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E-COMMERCE USAGE BY WHEAT-ORIENTED FARMERS IN KAZAKHSTAN

AIGUL MEIRMANOVA

DOCTORAL DISSERTATION

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DISSERTATION SUBMITTED TO UNIVERSITY OF MISKOLC IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF Ph.D. IN ECONOMICS

HANTOS ELEMÉR DOCTORAL SCHOOL OF BUSINESS, MANAGEMENT AND REGIONAL SCIENCES
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DECLARATION

I, Aigul Meirmanova, confirm that this dissertation submitted for Ph.D. in Economics is my original work. Further, I have acknowledged all sources used and have cited these in the reference section.

Signed: Aigul Meirmanova

Miskolc, 2022

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EXECUTIVE SUMMARY

There have been several empirical research efforts related to technology acceptance in the North American and European context, but not within the Central Asian context, and more particularly in Kazakhstan. Many researchers have studied and proposed theories and models of technology acceptance with different sets of determinants and moderators to predict users' behavioural beliefs. Therefore, it is questioned whether one of the prominent technology acceptance theories/models might play a significant role in prediction of e-commerce adoption by farmers in the Central Asian context. The aim of this study is to create e-commerce acceptance model that can demonstrate Behavioural Intention (BI) and Use Behaviour (BU) of the Kazakhstani farmers in adoption of e-commerce technologies and applications.

This thesis (1) reviewed the nine well-known theories and models including Innovations Diffusion Theory (IDT), Social Cognitive Theory (SCT), Theory of Reasoned Action (TRA), Theory of Planned Behaviour (TPB), Decomposed Theory of Planned Behaviour (DTPB), Technology Acceptance Model (TAM), Extended Technology Acceptance Model (TAM2), Augmented TAM or Combined TAM and TPB (C-TAM-TPB), Unified Theory of Acceptance and Use of Technology (UTAUT) and their limitations, the previous research related to the application of models/theories in adoption of e-commerce by individuals or by organizations, previous literature regarding to acceptance/adoption and usage of the information and communication technologies within individual, cultural, organizational and technology context characteristics, (2) represented conceptual model and hypotheses that emanate from consructs of different technology adoption models according to the previous studies and literature, (3) represented the formulation of the methodology in order to validate/verify the hypotheses between the established determinants, (4) examined the scope to which respondents use and intend to use e-commerce in farming tasks, (5) represented the technology acceptance model of e-commerce usage by Kazakhstani farmers in wheat growing farms, (6) examined to what extent using e-commerce helps to improve

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farmers' professional practice, personal practice and their quality of working life; examined to what extent using e-commerce is supported by farm management and government.

In this research the sample size S=384, where 384 individuals (farmers) were considered as the representatives of the population for generalisability. The generated model evidenced by goodness-of-fit of the model to the data, explained 56% (Squared Multiple Correlation) of the variance in Use Behaviour, 49% in Behavioural Intention.

The results revealed that Behavioural Intention was significantly and positively influenced by Perceived Usefulness, Perceived Ease of Use, Social Influence, and Facilitating Conditions; Use Behaviour was significantly and positively influenced by Behavioural Intention. Interestingly, Compatibility had insignificant effect on farmers' innovative e-commerce Behavioural Intention.

A thorough understanding of the model might provide practical reference for farms and decision-makers involved in designing e-commerce strategy for implementation in farms and to analyse the reasons for resistance towards the technology and also help them to take efficient measures to improve user acceptance and usage of the certain technologies in the future.

DOI: 10.14750/ME.2022.014

CONTENTS

DOI: 10.14750/ME.2022.014

DOI: 10.14750/ME.2022.014

DOI: 10.14750/ME.2022.014

CHAPTER I: INTRODUCTION

1.1 Background and Significance of the Study

The collapse of communism in the Soviet Union and Eastern Europe in 1990s was one of the most transformative events in economic history and led to economic reforms (Mankiw, 2016). After the abandoning the centrally planned economic system, Kazakhstan has gone through a difficult path of reformations of the main sectors of economy, including agriculture. Nowadays, agriculture in Kazakhstan has overcome the peak of the production decline, which was during the phase of transferring the management mechanisms from the centrally planned economy to a market economy. Since 1999, agricultural production and other related areas have been developing at a steady pace across all regions of the country. Adaptation of commodity producers to the new economic conditions, the development of other sectors of the national economy, and the increase of household incomes led to demand for the country's agricultural products and services, and to the development of state-led agricultural policies.

Kazakhstan traditionally has been an agrarian country for centuries and the development of virgin lands in 1960s turned it into one of the largest producers of wheat and other types of grain in the world. The initial results demonstrated a sharp increase in agricultural production: in 1954, Kazakh Soviet Socialist Republic harvested 85.5M tonnes of wheat (including 27.1M tonnes from virgin lands) and nearly 125M tonnes in 1960 (including 58.7M tonnes from virgin lands) (Kovalenko, 2010). In total, more than 597.5M tonnes of wheat were harvested in Kazakhstan between 1954 and 1960. Since 1991, during the period of independence of the Republic of Kazakhstan significant results have been achieved in agribusiness sector: there has been constant increase in agricultural production based on market relations and in labor productivity, fixed assets have been getting updated and the infrastructure of the industry has been restored, self-sufficiency in basic foodstuffs has been achieved. According to the data of the State Programme "Digital Kazakhstan" for 2016, GVA (Gross Value Added) of the agriculture, forestry and fisheries accounted for 4.6% of the country's GDP (Gross Domestic Product), and 18% of the working population of the country are employed in the agricultural industry (Government of the Republic of Kazakhstan, 2017).

The gross output of agricultural products and services in 2016 as a whole in the Republic was 3684.4B KZT (Kazakhstani tenge), which is 5.4% higher than in 2015. In 2016, the growth of crop production amounted to 7.5% and livestock products by 2.8%. Nevertheless, agriculture remains a sector with unrealized growth potential (Government of the Republic of Kazakhstan,

2017). Within the framework of digitalization, by 2021 at least 20 digital farms and 4,000 advanced farms have been created, while full automation of processes and public services are now provided throughout the country (Meirmanova, 2021). Digital farms operate without human intervention, and partially automated farms use fuel consumption sensors, GPS trackers, electronic weed maps and software for managing business processes. Digitalization measures have been focused on the farms and on simplification of their activities. E-commerce integration is one of the main components of the digitalization programme in the agriculture of Kazakhstan.

In recent 10 years, e-commerce in agriculture has been booming around the world. World Trade Organization (WTO) has prepared a study about the Covid-19 pandemic's impact on e-commerce, and experts note that e-commerce usage has grown as users were forced to adapt to social distancing measures. The document also sets out a vision of how the WTO Trade Facilitation Agreement could be instrumental in some of the challenges posed by the Covid-19 pandemic and its implications. According to its authors, the Covid-19 crisis could provide additional incentives for cooperation in the field of e-commerce (World Trade Organization, 2021). In 2020, the majority of farmers bought seeds, supplies and equipment online in order to avoid coronavirus infection. Experts claim that e-commerce development in agriculture helps farmers to get out from the shackles of the supply chain, particularly in selling unprocessed agricultural products and helping them to arrange the agricultural production structure. As a result, rural e-commerce is emerging as a new hub for the development of Kazakhstan's economy. The development of e-commerce might transform not only the lifestyle and trade model, but also the production scheme, habits and thinking of farmers, attract many excellent farmers who have left for cities to work, motivating them to return to their homeland and do business on the Internet.

Research on technology adoption in agriculture and on innovative farmer behaviour, and the perceptions and knowledge of farmers have been common in western countries, but less is known about farmers' adoption behaviour, perceptions and knowledge regarding technology adoption in the non-western world (Kuehne et al., 2017). The current research in farmers' adoption factors might be applied to e-commerce usage policies in Kazakhstan. The lack of useful studies makes it difficult to increase the effectiveness of e-commerce usage. Policymakers and change-agents must try to introduce new information and communication technologies and other innovations to farmers and motivate them to change their practices in the shortest possible time of period. In particular, this research should contribute to fill a knowledge gap with regard to the human and organizational side of agricultural technologies development. This study is expected to contribute to accelerating the usage of e-commerce

technologies and their applications in farming operations and demonstrate to the consumers how adoption of technologies provides a certain economic and social effect; as a result, the material prerequisites will be created for the effective management and development of production.

The purpose of this study is adoption of e-commerce by farmers in wheat-oriented farms which might contribute: to the intellectualization of labour in agricultural production by increasing their knowledge-intensiveness; to the achievement of a high technological level of production; to the expansion of the range of products by improving the quality and competitiveness; to the efficient use of all types of resources; to the improvement of working conditions; to the reduction of environmental pollution; and to an impact on the structure of reproduction in agriculture in accordance with the changing needs and the external environment. Generally, Kazakhstani farmers have access to the Internet and have experience in using e-commerce applications to some extent.

This research is a cross-sectional study as the data were collected over a short period of time and Behavioural Intention (BI) was measured as the main dependent variable due to the farmers have an intention to use e-commerce applications at a certain level. Use Behaviour (BU) is one of the main dependent variables in this study that might predict the Behavioural Intention (BI) of farmers in the future. Moreover, farmers' intention to use e-commerce applications will impact on their usage of the extended version of e-commerce applications to varying degrees in the future.

1.2 Research Aims of the Study

The aim of this study is to create e-commerce acceptance model that can demonstrate behavioural intention and usage behaviour of the farmers from wheat-oriented farms of Kazakhstan. The objectives of the study are:

R1. The first research aim is to discuss prominent well-known technology adoption theories/models and their limitations; the previous research related to the application of models/theories in the adoption of e-commerce by individuals or by organizations; and the previous literature regarding to acceptance/adoption and usage of the information and communication technologies within individual, cultural, organizational and technology context characteristics.

R2. The second research aim is to formulate a conceptual model and hypotheses based on relevant published literature.

DOI: 10.14750/ME.2022.014

R3. The third research aim is to formulate the methodology in order to validate the hypotheses between the established determinants.

R4. The fourth research aim is to examine the degree to which respondents intend to use and actually use e-commerce in farming tasks.

R5. The fifth research aim is to maintain and create a research model that describes the behaviour and behavioural intention of Kazakhstani farmers' (who work on wheat-oriented farms) in using e-commerce.

R6. The sixth research aim is to examine to what extent using e-commerce helps to improve farmers' professional practice, personal practice and quality of working life and to investigate to what extent using e-commerce is supported by farm management and Government.

1.3 Scope of the Study

This research targeted experienced farmers who use e-commerce within wheat-oriented farms in Kazakhstan. Use Behaviour (BU) along with Behavioural Intention (BI) are the main dependent variables of this study. Farmers were asked to evaluate their intention to use e-commerce along with the prediction of their future usage of e-commerce associated with their work.

In the present study the population – the number of wheat-oriented individual farmers who have experience in using e-commerce is N=14,813. According to Krejcie & Morgan (1970), the sample size is required to be S=375 in case that a given population is N=15,000. Therefore, the population size is N=14,813≈15,000 and the sample size is S=384, so 384 individuals (farmers) were considered as the representatives of the population for generalisability.

DOI: 10.14750/ME.2022.014

CHAPTER II: KAZAKHSTAN'S AGRICULTURAL SECTOR, ITS ROLE IN THE WORLD WHEAT TRADE MARKET AND DIGITALIZATION OF AGRO-INDUSTRIAL COMPLEX

2.1 Overview of the Agricultural Sector in Kazakhstan and its Role in the World Wheat Trade Market

Agriculture is one of the most complex and important sectors of the economies of the Commonwealth of Independent States (CIS). Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, and Uzbekistan are the CIS members. Among the above-mentioned countries Kazakhstan borders with three: Russia, Kyrgyzstan, and Uzbekistan. Hereafter, the agricultural sectors of Kazakhstan and its neighbors' (from CIS countries) will be described in a general and brief context.

Agriculture accounts for 5% of Gross Domestic Product (GDP) in Kazakhstan's economy. The wheat production of Kazakhstan boasts fifteenth place in the world and third place among the CIS countries. Despite the difficult geographic and climatic conditions, Kazakhstan is fully self-sufficient in wheat and flour and exports them in large amounts. The yield level might vary by 50% due to the country being located in the zone of risky agriculture. In addition to wheat, the production of oil crops, vegetables and cucurbitaceous crops (melons and squash) have been growing in the country since 1992. Livestock raising, sheep breeding, horse breeding and camel breeding are also well developed.

Agriculture accounts for 4.6% of GDP in the Russian Federation's economy. The range of agricultural products is very wide: it is in first place in the world in wheat production, fifth place in the world in sugarbeets production, first place in the world in sunflower production and third place in the world in potato production. The Russian Federation takes first place among the CIS countries in the production of the abovementioned crops. Russia began to show positive dynamics in comparison with 1989's index of agricultural production due to the general recovery of the country's economy and application of complementary versatile measures to support the countrysides and villages. Recently, the import substitution policy has been playing an important role in the development of agriculture.

Agriculture accounts for 17.7% of GDP in Kyrgyzstan's economy. The share of animal husbandry is higher than the crop production and only 12.9% of the country's agricultural land is allotted for arable land, the lowest figure among the CIS countries. Meanwhile, in terms of sheep and wool production figures, Kyrgyzstan takes second place after Kazakhstan and Russia,

respectively. The country fully provides its own consumption of dairy products. Grain crops and fodder crops, which are used for the provision of animal husbandry, are predominant in the agricultral sector of Kyrgyzstan.

Agriculture accounts for 19% of GDP in Uzbekistan's economy. The main agricultural crop is cotton, the country takes sixth place in the world for cotton production and the first place among the CIS countries. The volume of cotton production in the republic in the time of the Soviet Union was so huge that it entailed environmental consequences. Soil pollution with fertilizers, as well as drainage of Aral Sea, forced the republic to redistribute part of its arable land for grain crops and rid the country of the dominance of monoculture. Nowadays, the government of Uzbekistan is following the course of ensuring food security, systematically reducing the import of grain crops and vegetables. In addition to cotton and wheat, sesame, onion, flax, and tobacco are grown in the country. Also, Uzbekistan is the large exporter of dried fruits and cucurbitaceous crops (melons and squash) to the CIS market.

Kazakhstan transitioned from a nomadic herders' country into an agro-industrial country during the Soviet regime. Before World War II (1939-1945), regulations for nomads and semi-nomads were established, contributing to the modification of the agricultural sector. During the period of Soviet agricultural policy (1929-1934) of de-nomadization and collectivization, nomadic Kazakhs were compelled to settle down and hand their cattle to government collectors. Collectivization of the agricultural sector under the Soviet regime led to formation of collectively-controlled farms (Kolkhozy) and state-controlled farms (Sovkhozy) in Kazakhstan. In areas where the major agricultural activity was nomadic herding, such as in Kazakhstan, collectivization met with enormous resistance and huge losses, and confiscation of livestock. Livestock in Kazakhstan fell from 7M cattle to 1.6M and from 22M sheep to 1.7M. Restrictions on migration proved ineffective and 500K Kazakhs migrated to other regions of Central Asia, Turkey and 1.5M to China. Of those who remained, millions of people died in the resulting famine (Bruce, 2007). The process of changing into an agro-industrial country was completed during the period of Soviet rule in Kazakhstan. On the 25th of October 1990, Kazakhstan declared its sovereignty on its territory as a republic within the Soviet Union. Following the aborted coup attempt in Moscow in 1991, Kazakhstan declared independence on the 16th of December 1991, thus becoming the last Soviet republic to declare independence.

Nowadays, Kazakhstan is the world's largest landlocked country, and the ninth-largest country in the world. 50% of Kazakhstan's territory is semi-deserts and deserts, 25% is steppe lands, and the remaining quarter of the territory is covered with foothills and mountains. In all, 80% of the country's territory is characterized as agricultural land, which is more than 200M

hectares. However, from this territory only 40% or 96M hectares are used for agricultural purposes: 63.2M hectares are used for steppe grazing purposes, 24.4M hectares accounts as an arable land. Kazakhstan has five main agro-ecological zones: forest steppes and steppes span the northern and central parts of the country, deserts and semi-deserts span the central and southern parts of the country, mountains and foothills span to the south and southeast. All agro-ecological zones (except deserts) are crucially important for livestock and crop production. The detailed description of each zone is shown in Table 1. The flora in the forest steppe is dominated by grass and forest, which is suitable for seasonal grazing, and around 70% of meadow land is cultivated in this zone. The steppe zone spans 110.2M hectares and has been extensively cultivated by human activity, destroying the natural grassland. This zone is dominated by extensive crop production, particularly soft spring wheat grown for export. The desert zone covers 124.6M hectares and its ecosystem has been changed by road networks and mining. Kazakhstan's mountain ranges – the Western Tian-Shan, Northern Tian-Shan, Kazakhstan-Dzhungar, Altai ranges – have considerable biodiversity. Mixed farming and small-scale farms are scattered in this agro-ecological zone.

Table 1: Main agro-ecologial zones in Kazakhstan and their purposes

Agro-ecological zones	Land area (in ha.)	% of total land area	Purpose of agricultural land use
Forest steppe	758200	0.3	Seasonal grazing
Steppe	110200000	32.6	Crop and livestock production
Semi-desert	37258600	13.7	Seasonal grazing
Desert	124600000	41.2	-
Mountains and foothills	33486000	12.3	Mixed farming

Source: Based on Robinson (2000)

Kazakhstan is an agro-industrial country where the climate and soil of the country's north-central and southern regions are suitable for raising cattle and growing crops; however, agricultural land in Kazakhstan was depleted of its nutrients during a campaign of developing virgin lands in Soviet times. This continues to affect production nowadays.

There are three formats of agriculture landuse in Kazakhstan:

- Agricultural enterprises (considered as large farms). Large farms are legal entities. There are 17,669 agricultural enterprises (spanning 11.4M ha.) registered in the territory of the republic. The average area of one large farm is 5.4K ha. The number of agricultural enterprises by industry classification: seasonal crops cultivation – 7,450, livestock breeding – 4,153, mixed farming – 3,722, complementary types of activities for crops cultivation – 1,708, perennial crops cultivation – 406, hunting – 140,

manufacturing of nursery products – 90 (Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan, 2021). In the first three months of 2021, 563 new agricultural organizations (excluding forestry and fisheries) were registered in Kazakhstan.

- Farms (considered as medium-sized farms). Medium-sized farms in the legal form are individual entrepreneurs. There are 194,306 farms (spanning 6.7M ha.) registered in the territory of the republic. The average area of one medium-sized farm is 198.6 ha. Number of farms by industry classification: seasonal crops cultivation – 168,240, livestock breeding – 5,603, mixed farming – 20,431, complementary types of activities for crops cultivation – 24, provision of services – 82 (Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan, 2021).
- Private household plots (considered as small farms). Private household plots were excluded as a business form, despite remaining important producers of agricultural products, especially livestock products. There are 2,752,455 household plots (spanning 1.6M ha.) registered in the territory of the republic. The average area of one small farm is 32 acres.

