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PhD Thesis Summary

RESEARCH ON THE DEVELOPMENT OF A MODEL FOR DETERMINING THE DEGREE OF ADOPTION OF DIGITAL TECHNOLOGIES BY SMALL AND MEDIUM-SIZED ENTERPRISES IN ROMANIA

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Fundamental Field: Engineering Sciences

Doctoral field: Industrial Engineering

Bucharest
2024

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FIGURE LIST 5
TABLE LIST 8
ABBREVIATIONS LIST 10
ACKNOWLEDGMENTS 11
INTRODUCTION 12
CHAPTER 1. CURRENT CONTEXT, RESEARCH OBJECTIVES AND GENERAL STRUCTURE OF THE THESIS 15
1.1. Background to the research 15
1.2. Importance and scientific relevance of the thesis 19
1.3. Research objectives 20
1.4. General structure of the thesis 23
CHAPTER 2. STATE OF RESEARCH ON THE ADOPTION OF DIGITAL TECHNOLOGIES IN SMALL AND MEDIUM-SIZED ENTERPRISES 26
2.1. Technology acceptance models 26
2.1.1. Technology acceptance model 26
2.1.2. Extended technology acceptance model 27
2.1.3. Unified theory of technology acceptance and use 31
2.1.4. Technology acceptance model 3 32
2.2. Adoption of the customer relationship management system 40
2.3. Adoption of enterprise resource planning system 48
2.4. Adoption of "cloud-computing" technology 50
2.5. Adoption of blockchain technology 57
2.6. Conclusions of Chapter 2 65
CHAPTER 3. DIGITAL TECHNOLOGIES USED TO IMPROVE THE PERFORMANCE OF SMALL AND MEDIUM-SIZED ENTERPRISES 66
3.1. Digital technologies 66
3.1.1. Customer relationship management system 66
3.1.2. Blockchain 69
3.1.3. "Cloud computing" 77
3.1.4. Enterprise resource planning system 82
3.1.5. Artificial intelligence 86
3.1.6. Internet of things 90
3.1.7. Machine learning 99
3.2. Conclusions of Chapter 3 100
CHAPTER 4. RESEARCH FOR THE DEVELOPMENT OF A MODEL (DATAM MODEL) FOR DETERMINING THE DEGREE OF ADOPTION OF DIGITAL TECHNOLOGIES BY SMALL AND MEDIUM-SIZED ENTERPRISES IN ROMANIA 101
4.1. Focus group research on determining the main factors influencing the adoption and use of digital technologies by small and medium-sized enterprises 101
4.1.1. Research methodology 101
4.1.2. Data collection and analysis of results 105

4.1.3. Conclusions of the focus-group research 111
4.2. Study on measuring the perception of people using digital technologies in small and medium-sized enterprises 112
4.2.1. Research methodology 113
4.2.2. Defining the research problem 113
4.2.3. Data collection and analysis of qualitative research results 114
4.2.4. Conclusions of the interview-type research 125
4.3. Design of the proposed conceptual model 126
CHAPTER 5. VALIDATION OF THE PROPOSED MODEL (DATAM MODEL) FOR DETERMINING THE DEGREE OF ADOPTION OF DIGITAL TECHNOLOGIES IN SMALL AND MEDIUM-SIZED ENTERPRISES IN ROMANIA 128
5.1. Research methodology 128
5.2. Data collection tool 129
5.3. Data collection and analysis of results 139
5.3.1. Interpretation of questions on respondents' use of digital technologies in SMEs 140
5.3.2. Reliability and validity test of the research instrument 144
5.4. Structural equation model 158
5.5. Conclusions of Chapter 5 170
CHAPTER 6. CONCLUSIONS. CONTRIBUTIONS. FUTURE RESEARCH PERSPECTIVES AND DIRECTIONS 174
6.1. Concluding remarks 174
6.2. Personal contributions 175
6.2.1. Theoretical contributions 175
6.2.2. Practical contributions 176
6.3. Future research perspectives and directions 177
LIST OF PUBLISHED PAPERS 178
REFERENCES 181
ANNEXES 198
ANNEX 1. Questionnaire on the adoption of digital technologies in small and medium-sized enterprises in Romania 198
ANNEX 2. Factor correlation matrix 204
ANNEX 3. Pearson Factor Correlation Matrix 205
ANNEX 4. Correlation matrix of factors in relation to the demographic profile of respondents 207
ANNEX 5. Correlation matrix of factors in relation to the company profile 209
ANNEX 6. Pearson's correlation matrix of factors in relation to the company's profile 212

Keywords: *digital technology, technology acceptance, digital technology adoption, small and medium-sized enterprises, TAM model, factors influencing digital technology adoption.*

INTRODUCTION

Advances in digital technologies have brought significant improvements in almost every aspect of people's lives, including communication, work practices, entertainment, travel, banking, shopping, manufacturing, service industries, and more. Through digital technologies, businesses are transforming into businesses, becoming more competitive. There is general agreement that digital technologies allow companies to use new business models, reducing costs and allowing people to work remotely from the comfort of their homes.

Small and medium-sized enterprises are an integral part of the national economy, and technological innovation can significantly increase productivity while optimizing financial and operational performance. Small and medium-sized enterprises play an important role in a country's economic growth, contributing to the country's GDP. Developing countries like Romania face many challenges and need assistance, including high-performance IT systems.

In the literature, there is a Technology Acceptance Model (TAM). TAM is a theory that describes various factors that have a positive or negative effect on the adoption or use of a particular technology. When an individual is presented with a certain technology, there are factors that influence their behavior and perception of it (Davis, 1986).

This doctoral thesis presents the achievements of the author's research on improving the adoption and use of digital technologies in small and medium-sized enterprises in Romania. In this regard, the thesis presents the way in which the TAM model can be used to improve the use of digitalization in SMEs in Romania.

The main objective of the doctoral thesis is to *develop a model for determining the degree of adoption of digital technologies in small and medium-sized enterprises (SMEs) in Romania.*

In order to achieve the main objective of the doctoral thesis, the following secondary objectives have been defined:

O1. Defining and presenting the types of digital technologies.

O2. Presentation of the models and theories used in the adoption of digital technology.

O3. To identify the research directions regarding the analysis of the adoption of digital technologies in small and medium-sized enterprises, following the analysis of the specialized literature.

O4. Determine the main factors influencing the level of adoption and use of digital technologies by small and medium-sized enterprises.

O5. Identifying the perception of people in small and medium-sized enterprises in terms of the adoption and use of digital technologies.

O6. Developing a model for determining the degree of adoption of digital technologies in small and medium-sized enterprises in Romania.

O7. Validation of the proposed model (DATAM model).

In order to achieve the main objective of the doctoral thesis, several **researches** have been carried out , namely:

- three bibliographic researches: "Bibliographic research on the identification of digital technologies used in small and medium-sized enterprises", "Bibliographic research on the identification of models or theories on the analysis of the adoption and use of digital technologies" and "Bibliographic research on the identification of the most used theories in the field on measuring the performance of small and medium-sized enterprises in terms of the adoption of digital technologies";
- a qualitative focus-group research - "Focus-group research on determining the main factors influencing the adoption and use of digital technologies by small and medium-sized enterprises";
- a qualitative in-depth interview research – "Study on measuring the perception of people using digital technologies in small and medium-sized enterprises";
- a quantitative research – "Research on the analysis of the influence of factors on the degree of adoption of digital technologies in small and medium-sized enterprises in Romania".

Therefore, the 7 secondary objectives are approached by carrying out 6 researches, the results of which lead to the achievement of the general objective of the thesis, namely *the development of a model for determining the degree of adoption of digital technologies in small and medium-sized enterprises (SMEs) in Romania.*

Thus, the research carried out within the doctoral thesis led to the identification **of the novelty element** , namely starting from the factors of the TAM model, the introduction in the proposed model of the following additional factors: innovation, competitive pressure, purchase price, perceived security, optimism and technological support.

CHAPTER 1. CURRENT CONTEXT, RESEARCH OBJECTIVES AND GENERAL STRUCTURE OF THE THESIS

The great expansion of globalization over the past three decades has forced SMEs to adopt digital technologies so that they can compete to some extent with large corporations. New digital technologies are increasing performance and productivity in the modern age, where the world is much more economically interconnected. SMEs are now relying on essential technologies that will lead to the subsequent adoption of the technology in new markets, but it is a slow process (Turaev & Ganiev, 2021).

The TAM model is a theory that describes various factors that have a positive or negative effect on the adoption or use of a particular technology. When an individual is presented with a certain technology, there are factors that influence their behavior and perception of it (Davis, 1986).

Small and medium-sized enterprises are an integral part of the national economy, and technological innovation can significantly increase productivity while optimizing financial and operational performance. Small and medium-sized enterprises play an important role in a country's economic growth. In addition, SMEs can introduce process innovations by identifying errors in existing organizations and organizational processes. However, small and medium-sized enterprises are striving to improve the way technologies are applied.

Therefore, this study contributes to the addition of new knowledge in the field of the topic studied. First, the study offers some new ways to deepen and broaden the understanding of the factors driving the adoption of digital technologies in SMEs. Also, the research undertaken by the author is one of the few systematic researches on the implementation of digital technologies in SMEs in Romania. Therefore, the results will theoretically contribute to the literature and will generate a new perspective on the fact that the use of digital technologies in industrialized countries have similar characteristics in Romanian SMEs. Specifically, the results can provide additional empirical evidence on the role of drivers in the adoption of digital technologies in SMEs in Romania.

Taking into account these elements, the **purpose of the research** is as follows: ***To identify the factors that influence the adoption and use of digital technologies in small and medium-sized enterprises in Romania.***

The paper focuses on the analysis of the factors regarding the adoption and use of digital technologies in small and medium-sized enterprises. The research topic refers to the way in which the socio-economic situation together with the firm's objectives influence the adoption and use of digital technologies, and the extent to which the discovered influences have importance in small and medium-sized enterprises in Romania.

The research problem was formulated as follows: ***Research on the influence of the adoption and use of digital technologies in small and medium-sized enterprises in Romania.***

This doctoral thesis consists of 6 chapters and has a size of 212 pages. For the elaboration of the thesis, 280 bibliographic sources were consulted. The thesis contains 43 tables, 64 figures and 6 appendices to illustrate the results obtained by the author.

The first chapter presents the context of the research, the importance and scientific relevance of the studied topic. At the same time, the problems identified in the field of research are also mentioned, highlighting the problems related to the application of the model of acceptance and use of digital technologies in small and medium-sized enterprises to improve their activity. The last part of the chapter presents the specific objectives of the doctoral thesis and its structure.

In the second chapter, studying the literature, the current state of performance of small and medium-sized enterprises is presented, with precise references to the adoption and use of digital technologies. At the same time, the models of technological acceptance regarding the adoption and use of digital technologies are also presented.

In the third chapter, the current state of digital technologies is described, and their evolution is presented. Also, the particularities regarding their use in small and medium-sized enterprises in the context of economic development are mentioned.

Chapter four is dedicated to identifying existing problems in small and medium-sized enterprises regarding the adoption and use of digital technologies. They are a support in improving the activities in which both employees and customers of companies are involved. The research carried out is both qualitative, using the "focus-group" technique and the in-depth interview technique.

Chapter five presents the research – "Research on the analysis of the influence of factors on the degree of adoption of digital technologies in small and medium-sized enterprises in Romania". The research presented in this chapter is a quantitative one, with the main purpose of analyzing the influence of factors on the degree of adoption of digital technologies in small and medium-sized enterprises in Romania. This study aims to emphasize the importance of improving the TAM model regarding determining the degree of adoption of digital technologies in small and medium-sized enterprises in Romania.

