a key role in increasing financial management ability and reducing the harm caused by ignorance in the digital world.

In the field of financial socialization (informal education) in line with digital financial literacy, it is necessary to raise awareness of the target community regarding the process of learning and accepting concepts, skills, and behaviors related to financial management in a digital context, and to shape this process through informal education and social interactions. Finally, for financial socialization in a digital context, we can help form digital financial habits and behaviors, and combine the aforementioned process with informal education and practical experience to improve digital financial management skills and prepare individuals to face financial challenges in the digital age.

In the field of financial experience in digital financial literacy, it is necessary that through financial experience, we can use our achievements for individuals and society to strengthen and enhance the personal efficiency of individuals by using digital tools to improve budgeting, tracking expenses and income, and financial planning, so that ultimately we have a society where people with financial experience in digital financial literacy are able to help people make smarter financial decisions using new technologies, increase their financial security, and find new opportunities for economic growth. This process can ultimately lead to improved quality of life and reduced financial inequalities in society.

Regarding the comparison of the findings of the present study with other findings of researchers, it should be noted that this study uses most of the effective components presented in the development of the digital financial literacy model by other researchers, including: Moradi and Ahmadieh ۱۴۰۱ in the components of (financial literacy, financial technology and intellectual capital), Bikjani et al. ۱۴۰۱ (Risk-based investment portfolio optimization), Khushnood and Motwalian 1401 (Education), Kumar et al. 2023 (Financial Intelligence and Analytical Skills), Raju et al. 2020 (Use of Digital Financial Services), who have attempted to develop these models, have been consistent, so it can be said that an effective step has been taken towards better understanding the factors affecting the development of a digital financial literacy model.

Therefore, it is recommended that necessary steps be taken by strengthening and creating appropriate infrastructure for the development of educational infrastructure and strengthening financial benefits in order to create harmony and uniformity in the path and towards coherence in the generalities stated in the curriculum and university education of digital financial literacy so that we can achieve success, also, to create the necessary conditions in this regard and achieve success, constructive interaction with the target community and stakeholders, and reliance on educated, specialized, and successful entrepreneurs is essential in this regard. It is suggested that other researchers quantitatively implement the model obtained from the research using multi-criteria decision-making methods.

Reference

Andrianaivo, M. and Kpodar, K. (2011). ICT, financial inclusion, and growth: evidence from African countries, International Monetary Fund, 2011. Working paper. Available at www.imf.org/external/pubs/ft/wp/2011/wp1173.pdf.

Brey, P. (2018). The strategic role of technology in a good society. Technology in Society, 52, 39-45. https://www.sciencedirect.com/journal/technology-in-society/vol/52/suppl/C

Chirani, Ebrahim, Asi, Mehrdad, and Farahbod, Farzin. (2019). Designing a model to explain the financial literacy of retail investors in the capital market. Stock Exchange, 13(52), pp. 269-307(in persian)

Cohendet, P. (2003). “The digital divide in the European enlarged economic scenario: an assessment of the socio-economic effects”.

Report for ESA, University Louis Pasteur, Strasbourg.

Godlen, Wil and Cordie, Leslie (2022). Digital Financial Literacy, DOI:10.35847/WGolden.LCordie.4.3.20

Goldstein, I., Jiang, W., & Karolyi, G. A. (2019). To fintech and beyond. The Review of Financial Studies, 32(5), 1647-1661. https://doi.org/10.1093/rfs/hhz025

Goyal, K., & Kumar, S. (2020). Financial literacy: A systematic review and bibliometric analysis. International Journal of Consumer Studies, 2020, 1-26. https://doi.org/10.1111/ijcs.12605

Hanafizadeh, M. and Saghaei, A. and Hanafizadeh, P. (2009). "An index for cross-country analysis of ICT infrastructure and access". Telecommunications Policy, 33(7), 385–405. (in persian)

Hanifezadeh, Mohammad (2015). Financial Literacy, Auditor Magazine, 81, 126-132(in persian).

Heks, R. (2008). "ICT4D 2.0: the next phase of applying ICT for international development". IEEE Computer, 41(6), pp.26–33.

Ho, S. C. and Kauffman, R. J. and Liang, T. P. (2011). "Internet-based selling technology and ecommerce growth: a hybrid growth theory approach with cross-model inference". Information and Technology Management, 12(3), pp. 409–429.

Huang, X. (2010): "Industry investment experience and stock selection," Available at SSRN.

Ishmuhametov I. & Kuzmina-Merlino, I. (2017), What Motivates a Learner Manager of a Logistic Company to Achieve Financial Literacy? Procedia Engineering, 178: 76-84.

Khoshnood, Samaneh; Khoshkar, Farzin and Motwaliyan, Muhaddeseh (1401), Financial Literacy, Psychology and Educational Sciences in the Third Millennium, Spring 1401, No. 15, pp. 595-604 (in persian).