Livestock breeding is a traditional agricultural sector in Kazakhstan: pig and dairy cattle breeding prevail in the northern regions; cow, sheep, horse and camel breeding in the southern regions; and cow and horse breeding in the western and eastern regions of the country. Poultry farming is distributed almost evenly across all regions of Kazakhstan. According to the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (2021), the number of large horned livestock amounted to 7436.4K head, pigs amounted to 813.3K head, sheep and goats amounted to 19155.7K head, horses amounted to 2852.3K head, camels amounted to 216.4K head, birds (all kinds) amounted to 45M at the beginning of 2020 (see Table 2). It should be noted that more than half (59.6%) of the livestock population was poultry at the beginning of 2020. The second place is taken by sheep and goats (25.4%), followed by cattle (9.9%), horses (3.8%), pigs (1.1%) and camels (0.3%). Studies show that the largest number of livestock (except for birds) occurs on farms, and birds prevail in agricultural enterprises, most likely on large poultry farms (Kekchebayev & Zhakupova, 2021).

DOI: 10.14750/ME.2022.014

Table 2: Total number of livestock and poultry by category of farms in Kazakhstan

Year	Large horned livestock (head)	Sheep and goats (head)	Pigs (head)	Horses (head)	Camels (head)	Poultry (no.)
All categories of farms						
2020	7436.4K	19155.7K	813.3K	2852.3K	216.4K	45M
Agricultural enterprises						
2020	717.9K	874.2K	241K	181.1K	15.2K	32.8M
Farms						
2020	2624252K	7573.3K	78.7K	1321.2K	87.4K	0.7M
Household plots						
2020	4094.3K	10708.2K	493.6K	1349.9K	113.8K	11.6M

Source: Based on Kekchebayev & Zhakupova (2021)

According to the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (2021), the total number of livestock and poultry slaughtered on the farm or sold for slaughter (in live weight) amounted to 2059K tonnes, livestock and poultry slaughtered in the farm or sold for slaughter (in lethal weight – weighted after slaughter) amounted to 1169K tonnes, manufacture of eggs (all kinds) amounted to 5066M eggs, manufacture of wool (all kinds) amounted to 39297 tonnes, manufacture of milk (all kinds) amounted to 6051K tonnes at the beginning of 2020 (see Table 3).

Table 3: Manufacture of principal views of production of animal industries

Manufacture production	2019	2020
Livestock and poultry slaughtered in the farm or sold for slaughter (in live weight)	1975 (thousand tonnes)	2059 (thousand tonnes)
Livestock and poultry slaughtered in the farm or sold for slaughter (in lethal weight - weighted after slaughter)	1121 (thousand tonnes)	1169 (thousand tonnes)
Manufacture of eggs (all kinds)	5531 (million)	5066 (million)
Manufacture of wool (all kinds)	39492 (tonnes)	39297 (tonnes)
Manufacture of milk (all kinds)	5865 (thousand tonnes)	6051 (thousand tonnes)

Source: Based on Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (2021)

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Kazakhstan is one of the largest grain growing countries in the world, especially in wheat cultivation (Sikos T. & Meirmanova, 2020). Mainly hard varieties of wheat with high gluten are cultivated in grain growing regions, and this sort of wheat is in great demand on the world market. Some crops including barley, cotton, sugarbeets, sunflowers, flax and rice are cultivated in smaller amounts. According to the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (2021), the total number of vegetables amounted to 4591K tons, sugarbeet amounted to 466K tons, potato amounted to 4007K tons, olive cultures amounted to 2557K tons, sunflower amounted to 844K tons, grain and legumes crops amounted to 19509K tons, wheat amounted to 14258K tons, cotton amounted to 327K tons at the beginning of 2020 (see Table 4).

Table 4: Total gathering of basic agricultural crops

Agricultural crops	2019 (in thousand tonnes)	2020 (in thousand tonnes)
Vegetables	4355	4591
Sugarbeet	486	466
Potato	3912	4007
Olive cultures	2584	2557
Sunflower	839	844
Grain (including rise) and legumes crops	17429	19509
Wheat	11452	14258
Cotton	344	327

Source: Based on Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (2021)

There is a growing trend of wheat export from Kazakhstan to other countries. Wheat is the world's 85th most traded product, with a total trade of 44.1B USD. Between 2018 and 2019 exports of wheat worldwide decreased by 7.34%, from 47.6B USD to 44.1B USD. Trade in wheat represents 0.24% of total world trade (Baci International Trade Database, 2019). In 2019 the top exporters of wheat were Russia (8.14B USD), the United States (6.94B USD), Canada (5.97B USD), France (4.54B USD), and Ukraine (3.11B USD). In 2019 the top importers of wheat were Egypt (4.67B USD), Indonesia (2.31B USD), Turkey (2.15B USD), Italy (1.69B USD), and the Philippines (1.63B USD) (Baci International Trade Database, 2019).

Fruchterman & Reingold's layout algorithm was applied in the wheat trade map in the research of Sikos T. & Meirmanova (2020), thus determining the hubs and peripheral states of

the international wheat trade network as shown in Figure 1. This geo-based network displays a clear pattern of interconnected countries shown as categorized clusters of countries which supply wheat around the world. The wheat exportering countries are classified by attributes identified by to how many countries they export wheat to. The categorization is identified by red nodes – a very high amount of countries are exported to (5.32%), orange nodes – a high amount of countries exported to (5.32%), yellow nodes – a medium amount of countries exported to (14.89%), green nodes – a low amount of countries exported to (10.64%), and blue nodes – a very low amount of countries exported to (63.83%).

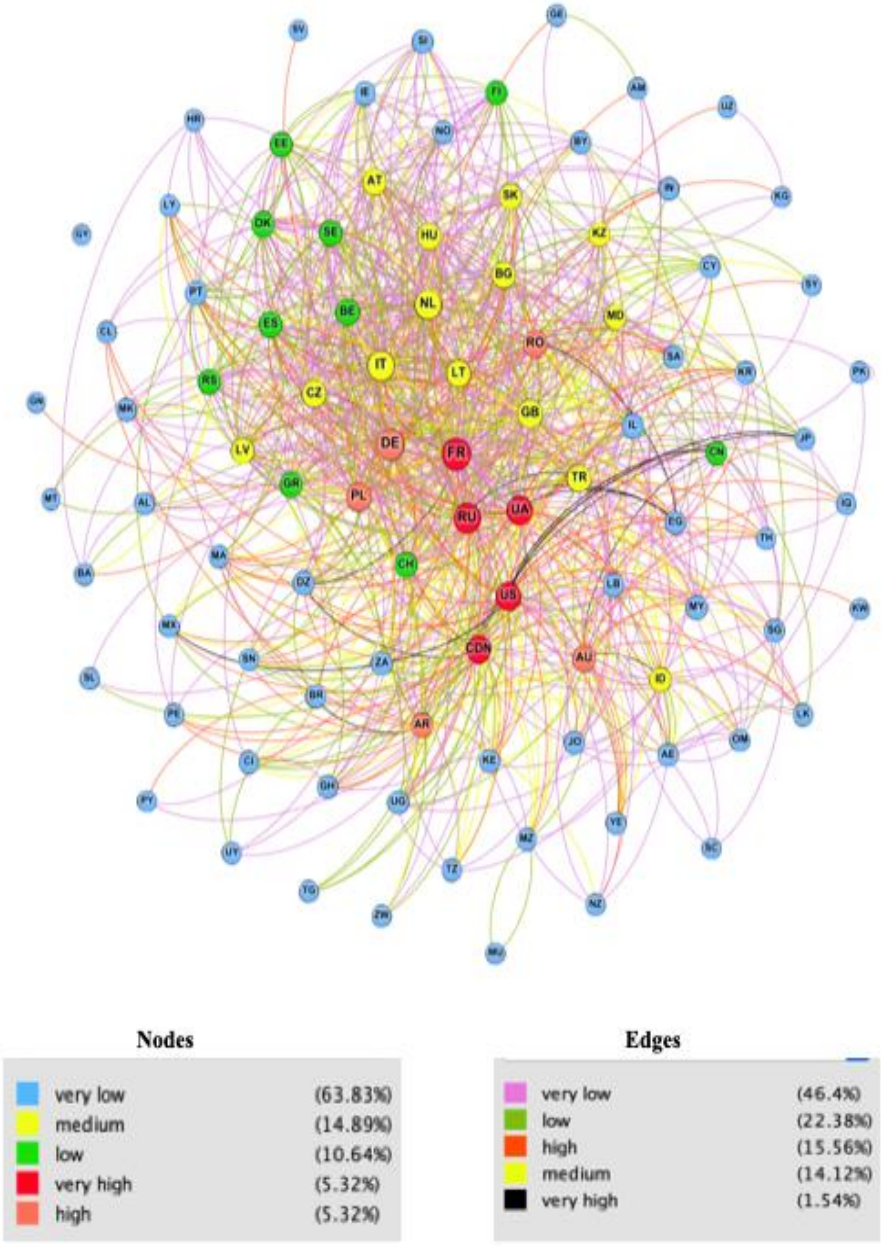

Figure 1: Graphical representation of worldwide wheat exporters (country-to-country connections for the year 2018-2019)

Source: Own edition

DOI: 10.14750/ME.2022.014

Geo layout algorithm was applied in order to spatialize a full geo-based network of wheat trade flow. The network represents the separate countries as the nodes in a directed spatial network, based on the geographic coordinates (latitude/longitude) for each country. Edges between node pairs were weighted by the value of wheat exports (USD) transferred between each origin and destination country in 2018-2019 (see Figure 2). The categorization is identified by black edges (lines) – exporter sends wheat to importer in very high value between 330M USD and 3B USD (consists of 1.54%), orange edges – exporter sends wheat to importer in high value between 30M USD and 330M USD (consists of 15.56%), yellow edges – exporter sends wheat to importer in medium value between 9M USD and 30M USD (consists of 14.12%), green edges – exporter sends wheat to importer in low value between 1M USD and 9M USD (consists of 22.38%), purple edges – exporter send wheat to importer in very low value between 1K USD and 1M USD (consists of 46.4%).

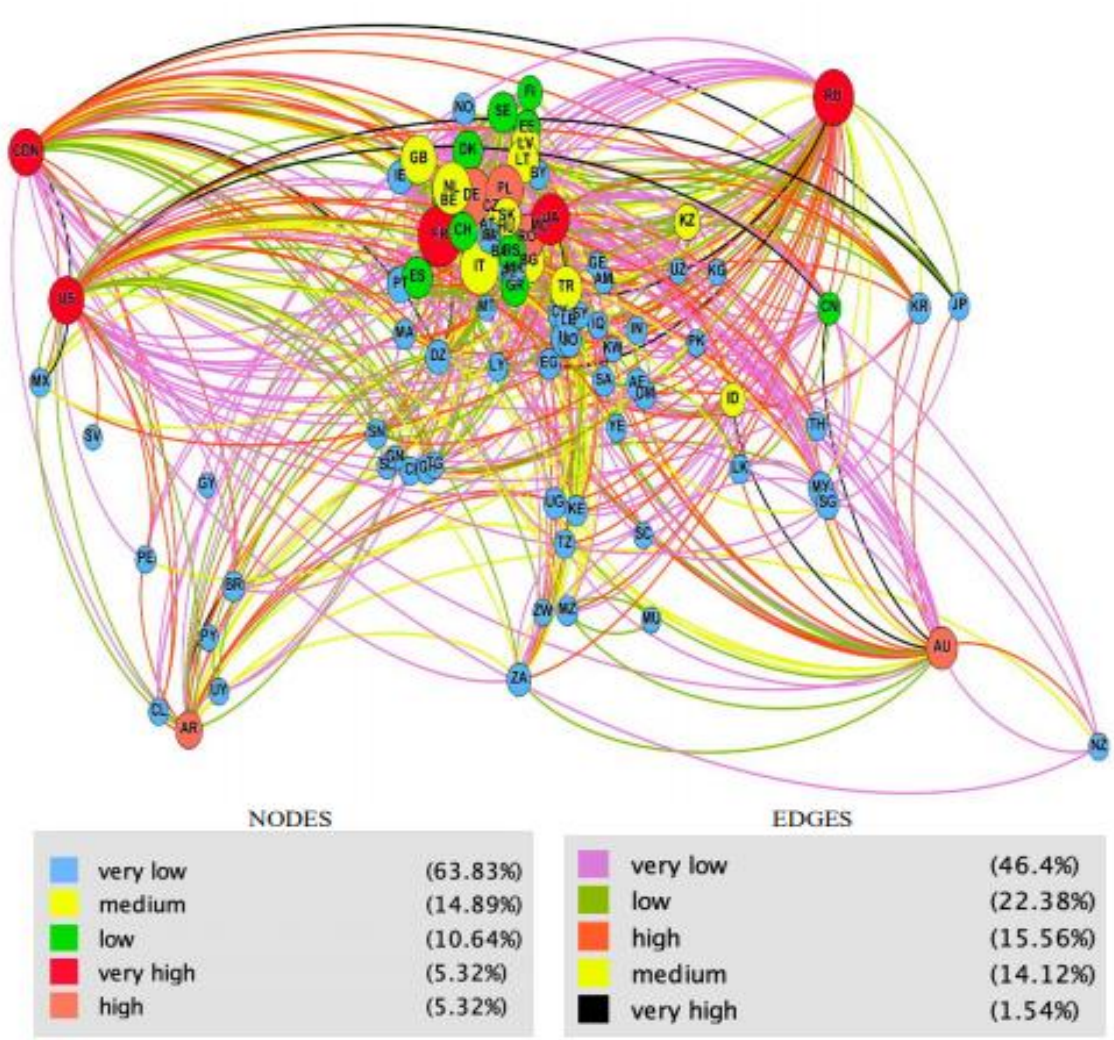

Figure 2: Graphical representation of the world trade flow of wheat: the number of nodes is proportional to the number of outflows, the number of edges is proportional to the amount of the export value

Source: Own edition

As shown in Figure 1, Kazakhstan is positioned at a middle level (indicated in a yellow node) for a number of countries that Kazakhstan exports wheat to. The importers of Kazakhstani wheat are: China (10.2%), Uzbekistan (36.3%), Tajikistan (19.4%), Afghanistan (5.6%), Turkmenistan (4.64%), Azerbaijan (4.5%), Turkey (4.27%), Kyrgyzstan (2.74%), Georgia (1.34%), Vietnam (0.29%), Iran (0.11%), Malaysia (0.027%), Russia (4.26%), Italy (3.13%), the UK (0.83%), Greece (0.43%), Sweden (0.32%), Belgium (0.25%), the Netherlands (0.24%), Norway (0.21%), Poland (0.12%), Finland (0.11%), Belarus (0.047%), Denmark (0.045%), Germany (0.02%), Tunisia (0.51%), other Europe (0.005%) (Baci International Trade Database, 2019). Kazakhstan's export value in wheat export is 1.02B USD (its world wheat market share is 2.31%). Among the 194,306 farms registered in the database of Kazakhstan's farms, 168,240 farms are fully or partially involved in grain production (including wheat production). Agricultural enterprises involved in wheat production span 8358M ha.; farms involved in wheat production span 4047M ha.

Based on the above-mentioned information, I noticed that there is a certain demand for Kazakhstani wheat and it is constantly growing, while the number of importers is increasing. And despite the annual whims of the weather, its wheat retains high protein and gluten, and might serve as a wheat improver in a number of countries. Kazakhstan can boast good examples of deep wheat processing, in particular the production of gluten, starch and bioethanol. Moreover, the export potential of wheat processed products is huge, and we should must maximize it in order to develop the wheat processing industry.

2.2 Digitalization of the Agro-Industrial Complex in Kazakhstan

Agriculture is considered one of the most important sectors of the economy, which largely ensures the country's food security. Several programmes for the development of the Agro-Industrial Complex (AIC) have been developed and changed over the past decades. The former president of the Republic of Kazakhstan Nursultan Nazarbayev's State of the Nation Address on January 10, 2018, set new goals regarding the industrialization and digitalization of Kazakhstan. Reorientation of the entire agro-industrial sector, the development of agrarian science, the transfer of cutting-edge technologies and their adaptation to local conditions, the introduction of new technologies and business models, and the development of the scientific sphere in the agro-industrial sector are the primary goals of the development of the agricultural sector (Akorda, 2018). Furthermore, the administration of the Republic of Kazakhstan

considers AIC as one of the most important resources for the growth of the national economy; therefore, in accordance with the concept of the State Programme for the Development of the AIC for the years 2017-2021, special attention was paid to factors of increasing its efficiency during this period. This programme includes diversification of the industry, expansion of subsidies and concessional loans, growth of processing products' share, growth in labor productivity and the introduction of innovations.

In the context of the new global reality, the goal is to increase the gross output of agricultural products by 30% through digitally transforming the industry. World experience shows that the use of information technologies (IT) in agriculture already allows users to reduce up to 20% of unplanned costs, and in the near future the effect of digitalization will only grow. Thus, with the proper use of IT, the agrarian sector might become the driver of the modernization of Kazakhstan's economy.

The definitions of agriculture, agribusiness and technology (from the Australian Concise Oxford Dictionary) can be a proper guide in understanding IT transfer in the industrial sector. Agriculture has been defined as "the science or practice of cultivating the soil and rearing farm animals" by Moore (2002). Nowadays agriculture has become a multinational business changing from the level of subsistence farming. According to Moore (2002), agribusiness refers "not only to farming, but to all the organizations engaged in the trade or commerce of agricultural activities, from R&D (research and development) and input provision to distribution, marketing and processing" and the technology has been determined as "a process designed to achieve a given action while reducing the uncertainty in the cause-effect relationship involved in achieving a desired outcome".

Therefore, the employment of cutting-edge and resource-saving technologies in agro-industrial complexes of the Republic of Kazakhstan might solve a number of tasks, such as optimizing the use of fertilizers, optimizing methods of plant protection, seeds, etc and lead several benefits: cost minimizations; increased crop yields; increased productivity of animals; improved quality of agricultural products; increased quality of agricultural land; efficient use of natural resources; improvements in the environmental situation; creation of climate risk management; creation of informative support for agricultural management and remote control of the units of the agro-industrial complexes; optimization of agricultural production operations and logistics; reduction in the number of agents between consumers and agricultural producers, etc. An integrated approach to the use of information and resource-saving technologies is required, covering all production stages. At the same time, management, information and resource-saving technologies are integrated into a single production system that contributes to

the improvement in the efficiency of production and product quality, reducing the negative impact on the environment, and allowing rational use of resources. The use of such technologies embraces the economy of resources, environmental sustainability and profitability of agricultural production in the region. One of the important links in the management system of the agro-industrial complexes of the Republic of Kazakhstan for the implementation of an effective agrarian policy in its territory would be the creation of a geoanalytical (situational) center of the agro-industrial complexes of the region, which will guarantee sustainable development of rural areas, improve interagency information interaction of agribusiness management authorities and competitiveness of agricultural products of the state.