This chapter elaborates on the research methodology used to investigate the problem studied. It describes the research methodology, data collection strategies, target population, sampling, reliability, and validity. The last section focuses on the ethical considerations of the research and the appropriate techniques for analyzing the data collected to test the hypotheses. At the same time, the validation of the proposed conceptual model on the sustainability of small and medium-sized enterprises in terms of the adoption and use of digital technologies is also presented. This model is designed and statistically evaluated using the SPSS-version 20 and SmartPLS-version 4 software tools, at the end of which the results of the testing of the researched model are presented.

Chapter six of the thesis presents a summary of the results obtained from the studies and research carried out. During the research, results were obtained that led to the design, testing and validation of the DATAM model, a model that determines the degree of adoption of digital technologies in small and medium-sized enterprises in Romania.

CHAPTER 2. STATE OF RESEARCH ON THE ADOPTION OF DIGITAL TECHNOLOGIES IN SMALL AND MEDIUM-SIZED ENTERPRISES

Technology Acceptance Model

Initially, the Technology Acceptance Model (TAM) was introduced by Fred Davis in 1986 for his proposal in his doctoral thesis, as illustrated in Figure 2.1. Davis (Davis 1989) is known to have introduced the TAM model, a well-known and widely accepted model for the adoption of new technologies. He developed and validated a measurement scale to predict user acceptance of technology based on two variables: perceived usefulness and perceived ease in using new technologies.

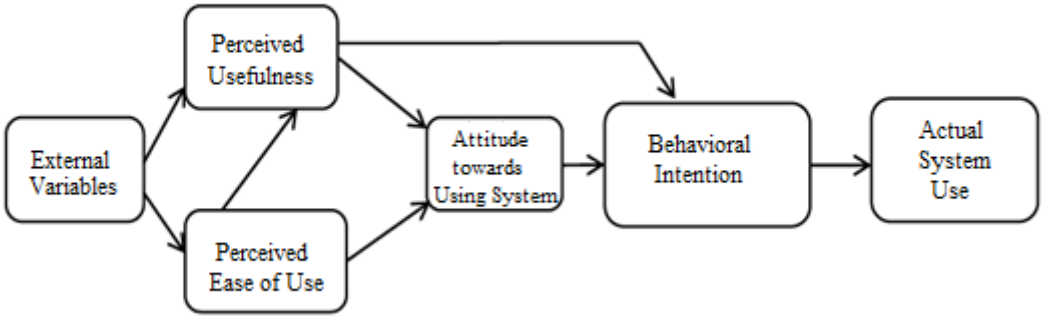

Figure 2.1 The original technology acceptance model

Source: adapted from Davis, F.D., 1989, Perceived Usefulness, Perceived Ease of Use and User Acceptance of Information Technology, p.985

Davis had a first refined version of the TAM model, when he found that two of the three factors, respectively UUP (perceived ease of use) and UP (perceived utility), directly influenced the intention to use (UI), which eliminated the previously used attitude factor. Later, Davis (1989) found that UUP (perceived ease of use) and UP (perceived utility) exert a strong impact on intent to use (UI), and the effect of attitude toward use decreases over time. With this argument they decided to remove the last construct from the TAM model. When Venkatesh and Davis (1996) analyzed the history of perceived ease of use, they no longer included the attitude towards use in the model (Figure 2.2) (Rondan-Cataluña et al., 2015):

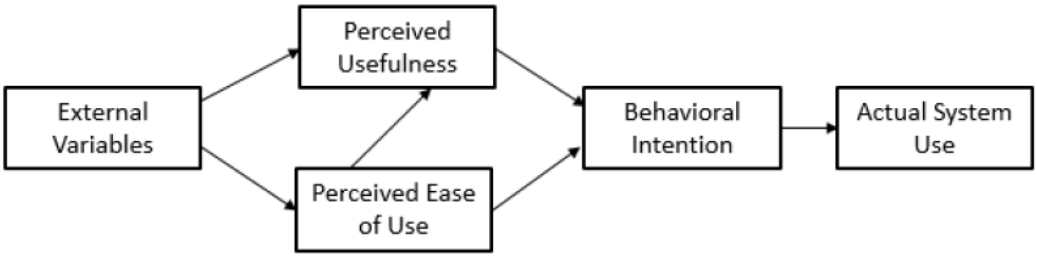

Figure 2.2 Technology Acceptance Model 1

Source: adapted from Venkatesh, V. and Davis, F.D. 1996, "A model of the antecedents of perceived ease of use: development and test", p.20

Extended Technology Acceptance Model

Another version of the TAM model – called TAM2 (in fig.2.3) – was discovered in 1996. Venkatesh and Davis provided a final version of the widely used TAM model in information systems research, which focuses on behavioral intent for information systems adoption (Bach, 2016). The most significant moderating variables that are analyzed for the TAM model were established as gender and age of users (Im, 2011).

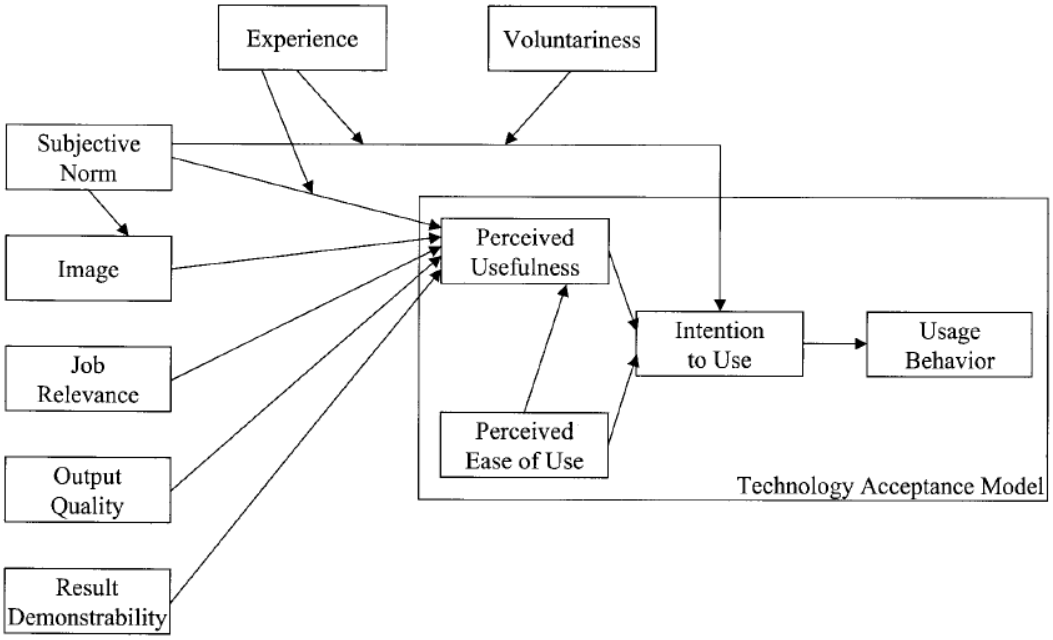

Figure 2.3 Extended Technology Acceptance Model (TAM2)

Source: adapted from Venkatesh, V., & Fred D. Davis, 2000, A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies, p. 197

Unified Theory of Technology Acceptance and Use

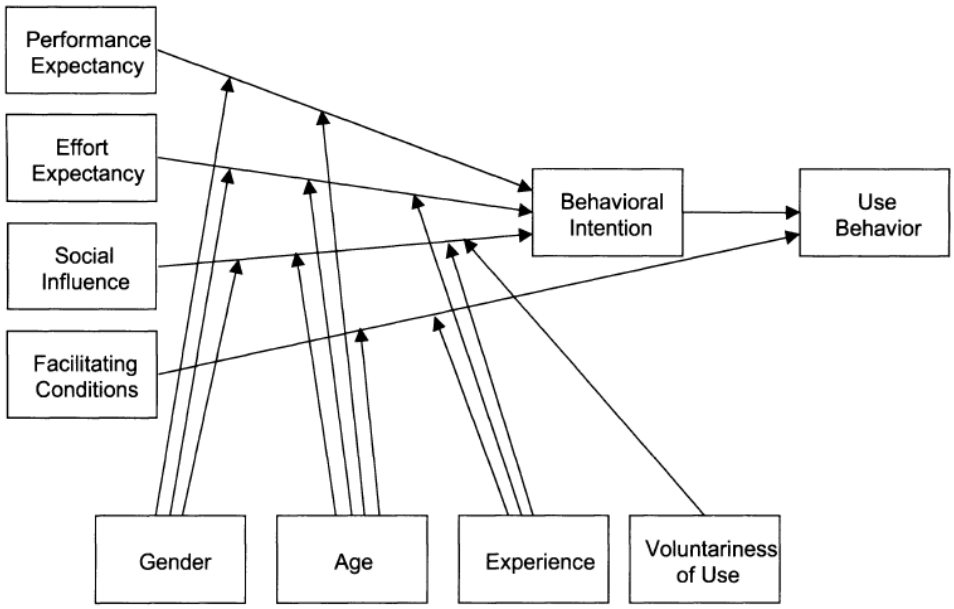

Figure 2.4 Unified Theory of Technology Acceptance and Use

Source: adapted from Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. 2003. User acceptance of information technology: Toward a unified view, p.447

The Unified Theory of Technology Acceptance and Use (UTAUT) was introduced by Venkatesh in 2003. The UTAUT model (Figure 2.4) theorizes that social influence has significance only in the mandatory use of technology in concrete situations (Hoong, Thi&Lin, 2017).

Technology Acceptance Model 3

Venkatesh and Bala (2008) combined TAM2 (Venkatesh & Davis, 2000) and the model of determinants of perceived ease of use (Venkatesh, 2000) and developed an integrated model of technology acceptance known as TAM3. Figure 2.5 shows the TAM 3 model.