Klapper, L., & Lusardi, A. (2020). Financial literacy and financial resilience: Evidence from around the world. Financial Management, 49(3), 589-614. https://doi.org/10.1111/fima.12283

Kumar, K., Banerjee, A., & Philip, D. (۲۰۲۳). Financial Literacy, Awareness and Inclusion.

Kuzmina-Mer ino I. (*2015*), Improving Financial Management System for Multi-business Companies, 5Procedia - Social and Behavioral Sciences 210:136-145; DOI: 10.1016/j.sbspro.2015.11.352

Lusardi, A. (2019). Financial literacy and the need for financial education: Evidence and implications. Swiss Journal of Economics and Statistics, 155(1), 1-8. https://doi.org/10.1186/s41937-019-0027-5

Maskay, Nephil Matangi (2022). FINANCIAL LITERACY FRAMEWORK, Nepal Rastra Bank.

Nazem Manbari, Seyed Jalal; Askarzadeh, Gholam Reza (2012). Investigating the effect of past behavior and financial literacy on investors' investment decisions within the framework of the theory of planned behavior in the Tehran Stock Exchange, Economic Studies, Financial Management and Accounting, Volume 8, Number 121, pp. 87-98(in persian).

noor, n., Batool, i., & Rehman, h. U (2022). an empirical assessment of mediating role of financial self efficacy on financial literacy and financial inclusion in Pakistan. Annals of Social Sciences and Perspective, 3(1), 77–103. https://doi.org/10.52700/assap.v3i1.160

Normawati, Rani, Sri Rahayu, and Saparila Worokinasih (2022). 'Financial Knowledge, Digital Financial Knowledge, Financial Attitude, Financial Behaviour and Financial Satisfaction on Millennials'. In. European Alliance for Innovation n.o. https://doi.org/10.4108/eai.6-3-2021.2305967.

OECD (2018), G20/OECD INFE Policy Guidance on Digitalization and Financial Literacy, www.oecd.org/going-digital.

Paighami, Adel, and Toorani, Haidar (2011). The role of economics curriculum in the world's formal and public education program, presenting an action plan for a neglected curriculum. Educational Innovations, 9(37), 31-52.SID. https://sid.ir/paper/75672/fa

Papaioannou, S. K. and Dimelis, S. P (2007). "Information technology as a factor of economic development: evidence from developed and developing countries". Economics of Innovation and New Technology, 16(3), 179–194.

Respati, Dwi Kismayanti; Widyastuti, Umi, Nuryati, Tutty; Michael Musyaffi, Ayatulloh; Dwi Handayani, Bestari and Ali, Najmatu Rahma

(2023). How do students' digital financial literacy and financial confidence influence their financial behavior and financial well-being? Volume 17, Issue 2, 40-50, 2023, 1994-1633/, 1994-1625; DOI: 10.55951/nurture. v17i2.154| URL: www.nurture.org.pk .

Seo, H-J. and Lee, Y. S. and Oh, J. H. (2009). "Does ICT investment widen the growth gap?" Telecommunications Policy, 33(8), 422–431.

Sharpe, N. (۲۰۱۸). An introduction to rethinking pedagogy for a digital age. London: Routledge.

Taftian, Akram; Mirbagheri, Zahra (2017). Innovation Strategy and Profit Management, International Conference on Modern Research in Management, Economics, and Capacity of the Tourism Industry in Development.

Theng, H. and Huet, J. M. and Viennois, I. and Romdhane, M. (2007). "Telecoms and development in Africa: the chicken or the egg?" Convergence Letter, 8, 16.

Tohidi Asl, Mansoureh (2012). Evaluating the level of digital literacy and its impact on people's willingness to use e-government services (Case study: residents of District 14 of Tehran Municipality). Master's thesis, Islamic Azad University, Electronics Branch (North Tehran) (in persian).

Tony, Nisha, and Kavitha Desai (2020). 'Impact of Digital Financial Literacy on Digital Financial Inclusion'. INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH 9: 1. www.ijstr.org.

Wargo, E., Carr Chellman, D., Budge, K., & Canfield Davis, K. (2020). On the digital frontier: Stakeholders in rural areas take on educational technology and schooling. Journal of Research on Technology in Education, 53(2), 140-158. https://doi.org/10.1080/15391523.2020.1760753

World Bank. (2020). The COVID-19 crisis response: Supporting tertiary education for continuity, adaptation, and innovation. Open Knowledge Repository. http://hdl.handle.net/10986/34571

Zait, A., & Bertea, P. (2014). Financial literacy – conceptual definition and proposed approach for a measurement instrument. Journal of Accounting and Management, 4(3), 37-42. https://EconPapers.repec.org/RePEc:dug:jaccma:y:2014:i:3:p:37-42