The main goal of the e-AIC programme is the introduction of the most effective and affordable tools for digitalization of agriculture to increase labor productivity by 2.5 times by 2022 compared with the level of 2017 (Akorda, 2018). The strategy provides for a similar increase in exports of processed agricultural products. In quantitative terms, by digitalizing the country's agricultural sector, it was planned to cover the maximum number of farms in the country and create 4,000 advanced-level farms and a further 20 digital farms (Akorda, 2018). Also, digitalization will embrace business processes in providing public services for the agricultural sector. There are a number of problems in the marketing process of finished agricultural products: poorly developed logistics, lack of granaries, lack of information on packing and sorting technologies, and a long and unregulated process of searching for buyers of agricultural products. For all identified problems, experts have developed measures to improve the efficiency of business processes. These measures formed the basis of e-AIC digital development programme. In Kazakhstan, a single platform will be developed for obtaining online information on all measures of state support, i.e. online consultations of specialists. Online applications will be set up for loans, subsidies and leasing. Online systems will simplify the search for investors, the search and rental of equipment, seeds, and even the search for specialists in the agricultural sector. A map of soil samples, quarantine and veterinary facilities will be formed. As part of the sales process, plan include the electronic online monitoring of agricultural products in warehouses, managing storage parameters, searching and booking transportation of products, as well as online sales.

E-commerce intergration is one of the most important components of the e-AIC programme. The absolute value of e-commerce market is increasing in small, medium-sized, and large farms around the world. Nowadays the digital technologies of the Fourth Industrial Revolution, including AI (Artificial Intelligence), blockchain, cloud computing, IoT (Internet of Things) and autonomous delivery devices (e.g. drones and robots) are shaping new business

models in the e-marketplace ecosystem. Moreover, the Covid-19 crisis has accelerated societal and economic changes by transferring and improving business conditions into e-commerce worldwide. E-marketplaces in the agriculture offer farmers a greater reach and provide them with large-scale alternatives from different suppliers.

Generally, there are some quantitative and qualitative studies on the adoption of Information and Communication Technologies (ICT) by farmers (Uematsu & Mishra, 2011; Machfud & Kartiwi, 2013). At the beginning farmers were frightened by the role of ICT, however, many farmers overcame their skepticism and ICT related issues and became at ease with the ICTs due to government policy frameworks which were provided in the form of education and funded technology purchases (Machfud & Kartiwi, 2013). Cecchini & Raina (2002) identified the key strategies for successful realization of government incentives: 1) the government should determine the needs of farmers; 2) the implementation procedure should comprise permanent participation and response from the farmers; 3) the incentives should take into consideration the necessities of farmers of lower socioeconomic status; 4) the abovementioned measurements are productive from a community perspective. These policies can be helpful in the realization of e-commerce incentives also. On the other hand, there are some factors that can act as an impediment to realization of e-commerce strategies from the farmers' side, such as low internet connectivity, low access to hardware and software, etc.

The concept of e-commerce is often described as selling and buying information, products and services using digital platforms and the Internet (Karev, 2006). This definition implies business transactions, as well as advertising of goods and services over the Internet, B2B (Business-to-business), B2C (Business-to-consumer), C2C (Consumer-to-consumer) electronic data exchange, online payment and transaction, and automated supply chain management. The process of integrating of technologies into agriculture is expected to affect on economy to a great extent. Electronic commerce technologies and applications have drastically changed the ways of conducting businesses, which is increased in extended markets for the sellers and for the consumers around the world (Chaffey et al., 2003). Electronic commerce technologies and applications usage have strengthened the opportunities for businesses and consumers in different sectors around the world, especially in agriculture (Jalava & Pohjola, 2002). By 2050, e-commerce is predicted to embrace all engagements in commerce and the majority of business deals are expected to be carried out online (Laudon & Traver, 2004). There are a number of studies aimed at perceiving and defining the determinants that affect the acceptance and usage of information technologies, representing the significance of recognizing and identifying the main determinants that impact on the behavioural beliefs in e-commerce tools adoption (Afshan

& Sharif, 2016; Al-Qeisi & Al-Abdallah, 2013; Çelik, 2016; Leonard, 2012; Li & Tang, 2010; Venkatesh, Thong, & Xu, 2012).

There is much hopefulness about the growth of e-commerce in the agricultural sector of the USA (Leroux et al., 2001). At the same, there is more optimism about the German farmers' intentions to use e-commerce for business purposes in the future. Around 70% of German farmers are willing to sell and purchase electronically (Rentenbank, 2015). E-Choupal, a conglomerate in India, encourages indian farmers to create a direct marketing channel and eliminate wasteful intermediation, thus reducing transaction costs and making logistics efficient (Goyal, 2010).

The agricultural market has always been one of the free markets due to the fact that agricultural production is strongly influenced by the external environment. In order to better cope with the external fluctuations, the agricultural market must adhere to the principles of a free market, and therefore to the principles of self-organization. Thus, the market can become a favorable environment for the introduction of e-commerce in the commodity market. Using e-commerce in the commodity market will help to make the agricultural market more adaptive and self-organizing. Research on the adoption of technologies in agriculture and on the innovative farmers' behaviour, their perception and knowledge has been common in western countries, but less is known about farmers' adoption behaviour, perceptions and knowledge regarding technologies adoption in the non-western world (Kuehne et al., 2017).

Moreover, the literature shows some facts that e-commerce adoption by farmers are based on a combination of rational, social deterministic, and behavioral reasons. From a rational point of approach, e-commerce incentives are rooted in business that leads to farmers' adoption of e-commerce strategies. From a social deterministic point of view, farmers from small and medium-sized farms rely on social reasons for making decisions on adoption of e-commerce strategies. Social determinism includes social constructs that play a substantial role in their decision-making. From the theory of behaviourism point of view, farmers' decision on acceptance of e-commerce technologies related to their environment are based on farmers' knowledge and experiences from farming. Research shows that e-commerce penetration in small-sized and medium farms was rare due to farmers' irrational reasons such as being busy or feeling intimidated (Machfud & Kartiwi, 2013). In previous research, the Theory of Reasoned Action (TRA) was used in revealing causes of avoidance in e-commerce adoption by farmers (Grandón et al., 2011). Madden et al. (1992) claim that "behavioral intentions, which are the immediate antecedents to behavior, are a function of salient information or beliefs about the likelihood that performing a particular behavior will lead to a specific outcome". The

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behavioural factors are the main determinants in defining farmers' perceptions on acceptance of e-commerce applications. Based on previous research, the present research was triggered to investigate the behavioural beliefs of the farmers of wheat-oriented farms in e-commerce usage using the UTAUT (Unified Theory of Acceptance and Use of Technology) model.

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CHAPTER III: LITERATURE REVIEW

3.1 Typology of Technology Acceptance Theories and Models: Review and Classification

According to Moody et al. (2010), the focal point of any research field is the theories that specifically determine identity of a certain study. Research cannot be completed without theory, therefore theory is an important requirement for conducting research. The adoption and dissemination of innovations and technologies is a relevant topic in the user' behaviour literature. According to the research by Sinha & Chandrashekaran (1992), there are two types of models are distinguished on the aforementioned topic: the first type attempts to increase the understanding of the diffusion process in a general context. These models are analytical representations of a dissemination process at the aggregate level. They are often referred as diffusion models. The second type of models aims to provide clarity regarding the factors that determine the decision of technology adoption or non-adoption by the individuals. These models take a disaggregated perspective and are generally known as adoption models.

Technology adoption models and theories have been applied in various sectors to comprehend and to forecast the behaviour of individuals, for instance in elections, in choosing the transport mode, or in purchasing different technologies, i.e. gadgets, laptops. Several technology adoption studies elaborated theories/models to evaluate the individuals' usage of certain cutting-edge and implemented technologies. There are well-known theories and models such as UTAUT (Unified Theory of Acceptance and Use of Technology), TAM (Technology Acceptance Model), TAM2 (Extended Technology Acceptance Model), DTPB (Decomposed Theory of Planned Behaviour), TPB (Theory of Planned Behaviour), C-TAM-TPB (Augmented TAM or Combined TAM and TPB), TRA (Theory of Reasoned Action), SCT (Social Cognitive Theory), and IDT (Innovations Diffusion Theory) which are focused on the behavioural and psychological views of the users.

The aforementioned theories and models are developed from psychological, social and information technologies studies, furthermore adding and subtracting constructs and moderators which leads to creating a new model for anaysing adoption behaviour of users and usage of technologies. Despite having a similar concept and close connection of the theories and models, each of them use different terminologies in their determinants and variables and each of them has advantages and disadvantages. The typology, strengths and weaknesses of the aforementioned theories and models are summarized in Figure 3 and Table 5.

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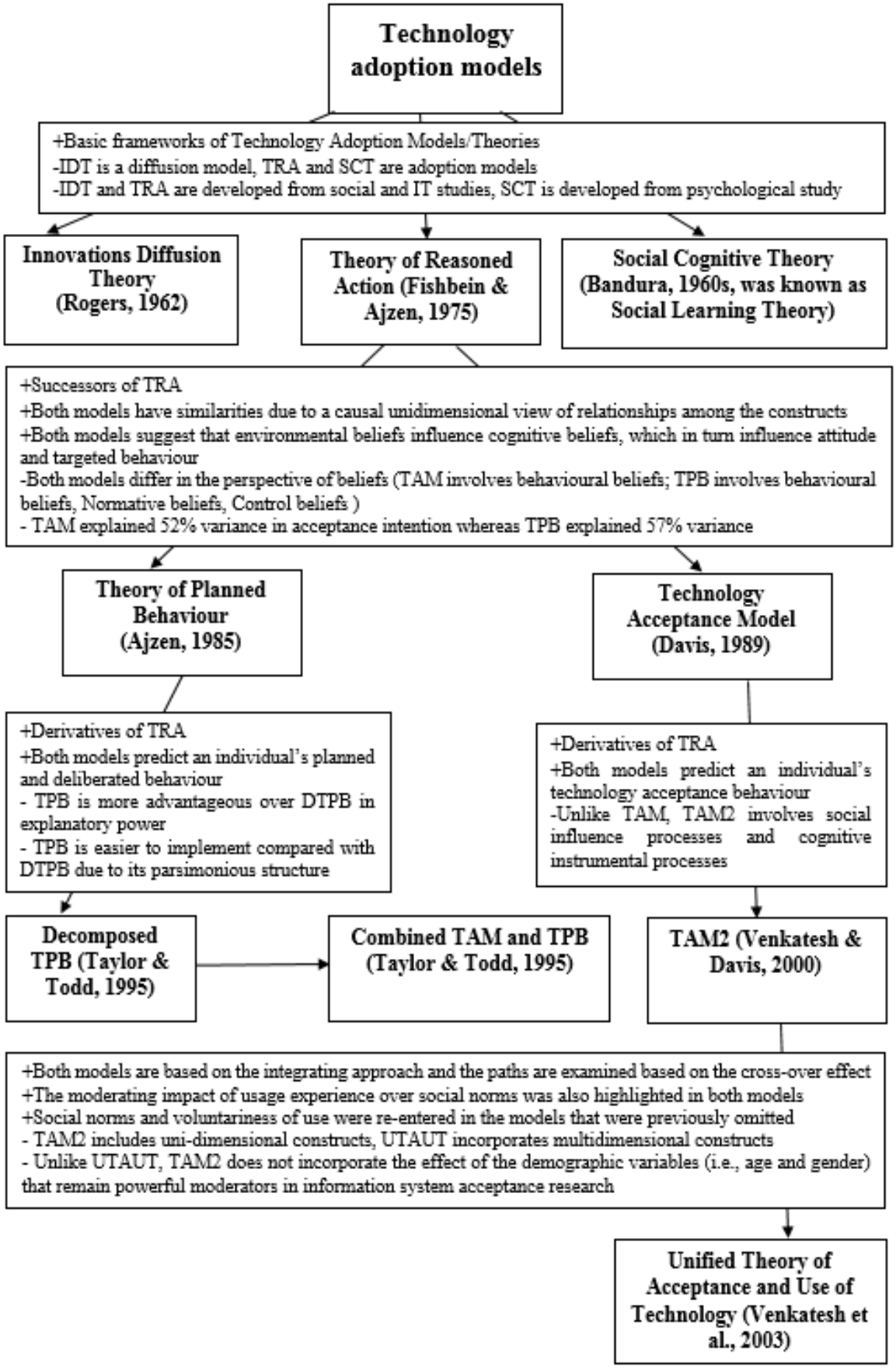

Figure 3: Typology of technology adoption theories/models
Source: Own edition

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Table 5: Strengths and weaknesses of the technology acceptance theories/models

Theories	Strengths of the theories	Weaknesses of the theories
TRA	• "It is the main and basic theory of human behaviour" • "Explains any human behaviour de facto"	• "It does not account for the variables that displays behavioural intention like threat, fear or previous experience"
TPB	• "It is applied to the conception of user adoption and use of many different technologies, innovations"	• "It does not account for the variables that effects behavioural intention"
DTPB	• "It is extended by including some factors from IDT model" • "This extension makes the model more managerially relevant in influencing acceptance and use"	• "It is similar to TPB"
TAM	• "It is a powerful model for technology applications" • "It replaced TRA's attitude toward behaviour with two technology acceptance measures which are: Perceived Usefulness and Perceived Ease of Use" • "It provides feedback on two factors: usefulness and ease of use"	• "It does not provide any feedback on some factors that may enhance the adoption like integration, flexibility, compeleteness of information and information currency"
TAM2	• "It explains Perceived Usefulness and Perceived Ease of Use in terms of social influence and cognitive instrumental processes" • "It explains the changes in technology acceptance over time as individuals gain experience in using the targeted technology"	• "It does not specify how expectancies are influencing on behaviour"
C-TAM-TPB	• "It combines the TPB model from social psychology field with TAM from information technology field in order to get better use of TPB in technology acceptance"	• "The determinants of TAM are not fully displays the specific influences of usage-context factor that may change user's acceptance" • "It still does not pay attention to fear or threat concerning use"
IDT	• "It has the ability to study any kind of innovations" • "It explains the decision of innovation and predicts the rates of the adoption factors of innovation"	• "It does not indicate how the attitude impacts on accepting or rejecting the decisions, or how innovation factors effect on decisions" • "It does not give any concern to individual's resources or social support for adopting the new behaviour"

SCT	• "It is one of the most significant theories in examining the human learning process"	• "It is not thoroughly organized, especially while trying to study the relation among environment, individuals and behaviour" • "It focuses on human learning process not on adoption of IT"
UTAUT	• "Effort Expectancy, Facilitating Conditions, Social Influence and Performance Expectancy are the main four core determinants of usage and intention in UTAUT" • "UTAUT is able to account for 70% of the variance in usage intention – a significant improvement in comparison with the other technology acceptance models and theories"	

Source: Information in columns 2, 3 is replicated from the article "Technology acceptance theories: review and classification" by A. M. Momani, M.M. Jamous and M. S. Hilles, 2018, in "Technology Adoption and Social Issues: Concepts, Methodologies, Tools and Applications". Information Resources Management Association, p. 10.

3.1.1 Innovations Diffusion Theory (IDT), its Limitations and Application to e-commerce

Innovations Diffusion Theory (IDT) was developed by the American researcher Everett Rogers. The researcher analyzed the diffusion of new ideas, products, etc. and classified tendencies into the new technologies in different segments of society. Rogers' research is based on five key elements: innovation, adopters, communication channels, time, social system. The definition of these elements are needed in order to understand the diffusion process thoroughly: *innovation* is any idea, experience or object that is perceived by an individual as discovered recently, also the idea of innovation is exclusively subjective within the users' perceptions; *adopters* are individuals, organizations, clusters within social networks, countries; *communication channels* are the ways by which innovation is transmitted from one individual to other individual, from one organization to other organization; *time* is the adoption rate, which is measured as the relative speed until a certain percentage of the population adopts the innovation. If the number of individuals who adopt the idea is plotted on a graph of cumulative frequency over time, the result may be a "S" shaped curve; *social system* is the synthesis of internal and external influences. The individuals, groups, organizations or subsystems are the elements of the social system (Rogers, 1995).

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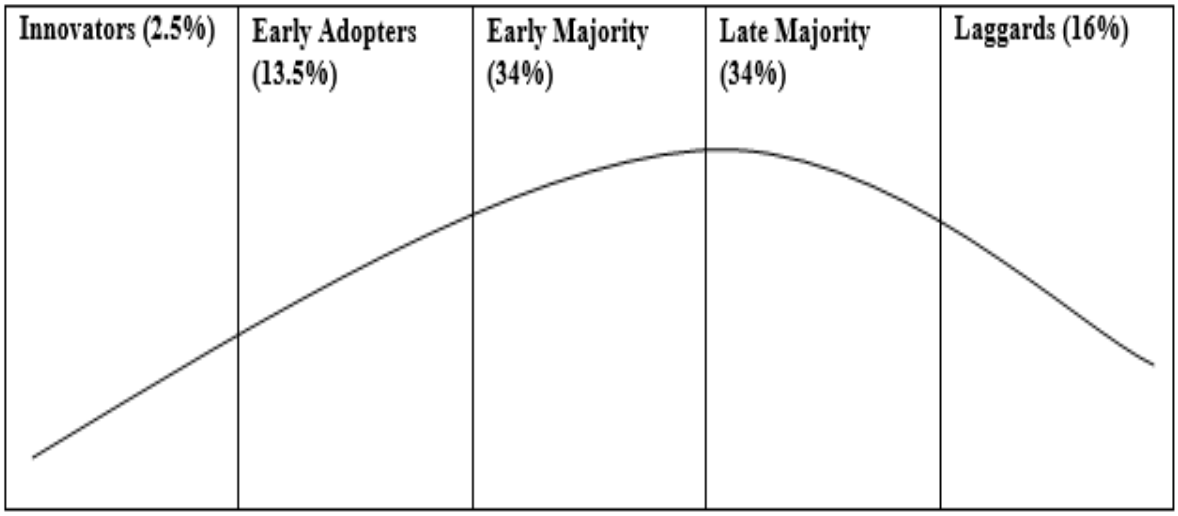

Figure 4: The categorization of the adopters on the basis of innovativeness
Source: Based on Rogers (1995)

Rogers described five classes of people according to their acceptance of new ideas and products, highlighting the average approximate quantitative indicator from the total mass of recipients as shown in Figure 4: innovators are more mobile, have contacts outside their circle, can easily grasp and accept abstract ideas, they agree to take risks; this group constitutes 2.5% of the population. Early adopters are respected people tied to the local structure, also known as "opinion leaders" with whom people consult before making an independent decision, and constitute 13.5% of the population. The early majority adopt new ideas just before the innovations are accepted by the average citizen, they often receive necessary information from the previous group of adopters, and they make up 34% of the population. The late majority accept innovations after the majority of people have already determined their opinion on this issue and the average citizen has accepted them. Laggards are conservative in their judgments, traditionally-oriented, very distrustful and suspicious of everything new and adhere to traditional values; they constitute 16% of the population (Rogers, 1995).