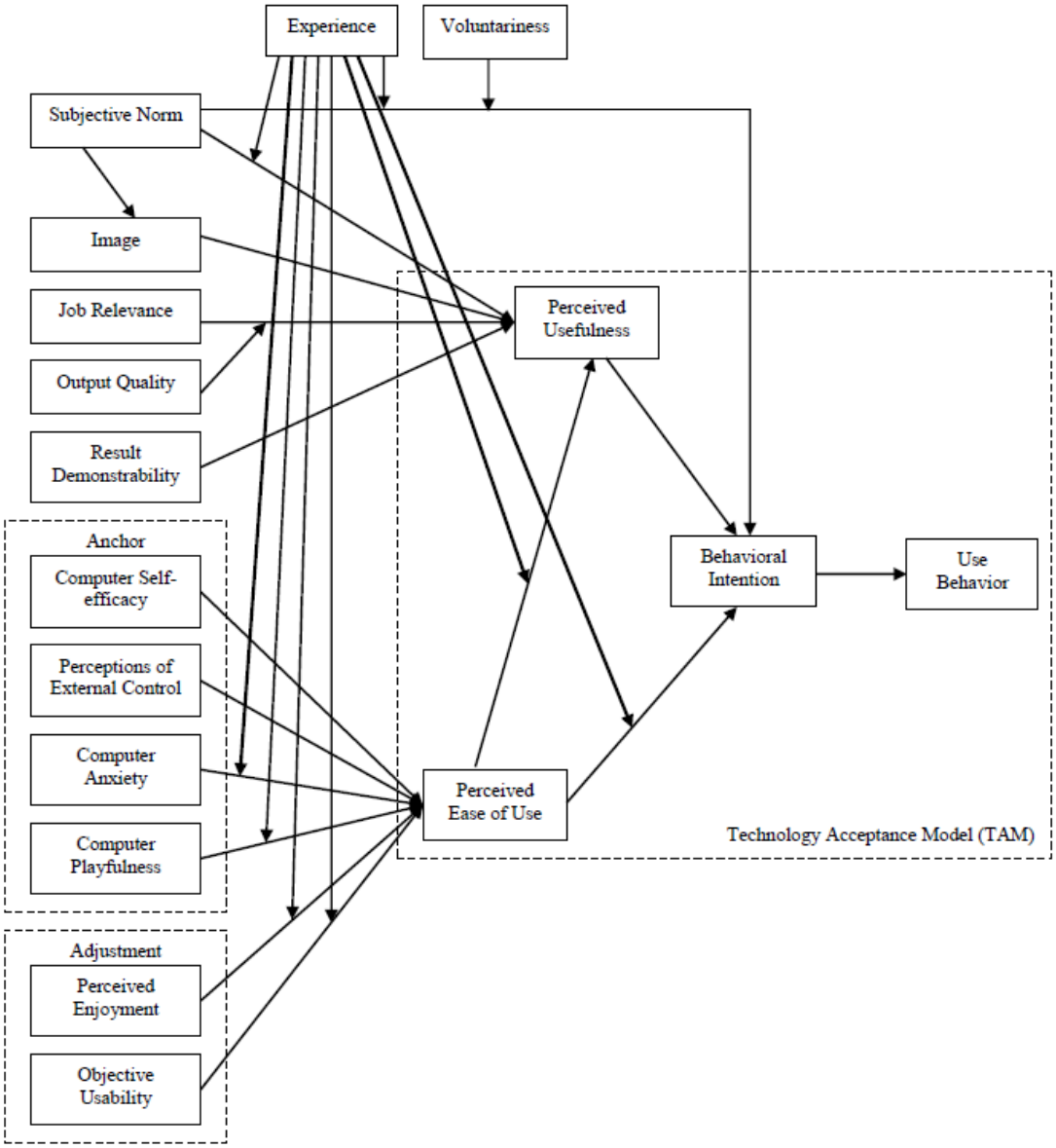

Figure 2.5 Model TAM 3

Source: adapted from Venkatesh V. & Bala, H., 2008, Technology Acceptance Model 3 and a Research Agenda on Interventions, p.280

CHAPTER 3. DIGITAL TECHNOLOGIES USED TO IMPROVE THE PERFORMANCE OF SMALL AND MEDIUM-SIZED ENTERPRISES

3.1. Customer relationship management system

CRM is a useful system for generating, storing, representing, reproducing, and translating information. In a broad sense, CRM includes activities related to marketing, sales, finance, and technical support departments related to customers, prospects, suppliers, and partners.

Factors influencing CRM system implementation and key performance indicators (KPIs)

These factors were drawn from an extensive range of frameworks and literature review. These factors were then assessed by SME CRM practitioners for verification and recommendation of new factors, where appropriate (Table 3.2):

Table 3.2 Definition of factors influencing CRM system adoption

No. Crt.	Factor	Definition of the factor
1	Compatibility	The degree to which an innovation is perceived to be consistent with existing values, past experiences, and the needs of potential adopters
2	Relative Advantage	"The degree to which an innovation is perceived as better than the idea it replaces"
3	Complexity	The level at which it is considered an innovation that is difficult to understand and use
4	IT Infrastructure	IT assets (software, hardware and data), IT systems and their components, network, telecommunications facilities and applications
5	Security	Ability to protect consumer transaction information and data to ensure their privacy
6	Top Management Support	Support from the organization's top leaders that facilitates the success of CRM implementation
7	Financial support	The financial resource that covers all the financial funds of the organization
8	Information policy	A group of interconnected laws, guidelines, principles, regulations, rules, and procedures that guide the management and monitoring of the information lifecycle
9	Employee Engagement	An employee is aware of the business context and cooperates with colleagues to improve the company's performance
10	Customer pressure	Customer Requirements and Behaviors That Are Driving Companies to Adopt New Technologies
11	Competitive pressure	The level of competitiveness in the industry in which the organization operates

Source: adapted from Salah, O.H., Yusof, Z.M., & Mohamed, H., 2018, A conceptual framework of CRM adoption among Palestinian SMEs, p.2256

3.2. Blockchain

The term "blockchain" reached its peak in December 2017. Blockchain is defined as an open-source dataset, distributed across computers, using cutting-edge cryptography (Tapscott et al. 2016). Blockchain is "*a distributed ledger or database, shared in a public or private computing network*" (Carson et al., 2018, p.2). This concept was first introduced in 2008, when the article "Bitcoin: A Peer-to-Peer Electronic Cash System" (Nakamoto, 2008) came to fruition.

Blockchain in the context of SMEs

In order to overcome knowledge attrition and manage current and future knowledge resources in the best possible manner, SMEs need to rely on effective knowledge management (Durst & Edvardsson, 2012). In addition, the fact that many smaller firms are struggling with the adoption of more sophisticated computer information technologies that could help them benefit from the opportunities offered by digitalisation should not be overlooked in this context (OECD, 2017a). In this regard, the innovative features of blockchain should be evaluated together with the major challenges of SMEs, aspects detailed below:

1. **Cost reduction** – One of the solutions that blockchain offers to SMEs is the elimination of the middleman for value transactions. For SMEs, this intermediary could be a bank, broker or intermediary that secures the value transaction between SMEs and their trading counterpart. Relying on an intermediary, transaction costs inevitably increase due to the commissions the intermediary takes or the margin they add (Madhok & Tallman, 1998).
2. **Internalization** – Internalization is one of the challenges for SMEs to increase their share in global markets. They need both additional resources (Welch and Luostarinen, 1988) and trusting relationships (Zain & Ng, 2006) to successfully implement their internalization strategies. In this sense, smart contracts provide SMEs with an opportunity to do business with parties they do not trust.
3. **Digital representation of assets** – Blockchain ledgers are composed of digital codes. By using hash functions, digital assets are represented in the blockchain with unique hash codes. This makes it easier for business counterparts to follow their business process by tracking the codes. The major concern in this regard is that these digital codes should not represent the assets that can change shape (Ilbiz & Durst, 2019).
4. **Unalterable data logging** – If blockchains are used for online documentation purposes, they are not flexible systems to tolerate human error. The data recorded in the blockchain is unalterable. This problem may not be the ideal solution for SMEs that may be looking for flexible and changeable databases, as SMEs have less formal business processes than larger enterprises (Singer, 2015).
5. **Network size** – The major advantage of blockchain is that it eliminates peers' dependence on a central authority. Its decentralized nature increases the significance of the network effect. For SMBs that would like to take full advantage of blockchain, they must have or be part of a robust and large network that distributes a network of nodes. If a small group of companies aims to use blockchain, they are more vulnerable to external attacks,

due to their computing power, which can be overcome by external factors (Ilbiz & Durst, 2019).

6. **Transparent and synchronized ledger** – Common ledgers have two advantages for businesses that want to use them. First, it provides transparency to trusted shareholders, and none of these parties can corrupt the data. Second, a copy of the registry is kept by each node, which is saved in case of a crash of their data storage tools. Any conflicts in the records can be resolved by examining the shared ledger (Ilbiz & Durst, 2019).

7. **Scalability** – Scalability is another issue that should be considered to determine the suitability of the blockchain. Higher transaction speeds could be an important expectation for SMEs as they adopt blockchain (Ilbiz & Durst, 2019).

8. **Fair trade** – Customers who are sensitive to these principles can trace the provenance of the products they purchase through the blockchain ledger (Teo, 2018). The transparency offered by blockchain can increase trust between SMEs and their customers and contribute to a competitive advantage.

9. **Funding -** Blockchain technology offers SMEs a fundraising opportunity called "Initial Coin Offerings" (ICOs). ICOs allow for a fast and less regulated funding process for SMEs and no equity losses are required. On the other hand, due to the fact that ICOs are not regulated in many countries, they could be subject to cases of fraud if their investors are sued (Ilbiz&Durst, 2019).

3.3. "Cloud computing"

According to a simplified definition, the term "cloud computing" refers to the storage, processing and use of data on remote systems accessed via the Internet. "Cloud computing" has the benefit of reducing users' IT expenses and favoring the development of a large number of new services. "Cloud computing" refers to services and applications that run on distributed network systems (Sosinsky, 2011), using resource virtualization methods and accessing them using the Internet, using standard network services and protocols (Collier & Shahan, 2015). "Cloud computing" offers the transparency of physical resources and their configurations, users having the impression of having theoretically unlimited resources.

Cloud Computing Models

From the point of view of cloud computing models, 4 main models of use are identified (private, public, hybrid, community) and a derived model (institutional):

1. Private Cloud: The first type of IT Infrastructure is used by a single company consisting of several users and can be managed by the company itself or can be outsourced to a third party. In private cloud computing, the available resources are optimized. There are many organizations that have implemented their own system such as IBM, HP, Microsoft, etc.

2. Public Cloud: The second type of "Cloud computing" is available to the public or to a part of the public based on criteria, an industry segment or area of interest. This IT infrastructure is managed and owned by a service provider.

3. Hybrid Cloud: The hybrid cloud is composed of one or more components of the private or public cloud and are considered as a whole, using the same technology.

4. Community Cloud: The type of community cloud is shared by several companies to provide services to a community that shares identical functional requirements.

5. Institutional Cloud: institutional cloud infrastructure is managed only by one enterprise and used by several employees. Data protection is provided by the administrator, the institutional cloud being a combination of public and private.

3.4. Enterprise resource planning system

The history of ERP systems dates back to the 1960s when this type of software application was mainly used to assist the production process (Bansal, 2013). In the 1970s, the focus shifted to the famous material planning systems (MRPs) to plan and control production. In the 1980s, MRP systems further evolved into Manufacturing Resource Planning (MRP-II) systems, which began with aggregate planning and demand management and ended with a comprehensive program that included components to be manufactured in-house as well as those to be purchased externally. ERP system modules handle a wide and diverse range of organizational functions (Figure 3.5):