Rogers believed that interpersonal communication among the people of the same circle and age group is very important; patriotic exhortations from government circles are ineffective; the reliability of the communicative source partly predetermines the success of the campaign; and the mass media cannot change the behaviour of those who hold a different point of view. IDT allows us to understand how to introduce a new product into the mass. The adoption of innovation by an individual creates a need to make a decision about whether to adopt or not to adopt. The decision-making process is a series of actions that occurs over time and takes place

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over five stages. Most research in IDT mentions five stages in how an individual adopts or rejects a certain innovation.

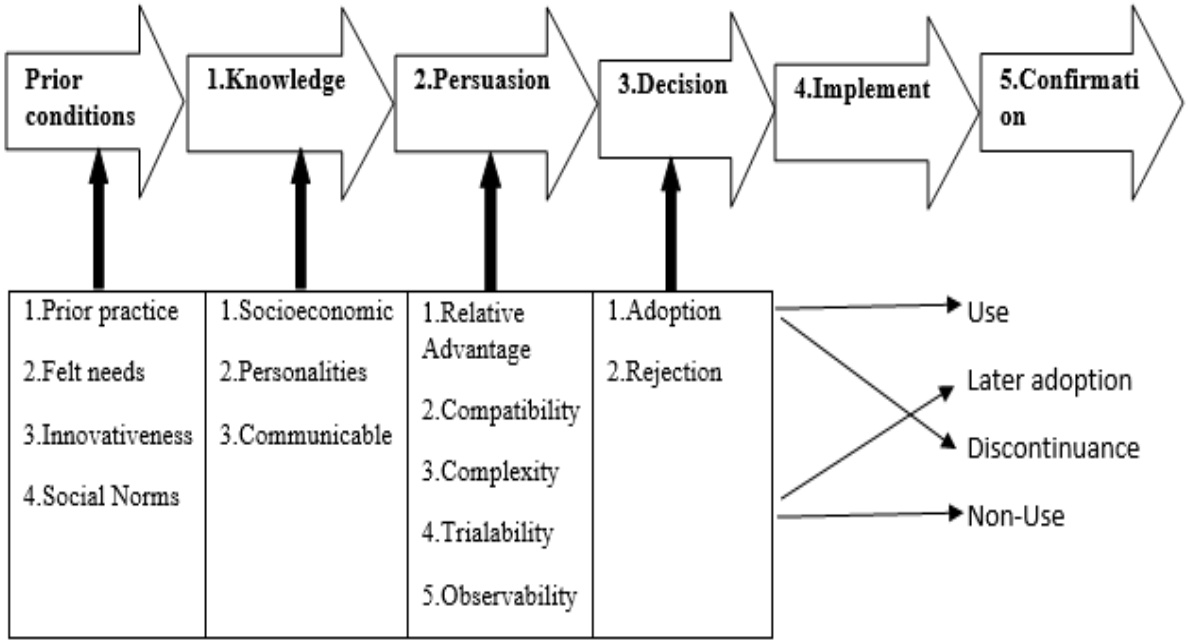

Figure 5: Phases in the innovation-decision process
Source: Based on Rogers (1995)

There are five stages in the innovation-decision process as shown in Figure 5: *knowledge* is the first phase taken in order to achieve having knowledge or perception not only of the existence of the innovation, but also of how it operates; *persuasion* is the second stage where a person creates a conducive or unconducive opinion about innovation at this stage; *decision* is the step in which the individual starts a series of activities in order to adopt or reject the innovation (if the user decides to reject it, the two subsequent stages will not be executed); after accepting the innovation, *implementation* is putting its into use in everyday activities; *confirmation* is an activity in which an individual attempts to find reinforcement on the taken decision (Rogers, 1995). These five stages of the adoption process set the paradigm for many factors that researchers have continued to explore and expand on to this day (e.g. Kiwanuka, 2015; Sánchez-Torres & Arroyo-Cañada, 2016; Weber & Kauffman, 2011).

According to Greenhalgh et al. (2005), there were more than 4,000 papers published on IDT in several fields after the model was developed by Rogers, and there have been a few adopted modifications to the theory. Although some studies applied the theory with a different perspective, the theory is still stagnant and complicated to use for new problems due to lack of cohesion (Meyers et al., 1999). Rogers divided the contributions and the criticisms of innovation dissemination studies into four classifications: individual-blame bias, pro-

innovation bias, issues of equality and recall problem. Rogers' theory was criticized by researchers for its lack of consideration of the fact that some individuals' preferences are dynamic and unstable (Mansell, 1996). In some cases model of the innovation usage could be changed depending on the nature and usage of innovation. Since Rogers' theory shows a linear relationship to explain basic assumptions, researchers cannot apply this model to a non-linear relationships. According to Abrahamson (1991), organizations cannot adopt technologies or innovations entirely rationally and independently, there might be some trends or forces that push them to accept innovations. His criticism was mentioned in Rogers' work by classifying the innovation process that ranges from optional to authoritative options.

The perceived features of technologies, preparedness of organizations and personal preferences have been used to interpret e-services acceptance. According to Molla and Licker (2005), there are two determinants ─ POER (Perceived Organizational eReadiness) and PEER (Perceived External eReadiness) ─ that define the acceptance and usage of e-commerce as shown in Figure 6.

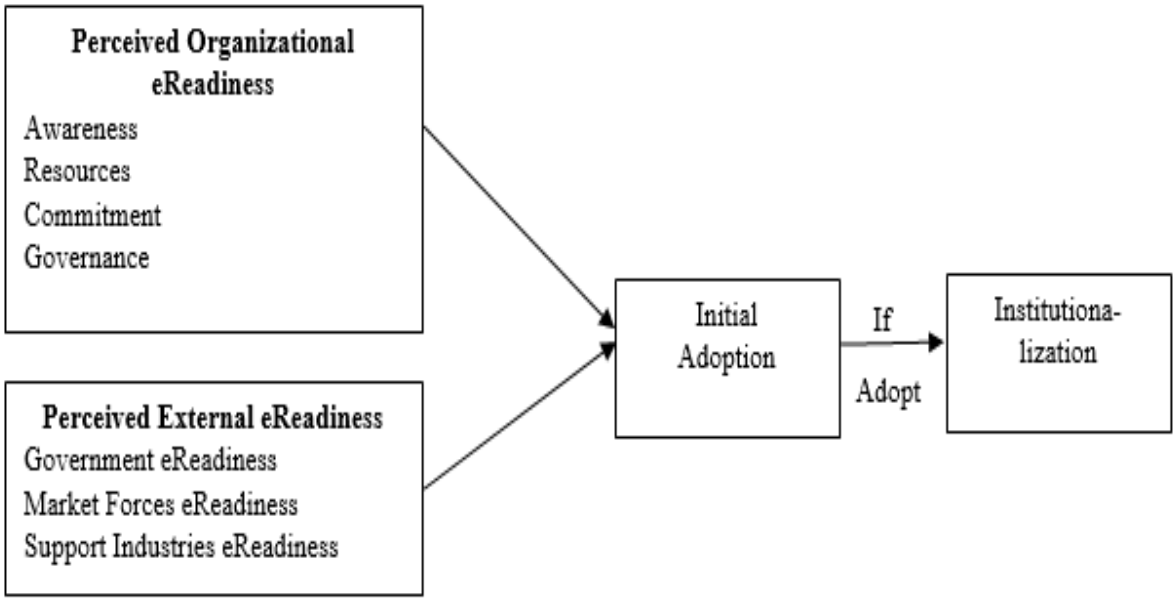

Figure 6: Perceived e-readiness model for businesses in developing countries
Source: Based on Molla & Licker (2005)

Human resources (people with IT skills), business resources (financial resources for maintaining e-commerce technologies), and technology resources (software and hardware) are the crucial components of POER (Perceived Organizational eReadiness) in promoting initial acceptance and successive institutionalization of e-commerce adoption in organizations. Market forces e-readiness, government eReadiness, support industries eReadiness are the main components of PEER (Perceived External eReadiness). The factors of POER (Perceived Organizational eReadiness) and PEER (Perceived Environmental eReadiness) play a crucial

role in the final decision of organizations as to whether to adopt e-commerce (Molla & Licker, 2005). IDT has been employed as a background in the majority of research in order to examine the factors in adoption of certain systems in various contexts: education; retailing and consumer services adoption; manufacturing technologies; social media usage; and health services. Al-Rahmi et al. (2019) investigated students' intention (motivational determinants) to use e-learning systems. Shaw et al. (2022) examined digital wallet' usage across countries by applying IDT as an integral part of their study. Schwabe et al. (2021) applied IDT to multiple case studies in order to investigate the diffusion of 3-D printing technology, the diffusion of novel cement manufacturing technology and the manufacturing of intensive care ventilators during the Covid-19 pandemic. Kwon et al. (2021) examined small retail businesses' social media use through IDT, while Wang et al. (2021) examined the diffusion of pharmacy workplace trainings and education programmes.

IDT has been used as a framework for e-commerce related studies also. Al-Qirim (2007) examined e-commerce adoption and diffusion in non-governmental organizations in Jordan. Perceived characteristics of the innovation ─ compatibility, complexity, observability, image, and relative advantage ─ had a significant impact on e-commerce usage. Slyke et al. (2010) employed IDT to interpret the moderating role of gender on users' e-commerce acceptance. The results of the study showed that gender moderated the relationship between the exogenous and endogenous constructs; moreover, perceived characteristics of the innovation, such as compatibility, case of use, result demonstrability, visibility, relative advantage, trustworthiness, image had impacts on use intention.

By evaluating the above-mentioned authors' research on applying IDT on e-commerce acceptance and usage studies, it has been established that perceived characteristics of the innovation formulate and demonstrate benefits to using e-commerce. Therefore, a compatibility component was involved in the model of the current study. Wu & Lin (2018) developed a model by integrating IDT that helps to identify e-commerce logistics issues. The analytical results of their study may stimulate future research related with e-commerce logistics management. The above-mentioned studies have several novel implications for academia and practice.

3.1.2 Social Cognitive Theory (SCT), its Limitations and Application to e-commerce

Social Cognitive Theory (SCT) has been applied in education, psychology, and communication and posits that knowledge acquisition of the individual is directly influenced by his/her observation of the other individuals' behaviour (Bandura, 1971). Consequently, the

behavior can be performed as an indicator for individuals to act based on symbolic constructions that derived from observation. SCT, as shown in Figure 7, is defined by the interaction of three different elements: environmental factors – the influence of the physical and a social environment on human behaviour; cognitive factors ─ the individual's attributes that characterize a person; behaviour ─ the way of acting of an individual (Bandura, 1971). The interrelation between these three elements makes up the nature of the person, building his/her behaviour according to his/her principles and standards (Chang & Lu, 2004; Amin, 2007).

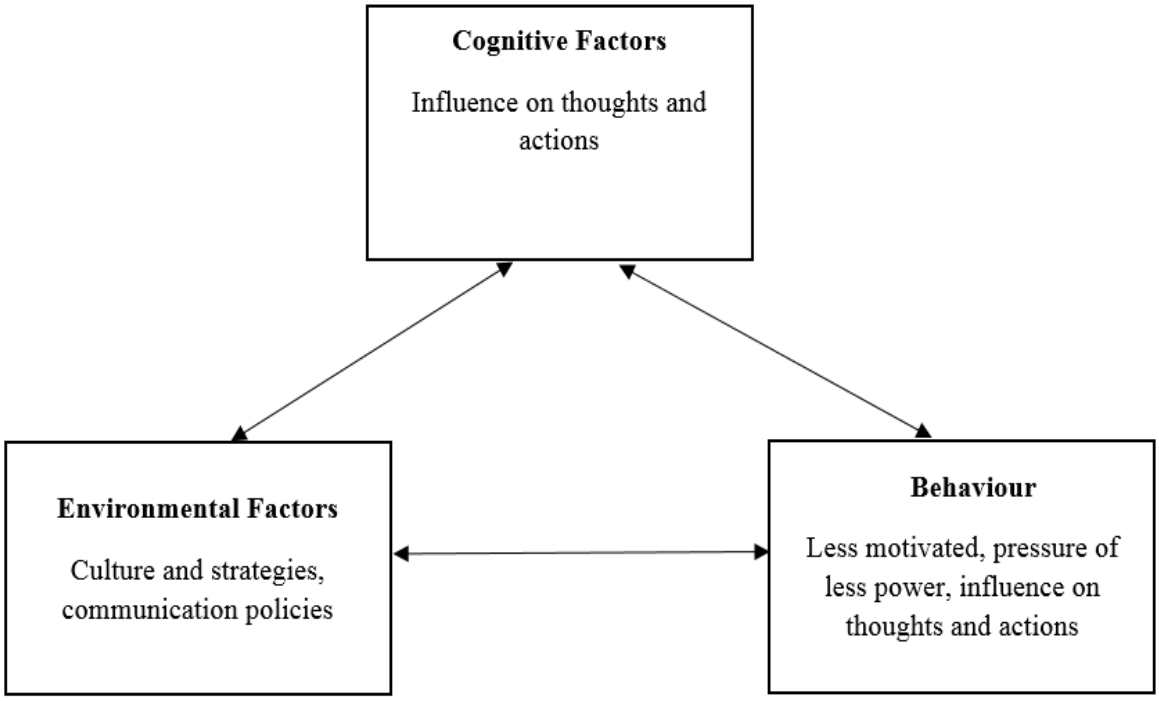

Figure 7: Social Cognitive Theory
Source: Based on Bandura (1971)

SCT has several limitations which should be considered when using this theory in the technology acceptance field. Limitations of the model are that the theory presumes that environmental factors automatically affect changes in the individuals' personalities, which may not be true always; it is not clear which one of the factors (cognitive factors, behaviour, environmental factors) affects actual behaviour of the individual and which one is more influential than others; the theory disregards biological inclinations of the person that might influence on his/her behavior; the theory also does not focus on other cognitive factors such as emotional or motivational factors or outcome expectations (Boston University School of Public Health, 2019).

These limitations may raise questions during review of the research that focuses only on either individual or technological factors in predicting the usage or acceptance of a certain

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system. Taking into consideration that IS (Information Systems) related studies mainly focus on usage and acceptance of technologies, some variables of SCT have been accepted and validated in technology acceptance research within the proposed framework of Carillo (2010).

SCT has been employed as a background in the majority of research in contexts related to health, the environment, educational psychology and hospitality management. Jeng et al. (2021) examined psychosocial factors of SCT (i.e., barriers, goal-setting, functional limitations, planning, self-efficacy, social support) in order to identify correlations of physical activity among people who suffer from multiple sclerosis. Shahangian, Tabesh & Yazdanpanah (2021) examined the household adoption of water self-efficiency user behaviour in Tehran through the framework of SCT. Motivation was investigated from the perspective of SCT by Schunk & DiBeneditto (2020) which led to the formation of a framework of reciprocal interactions on motivational processes (i.e., attributions, goals, outcome expectations, self-regulation, self-efficacy, social comparisons, values). Wang, Hung & Huang (2019) investigated the nature of personal and environmental factors that influence motivations for entrepreneurship.

With the advent of the usage and acceptance of internet-based technologies, topics such as B2C (Business-to-Consumer) e-commerce have been modeled from the perspective of SCT. Al-Dalahmeh et al. (2014) found that factors of SCT (i.e., self-efficacy, outcome expectations, anxiety, trust) had a strong influence on the usage of e-commerce by Jordanians. Self-efficacy was the second significant factor in defining individual's intention to buy goods on websites following consumer trust. Evaluating the research of Al-Dalahmeh et al. (2014) on applying SCT as the conceptual framework on e-commerce acceptance and usage, it has been discovered that personal factors play a crucial role in adoption of e-commerce applications by individuals. In the experimental study of Friedrich, Schlauderer & Overhage (2019), e-commerce website attractiveness was examined through the influence of feature richness on cognitive and affective factors. The findings of the study revealed that socially rich design elements of e-commerce websites attract consumers and stimulate them to search and purchase products. Leong et al. (2021) have developed a research model that predicts consumer's trust in mobile social commerce usage. The results of the model showed that there are positive impact of cognitive and emotional trust on trust in mobile social commerce. These studies have yielded several useful contributions to the existing literature related with the adoption and usage of e-commerce tools.

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3.1.3 Theory of Reasoned Action (TRA), its Limitations and Application to e-commerce

The Theory of Reasoned Action (TRA) was developed as a model of the interconnections between its determinants (i.e., Attitude toward Behaviour, Subjective Norms, Behavioural Intention and Behaviour) by Ajzen & Fishbein (1980). TRA is supposed to predict human behaviour based on an individual's pre-existing attitudes and behavioural intentions. The main objective of TRA is to investigate a person's self-inflicted behaviour by considering it as the main predictor that carries out an action. An individual's intention is considered as the basic motivation to perform a behaviour, whether or not the individual actually carries out that behaviour, as shown in Figure 8.

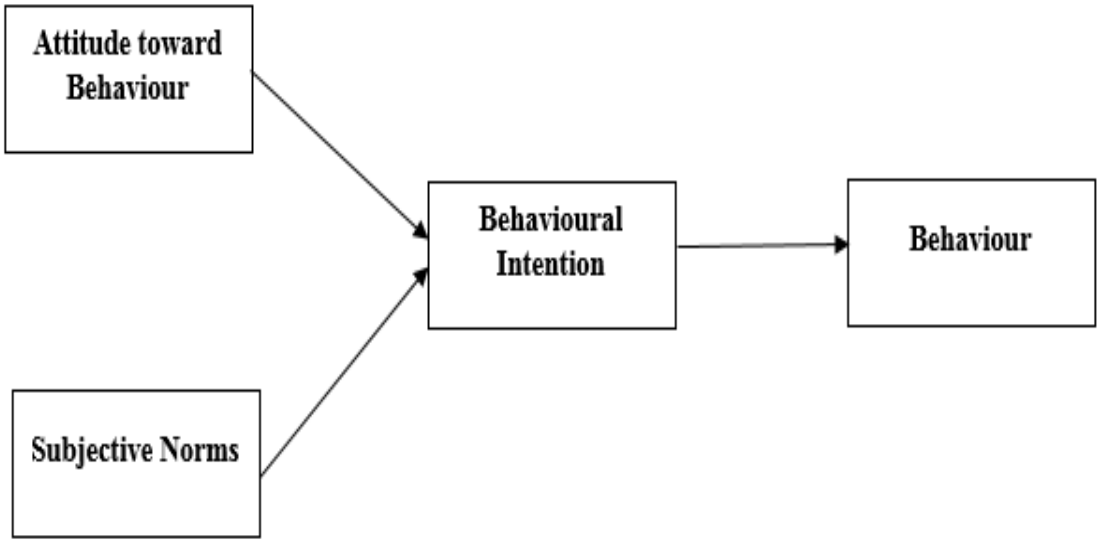

Figure 8: Theory of Reasoned Action
Source: Based on Ajzen & Fishbein (1980)

TRA aims to predict and explains a person's intention to perform a distinct behavior. The behaviour is defined by action, objective, context and time. In the Theory of Reasoned Action, BI (Behavioural Intention) is the basic predictor of B (Behaviour), while the other main determinants A_B (Attitude toward Behaviour) and S_N (Subjective Norms) are the main predictors of the intention. A_B (Attitude toward Behaviour) is influenced by two factors: by B_B (Behavioural Beliefs) that are related to the ramifications of the performed behaviour and by O_E (Outcomes Evaluation) of the possible ramifications. A_B (Attitude toward Behaviour) can be categorized as positive, negative or neutral. S_N (Subjective Norms) is influenced by N_B (Normative Beliefs) and by M_C (Motivation to Comply). The theory was stipulated by a direct correlation between attitudes and consequences. Consequence assessment refers to the way in which individuals comprehend and assess the possible consequences of a performed behaviour.

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Although TRA is employed as a theoretical basis to explain the BI (Behavioural Intention) and B (Behaviour) in several disciplines, the theory still has its limitations and restrictions related to the extension to choice and goals. The difference between behavioural intention and goal intention refers to the ability to reach user's purpose, which includes several variables that lead to a huge uncertainty. Ajzen (1985) confirmed this with the folowing statement: "Some behaviours are more likely to present problems of controls than others, but we can never be absolutely certain that we will be in a position to carry out our intentions. Viewed in this light, it becomes clear that strictly speaking every intention is a goal whose attainment is subject to some degree of uncertainty". TRA has limitations in behaviour prediction that demand a certain access to some resources, skills, conditions, and/or opportunities (Eagly & Chaiken, 1993).

TRA has been employed as a background in the majority of research related to the following contexts: hospitality management; international business; IT; marketing; and e-commerce. Untaru et al. (2016) examined individuals' intentions to conserve water in a lodging setting by intergrating critical variables of TRA. Marshall et al. (2010) tested hypotheses based on TRA in order to examine the drivers of environmental practices adoption in the wine industries of the USA and New Zealand. Mishra, Akman & Mishra (2014) examined behaviour for the adoption of Green Information Technologies by IT professionals.

The Theory of Reasoned Action has been applied widely to the investigation of the consumer behaviour and e-commerce. TRA was used in Shim & Drake's (1990) research in order to investigate consumers' intention to use e-shopping to buy clothes. The researchers found out that A_B (Attitude toward Behaviour) and S_N (Subjective Norms) components were predictors of BI (Behavioral Intention). During the thorough investigation of the mutual correlation between the S_N (Subjective Norms) component and BI (Behavioral Intention), it was found out that N_B (Normative Belief) was the predictor of the BI (Behavioral Intention) while M_C (Motivation to Comply) was not. Dakduk et al. (2017) integrated TRA using a Bayesian approach to evaluate the main predictors of online purchase intention among Colombians, thus contributing to the explanation of e-commerce adoption. Zarzuela & Antón (2015) applied the conceptual framework of TRA on formation of the marketing approach. The results revealed that youngsters' intention to cooperate with non-government organizations is determined directly by their attitudes. By evaluating these studies on applying TRA on e-commerce acceptance and usage, it became obvious that TRA allows us to accurately predict individual behaviour related with e-commerce adoption.

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3.1.4 Theory of Planned Behaviour (TPB), its Limitations and Application to e-commerce

The Theory of Planned Behavior (TPB) is a social-psychological model that was created by Ajzen in 1985 on the basis of the Theory of Reasoned Action. This theory contains five variables that include B (Behaviour), I (Intention), A_B (Attitude toward Behaviour), S_N (Subjective Norms) and P_{BC} (Perceived Behavioral Control). Unlike the Theory of Reasoned Action, P_{BC} (Perceived Behavioral Control) was added to TPB in order to denote the perceptions of a person about the availability or unavailability of required resources and opportunities. Likewise, TPB has proven to be superior in comparison with the Theory of Reasoned Action for predicting behaviour as shown in Figure 9.

Human social behaviour is guided by B_B (Behavioral Beliefs), N_B (Normative Beliefs), and C_B (Control Beliefs). Given all the relevant aspects, B_B (Behavioral Beliefs) positively influences A_B (Attitude toward Behaviour), N_B (Normative Beliefs) positively influences S_N (Subjective Norms), and C_B (Control Beliefs) positively influences P_{BC} (Perceived Behavioral Control). Altogether A_B (Attitude toward Behaviour), S_N (Subjective Norms), and P_{BC} (Perceived Behavioral Control) jointly lead to the formation of an individual's I (Intention) (Ajzen, 2002). Particularly, P_{BC} (Perceived Behavioral Control) has an impact on B (Behaviour) indirectly and directly through behavioural intention. Generally, the more positive the A_B (Attitude toward Behaviour) and S_N (Subjective Norms), the more significant the P_{BC} (Perceived Behavioral Control) and individual's I (Intention) to implement a certain B (Behaviour). Ultimately, given an adequate level of actual control over behavior, it is assumed that people realize their intentions when opportunities arise.

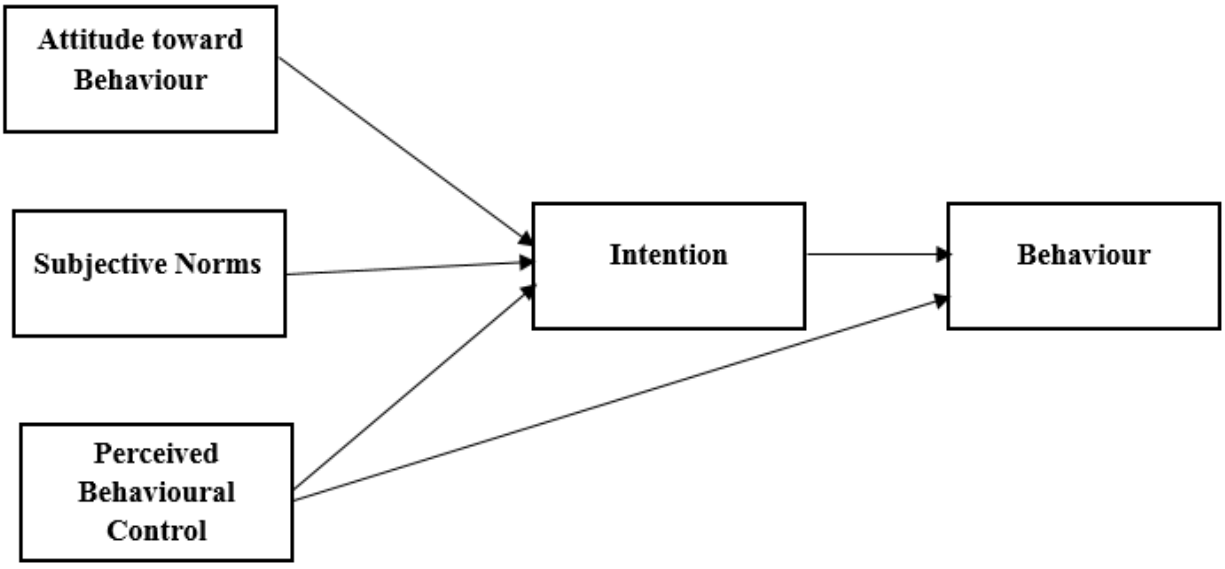

Figure 9: Theory of Planned Behaviour
Source: Based on Ajzen (2002)

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Key variables of TPB: S_N (Subjective Norms) relates to the person's beliefs about whether significant people (i.e., parents, friends, teachers) approve or disapprove of his/her behaviour; C_B (Control Beliefs) relates to the individual's beliefs about the availability of factors that can contribute to or hinder the implementation of behaviour (Amjad & Wood, 2009). P_{BC} (Perceived Behavioral Control) is conceptually defined by the general series of available C_B (Control Beliefs). I (Intention) is individual's readiness to perform a certain behaviour that is based on A_B (Attitude toward Behaviour), S_N (Subjective Norms) and P_{BC} (Perceived Behavioral Control); while B (Behaviour) is considered to be the observed reaction of an individual in a concrete situation towards the given target.

There are some limitations of TPB. Individual's emotions (unconscious influences) were not integrated into the model as one of the factors that might impact on generating intentions. According to Sniehotta (2009), most TPB related studies are correlational. More evidence from randomized experiments might be useful in research. The rational nature of TPB does not demonstrate the behavioural effects on cognitions and future behaviour (McEachan et al., 2011).

TPB was successfully applied as a conceptual framework in studies related mostly with a pro-environmental issues context. Karimi & Saghaleini (2021) examined psychosocial factors that might influence farmers' intentions to conserve rangelands and natural resources. Wolstenholme et al. (2021) investigated psychosocial factors associated with the intention to reduce the consumption of red and processed meat in the UK and Italy.

Several studies have proven that TPB more accurately predict commerce-related behavioural intentions than the Theory of Reasoned Action. Thus, TPB has increased the predictability of intention in different issues related to commerce, i.e. in online shopping etc. Berki-Kiss & Menrad (2022) examined consumer intentions to make pro-social purchases in Germany. The main contribution of their study was the finding that emotions significantly influenced the intention of the target group. Applying TPB by decomposing belief constructs, Gangwal & Bansal (2016) found that A_B (Attitude toward Behaviour), S_N (Subjective Norms) and P_{BC} (Perceived Behavioral Control) are the direct antecedents of the intention to accept m-commerce in India. Lim & Dubinsky (2005) extended the original TPB by decomposing belief constructs and by comprising interdependency terms between noticeable beliefs to provide more concrete explanation of consumers' intention to purchase on the Internet. The findings of this research supported the existence of interdependencies between salient beliefs in TPB. By evaluating these studies on applying TPB to m-commerce acceptance and usage, it was verified

that the decomposition of TPB allows an individual's behaviour and intention related to e-commerce adoption to be precisely forecast.

3.1.5 Decomposed Theory of Planned Behaviour (DTPB), its Limitations and Application to e-commerce

The Decomposed Theory of Planned Behaviour (DTPB) decomposes A (Attitude), S_N (Subjective Norms) and P_{BC} (Perceived Behavioural Control) into multi-dimensional belief determinants. According to Taylor & Todd (1995), DTPB proved its effectiveness in explaining behaviour.

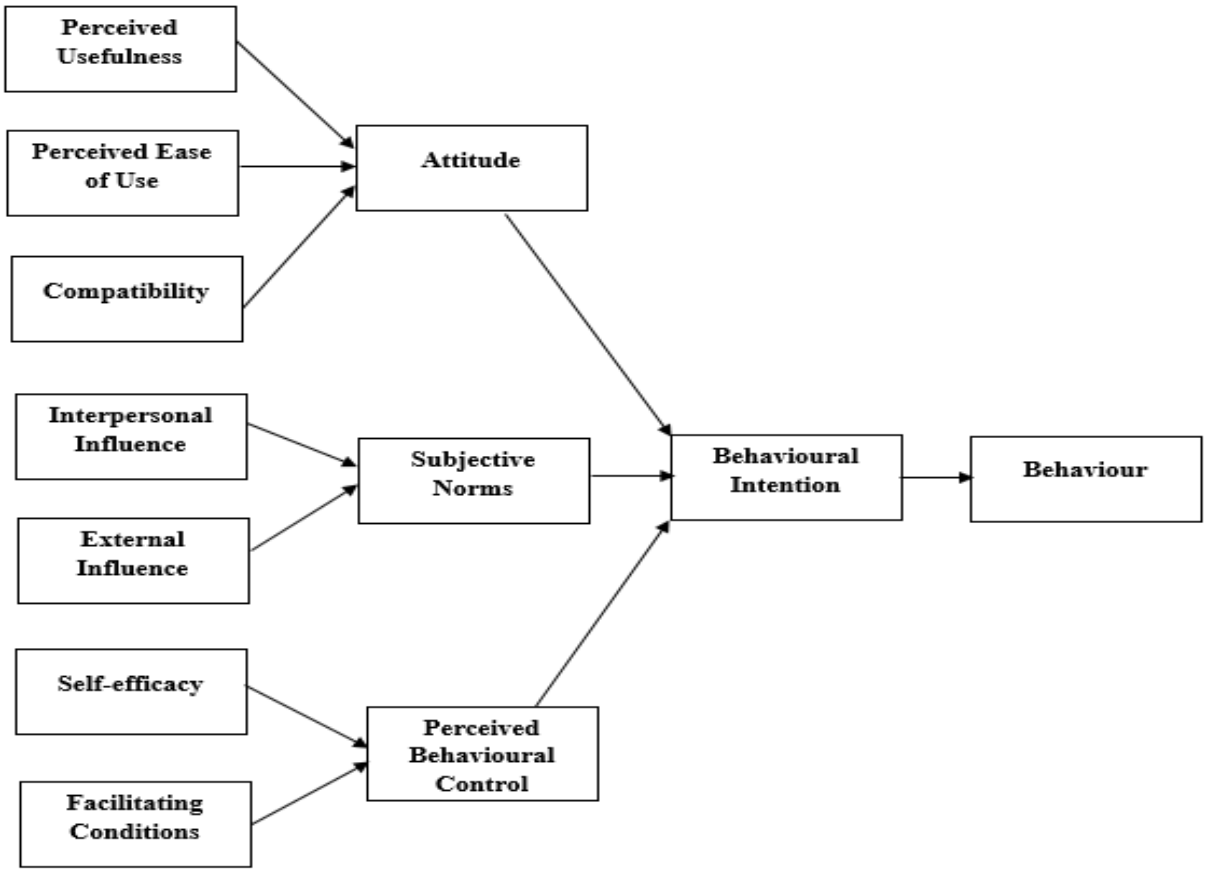

Figure 10: Decomposed Theory of Planned Behaviour
Source: Based on Taylor & Todd (1995)

In the model proposed by Taylor & Todd (1995), the original components of the Theory of Planned Behaviour were used as the basis for DTPB, as shown in Figure 10. In this sense, the A (Attitude) dimension it can be verified by three related attributes: (1) PU (Perceived Usefulness) is a construct previously used in the Technology Acceptance Model and incorporates the characteristics of the RA (Relative Advantage) component, which includes the benefits which users might have, such as convenience or image enhancement; (2) PEOU

(Perceived Ease of Use) was also incorporated into this decomposed model as a factor of complexity that assesses the degree of difficulty of operation or understanding of a particular technology; (3) C (Compatibility) is the degree to which the user adjusts or adapts to the new technology based on his/her previous needs or experiences (Rogers, 1995; Taylor & Todd, 1995; Davis, 1989; Moore & Benbasat, 1991). SN (Subjective Norms) is broken down into the main reference groups in the organizational context. However, only two reference groups are used in the model: peers and superiors, excluding subordinates from the model (Taylor & Todd, 1995). As the last component of analysis, P_{BC} (Perceived Control Behaviour) comprises internal and external beliefs, which are self-efficacy, facilitated resources and technological resources. Self-efficacy is an internal belief related to perceived abilities in relation to the use of technology. The other two attributes are resources and technology, which are considered as facilitating conditions by Taylor & Todd (1995) and Triandis (1977).

Some studies have used DTPB in order to explain individual's actual behavior in technology usage (Taylor & Todd, 1995; Pavlou & Fygenson, 2006). The decomposition of the Theory of Planned Behaviour factors leads to the manipulation of specific factors, those adapted in the initial design phase and implementation, which reveals greater impact on business and helps to overcome the operational problems of other previous models (Mathieson, 1991). However, DTPB is limited in terms of the relationship between its attributes and the existence of high covariances between some of them, such as the case with the influence of peers and superiors or perceived utility and compatibility (Taylor & Todd, 1995). Therefore, DTPB has not been applied to the study of e-commerce usage and acceptance studies.

However, DTPB has been successfully applied as a conceptual framework in studies related mostly with the technology adoption context. Hung, Chang & Ma (2021) examined continuance intention to use mobile AR (Augmented Reality) for entertainment purposes by applying DTPB. The research results showed that S_E (Self-efficacy) significantly influence P_{BC} (Perceived Behavioural Control), but F_C (Facilitating Conditions) insignificantly influence P_{BC} (Perceived Behavioural Control), while A (Attitude), SN (Subjective Norms), and P_{BC} (Perceived Behavioural Control) significantly influence an individual's intention to continue to use AR mobile entertainment applications. Ho et al. (2020) examined factors affecting the behavioural intention to adopt m-banking by integrating DTPB, Innovations Diffusion Theory, and the Technology Acceptance Model. The research findings showed that P_{BC} (Perceived Behavioural Control) and SN (Subjective Norms) had a positive impact on the intention of consumers. These studies enrich the research related with the integration of DTPB and technology adoption.

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3.1.6 Technology Acceptance Model (TAM), its Limitations and Application to e-commerce

The Technology Acceptance Model (TAM) is a model that predicts the acceptability of an information system(s) by individuals. TAM comprises a number of primary factors that impact on individuals' decision in usage of a certain technologies. Davis (1989) used the following definitions:

1) PU (Perceived Usefulness): "the degree to which a person believes that using a particular system will highlight him/her or his/her job performance".
2) PEOU (Perceived Ease of Use): "the degree to which a person believes that using a particular system will be released from effort".
3) AU (Actual Usage): "the end-point where people use the technology"; BI (Behavioural Intention): "a factor that leads people to use the technology"; A (Attitude toward Using): "the general impression of the technology".

According to Davis (1989), TAM is based on the combination of two models, the Theory of Reasoned Action and the Theory of Planned Behaviour. The model provides a theoretical basis in order to understand and evaluate users' acceptance and usage of new technologies, allowing IT (Information Technology) implementers to develop and implement better systems. TAM has been tested in many investigations and in various contexts and has proven to be a reliable tool to understand technologies acceptance. TAM has been investigated and extended continuously. There are two major extensions of TAM: the extended Technology Acceptance Model and the Unified Theory of Acceptance and Use of Technology.

Several scholars have reduplicated and modified the primary study of TAM in order to provide experimental proof of the correlations among PU (Perceived Usefulness), PEOU (Perceived Ease of Use), and A (Attitude toward Using). Adams et al. (1992) tried to show the existence of the validity and reliability of Davis' research instrument and its measurement scales. The researchers extended the research to different configurations and demonstrated internal consistency and replication reliability using different samples. Hendrickson et al. (1993) found out high, good reliability of the test and its verification. Some researchers re-examined the work of Adams et al. (1992) and criticized the measurement model by suggesting a different model based on PU (Perceived Usefulness) and PEOU (Perceived Ease of Use) as shown in Figure 11. These findings do not seem to have been replicated yet. Moreover,

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Workman (2007) tested some aspects of the abovementioned findings, dividing the endogenous variables into information use versus technology use.