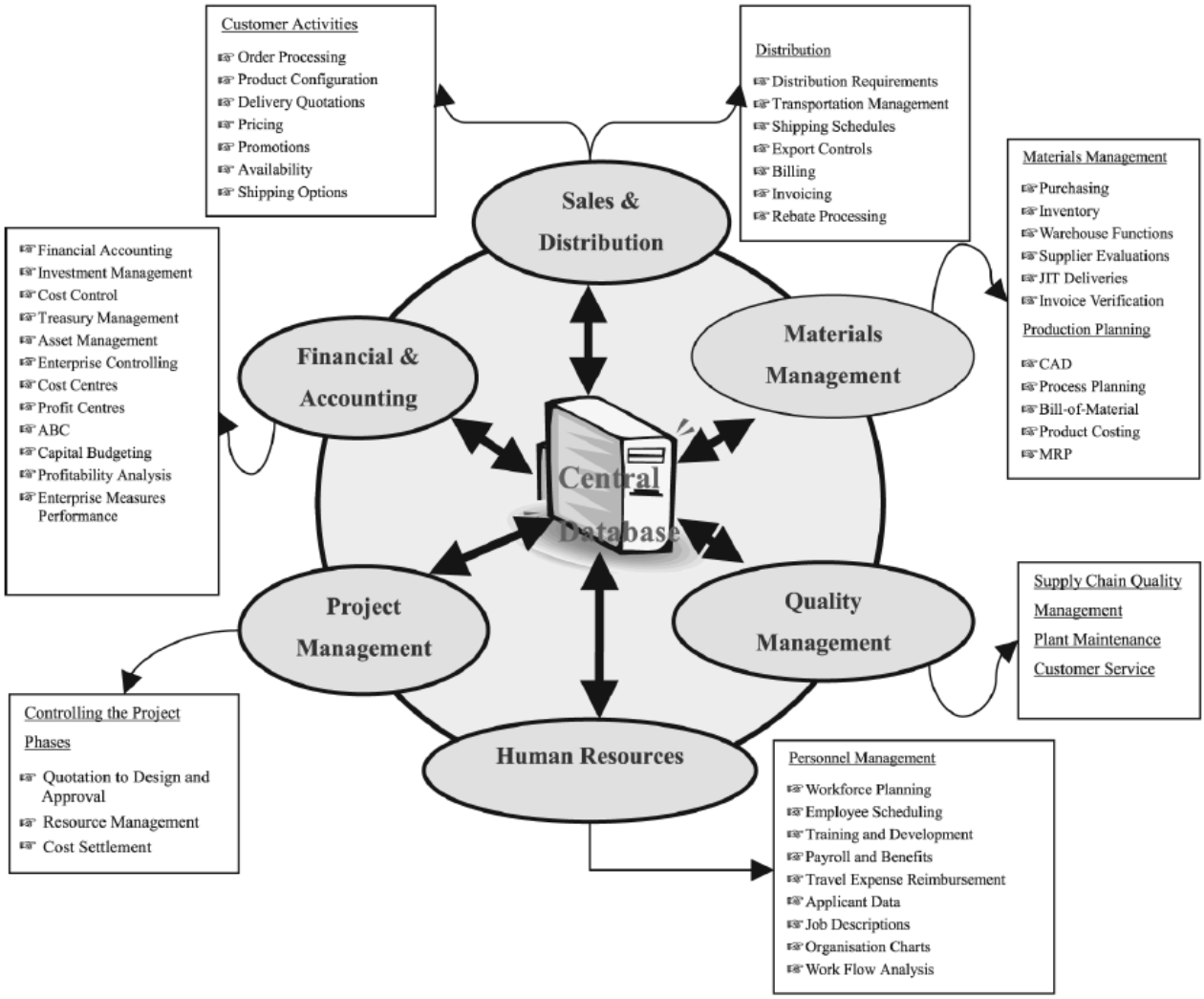

Figure 3.5 Modules of an ERP system
Source: adapted from Shehab, E. M., Sharp, M. W., Supramaniam, L., & Spedding, T. A. 2004. Enterprise resource planning: an integrative review, p.363

3.5. Artificial Intelligence

Artificial intelligence (AI) is a broad topic in which a number of terms such as "machine intelligence", "intelligence agents", "intelligent behavior", "intelligent systems" and "algorithms" have been used in its definition.

Intelligent systems can be defined as systems that process input signals to act an output, the form of which will depend on previous experiences in which the system has learned which actions best allow it to achieve its goals. Therefore, the degree of intelligence in a system refers to the level of performance of the system in achieving its own objectives (Barton & Thomas, 2009).

Currently, robotics, artificial intelligence, machine learning and big data are inseparably linked to that innovation economy, especially in the industrial sector. As they evolved, firms large and small focused on the need to offer better products with higher quality and technology used to improve their performance and open space for further development (Dickson & Hadjimanolis, 1998; Edwards et al., 2017). There is a need for automated systems with an acceptable investment, high efficiency, high adaptability and with such flexibility that they can produce several different products and adapt to future product variants without large additional investments (Hedelind et al., 2008).

3.6. Internet of Things (IoT)

The term Internet of Things (IoT) according to the 2020 conceptual framework is expressed by a simple formula, such as: **IoT = Services + Data + Networks + Sensors** (Atzori et al., 2017). The Internet of Things (IoT) is a global infrastructure for the information society, enabling advanced services through the interconnection (physical and virtual) of things based on existing and evolving interoperable information and communication technologies (Patel & Patel, 2016). Although there are many ways in which IoT could or could not impact the business, the following advantages and disadvantages are highlighted in Table 3.14:

Table 3.14 Advantages and disadvantages of using IoT technology

Advantages		**Disadvantages**	
Communication	IoT has communication between devices, and hence full transparency is available with higher quality. The key advantage is the ability to communicate continuously and smoothly with improved end-to-end interaction.	**Compatibility**	Since devices from different manufacturers will be interconnected in the IoT, there is currently no international standard of compatibility for labeling and monitoring equipment.
Automation and control	Without human involvement, machines automate and control a large amount of information, leading to faster production without delay.	**Complexity**	IoT is a diverse and complex network. Any software/hardware failure or error will have serious consequences. Even cutting

Advantages		Disadvantages	
			off the power supply can cause damage.
Monitoring saves money and time	IoT uses smart sensors to monitor different aspects of our daily lives for various applications that save money and time.	**Security**	IoT involves multiple devices and technologies. Since a lot of context-related data will be transmitted by smart sensors, there is a high risk of losing private data.
A better quality of life	IoT-based applications increase convenience and ensure better management in everyday life; thus improving the quality of life.	**Engaging reduction in staff**	With the advent of technology, daily activities are automated through the use of IoT with less human intervention, which in turn results in fewer human resource requirements. This causes the problem of unemployment in society.
New business opportunities	It creates new businesses for IoT technology, developing economic growth and creating new jobs.	**Technology takes control of life**	Life will be increasingly controlled by technology and will depend on it. The younger generation is already addicted to technology for every little thing. With IoT, this addiction will spread across generations and in users' daily routines.
Environmentally friendly	It saves natural resources and helps create a greener and more sustainable planet.		

Source: adapted from Soumyalatha, S. G. H. 2016. Study of IoT: Understanding IoT architecture, applications, is-sues and challenges. In 1st International conference on innovations in computing and net-working (ICICN16), CSE, RRCE, pp.480-481

3.7. Machine Learning

According to Mitchell's definition of machine learning: "*A computer program is set to learn from an experience E with respect to a given load T and a certain measure of performance P if its performance on T as measured by P improves with experience E*." (Mitchell, 1997, p.2).

Applications of machine learning in SMEs

Customer relationship management (CRM) – SMBs use machine learning algorithms to analyze customer data and improve different aspects of CRM, such as customer segmentation, targeted marketing, churn prediction, and personalized recommendations. Machine learning algorithms can analyze large volumes of data, allowing SMBs to understand customer behavior patterns and preferences. Machine learning-based CRM systems provide personalized product recommendations and promotions, which result in better customer engagement and satisfaction (Vajjhala, 2024).

Supply Chain Management – Machine learning techniques are applied to optimize various aspects of supply chain management, including demand forecasting, inventory management, and supplier evaluation. Machine learning algorithms analyze data from various sources to identify potential risks and disruptions in the supply chain (Vajjhala, 2024).

Process automation – SMBs are embracing machine learning to automate repetitive tasks such as data entry, document processing, and quality control. Machine learning improves robotic process automation systems, allowing them to learn from data and adapt to new situations. Machine learning predicts equipment failures and schedules maintenance tasks, thereby minimizing downtime and reducing maintenance costs for SMEs (Vajjhala, 2024).

CHAPTER 4. RESEARCH FOR THE DEVELOPMENT OF A MODEL (DATAM MODEL) FOR DETERMINING THE DEGREE OF ADOPTION OF DIGITAL TECHNOLOGIES BY SMALL AND MEDIUM-SIZED ENTERPRISES IN ROMANIA

4.1. Focus group research on determining the main factors influencing the adoption and use of digital technologies by small and medium-sized enterprises

The main objective of this qualitative research is to determine the problems faced by the employees of small and medium-sized enterprises in terms of the adoption and use of digital technologies.

A qualitative research was carried out, using the focus-group technique to meet the objectives of the research mentioned above.

In order to adopt and use a digital technology, its efficiency, ease of use and perceived usefulness matter a lot to employees. To be useful, a technology must be easy to use, can be integrated with other technologies, be efficient, fast, have an advantageous price at the time of purchase and ensure a good level of data security.

Each participant in the focus group expressed their opinion on the factors they perceive to be important for the use of digital technology in the workplace in terms of internal communication between employees and carrying out the activity in optimal parameters. To carry out activities between departments, employees emphasize communication and collaboration between them, time allocated and management of activities, competitiveness, organizational culture, performance evaluation, feedback and ease of use of these digital technologies.

Regarding the relationship with the supplier, it matters that a digital technology is fast, useful for the high workload, the purchase price is as low as possible, ensures transparency, is within the reach of employees, benefits from technical support in solving problems and fast response time.

In the relationship between the company and the customer, the digital technology must be performant, efficient, easy to use, be fast and identify the customer's requirements, costs must be reduced, ensure transparency and project management must be at a high level.

The most important factors regarding the analysis of the adoption of technologies are the purchase price, the monthly costs involved, security and compliance requirements, the organizational context, the business strategy, the user's needs and expectations, the sustainability of the investment, compatibility with the company's resources, the quality-price ratio, the measures taken against cyber vulnerabilities, the ease of use, the level of productivity (through the workspace, the relationship with the company). employees and superiors, etc.), the response time in case of solving technical problems/certain functionalities, the benefits brought by the use of digital technology.

4.2. Study on measuring the perception of people using digital technologies in small and medium-sized enterprises

Interviews are the most widespread and at the same time the most valuable qualitative method of market research. Next, *a qualitative research of the type of in-depth interview is* presented, as a case study.

The objectives of the research are aimed at the subject of digital technologies within small and medium-sized companies on the Romanian market, as follows:

- Identifying the most used types of digital technologies within SMEs in Romania;
- Identifying the advantages brought by the implementation of digital technologies;
- Determining the employees' own perception of SMEs in Romania on the current situation and future directions in terms of the company's marketing policies and strategies.

Starting from the formulation of the research topic and the research objectives, the key concepts used in the elaboration of the research questions can be identified and a list of concepts that have been analyzed has been made: perceived utility, perceived ease of use, subjective norm, intention to use, attitude towards use, competitive pressure, innovation, technological support and optimism.

Taking into account **the company's object of activity and the department in which it operates,** a large part of the respondents work in the field of e-commerce, and the rest in construction and logistics services.

Asked **"What does cutting-edge technology mean to them at home and at work",** most answered thinking about the facilities of using technology or simply what they usually use, mostly associating digital technologies as something that helps facilitate the completion of activities and reduce the time allocated.

Summarizing the answers to the question "**How do you think adopting technology could allow the company you work for to function efficiently? Could these technologies meet your suppliers/customers in a timely manner following the adoption of the technology?"**, the majority of respondents stated that the adoption of digital technologies would allow the company to operate efficiently, taking into account the perceived utility and would reduce the waiting time in the relationship with suppliers/customers, increasing efficiency. A response was also obtained indicating that the technology used in the Human Resources department is not directly related to the company's suppliers and customers, so it does not influence this aspect.

Ask if **"Learning to use digital technologies requires mental effort and why? Is the functionality of certain technologies clearer and easier to understand than others that are more complex?",** the answers depend on the case, but any technological use requires learning. There are probably certain factors that influence the learning to use digital technologies, but I think it also depends on how its use is perceived and the time that everyone is willing to allocate. The functionality of certain technologies is clearer because they also have a more intuitive interface, but it is also necessary to take into account the scope of activity that the person is used to.

Regarding the question that concerns the question "**Could you tell me about digital technologies? What factors influence the use of technology?",** those interviewed focused

in most cases on the cost, benefit, efficiency, utility side. Concluding the ideas about the actual use of technology, the ideas are divided. First of all, the costs matter. People are not willing to pay a certain amount to benefit from a particular program, they prefer to be able to get it for free. If it also contained a free use of at least 30 days, it would be much better, during this time you can test the application to see how it is used. They are most interested in whether and how much they would reduce the time of the work tasks and the benefits they bring.

Regarding the question " **What motivates you to try new technologies? What makes you hesitate to try new technologies?",** they are motivated primarily by the time they save with the help of a schedule, the desire to progress or the reduction of staff involvement in repetitive activities. What makes them hesitate to use digitalization are the implementation costs, the uncertainty of the results or the degree of difficulty.