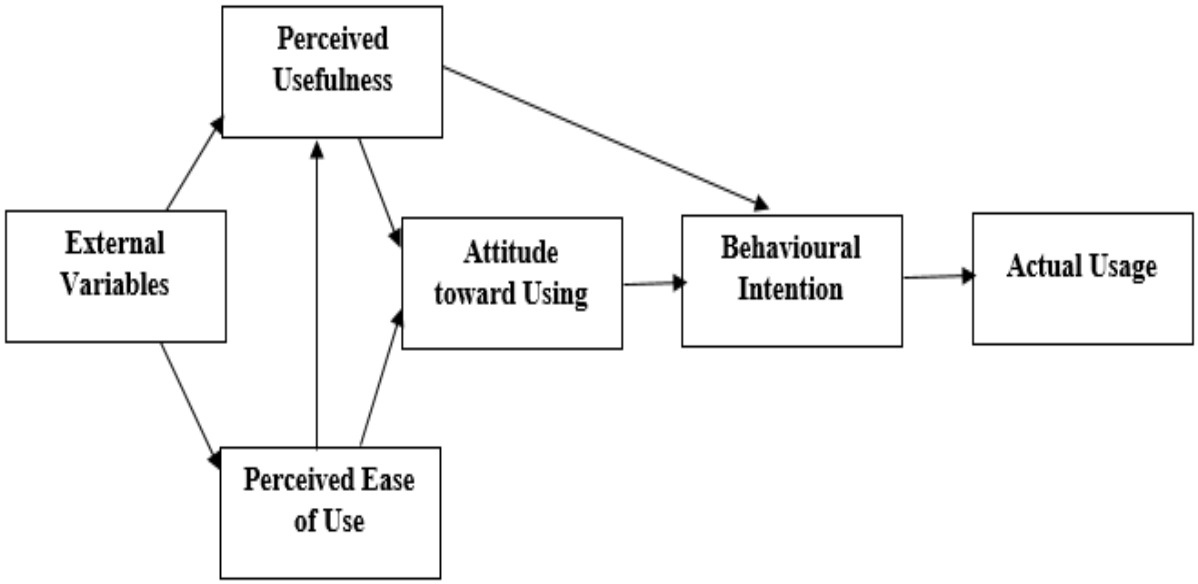

Figure 11: Technology Acceptance Model
Source: Based on Davis (1989)

There are several models that can be considered as an alternative to TAM:

MPT: Scherer (2005) created the Matching Person and Technology (MPT) model as a component of his research dissertation funded by the NSF (National Science Foundation). Scherer (2005) stated that the "MPT model is accompanied by evaluation measures used in the selection of technology and in decision-making, as well as in the investigation of results in the differences between users, non-users, evaders and reluctant users of technologies".

HMSAM: The Technology Acceptance Model is effective in giving an explanation in online learning systems, web-portals usage, etc. by individuals (Fathema et al., 2015). TAM is not acceptable in giving an explanation of hedonistic systems usage. Lowry et al. (2013) formulated HMSAM (Hedonistic Motivation System Adoption Model) in order to upgrade the understanding of the adoption of HMS (Hedonistic Motivation Systems). Lowry et al. (2013) stated that "HMS are systems used primarily to satisfy the intrinsic motivations of users, such as in online gaming, virtual worlds, online shopping, online learning/education, social networks etc.".

TAM2: Venkatesh & Davis (2000) proposed TAM2 by extending the original TAM. The main objective of TAM2 is to examine the impact of external variables on user attitudes, behavioral intention and usage behaviour.

The TAM model has been employed frequently in research, but the authors of TAM have tried to redefine it due to a wide range of critiques. According to Mathieson (1991), TAM

received critiques as being too parsimonious and not comprehensive. Moreover, TAM does not involve an SI (Social Influence) factor that can directly influence technology acceptance (Bagozzi, 2017). Despite this, several studies have used TAM to predict individuals' behaviour towards the use of e-commerce systems. PU (Perceived Usefulness) and PEOU (Perceived Ease of Use) are the only direct determinants of the attitude that make it possible to explore a series of external variables on the intention of technology use (Davis, 1989; Venkatesh & Morris, 2000). According to the literature review, TAM is the most widely used model/theory in technology acceptance research on online commerce. However, some authors have criticized its parsimony (Hu et al., 2003). TAM was successfully applied and validated as a conceptual framework in studies related mostly with the technology adoption context and/or safety management context. Alwabel & Zeng (2021) successfully formulated and validated a predictive model integrating 37 factors into TAM that shape the influence of machine learning on technology adoption. Wong, Man & Chan (2021) examined the acceptance of personal protective equipment (safety training, safety supervision, safety-offense points system, safety consciousness) by construction employees. PU (Perceived Usefulness) and PEOU (Perceived Ease of Use) were crucial determinants of the PPE acceptance by construction employees. Cho, Chi & Chiu (2020) investigated the relationships among PEOU (Perceived Ease of Use), PU (Perceived Usefulness), satisfaction, investment size, quality of alternatives, commitment, and continuance intention by integrating TAM and IM (Investment Model). The findings of their study reveal how health/fitness app users maintain a relationship with IT (Information Technologies) systems. Fedorko et al. (2018) methodically examined the effect of individual's experience factors on e-commerce site visiting through modifiying constructs of TAM. Results suggest that modern technologies have a direct impact and are therefore directly related to the frequency of using the e-commerce websites. Fayad & Paper (2015) incorporated TAM in e-commerce research by adding four exogenous variables, such as process satisfaction, outcome satisfaction, expectations and e-commerce usage factor.

By evaluating these studies on applying TAM on e-commerce acceptance and usage, it has been established that PU (Perceived Usefulness), PEOU (Perceived Ease of Use) formulate and demonstrate benefits from using e-commerce. However, these two variables alone do not seem to be sufficient, Chen & Tan (2004) empirically examined the theoretical model regarding the consumers' perception about using virtual stores through the use of both TAM and Innovations Diffusion Theory. The findings reveal PU (Perceived Usefulness) and PEOU (Perceived Ease of Use) positively affected virtual store use, a finding that might yield insights

that can help virtual stores better target the needs of different market segments. Therefore, both constructs were involved in the research model of the current study.

3.1.7 Extended Technology Acceptance Model (TAM2), its Limitations and Application to e-commerce

The Extended Technology Acceptance Model (TAM2) incorporates PU (Perceived Usefulness) and usage intentions as they are related to the processes of social influence and cognitive processes. The following variables are added to TAM2, as shown in Figure 12 (Venkatesh & Davis, 2000):

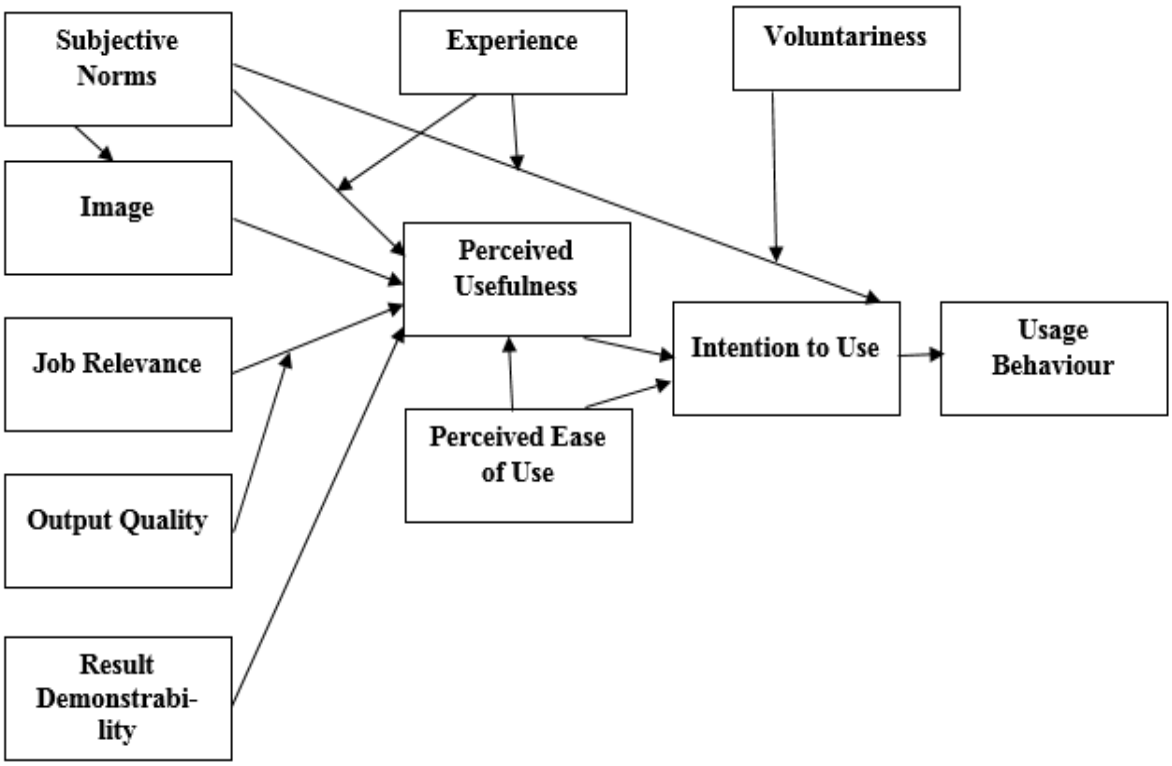

Figure 12: Extended Technology Acceptance Model
Source: Based on Venkatesh & Davis (2000)

The variables are explained by Venkatesh & Davis (2000) as follows:

1) Subjective Norms: "refer to the belief that an important person or group of people will approve and support a particular behaviour".
2) Voluntariness: "degree to which people perceive that the decision to adopt a tool is not mandatory".
3) Image: "degree to which is perceived that the use of a system improves one's social status".
4) Experience: "experience regarding the use of a system".

5) Relevance at work: "perception about the degree of application of a system at work".
6) Output quality: "perception of the quality of the performed tasks in the system".
7) Demonstrability of results: "the tangibility of the results obtained by the system".

TAM2 confirms the relevance of the original model and identifies the significance of social influence factors (subjective norms, image, experience and voluntariness) and the additional influence of instrumental cognitive factors (relevance in the work, quality of the result and evidence of the result) as the determinants of the perceived utility towards the intention of using technological systems. There are some limitations that have been acknowledged by the proposers of TAM2: in each four longitudinal studies the number of participants was less than 50; a wide range of determinants was measured with only two items; independent variables were eliminated by researchers without any explanations (Venkatesh & Davis, 2000).

TAM2 has been successfully validated in several technology adoption studies. Zhong, Oh & Moon (2021) examined determinants that drive Chinese customers' intention to use facial recognition payment. The findings of the research yield theoretical and practical insights that might be an indicator for studies related to facial recognition payment in other countries' contexts. Lew et al. (2020) examined the acceptance of a mobile wallet among consumers. Van Raaij & Schepers (2008) made a collaboration of TAM2 with the Unified Theory of Acceptance and Use of Technology in order to increase the predictive power of TAM2. This research used the extended TAM as a main model to evaluate the adoption of the Teletop online management system in China among Master's students with the aim of identifying the cultural differences among Asian students (all participants were Asian from different countries/cultures). Guzzo et al. (2012) used TAM2 to investigate how social influence can impact on e-commerce adoption by clienteles in the context of social networks. By evaluating these studies on applying TAM2 on e-commerce acceptance and usage, it has transpired that social influence formulates and demonstrates benefits from using e-commerce.

3.1.8 Combined TAM and TPB (C-TAM-TPB), its Limitations and Application to e-commerce

Taylor & Todd (1995) combined the Theory of Planned Behaviour from the social psychology field with the Technology Acceptance Model from the information technologies field in order to provide a full view of the significant constructs of information technology usage. The hybrid model is called the Combined TAM and TPB (further C-TAM-TPB) and is

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shown in Figure 13. Safeena et al. (2013) described it in this manner: "TAM and TPB theories supposed that behavior is determined by the intention to perform the behavior. Intention itself is determined by the attitude towards behavior. The constructs of TAM do not fully reflect the specific influences of technological and usage-context factor that may change user's acceptance". Taylor and Todd (1995) found the correlations between the determinants involved in the C-TAM-TPB model which are moderated by the experience of the individual. Their research hypothesized that the influence of PU (Perceived Usefulness), A (Attitude), and P_{BC} (Perceived Behavioral Control) on behavioural intention was more significant in the case of individuals who have more experience. Conversely, the influence of S_N (Subjective Norms) was mitigated under high levels of experience.

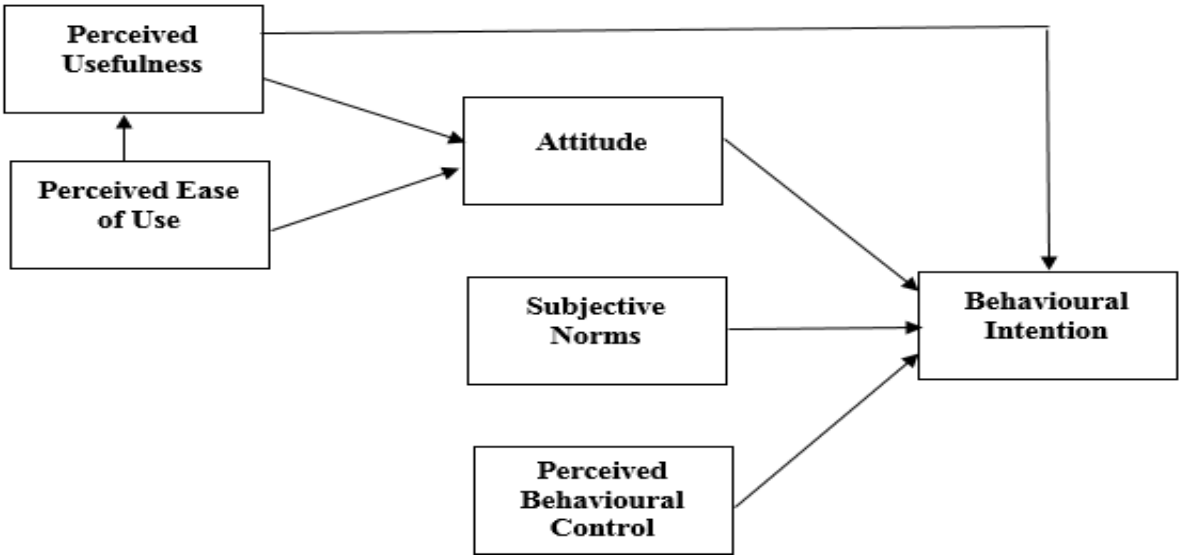

Figure 13: Combined TAM and TPB

Source: Based on Taylor & Todd (1995)

C-TAM-TPB has been applied extensively in the context of the sharing economy. Ning et al. (2021) proposed and validated a mathematical model that formulates shared parking acceptance by integrating C-TAM-TPB model. Liang, Eccarius & Lu (2019) examined factors that influence the behavioural intention of demanders to use shared parking. Riemenschneider & McKinney (2001) tested TPB and analyzed the beliefs of SME executives regarding the adoption of e-commerce. Riemenschneider et al. (2003) examined the factors that impact on the acceptance of the websites by small and medium enterprises; the researchers investigated models separately, partially and fully integrated and found that the aggregated model provides a better fit than the Technology of Planned Behaviour and Technology Acceptance Model do separately.

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3.1.9 United Theory of Acceptance and Use of Technology (UTAUT), its Limitations and Application to e-commerce

The Unified Theory of Acceptance and Use of Technology (UTAUT) is a technology acceptance model created methodically by Venkatesh et al. (2003). The objective of UTAUT is to interpret the intentions of consumers in the usage of information technologies and the consumer's behaviour in subsequent usage. This theory maintains four main exogenous determinants: PE (Performance Expectancy), EE (Effort Expectancy), and SI (Social Influence) are the direct determinants of BI (Behavioural Intention), FC (Facilitating Conditions) is a direct determinant of BU (Use Behaviour). Moderating variables (i.e. gender, age, experience, and voluntariness) are applied to moderate influence of exogenous variables on BI (Behavioural Intention) as shown in Figure 14. UTAUT was improved by reconsidering and aggregating the determinants of eight models that had been used in previous research to interpret usage behaviour in the information systems field. Subsequent validation in a longitudinal research showed that it had explanatory power of 70% in behavioural intention and approximately 50% in actual usage.

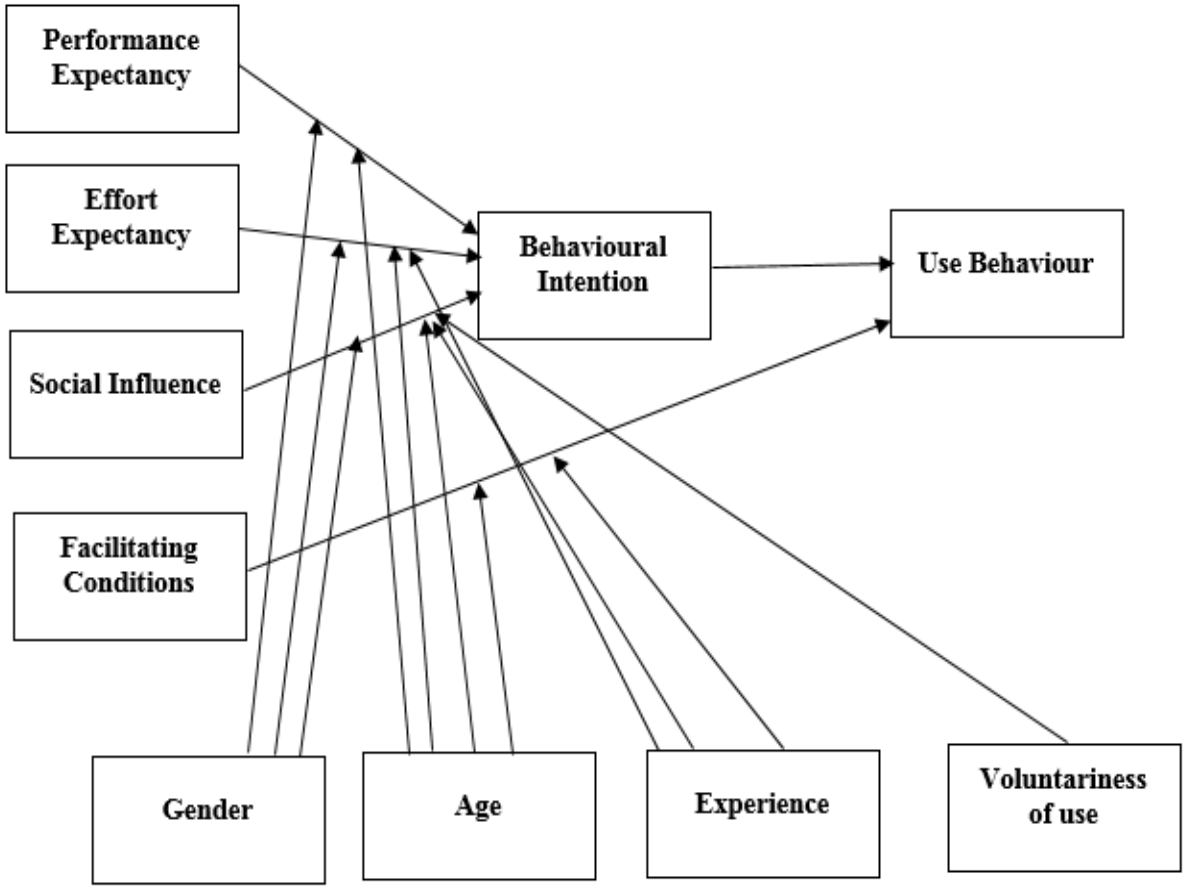

Figure 14: United Theory of Acceptance and Use of Technology
Source: Based on Venkatesh et al. (2003)

Koivimäki et al. (2008) employed UTAUT in order to examine the perceptions of 243 individuals on mobile technologies and services adoption in Finland; Eckhardt et al. (2009) applied UTAUT to their research in order to examine the social influence of workplace groups (supervisors, colleagues) on the intention of employees in technology adoption; Curtis et al. (2010) applied the model to the acceptance of social media by 409 US nonprofit organizations.

Bagozzi (1990) criticized UTAUT and its extensions, claiming that a model with 41 independent variables to predict intentions and at least 8 other independent variables to predict behaviour might reach a state of chaos. UTAUT brings together many branches of knowledge in order to explain the decisions taken. Van Raaij & Schepers (2008) criticized UTAUT for being less parsimonious than the Technology Acceptance Model and the extended Technology Acceptance Model, since the highest level was achieved only during the main interrelations with four moderators. The researchers pointed out that the categorization of elements and determinants is questionable due to a variety of different elements being integrated to represent an unified psychometric determinant. Guo (2010) examined the factors that influence individuals in the usage of B2C (Business-to-Consumer) in his exploratory study. Guo (2010) criticized UTAUT and Technology Acceptance Model for eliminating the threat estimation encountered in e-commerce transactions and perceived estimation constructs encountered in Internet transactions.

UTAUT has been successfully employed in an e-commerce adoption context. Jadil, Rana & Dwivedi (2021) examined 127 m-banking studies that were conducted in 39 countries by the UTAUT model. Patil et al. (2020) developed a meta-UTAUT model in order to examine Indian consumer use behaviour towards m-payment. Cao & Niu (2019) proposed a context-awareness integrated UTAUT model which explains Alipay user adoption. Zhou et al. (2021) investigated Chinese consumers' intention to use live e-commerce shopping. UTAUT along with ITM (Initial Trust Model) was applied to examine C2C (Consumer-to-Consumer) e-commerce usage in emerging markets. Results from the study demonstrated that PE (Performance Expectancy) had a highly significant impact on BI (Behavioural Intention); likewise BI (Behavioural Intention) had a significant influence on BU (Use Behaviour) (Ofori et al., 2018). UTAUT was also used to explore the strength of the determinants on e-commerce acceptance amongst women entrepreneurs in India. The results showed that PE (Performance Expectancy), EE (Effort Expectancy), and SI (Social Influence) significantly influenced BI (Behavioural Intention) of businesswomen to use e-commerce (Goswami & Dutta, 2017). By evaluating the research on applying UTAUT on e-commerce acceptance and usage, it appears that main constructs formulate and demonstrate benefits of using e-commerce.

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3.2 Comparison of Technology Acceptance Models

The above-mentioned technology adoption models/theories were all developed in order to predict an individual's behavior/intention and assess the level of adoption and contentment of individuals in ICT (information and communication technologies) usage. The prediction and assessment have been developed from constructs and the field in which the theories/models have been developed. Technology adoption theories/models can be categorized by (1) their method of development, or, (2) the scientific field. These two categorizations are developed from deep understanding of the origin of technology adoption theories/models and from the relation between the individual's behavior with psychology, sociology, and ICT.

The comparison of technology adoption models is important to create a theoretical paradigm that might provide a general pattern of basic concept of models that have been employed on the technology adoption setting. Well-known theories are derived from different backgrounds: the Innovation Diffusion Theory from sociology, the Theory of Reasoned Action from social psychology, the Theory of Planned Behaviour and the Social Cognitive Theory from psychosocial theories (Bouten, 2008; Gagnon et al., 2006). The above-mentioned theories are effective in predicting and explaining human behaviour. The Technology Acceptance Model, the Theory of Planned Behaviour, the Theory of Reasoned Action, the Extended Technology Acceptance Model, and the Unified Theory of Acceptance and Use of Technology are well-known technology adoption models that are being applied in various environments, specifically in information systems research. Because the author intends to use a solid approach to predict usage behaviour and behavioural intention, therefore the author refers especially to the report of Venkatesh et al. (2003) and Kripanont (2007) where the researchers differentiated models/theories and determined their abilities to explain behavioural intention based on empirical data, summarized in Table 6.

Table 6: Technology acceptance theories/models comparison

Theories	**Exogenous variables (constructs)**	**Moderators**	**Explained variance (R^2)**
IDT	Relative advantage, Ease of use, Result demonstrability, Triability, Visibility, Image, Compatibility, Voluntariness of use	Experience	40%

DOI: 10.14750/ME.2022.014

SCT	Outcome expectation, Self-efficacy, Affect, Anxiety	___	36%
TRA	Attitude toward behavior, Subjective norm	Experience, Voluntariness	36%
TAM	Perceived usefulness, Perceived ease of use, Subjective norm	Experience, Voluntariness	53%
DTPB	Attitude toward behavior, Subjective norm, Perceived behavioral control	Experience, Voluntariness	36%
C-TAM-TPB	Attitude toward behavior, Subjective norm, Perceived behavioral control, Perceived usefulness	Experience	39%
UTAUT	Performance expectancy, Effort expectancy, Social influence, Facilitating conditions	Gender, Age, Experience, Voluntariness	69%
MPCU	Job fit, Complexity, Long term consequences, Affect towards use, Social factors, Facilitating conditions	Experience	47%
MM	Extrinsic motivation, Intrinsic motivation	___	38%

Source: Based on Venkatesh et al. (2003) & Kripanont (2007)

The juxtaposition of the heavily weighted models such as the Theory of Reasoned Action, the Technology Acceptance Model, the Theory of Planned Behaviour, the Decomposed Theory of Planned Behaviour, augmented TAM, and the Unified Theory of Acceptance and Use of Technology models relates with the determining IT adoption and usage that helps to distinguish similarities and differences among them.

3.2.1 TAM vs. TPB

The TAM and TPB models are successors of TRA, and as a result these models are based on the SCT model. Particularly, both models propose that environmental beliefs have an impact

on cognitive beliefs, which subsequently might influence attitude and targeted behaviour. There is a difference between the models in their core constructs: TAM considers BI (Behavioural Intention) as the outcome of PEOU (Perceived Ease of Use) and PU (Perceived Usefulness); while TPB considers BI (Behavioural Intention) as the outcome of control and situational beliefs (Ajzen, 1991; Davis, 1989).

TAM does not investigate external and internal beliefs; but shows significant explanatory variance in internal situational beliefs measured by PU (Perceived Ease of Use), but is less acceptable within external control beliefs. The TPB model, in comparison with TAM model, is less relevant, with an explanatory power of 4-5% in BI (Behavioural Intention) and 1% in BU (Usage Behaviour) (Mathieson, 1991). In Mathieson's study, TAM had a low advantage over TPB, in spite of models' explanatory power being almost the same. TAM performed with 69% variance and TPB performed with 60% variance when using both models in predicting students' intention to adopt electronic documents (Mathieson, 1991). Later Chau & Hu (2002) also examined variance, finding values of 40% for TAM and 32% for TPB in predicting phycisians' adoption of telemedicine technologies. On the other hand, Taylor & Todd's (1995) study finds TAM's variance to be 52% and TPB's to be 57% finding out that TPB had a slight advantange in comparison with TAM. In conclusion, TAM appears to have some advantages over TPB in explanatory power and its parsimonious structure is capable of predicting consumer intention in the adoption of technologies.

3.2.2 DTPB vs. TPB

DTPB and TPB models are also successors of TRA, and are models that estimate an user's deliberated, planned attitude. The major difference between them is that in TPB the variable of BI (Behavioural Intention) is formed by A (Attitude), SN (Subjective Norms) and PBC (Perceived Behavioural Control), whereas DTPB's aim is to be generalisable across situations due to the absence of explanatory power in BI (Behavioural Intention) (Taylor & Todd, 1995). Taylor & Todd (1995) juxtaposed TAM, TPB, and DTPB in a study involving students of business schools. DTPB's variance was found to be 60% in BI (Behavioural Intention) and 76% in A (Attitude); while DTPB's variance was 57% in BI (Behavioural Intention) and 58% variance in A (Attitude). In conclusion, DTPB has advantages over the original TPB in increasing explanatory power and explains the antecedents of behaviour by complementary belief determinants:

1) C (Compatibility), PEOU (Perceived ease of use), and PU (Perceived Usefulness) are the key determinants in predicting AB (Attitude towards Behaviour).
2) SN (Subjective Norms) includes PI (Peer Influence) and SI (Superior's Influence).
3) Technology and resource facilitating conditions and SE (Self-efficacy) are the main elements of CI (Control Influence).

DTPB provides better diagnostic value into the factors that have an impact on Information Technology usage (Taylor & Todd, 1995). DTPB is more favorable in explaining distinguished beliefs of users in the adoption of cutting-edge technologies.

3.2.3 TAM vs. TRA

Davis et al. (1989) juxtaposed TAM with TRA:

1) PEOU (Perceived Ease of Use), PU (Perceived Usefulness), and BI (Behavioural Intention) are the only core detreminants of the framework in the integration of TAM and TRA.
2) SN (Subjective Norms) is a poor psychometric standpoint, despite being a crucial construct of behavioural intention.

Generally, the comparison showed that TAM is parsimonious and applicable for use across various study frameworks. TAM is more favorable in comparison with TRA and TPB regarding parsimonious scope (Han, 2003)

3.2.4 TAM vs. TPB vs. DTPB

All three models are derivatives of TRA. TAM was better than TPB from the explanatory power perspective and in explaining BI (Behavioural Intention); TPB was better than DTPB from the explanatory power perspective, but less efficient in explaining BI (Behavioural Intention). From the subchapters above, it can be concluded that TAM and DTPB are more accurate than TPB. The main difference between models is that the TAM model does not consist of SN (Subjective Norms) and PBC (Perceived Behavioural Control) as the constructors of BI (Behavioural Intention), which restrains its applicability to investigate BI (Behavioural Intention) when individuals have a low level of volitional control. On the contrary, TPB and DTPB are more advantageous in explaining users' behaviour adoption within obligatory situations. From the explanatory power perspective, Taylor & Todd (1995) found that TAM=52%, TPB=57%, DTPB=60% of variance; Lin (2007) found TAM=41%, TPB=46%,

DTPB=57% of variance; and Huh et al. (2009) found TAM=61%, TPB=59%, DTPB=63% of variance showing that TAM and DTPB models are more favourable in explaining intention to accept information technologies.

3.2.5 TPB vs. DTPB vs. TRA

TRA is the extension of the psychological theory SCT, while TPB is an extension of TRA. Ajzen (1985) claimed that "usage behaviour in TRA and TPB models is influenced by an individual's behavioural intention, which alternately is defined by the individual's attitude and subjective norms towards behavioural intention". Nevetheless, TPB has an additional factor ─ PBC (Perceived Behavioural Control) ─ as a predictor of BI (Behavioural Intention) and BU (Usage Behaviour) which can be advantageous in predicting behaviour under low or no volitional control (Ajzen, 1991). Taylor & Todd (1995) compared the TPB, DTPB, and TRA models and found that DTPB has the highest explanatory power and the lowest parsimonius structure in comparison with other models. Shih & Fang (2004) established that DTPB's BI (Behavioural Intention) shows 66% of variance and its BU (Usage Behaviour) shows 23% of variance, TPB figures are 54% and 24% of variance, respectively, while TRA's results give 46% and 20% of variance, respectively. In conclusion, DTPB is parsimonious and applicable for use across various study frameworks.

3.2.6 TAM vs. TPB vs. TRA

TAM is the extension of TRA. The similarities of both models are that BI (Behavioural Intention) is the major construct of BU (Usage Behaviour) and supposes that indiviuals are rational in making decisions (Davis et al., 1989). Neither model possess SN (Subjective Norms) due to its uncertain theoretical properties and TAM's two core constructors PU (Perceived Usefulness) and PEOU (Perceived Ease of Use) predicting individual's A (Attitude) and BI (Behavioural Intention). Subsequently, TRA and TAM are important models in explaining behaviour to accept information technologies. There is little research comparing TAM, TPB, and TRA. During a comparison of the TRA, TAM, TPB and DTPB models by Venkatesh et al. (2003) in a context where adoption was voluntary found that TAM performed better in comparison with the other models. TAM's variance was 38%, TRA's variance was 30%, and TPB/DTPB's variance was 34% in explaining BI (Behavioural Intention). Generally, all models

have advantages over each other, but TAM exceeds in explanatory power and framework simplicity.

3.2.7 UTAUT vs. TAM2 vs. other models

UTAUT and TAM2 are the derivatives of the models developed by Venkatesh & Davis (2000) and Venkatesh et al. (2003) accordingly. The similarity of both models is examined based on the cross-over effect (Venkatesh & Bala, 2008). The differences are: UTAUT considers moderators as an integrating part of the whole structure; meanwhile TAM2 does not involve demographic variables (i.e., age and gender) (Venkatesh & Morris, 2000). Moreover, UTAUT includes multi-dimensional constructs, while TAM2 incorporates uni-dimensional determinants. Both models possess significant explanatory power, but less parsimonious structure.

In conclusion, Table 7 shows a comparison of different technology acceptance models based on constructs' significance and explanatory power (i.e. R^2), their purposes of study, methodologies, and findings.

Table 7: Comparison of technology acceptance models based on significance and explanatory power (R^2) of constructs

Purpose of Study	Context/Sample/Methodology	Model	Variance	Findings
"Comparative study between TAM and TPB"	"Spreadsheet word program, 262 students, longitudinal study"	TAM	"A = 0.727, PU=0.442, BI=0.69"	"PEOU→PU, PEOU+PU→A, A+PU→BI"
		TPB	"A= 0.388, BI= 0.60"	"PBC+A→BI"
"Comparative study between TAM, TPB, DTPB"	"Computing resource project, 786 students, longitudinal study"	TAM	"BU=0.34, BI= 0.52, A= 0.73"	"PU→BI, PU→A, PEOU→PU, PEOU→A, BI→BU"
		TPB	"B=0.34, BI =0.57, A=0.58, SN=0.50, PBC=0.84"	"A→BI, BI→BU, PBC→BI, PBC→BU, SN→BI"
		DTPB	"B=0.36, BI =0.60,	"PU→A, A→BI, PI→SN, SI→SN,

			A=0.76, SN=0.57, PBC=0.69"	SN→BI, SE→PBC, RF→PBC, PBC→BI, PBC→BU"
"Comparison of TPB and DTPB with TRA"	"Internet banking in Taiwan, 425 individuals, cross-sectional study"	TRA	"BI= 0.46, BU=0.20, A=0.59, SN=0.78"	"A→BI, BI→BU"
		TPB	"BI= 0.54, BU=0.24, A=0.63, SN=0.90, PBC=0.41"	"A→BI, BI→BU"
		DTPB	"BI= 0.66, BU=0.23, A=0.82, SN=0.99, PBC=0.39"	"A→BI, PBC→BI, BI→BU, NI→SN, RA→A, COLX→A, SE→PBC"
"Comparison between TAM, TPB and DTPB"	"IT acceptance in hotel industry in South Korea, 319 employees, cross-sectional study"	TAM	"PU=0.34, A=0.58, BI=0.61"	"PEOU→PU, PEOU→A, PU→A, PU→BI, A→BI"
		TPB	"BI=0.59"	"A→BI, SN→BI, PBC→BI"
		DTPB	"A=0.69, SN=0.38, PBC=0.50, BI=0.63"	"PU→A, COMP→A, PI→SN, SI→SN, SE→PBC, TS→PBC, A→BI, SN→BI, PBC→BI"
"Integrated view of technology acceptance models"	"Healthcare use, 222 PDA Physicians, cross-sectional study"	TPB, TAM, IDT,	"PEOU= 0.70, PU=0.49, SN=0.07, PBC=0.29, BI=0.57, RD=0.31, IMG=0.24"	"PII→RD, PI→PBC, PII→SN, PII→PEOU, RD→PU, RD→PEOU, IMG→PU, PBC→BI, PBC→PEOU, PEOU→PU, PEOU→BI, PU→BI, SN→BI, SN→IMG, SN→PU"
"Extension of TAM and	"Use of internet for online banking,	TAM, TAM2, IDT	"RSK, CO, PU, PEOU, BI, BU> 0.5"	"BI→BU, CO→BI, COMP→BI, COMP→PU,

testing in mobile commerce"	shopping, investing , services in Taiwan, 310 customers, cross-sectional study"			PEOU→PU, PU→BI"
"Unified view of acceptance of information technology: integrated view based on TRA, TAM, MM,TPB, C-TAM-TPB, IDT, SCT"	"Four different organisational systems, 215 employees, longitudinal study"	UTAUT	"BI= 0.70"	"PE x AG→BI, PE x G→BI, EE x AG→BI, EE x G→BI, EE x EXP→BI, FC x AG→BI, FC x EXP→BI"

Source: Based on Abbasi (2011)

*Note: "PEOU=perceived ease of use, PU=perceived usefulness, A=attitude, BI= behavioural intention, BU=Behaviour (usage), PBC=perceived behavioural control, SN=subjective norms, EXP=experience, IMG=image, RD=result demonstrability, G=gender, AG=age, PE=performance expectancy, EE=effort expectancy, SI=social influence, FC=facilitation conditions, SE=self efficacy, COMP=compatibility, PI=peer influence, RF=resource facilitation, RSK=risk, TS=technical support, PII=personal innovativeness in IT, RA=relative advantages, COLX=complexity, CO=Cost".

3.3 Context consideration: Technology Context, Individual Context, Organizational Context, Cultural Context

Integration of moderators into the technology acceptance models or theories leads to the modification of the strength of the relation between an independent and a dependent variables (Imai et al., 2010). Kosar & Mehdi Raza Naqvi (2015) defined a moderator as the "variable that affects the direction and/or strength of the relation between independent or predictor variable and dependent criterion variable". Moderators can be applied within four well-known contexts: the Technology Context, Individual Context, Organizational Context, and Cultural Context (Han, 2003).

The technology context determines the technology factors and their impact on usage behaviour. These are: quality, usability, security, efficiency, information richness, design and their effects on usage behaviour. There are a number of studies based on technology acceptance

theories/models across a wide range of IS applications, mobile commerce services, and B2C applications (e.g. Pedersen & Nysveen, 2003; Pedersen, 2005; Koufaris, 2002).

Individual context includes the main characteristics of personal factors in adoption and acceptance of technologies. Individuals may feature different personal characteristics within an organization or culture. Researchers have used the following types of subjects in order to investigate technology adoption: students in business schools of the universities in North America, physicians, and government employees (Chau & Hu, 2002; Hu et al., 2003; Roberts & Henderson, 2000; Mathieson, 1991; Szajna, 1996; Taylor & Todd, 1995).