To the question **"Does technology make you more efficient at work? Does it give you more freedom to move resources in a company?",** all those interviewed are optimistic about the efficiency of using digital technologies and approve of the fact that they give them greater freedom of mobility.

Regarding the questions "**Does the desire to be up to date with innovations make you feel better?? Are you interested in news from the world of innovation? If you were to think about the innovative factor, what words would be representative for you (the first 3 that come to mind)?",** not all of them are passionate about technology, but only interested and follow the informative news. The first representative words that are most important for them when thinking about the innovative factor are: efficiency, utility, adaptability, profitability, digitalization, good management, design or necessity.

Taking into account the subjective norm by asking the questions "**If you were to talk to the person closest to you about the use of digital technologies, would it influence your behaviour regarding the use of new technologies? Does that person think you should use new technologies?** ", from the answers received, it appears that for some, the decisions or opinions of people close to them would not influence their behavior regarding the adoption of technologies, but would take into account their opinions/advice/recommendations for a subsequent final decision. Others consider the decision of those close to them very important and would take it into account to a very large extent before using a technology.

Taking into account the competitive pressure, asking **"If the company's supplier adopts a digital technology, does it influence your activity at work, in terms of activity? Do you think that the choice of technologies would be strongly influenced by what competitors in the industry are doing?",** those interviewed have divided opinions. They say that if that technology helps them streamline their processes, also lowering costs, then they could win a larger market share. Also, these investments should be made according to departmental analyses, not through decisions taken on the spot. Those who work in the field of human resources say that the technologies adopted by the client do not affect us directly, but they do affect the operational and execution departments. If the company's supplier adopts a digital technology, this aspect can be analyzed in comparison with the company's activity to see if it meets its needs. To a large extent, the novelties in the workplace could influence the activity in terms of competitors in the industry, but such innovative decisions require a thorough study. Equally important is the fact that the human resource must be

trained in the reasons for the change and told what are the advantages of using a new technology in the workplace.

Finally, analyzing the technological support, the following questions are asked **:** **"Regarding the qualities of technologies, do you think they are important for their adoption? Does the technological infrastructure available in Romania determine small and medium-sized enterprises to adopt new digital technologies?"**, we received both positive and negative responses. Indeed, there is a lack of digital education on openness to new technologies. There is not enough willingness to learn for the digitization of processes in small and medium-sized enterprises. However, lately there has been a slight increase in the adoption of digital technologies, but it is not enough.

4.3. Design of the proposed conceptual model

Figure 4.15 shows the conceptual model proposed based on the results of the qualitative focus-group research and the interview.

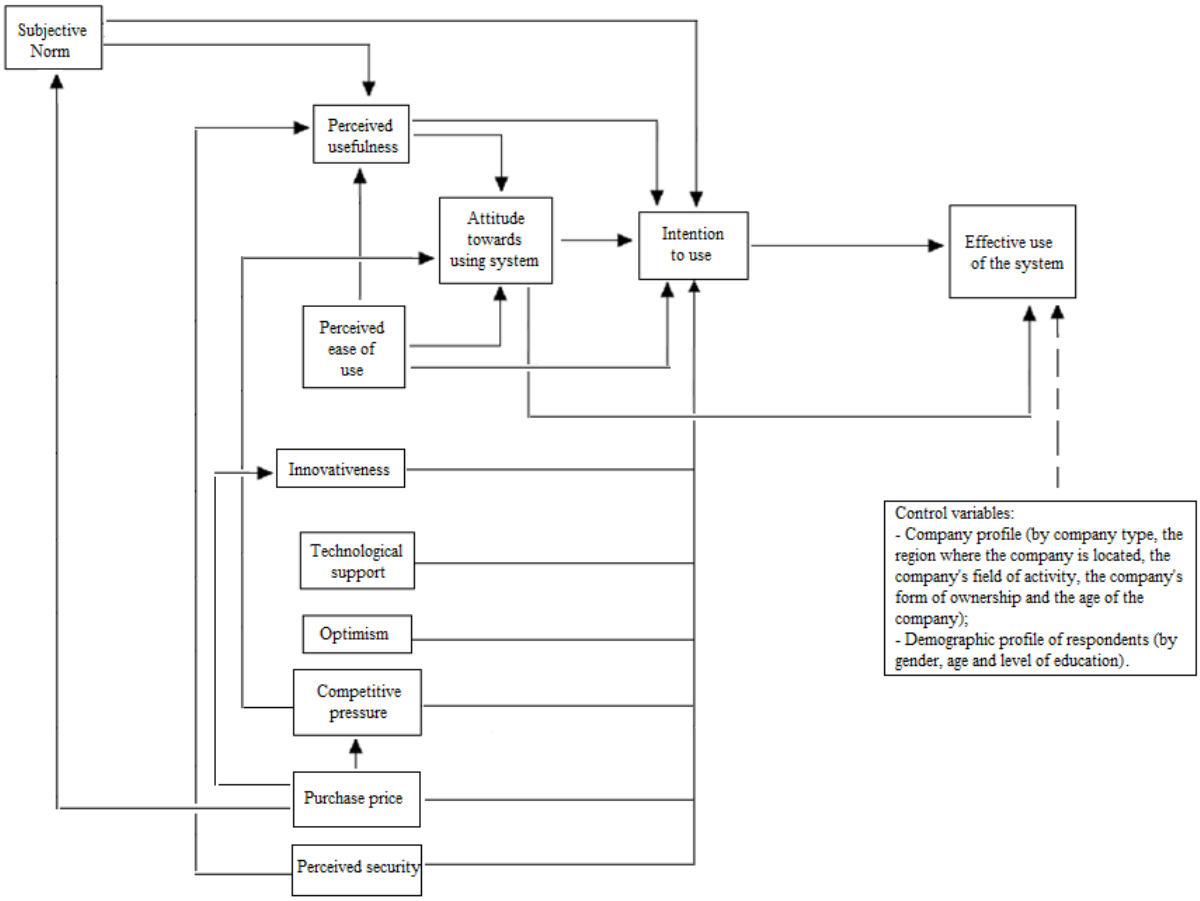

Figure 4.15 Conceptual model proposed based on qualitative research results - Digital Adoption Technology Assessment Model (DATAM) - Digital Technology Adoption Assessment Model

Subsequently, a quantitative research will be carried out to analyze the influence of the main factors in determining the degree of adoption of digital technologies in small and medium-sized enterprises in Romania and to validate the proposed conceptual model.

CHAPTER 5. VALIDATION OF THE PROPOSED MODEL (DATAM MODEL) FOR DETERMINING THE DEGREE OF ADOPTION OF DIGITAL TECHNOLOGIES IN SMALL AND MEDIUM-SIZED ENTERPRISES IN ROMANIA

In this section, the quantitative research for the validation of the proposed model that is tested on a sample of respondents is presented. One of the most common methods used to collect quantitative information is through the use of a questionnaire.

Table 5.1 presents the research tool, which consists of the following parts: the profile of the organization, the independent variables (perceived usefulness, perceived ease of use, intention to use, optimism, innovation, subjective norm, attitude towards use, competitive pressure, technological support, purchase price and perceived security), the actual use of technology (dependent variable), the demographic profile of the respondent and the profile of the company as a control variables.

Table 5.1 Scales used for the construction of the questionnaire

No. Crt.	Factor	Code	Items	Source Items
1	Perceived utility - UP	UP1-Q8	Using digital technologies would improve my performance at work	adapted from Venkatesh, 2000
		UP2-Q9	The use of digital technologies is useful in my workplace	
		UP3-Q10	Using digital technologies would increase my productivity	
		UP4-Q11	Using digital technologies increases my efficiency in my work	
2	Perceived ease of use - UUP	UUP1-Q12	Interacting with technologies does not require a lot of mental effort.	adapted from Hans van der Heijden. (2004)
		UUP2-Q13	The functionality of the technologies is clear and easy to understand	
		UUP3-Q14	Digital technology system controls are easy to access	
3	Actual use of technology - UET	UET1-Q15	Frequently use digital technology in the workplace	Adapted from Lai & Lee, 2020
		UET2-Q16	I have considerable experience in the use of digital technology	Adapted from Zuroni & Jing, 2019.
		UET3-Q17	I currently use and will continue to use digital technology	
4	Intent to use – UI	IU1-Q18	Assuming I had access to digital technology, I intend to use it	Venkatesh& Bullet, 2008
		IU2-Q19	Given that I have had access to digital technology, I foresee that I will use it	
		IU3-Q20	I plan to use digital technology in the next <n> months	
		OPT1-Q21	New technologies contribute to a better quality of data processing	

No. Crt.	Factor	Code	Items	Source Items
5	Optimism - OPT	OPT2-Q22	Technology gives me more freedom to use resources in an enterprise	Parasuraman, & Colby (2014)
		OPT3-Q23	Technology makes me more productive in my professional life	
		OPT4-Q24	Technology makes me more efficient at work	
6	Innovativeness - INO	INO1-Q25	I keep up with the latest technological developments in my areas of interest	Parasuraman, & Colby (2014)
		INO2-Q26	I prefer to use the most advanced technology available, to complete various operations	
		INO3-Q27	Other people come to me for advice on new technologies	
7	Subjective norm-NS	NS1-Q28	People who influence my behavior think I should use new technologies	Venkatesh& Bullet, 2008
		NS2-Q29	People who are important to me think I should use new technologies	
		NS3-Q30	In general, the company has supported the use of digital technology.	
8	Attitude towards the use of UA-technologies	AU1-Q31	The use of digital technology in the workplace is favorable.	adapted from Weng etl a., 2018
		AU2-Q32	It is a positive influence for me to use digital technology in the workplace.	
		AU3-Q33	I think it's valuable to use digital technology in the workplace.	
9	Competitive pressure-PC	PC1-Q34	I will lose my customers to competitors if I do not adopt digital technologies.	adapted from Shahadat et. to, 2023
		PC2-Q35	I believe that it is a strategic necessity to use digital technologies to compete in the market.	
		PC3-Q36	I believe that digital technologies would help my business gain a competitive advantage.	
10	Technology Support-ST	ST1-Q37	My company's technological infrastructure allows us to cooperate with all stakeholders.	adapted from Hasan et.al, 2021
		ST2-Q38	My company's technological infrastructure can support all processes.	
		ST3-Q39	My company's technological infrastructure is adequate.	
11.	Perceived security-SP	SP1-Q40	They perceive information related to the use of digital technology as safe.	adapted from Zuroni & Jing, 2019.
		SP2-Q41	I believe that inappropriate parties will not be able to see the information I provide while using digital technology.	
		SP3-Q42	I will continue to use the digital technology system even when I hear that a security breach has occurred.	
12.	Purchase price-	PA1-Q43	The benefits are considered together with the price at the time of purchase.	Own contribution
		PA2-Q44	The price influences the decision on the acquisition of the technology.	

No. Crt.	Factor	Code	Items	Source Items
	GOODBYE	PA3-Q45	The cost-benefit ratio matters more than the quality-price ratio.	

The hypotheses to be tested later are presented below.

H1. The subjective norm is positively associated with the perceived usefulness of using digital technologies.

H2. The subjective rule will not have a significant direct effect on the intention to use when the use of the system is perceived as voluntary.

H3: The perceived usefulness of digital technologies is positively associated with attitudes towards their use.

H4: The perceived ease of use of digital technologies is positively associated with the attitude towards use.

H5: The perceived ease of use of the implementation of digital technologies is positively associated with the perceived utility.

H6: Attitude towards the use of digital technologies is positively associated with the intention to use them.

H7: Perceived usefulness is positively associated with the intention to use digital technology.

H8: Innovativeness significantly influences the intention to use digital technology.

H9: Technology support is positively associated with SMEs' intention to adopt digital technology.

H10: Optimism significantly influences the intention to use digital technology.

H11: Competitive pressure is positively associated with the intention to adopt digital technologies.

H12: The purchase price is associated with the intention to use digital technologies.

H13: Perceived security is positively associated with the intention to use digital technologies.

H14: Perceived security positively influences perceived utility.

H15: The intention to use digital technology is positively associated with the actual use of digital technology.

H16: Perceived ease of use is positively associated with intent to use digital technology.

H17: Attitudes towards the use of digital technologies are positively associated with the actual use of technologies.

H18: Competitive pressure is positively associated with attitudes towards the use of digital technologies.

H19: The purchase price is associated with the innovativeness regarding the use of digital technologies.

H20: The purchase price is associated with competitive pressure on the use of digital technologies.

H21: The purchase price is associated with the subjective norm regarding the use of digital technologies.

The control variables in the research refer to the profile of the enterprise and the demographic profile of the respondents.

The control variable on the company profile includes the type of company, its age, the region where it is located, the form of ownership and the field of activity of the company.

H: The type of company will influence the actual use of digital technology.
H: The company's scope of activity will influence the actual use of digital technology.
H: The age of the company will influence the actual use of digital technology.
H: The region where the company is located will influence the actual use of digital technology.
H: The form of ownership of the company will influence the actual use of digital technology.

The control variable regarding the demographic profile of the respondents includes their gender, age and level of education.
H: Gender will influence the actual use of digital technology.
H: Age will influence the actual use of digital technology.
H: The level of education will influence the effective use of digital technology.

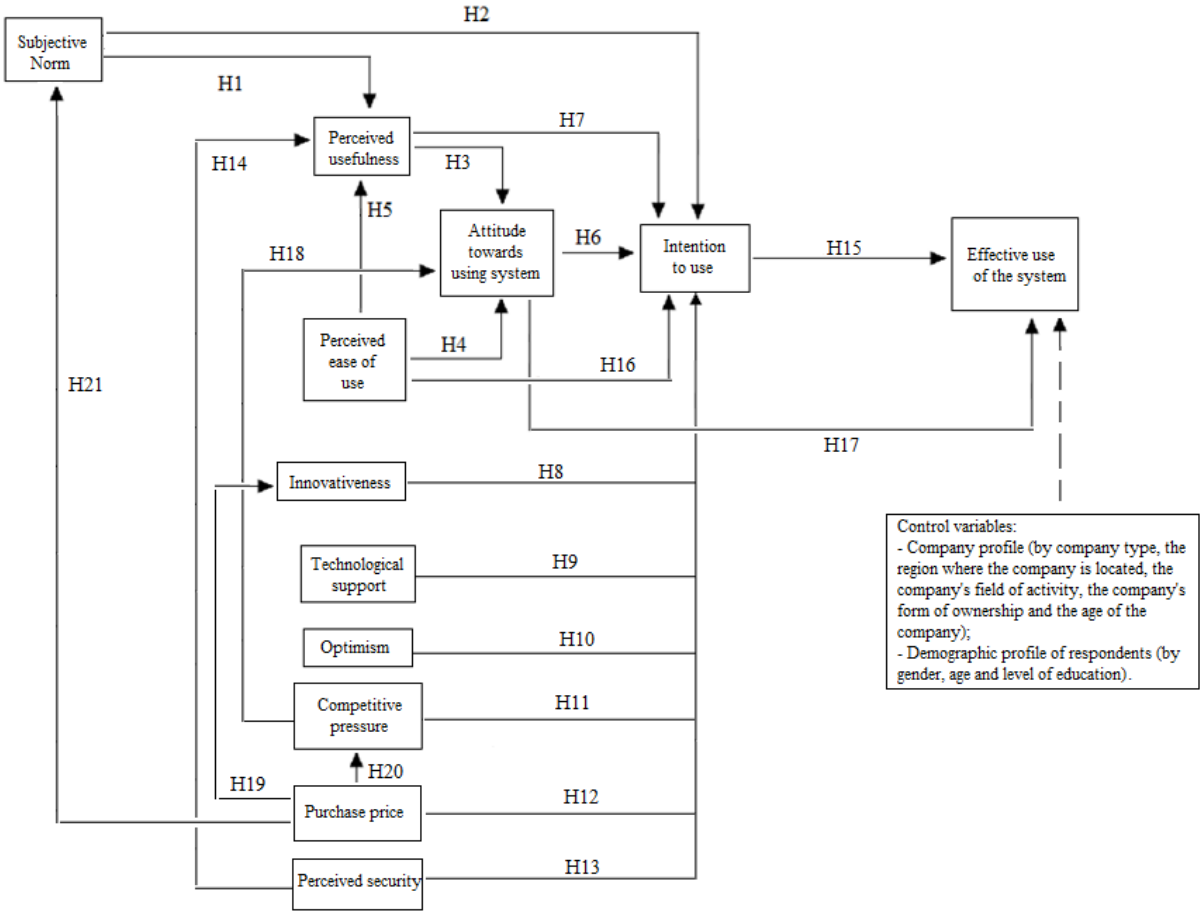

Figure 5.1 Proposed model for the adoption and use of digital technologies in SMEs - Digital Adoption Technology Assessment Model - Digital Technology Adoption Assessment Model

Figure 5.1 shows the proposed research model (**DAM Model – Digital Adoption Technology Assessment Model)** which also includes the hypotheses formulated with the help of the literature. These hypotheses are to be tested later.

Factor correlation matrix

Figure 5.13 shows the conceptual model of the research highlighted with the correlation coefficients:

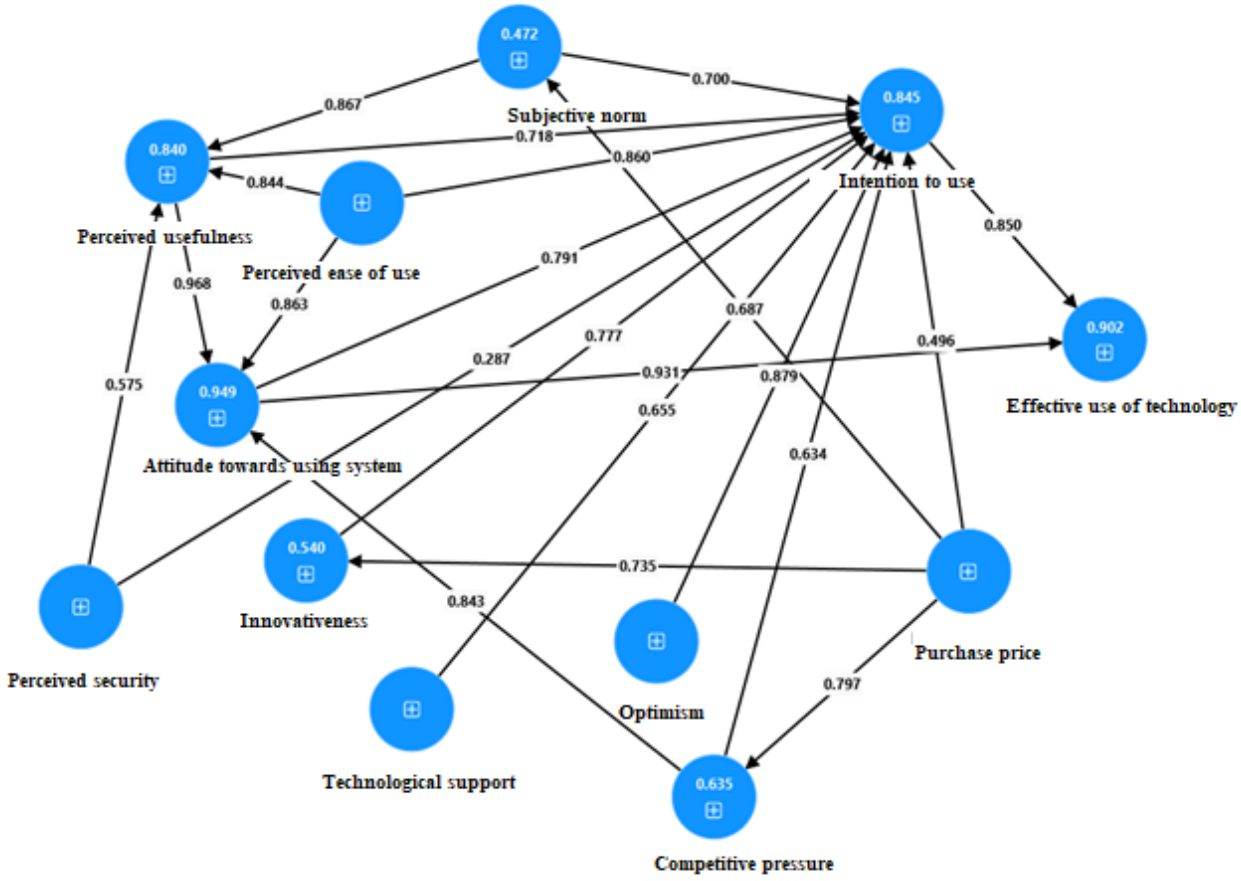

Figure 5.13 Conceptual model of factors highlighted with correlation coefficients

Structural equation model

The formative model (the external model)

The formative model was evaluated with the help of convergent and discriminating validity.

Convergent model validity

According to Chin (2010), variables with path coefficients less than 0.5 should be excluded from the model. Thus, the following variable will be excluded from the model: SP3, it has a path coefficient of less than 0.5.

Discriminant validity of the model

Thus, the square root of the AVE for each latent variable is compared with its inter-construction correlation and if it is higher, then the discriminant validity is confirmed. It can be seen that the values of the square root of the AVE indicator are higher than the inter-construction correlation coefficients for nine of the twelve latent variables in the model (for the square value of the correlation coefficients of the latent variables there is a higher value for the UET-AU, UP-AU, OPT-AU and UET-OPT correlations), which partially confirms the discriminant validity of the model.

The statistical hypotheses were tested using the Partial Least Square - Structural Equation Modeling (PLS-SEM) method, the data being analyzed using the statistical software SmartPLS - version 4.1.0.6 and presented in table 5.20:

Table 0.1 Test results of the studied hypotheses (H1-H21) for the DATAM model

Research hypothesis	**Coefficient β**	**Standard error**	**Value t**	**P-value (sig)**	**Hypothesis Testing Result**
H1. The subjective norm is positively associated with perceived utility.	0,510	0,101	5,061	0,000	Permissible
H2. The subjective rule will not have a significant direct effect on the intention to use when the use of the system is perceived as voluntary.	-0,124	0,257	0,480	0,631	Rejected
H3: The perceived usefulness of digital technologies is positively associated with attitudes towards their use.	0,743	0,062	12,031	0,000	Permissible
H4: The perceived ease of use of digital technologies is positively associated with the attitude towards use.	0,145	0,043	3,369	0,001	Permissible
H5: The perceived ease of use of the implementation of digital technologies is positively associated with the perceived utility.	0,325	0,113	2,878	0,004	Permissible
H6: Attitude towards the use of digital technologies is positively associated with the intention to use them.	0,502	0,924	0,543	0,587	Rejected
H7. Perceived usefulness is positively associated with the intention to use digital technology.	-0,658	0,753	0,874	0,382	Rejected
H8. Innovativeness significantly influences the intention to use.	-0,240	0,516	0,464	0,643	Rejected
H9. Technological support is positively associated with the intention to use digital technology.	0,224	0,207	1,085	0,278	Rejected
H10. Optimism significantly influences the intention to use digital technology.	0,696	0,413	1,686	0,092	Rejected
H11. Competitive pressure is positively associated with intent to use.	0,104	0,413	0,253	0,801	Rejected
H12. The purchase price is associated with the intention to use digital technologies.	-0,145	0,174	0,835	0,404	Rejected
H13. Perceived security is positively associated with the intention to use digital technologies.	-0,040	0,153	0,261	0,794	Rejected
H14. Perceived security positively influences perceived utility.	0,166	0,058	2,850	0,004	Permissible
H15. The intention to use digital technology is positively associated with the actual use of digital technology.	0,302	0,096	3,157	0,002	Permissible

Research hypothesis	Coefficient β	Standard error	Value t	P-value (sig)	Hypothesis Testing Result
H16. Perceived ease of use is positively associated with the intention to use digital technology.	0,527	0,335	1,575	0,115	Rejected
H17: Attitudes towards the use of digital technologies are positively associated with the actual use of technologies.	0,697	0,102	6,804	0,000	Permissible
H18. Competitive pressure is positively associated with attitudes towards the use of digital technologies.	0,125	0,063	1,988	0,047	Permissible
H19. The purchase price is associated with innovation.	0,742	0,049	15,253	0,000	Permissible
H20. The purchase price is associated with competitive pressure on the use of digital technologies.	0,803	0,043	18,728	0,000	Permissible
H21. The purchase price is associated with the subjective norm regarding the use of digital technologies.	0,681	0,043	15,795	0,000	Permissible

For the DATAM model, statistical hypotheses were tested using the Partial Least Square - Structural Equation Modeling (PLS-SEM) method. Assumptions for which the p-values are less than 0.05 are validated, while the others are invalidated. Thus, we conclude that hypotheses H1, H3 and H4, H5, H14, H15, H17, H18, H19, H20 and H21 are valid, and H2, H6 ÷ H13 and H16 are not statistically valid;

Following the elimination of the ten rejected statistical assumptions, the factors of optimism and technological support were also excluded from the final model.

Analyzing the hypotheses of the factors eliminated from the final model, namely technological support and optimism, for hypothesis H9: Technology support is positively associated with intention towards use (beta coefficient=0.224; p=0.278), it is not confirmed. In general, the technological characteristics of an organization explain the attributes of technology innovation that affect the organization's intentions to adopt technology innovation (Kapoor et al., 2014; Thong, 1999). Infrastructure readiness refers to the technical competence of SMEs to acquire new technologies. The probability of adopting new information technologies will be higher if the firm already has technological infrastructure requirements (Mohamed et al., 2009).

For hypothesis H10: Optimism significantly influences the intention to use digital technology (beta coefficient = 0.696; p = 0.092), this is also refuted, the p value being higher for confirming the hypothesis at a level of 95%.

Figure 5.22 shows the results of the final structural model with the values of the β coefficients, also indicating the direct influences of the predictor on the predicted latent variables:

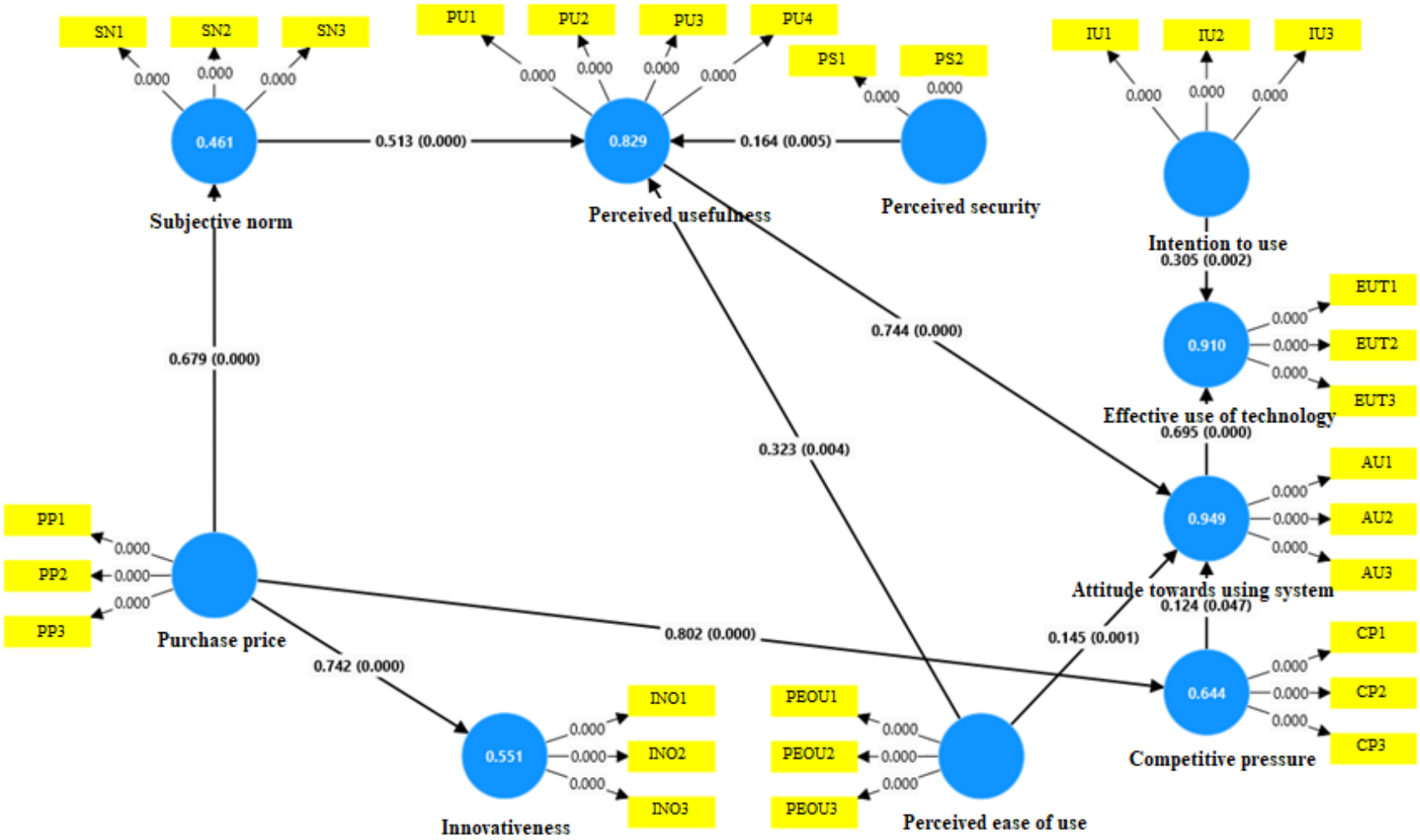

Figure 5.22 Results of the final structural model

The proposed conceptual model (DATAM model) brought as improvements the introduction of the following additional factors: innovation, competitive pressure, purchase price, perceived security, optimism and technological support, hypotheses H1-H21 being proposed.

Data were collected from a sample of 135 people working in small and medium-sized enterprises and following the data processing through the SPSS-version 20 and SmartPLS-version 4 software tools, the following aspects resulted:

— Regarding the demographic profile of respondents, several researchers have found that, compared to younger employees, older employees tend to lack the necessary qualifications and skills to use the information systems implemented in their organizations (Cragg and King, 1992). Most of the respondents are from the male category, who are 78 people (57.8%), and women the difference of 57 people (42.2%). Descriptive statistics show a fairly young and well-educated population, with about 77% of respondents under the age of thirty-seven (most of them in the 24-30 age range-44.4%), while 43% of them have postgraduate education;

— Regarding the type (size) of the enterprise, 19.3% are small, 58 of them (43%) are micro enterprises and 51 or 37.8% are medium-sized enterprises. Of the total answers, 97 respondents ticked that they work in a large company, later they were eliminated from the questionnaire analysis, obtaining 135 answers;

— Looking at the correlation matrix, the highest positive relationships exist between perceived utility and attitude towards use (r = .968, sig = .000), followed by the link between attitude towards use and optimism (r = .940, sig = .000) and then the link between attitude towards use and actual use (r = .931, sig = .000);

— Assumptions regarding the respondent's gender (beta coefficient=0.255; p=0.034), age (beta coefficient=-0.469; p=0.000) and level of education (beta coefficient=0.851; p=0.000) in relation to the actual use of digital technology are accepted;

— Looking at the profile of the company, the only variable that has a statistical effect is the type of company, its size negatively influencing the use of digital technology.

— The main factors influencing the level of adoption and use of digital technologies in small and medium-sized enterprises have been identified, namely: perceived utility, perceived ease of use, intent towards use, competitive pressure, purchase price, innovativeness, subjective norm, attitude towards use and perceived security. These results are essential to understand the problems and needs of employees in SMEs in order to propose solutions to improve the use of digital technologies;

— The conclusions of the study after testing the hypotheses suggest that the perceived usefulness of the technology, the perceived ease of use, the subjective norm, the attitude towards the use and the price of the purchase are influential factors in the increase in the use of the technology. SMEs have limited capacity to advance technology, so the perceived usefulness of technology is essential. The ease of use of the technology will lead to perceived benefits for SMEs, but the perceived utility only sometimes increases the intention of SMEs to use the technology.

In conclusion, the model shown in Figure 5.22 is statistically valid.

CHAPTER 6. CONCLUSIONS. CONTRIBUTIONS. FUTURE RESEARCH PERSPECTIVES AND DIRECTIONS

This chapter presents the conclusions of the doctoral thesis, as well as the future research perspectives and directions. Also, the personal contributions are highlighted, the work ending with the list of works published within scientific events.

6.1. Concluding remarks

From the study of the aspects of the present research, the following conclusions can be drawn:

— The thesis presents a topical review of the literature and identifies a number of novel constructs that, although not included in the models of technology acceptance described above, have the potential to increase the understanding of technology adoption, especially of digital technologies in the workplace;

— At the same time, this topic has not been studied in Romania despite its importance and topicality, nor have the models of technology acceptance been investigated so deeply and thoroughly in the Romanian socio-cultural context;

— Following the discussions on the adoption and use of digital technologies, it emerged that the most important factors in the perception of the focus group participants are: the purchase price, the monthly costs involved, security and compliance requirements, the organizational context, the business strategy, the user's needs and expectations, the sustainability of the investment, compatibility with the company's resources, the quality-price ratio, the measures taken against vulnerabilities cyber, ease of use, level of productivity (through the workspace, relationship with employees and superiors, etc.), response time in case of solving technical problems/certain functionalities, benefits brought by the use of digital technology;

— Following the "Bibliographic research on the identification of the most used theories in the field regarding the measurement of the performance of small and medium-sized enterprises in terms of the adoption of digital technologies" it was found that in order to analyze the degree of adoption of digital technologies in small and medium-sized enterprises, the technological acceptance model (TAM model) will be used;

— The results of the "Bibliographic research on the identification of models or theories regarding the analysis of the adoption and use of digital technologies" indicated that the main models/theories that are associated with the analysis of the degree of adoption and use of digital technologies in small and medium-sized enterprises are the technology acceptance model, the technology-organization-environment framework, the theory of innovation diffusion, as well as the integration of one or more of the mentioned variants;

— The results of the interview study indicate that the most important factors in the perception of the focus group participants are: the purchase price, the monthly costs involved, the security and compliance requirements, the organizational context, the business strategy, the user's needs and expectations, the sustainability of the investment, compatibility with the company's resources, the quality-price ratio, the measures taken

against cyber vulnerabilities, the ease of use, the level of productivity (through the workspace, the relationship with employees and superiors, etc.), the response time in case of solving technical problems/certain functionalities, the benefits brought by the use of digital technology;

— The results of the focus-group study indicate that the most important representative first words for people using digital technologies in small and medium-sized enterprises are: efficiency, utility, adaptability, profitability, digitalization, good management, design or necessity of technologies;

— As a result of the two qualitative researches, namely the in-depth interview and the focus-group research, the scheme and model for the formation of the proposed conceptual research model (the DATAM Model) were created, taking into account the factors from the bibliographic research and the results of the two qualitative researches, namely: perceived usefulness, perceived ease of use, intention to use, innovation, subjective norm, attitude towards use, actual use of technologies, competitive pressure, purchase price, perceived security, optimism and technological support;

— Following the statistical analysis, the proposed and tested conceptual model is validated. The results of the quantitative study indicate that the final DATAM model consists of the following factors: perceived utility, perceived ease of use, intent to use, innovation, subjective norm, attitude towards use, actual use of technologies, competitive pressure, purchase price and perceived security. These results are essential to understand the problems and needs of people in small and medium-sized enterprises and to propose solutions to improve the use of digital technologies.

6.2. Personal contributions

6.2.1. Theoretical contributions

— Making a classification of digital technologies and their role in small and medium-sized enterprises;

— Identifying and analyzing the role of small and medium-sized enterprises in the socio-economic context;

— Creation of the theoretical model for substantiating the research methodology;

— Conclusions on the impact of factors influencing the adoption and use of digital technology in small and medium-sized enterprises in Romania;

— Presentation of the factors that improve the technology acceptance model;

— Develop a model for the adoption of digital technologies.

6.2.2. Practical contributions

— Building a conceptual framework and a coherent research methodology, which allows the study of research variables in Romanian companies;

— Comparative evaluation of the models/theories regarding the adoption and use of technology used internationally in terms of the adequacy of implementation in Romanian companies, and justification for choosing the TAM Model as the most appropriate for this purpose;

— Establishing the best models, methods, techniques, procedures and working tools, specific to the organizational culture, scientifically based, to facilitate the analysis of the adoption and use of digital technology in small and medium-sized enterprises in Romania
— Application of the research methodology in qualitative research (interview and focus-group type);
— Establishing the best models, methods, techniques, procedures and scientifically substantiated working tools, specific to the studied variables, to facilitate the analysis of the adoption and use of digital technology in small and medium-sized enterprises in Romania;
— Construction of original research tools (questionnaire, interview guide and focus-group guide), adapted to the specificity of small and medium-sized enterprises in Romania, validated within the present research, for the investigation of each of the research variables.
— Developing its own model for conducting research on identifying the critical factors influencing the adoption and use of digital technology in small and medium-sized enterprises in Romania;
— Modeling data through structural equations and validation of the proposed model.

6.3. Future research perspectives and directions

In the future, the aim is to improve the DATAM model and promote it among small and medium-sized enterprises in Romania, supporting the actions taken in Romania for the adoption of digitalization. This research has successfully established a research framework that identifies the essential factors related to the implementation of digital technologies in the context of small and medium-sized enterprises (SMEs), the Romanian context being highlighted in this study. Among the aspects that are proposed to be analyzed are:

— Applying the research to a larger sample to obtain representativeness of the results;
— Creating a model for public institutions;
— Application of the DATAM model in enterprises to check whether it is accepted or not;
— Research indicates that digital technologies are an important issue for businesses in all industries. However, it is important to emphasize that the nature of each industry varies, so its business practices may vary accordingly. Therefore, the application of the model in different industrial contexts needs to be examined;
— Identify how the application of different types of technologies influences the model of technology acceptance;
— Development of specific strategies for optimizing digitalization in companies;
— Assessing the impact of the adoption of digital technologies on the company's activity;
— Involving employees in the process of identifying and implementing the necessary digital technologies;

— Expressing the adoption of digitalization through financial indicators, and investigating the impact of research variables on the adoption of digital technologies.

LIST OF PUBLISHED WORKS

The following is a list of scientific papers published in national and international scientific events, reflecting both the scientific concerns during the doctoral studies and the dissemination of the results of the research carried out during this period. So far, the following types of papers have been published:

— 1 scientific article published in an ISI indexed journal;
— 13 scientific articles published in the volumes of national and international scientific events indexed ISI;
— 2 scientific articles published in BDI indexed journals;
— 5 scientific articles published in the volumes of national and international scientific events indexed BDI.

List of published works

Scientific articles published in ISI indexed journals

[1] Mănescu, V. A., Neghină, R. A., Barbu, A., **Ganciu M.R.** & Militaru, G. (2021). Analysis of SSL certificates trends and extended validation ssl usage for e-commerce websites and Internet of Things, U.P.B. Scientific Bulletin, Series C, Vol.83, Iss.4, 2021, pp. 201-214, WOS:000741473700017, ISSN 2286-3540.

Scientific articles published in the volumes of national and international scientific events indexed ISI

[1] **Ganciu, M.R.,** Stănciulescu, G.D., Pipera, C.E., Barbu, A., Neghină, R.A., Mănescu, V.A., Militaru, G. (2019), Business process digitization: empirical findings of small and medium-sized enterprises from Romania, The 9th International Conference of Management and Industrial Engineering ICMIE 2019, November 14th – 16th, 2019, Management Perspectives in the Digital Transformation, Bucharest, Romania, NICULESCU Publishing House, 2019, pp. 191-201, WOS:000519338200018

[2] Mănescu, V. A., Neghină, R.A., **Ganciu, M. R.,** Ilie, D. G., & Militaru, G. (14-16 November 2019). Examining the role of digitalization for improving the value proposition of e-commerce stores. 9th International Conference of Management and Industrial engineering. Bucharest: Niculescu Publishing House, pp.250-260, ISSN: 2344-0937, WOS:000519338200024.

[3] **Ganciu, M. R.,** Costea-Marcu, I.C., Neghină, R.A., Mănescu, V.A., Moiceanu, G., Simion, P.C. (2019). Analysis on the adoption of George - smart banking application, by using the technology acceptance model: an empirical research in Romania, 9th International Conference of Management and Industrial engineering. Bucharest: Niculescu Publishing House, pp.45-56, ISSN: 2344-0937, WOS: 000519338200004.

[4] **Ganciu, M. R.,** Neghină, R. A., Mănescu, V. A., Simion, P. C., & Militaru, G. (2019). Understanding the Internet banking adoption factors in the romanian market. Proceedings of the 13th

International Conference on Business Excellence. Volume 13: Issue 1, Bucharest: ASE, pp. 347-360, ISSN: 2502-0226, WOS: 000501603000031.

[5] Ilie, D. G., Neghină, R. A., Mănescu, V. A., **Ganciu, M. R.,** & Militaru, G. (March 2020). New media, old problems: social stratification, social mobility and technology usage. 14th International Technology, Education and Development Conference. Valencia, Spain: INTED Proceedings, pp. 6319-6326, ISSN: 2340-1079, WOS:000558088806067.

[6] Neghină, R. A., Mănescu, V. A., **Ganciu, M. R.,** Ilie, D. G., & Militaru, G. (May 2019). Online business networking experience research on ecommerce entrepreneurs. Proceedings of the 13th International Conference on Business Excellence 2019. Volume 13: Issue 1, Bucharest: ASE, pp. 385-398, ISSN: 2502-0226, WOS 000501603000034.

[7] Neghină, R. A., Ilie, D. G., Mănescu, V. A., **Ganciu, M. R.,** & Militaru, G. (March 2020). The digital generation: a study on how undergraduate students from romania are consuming digital media. Conference: 14th International Technology, Education and Development Conference, Valencia, Spain: INTED Proceedings, pp. 6399-6406, ISSN: 2340-1079, WOS: 000558088806078.

[8] Neghină, R. A., Mănescu, V. A., **Ganciu, M. R.,** Ilie, D. G., & Militaru, G. (14-16 November 2019). Improving the online ordering process: a SME romanian perspective. 9th International Conference of Management and Industrial Engineering. Bucharest: Niculescu Publishing House, pp.261-270, ISSN: 2344-0937, WOS: 000519338200025.

[9] Neghină, R. A., Mănescu, V. A., **Ganciu, M. R.,** Ilie, D. G., & Militaru, G. (14-16 November 2019). Success factors in using drones for deliveries. 9th International Conference of Management and Industrial Engineering (ICMIE 2019). Bucharest, pp.108-119, ISSN: 2344-0937, WOS:000519338200010.

[10] **Ganciu, M.R.**, Barbu, A., Costea-Marcu, IC., Deselnicu, D.C., Militaru, G. (2022). Improving Organizational Performance Through in Terms of Using the Customer Relationship Management system—an Exploratory Study for SMEs in Romania. In: Busu, M. (eds) Digital Economy and New Value Creation. ICBE 2021. Springer Proceedings in Business and Economics. Springer, Cham. https://doi.org/10.1007/978-3-031-07265-9_10, pp. pp 115–127.

[11] Stănciulescu, G.D., Scarlat, C., **Ganciu, M.R.** (2019). The development tendencies of the family-own technology-based businesses in Romania. The 9th International Conference of Management and Industrial Engineering – ICMIE (2019): 'Management Perspectives in the Digital Transformation', Bucharest, Romania, pp. 88-95.

[12] **M.R. Ganciu**, G. Militaru (2020) Blended learning: adapting technology in technical higher education as a new approach - evidence from romania, INTED2020 Proceedings, pp. 5349-5356.

[13] **M.R. Ganciu**, R.A. Neghină, G. Militaru (2020) An empirical investigation on students acceptance of social media used for learning: an evidence from Romania, INTED2020 Proceedings, pp. 1138-1144.

Scientific articles published in BDI indexed journals

[1] **Ganciu, M.-R.,** Barbu, A., Neghină, R.-A., Mănescu, V.-A., Militaru, G. (2020), Factors Affecting CRM System Adoption: Evidence from Romanian SMEs, Journal of Emerging Trends in Marketing and Management, 1(1), pp. 23-31. ISSN: 2537-5865.

[2] **M.-R. Ganciu**, A., Niculescu. (2019). Using Technology Acceptance Model to Adopt Intelligent Banking, FAIMA Business & Management Journal, Volume 7, Issue 4 – December 2019, Niculescu Publishing House, pp. 13-23, ISSN: 2344-4088.

Scientific articles published in the volumes of national and international scientific events indexed BDI

[1] Barbu, A., Militaru, G., Mănescu, V.A., Neghină, R.A., **Ganciu, M.R.** (2020). Analysis of the influence of process performance on organizational performance. Evidence from Romania, Proceedings of the 36th International Business Information Management Association Conference (IBIMA) 4-5 November 2020 Granada, Spain, pp. 77-84, ISBN: 978-0-9998551-5-7

[2] Costea-Marcu, I.C., Militaru, G. and **Ganciu, M.R.** (2021). Real-time Monitoring of Patients with Diabetes Using Software Applications-Proposing a Conceptual Model. In Proceedings of the International Conference on Business Excellence (Vol. 15, No. 1, pp. 33-43).

[3] Barbu, E.A., Militaru, G., Popescu, M., Costea-Marcu, I.C. and **Ganciu, M.** (2021). A study on factors affecting the intention to use smart meters. evidence from Romania. International Multidisciplinary Scientific GeoConference: SGEM, 21(4.1), pp.11-18, DOI:10.5593/sgem2021/4.1/s17.02

[4] G., Militaru, A., Barbu, **M.-R., Ganciu.** (2020). Exploring the Relationship between Big Data Analytic Capability and Business Performance, Proceedings of the 36th International Business Information Management Association Conference (IBIMA) 4-5 November 2020 Granada, Spain, ISBN: 978-0-9998551-5-7

[5] **Ganciu, M.-R.,** Deselnicu, D. C., Moiceanu, G., Mănescu, V.-A., & Militaru, G. (2020, September 17). Using customer relationship management system to improve organizational performance – exploratory study on Romanian SMEs. 7th Review of Management and Economic Engineering International Management Conference: "Management Challenges Within Globalization", Cluj-Napoca, Romania. https://doi.org/10.5281/zenodo.6557329, pp. 511-517, ISSN ISSN 2247 – 8639.

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