Organisational context refers to "the concrete environment where the individual works and the investigated technology acceptance takes place" (Han, 2003). For acceptance of a certain technology, the organization should encourage users to adopt it and create training programmes to increase individual's adoption of technology. Interpretation of technology adoption in the organizational context will help to interpret the impact of organisational factors on the behaviour of the users. Research on technology adoption have been conducted in different kind of organisations, such as in North American universities or dairy farms of New Zealand (Agarwal & Karahanna, 2000; Davis, 1989; Flett et al., 2004).

The cultural context defines the macroenvironment where the investigated user acceptance behaviour may occur. The core cultural factors ─ goals, attitude, practices, customs and others ─ may lead to the acceptance of certain technologies. Researchers should take into consideration the above-mentioned four contexts in order to explain the adoption or non-adoption rate of particular technologies by individuals within a concrete environment and under given conditions. The impact of the above-mentioned context on behavioural beliefs will provide a solid basis for technology acceptance models.

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CHAPTER IV: RESEARCH MODEL AND HYPOTHESES

4.1 Basic Concept of the Research Model

All theories and models of technology acceptance have been applied in many studies for years. Models should be evaluated as much as possible in terms of parsimony and their contribution to understanding (Taylor & Todd, 1995). The Unified Theory of Acceptance and Use of Technology (UTAUT) was adapted and modified as the theoretical basis to propose the conceptual model of this research. The UTAUT model was selected due to its comprehensiveness and a strong background in explaining the various factors of e-commerce applications usage and adoption. Taylor & Todd (1995) suggested that a combination of strong different constructs from various models gives better results than using a single model. Hardgrave & Johnson (2003) proposed that synthesis of constructs from different models and theories generates a more efficient explanatory model.

Generally, intention and/or usage are the key variables in order to measure the behaviour of individuals on the adoption of technologies (Szajna, 1996). Intention or/and usage were the main dependent variables in previous studies, which were focused on adoption of the information and communication technologies (ICT). Apparently, technology acceptance models/theories can be focused either on usage behaviour or on behavioural intention ─ or on both ─ depending whether the research conducted is a cross-sectional study or a longitudinal study. A cross-sectional study is defined by Sekaran (2003) as "an observational study in which data is collected at once or over a period of days, weeks, months", while the longitudinal study is defined as "an observational study in which data from the same sample is collected repeatedly over an extended period of time". The studies below show how behaviour was examined in cross-sectional or longitudinal studies:

1) In longitudinal studies, both intention and usage were examined as the key dependent variables (Szajna, 1996; Venkatesh & Davis, 2000; Venkatesh et al., 2003).

2) In cross-sectional studies, intention was examined as the key dependent measurement (Venkatesh & Morris, 2000; Chau & Hu, 2002).

3) In cross-sectional studies, only usage was examined as the key dependent measurement (Davis, 1989; Szajna, 1994; Lederer et al., 2000).

BI (Behavioural Intention) was examined as the main variable in the cross-sectional studies for technologies that had never been or had just been presented; and where users had no experience or were at the early stage of experience in using a certain technology. In the

longitudinal studies, BI (Behavioural Intention) and BU (Use Behaviour) were the main measurements due to the technologies having been presented a long time ago and users having experience about the given technology.

One of the decisive factors determining the development of electronic commerce is access to ICT and the Internet. Today, the number of Kazakhstani internet users has reached 81% of the country's population. According to the UN (United Nations) assessment on the development of e-government, Kazakhstan is positioned in 28th place among 190 countries. The next stage of development is expected to promote e-commerce applications and technologies actively. The results of activities in this sector are evidenced by the fact that e-commerce turnover in Kazakhstan amounted to about 700M USD, and from year to year it is growing at a fairly high pace, namely more than double (Kuzhukeeva, 2018). However, the future depends on the development of e-commerce, which in recent years has shown a very impressive increase in payments. According to experts, one of the limiting factors in the development of e-commerce is the concern of users for the safety of their funds and the need to refine the quality of service.

Kazakhstani farmers have access to Internet and have experience in using e-commerce applications to a certaint extent. This research is a cross-sectional study due to the data being collected over a short period of time, therefore, BI (Behavioural Intention) is measured as the main dependent variable in order to investigate farmers' intention to use e-commerce applications. BI (Behavioural Intention) is one of the main dependent variables in order to predict BU (Use Behaviour) in the future. Farmers' intention to use e-commerce applications might impact on the degree of future usage of the extended version of e-commerce applications.

Venkatesh et al. (2003) proposed the basic concept of technology adoption models/theories by suggesting that individual's reactions to using ICT might impact on their intention to use ICT and consequently, their intention to use ICT on actual usage of ICT, as shown in Figure 15.

Figure 15: Basic concept of underlying user acceptance models
Source: Based on Venkatesh et al. (2003)

The theoretical framework is defined as the group of theories/models from the previous research and a set of the theoretical considerations based on research projects, analyses, hypotheses or experiments that lead to interpretation of the results and the formulation of

conclusions. The importance of the theoretical framework is that it allows us to justify, demonstrate, support, and interpret the hypotheses and the results of an investigation in an orderly and coherent manner.

The theoretical framework incorporated two main categories of variables as shown in Figure 16.

1) There are five exogenous variables (independent variables): Perceived Usefulness, Perceived Ease of Use, Social Influence, Facilitating Conditions, and Compatibility. These exogenous variables are expected to impact on the behavioural intention to use e-commerce applications.

2) There are two endogenous variables (dependent variables): BI (Behavioural Intention) and BU (Use Behaviour). Intention to use e-commerce applications is expected to influence usage of e-commerce applications.

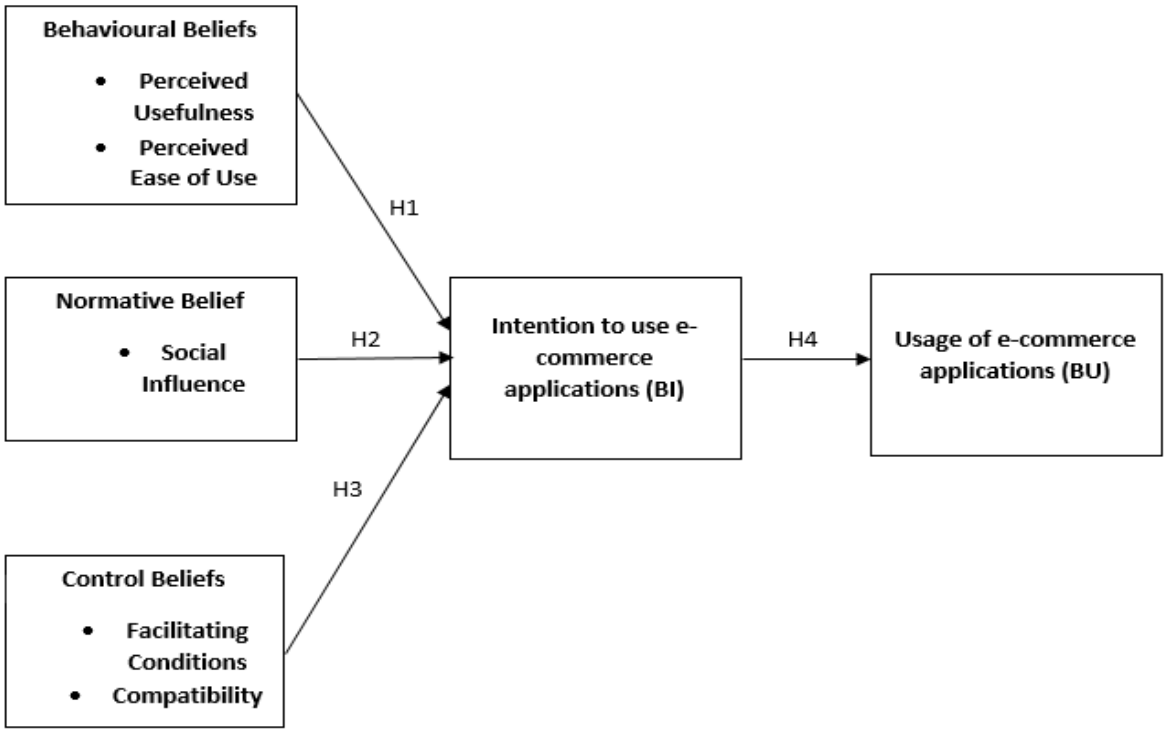

Figure 16: Proposed research model
Source: Based on Venkatesh et al. (2003)
*Note: BU=Usage Behaviour, BI=Behavioural Intention

4.2 Research Hypotheses

Direct Path Hypotheses were tested in order to investigate the effect of exogenous variables on intention to use e-commerce applications by farmers, and the effect of BI (Behavioural Intention) on BU (Use Behaviour). The major constructs such as Perceived

Usefulness, Perceived Ease of Use, Social Influence, Facilitating Conditions, and Compatibility are integrated in the proposed research model.

Perceived Usefulness is the behavioural belief when users are sure that technology usage improves his/her labor productivity and Perceived Ease of Use is the behavioural belief when users are sure that a certain technology adoption does not cost him/her much effort. These two beliefs are the most important constructs for technology usage (Davis, 1989). The Perceived Usefulness construct has a significant impact on individual's BU (Usage Behaviour) and BI (Behavioural Intention) in ICT adoption. This direct determinant is used in the TAM, TAM2, C-TAM-TPB models; this construct is analogous to the PE (Performance Expectancy) construct of the UTAUT model, to the RE (Result Expectations) construct of the SCT model and to the RA (Relative Advantage) construct of the IDT model (Venkatesh et al., 2003). Findings from Chong et al. (2010) and Wei et al. (2009) demonstrate that PU plays an important role in determining individuals' intentions to use e-commerce applications. It is expected that Perceived Usefulness significantly defines the intention to use e-commerce applications by farmers, since this determinant is employed as a fundamental basis to define the effort that needs to be done to support person's intention to use technology (Venkatesh & Davis, 2000).

Perceived Ease of Use is the behavioural belief that is determined as "the degree to which a person believes that using a particular system would be free of effort" by Davis (1989). This construct is analogous to the EE (Effort Expectancy) construct of the UTAUT model. Perceived Ease of Use has a strong influence on the increase of Perceived Usefulness, described by Lam et al. (2007) as "easy-to-use technology does not take long time to be learned so that users have the opportunity to work on something that is related to performance effectiveness". Perceived Ease of Use and Perceived Usefulness are the constructs that account for 88% of the variance in BI (Behavioral Intention) (Agarwal & Karahanna, 2000). Numerous studies have researched the impact of Perceived Ease of Use on individuals' intention to adopt e-commerce applications (e.g. Hsu et al., 2014; Nassuora, 2013; Sun & Chi, 2017). Davis (1989) proposed that Perceived Usefulness and Perceived Ease of Use describe significantly technology usage by individuals or groups. Moreover, these two variables were also supported from the perspective of behavioural decision theory. It is expected that Perceived Ease of Use will significantly determine farmers' intentions to use e-commerce applications.

Social Influence is the normative belief that is defined as "the degree to which an individual perceives that other important persons believe he or she should use the system" by Venkatesh et al. (2003). Social Influence is analogous to the Subjective Norms construct from the TAM model. Social Influence was validated in several studies in the context of e-commerce

adoption by Kim et al. (2009) and Escobar-Rodríguez & Carvajal-Trujillo (2014). However it was not validated in research of Tan et al. (2013). In this study it is expected that Social Influence will significantly define farmers' intentions to use e-commerce applications.

Facilitating Conditions is the control belief that is determined as "the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" by Venkatesh et al. (2003). Facilitating Conditions possess the possibilities to emphasize the hurdles to the top management of the enterprises in new technologies usage (Taylor & Todd, 1995). This construct was validated in the context of e-commerce adoption by Escobar-Rodríguez & Carvajal-Trujillo (2014) and Tan et al. (2013). Facilitating Conditions is divided into two measurements: Resource Facilititations, which are related to money and time, and Technology Facilitations that are related to the problems that constrain BI (Behavioural Intention) and BU (Use Behaviour) (Taylor & Todd, 1995). Technology Facilitations and Resource Facilitations are included in the formation of Facilitating Conditions construct of this study. Agudo Peregrina et al. (2014) and Wu et al. (2009) found that Facilitating Conditions positively influence intention. Farmers could incorporate e-commerce applications as a marketing strategy in their business, taking into account that Facilitating Conditions (infrastructure, access, costs, internet provider, and connectivity) are provided in their working setting. It is expected that Facilitating Conditions will have a significant influence on farmers' intentions to use e-commerce applications.

Compatibility is the control belief that is determined as a condition where the innovation that must be in accordance with the context and reality of the society should be implemented. In addition, the Compatibility construct is one of the core determinants in assessing the adoption of new technologies in organizations. It was found out that Compatibility has a significant impact on the adoption of the new technologies by the individuals (Tornatzky & Klein, 1982). There are several definitions of Compatibility in the literature. Moore & Benbasat (1991) determined Compatibility as "the degree to which an innovation is related with the users' past experience, values and needs", while Plouffe et al. (2001) determined it as "the degree to which an innovation is related with the individuals' habits and preferences". It is expected that Compatibility significantly defines farmers' intentions to use e-commerce applications.

Generally, the usage of e-commerce applications by farmers in Kazakhstani wheat-oriented farms depends on their willingness to do so. Similar to the previous studies, the current study was conducted in the framework of unconstrained use. Ajzen & Fishbein (1980) stated that "if behavioural intention is closely related to the way how individuals behave, this assumption only applies when the behaviour is under a person's volitional control".

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Consequently, it might be stated that farmers' intention to use e-commerce applications is correlated to farmers' usage behaviour in a case when technology usage depends on the farmers' own willingness. It has been found in previous studies that BI (Behavioural Intention) and BU (Use Behaviour) have a significant relationship (Taylor & Todd, 1995; Venkatesh & Davis, 2000). In conclusion, having the intention to use e-commerce applications will be significantly related to farmers' usage of the extended version of e-commerce applications in the future and this researcher expects that BI (Behavioural Intention) might have a significant influence on BU (Use Behaviour). This expectation is supported by Hee-dong & Youngjin's (2004) conceptual model of the attitude's affective and cognitive dimensions towards information systems usage. TAM claims that intention is an exact determinant to investigate and predict an individual's behaviour toward the adoption of a given new technology. Results from previous research have shown a significant correlation between them. Moreover, the path from BI (Behavioural Intention) towards BU (Use Behaviour) is significant in the TAM, TPB, DTPB and UTAUT models.

My hypotheses are:

H1: Behavioural Beliefs (Perceived Usefulness, Perceived Ease of Use) will positively impact on BI (Behavioural Intention)

H2: Normative Belief (Social Influence) will positively impact on BI (Behavioural Intention)

H3: Control Beliefs (Facilitating Conditions, Compatibility) will positively impact on BI (Behavioural Intention)

H4: BI (Behavioural Intention) has a positive impact on BU (Use Behaviour)

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CHAPTER V: RESEARCH METHODOLOGY

5.1 Research Philosophy and Approach

The aim of this study is to examine the predictors of the individuals' (farmers') adoption beliefs that are established through the impact of behavioural beliefs, normative belief, and control beliefs on behavioural factors. Consequently, the positivist approach justifies the present research from the ontological and epistemological philosophical paradigms. Methodologically the positivist approach is based on the nature of the problem and researchers advocate for this research approach to investigate the research objectives via the formation of hypotheses, experiments, discovery or causal relationship within constructs; via the application of quantitative methods to verify or validate relationships; and via the researcher's independent interpretation (Bryman & Bell, 2007; Chen & Hirschheim, 2004). According to Chua (2005), criteria for acceptance of a positivist approach can be viewed by examining the determinants of behavioural intention and usage behaviour for the adoption of new technologies; therefore, the research objective requires a conceptual framework with a clearly defined number of constructs and their relationships (i.e., independent variables, dependent variables, or moderators). Consequently, developing a conceptual model with rationales to achieve the goal of this research is feasible (Venkatesh et al., 2003). The positivistic approach involves quantitative data, a large sample and the use of existing theory to develop hypotheses to be tested during the research process. The positivistic approach was adopted in this study due to hypotheses being incorporated as the tool to reach the objectives of the current research.

5.2 Research Strategy

Quantitative and qualitative methodologies are associated with the research paradigms. Qualitative and quantitative research varies in its aims, methods, in the flexibility of data collection and in the type of data that is provided. The quantitative methodology approach is more structured and assists the researcher to decrease study bias. It focuses on the behaviour of an individual answering questions such as how many, how often and to what extent. Quantitative data can be used to test hypotheses or predict relationships by using statistical methods. The quantitative research strategy is applicable to this research since it is one of the useful methods in social sciences and directs the researcher to test the reliability and validity of

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previously researched theoretical propositions and hypotheses that are only dependent on experimentation and measurement techniques (Blumberg et al., 2005).

Qualitative research would also be a suitable method for the current research. However, there is a moderate research literature to outline determinants and their relationships (Gilbert, 2001). Qualitative research is not relevant to the present study since the research objectives require the testing of hypotheses related to an individual's behaviour towards the adoption of Information Technologies (IT); moreover, the conceptual framework of this study is formulated on appropriate literature and delineates concrete relationships between determinants needed to investigate the relevant data through quantitative methods (Collis & Hussey, 2003). According to Creswell (2003), validation and verification of theoretical propositions in social and business sciences require a positivist approach based on quantitative methods.

5.3 Survey Research Methodology

In the present study the methods applied are the interview method, employed to collect preliminary information during the exploratory stage of the research; the questionnaire method, employed to collect primary data; and statistical methods, employed for data analysis (Veal, 2005). Zikmund (2003) stated that "survey research is an appropriate method of research because it provides a quick, inexpensive, efficient and accurate means of assessing information about a target population; and facilitates the collection of primary data as a source of information from a sample of people by using questionnaires or interviews". Orlikowski & Baroudi (1991) found that the survey research approach was the most prevalent method in 49% of the research published in high-ranked journals. In addition, survey research is an appropriate method of research because it provides a quick, inexpensive, efficient and accurate means of evaluating data about a target group.

5.3.1 Interview Method for Developing the Questionnaire

Selection of a concrete interview method depends on the interview objectives and the researcher's experience (Creswell, 2007). There is no specific instructions in informal conversational interviews. Interviewers rely upon the cooperation of the interviewees to formulate questions during the interview (McNamara, 2009). The personal interview method was applied to collect preliminary information during the initial stage of the present study. The method of gathering information through personal interviews is usually conducted in structured,

semi-structured and unstructured ways (Kothari, 2004). The interviews were conducted in a face-to-face contact to the farmers in a semi-structured way. This method has its chief merits in that the interviewer can have the opportunity and flexibility to restructure questions as necessary, to rephrase the questions, clarify doubts etc.

The area sampling was chosen for the selection process of the farmers due to being convenient to carry out interviews. Seven farmers were selected from five different farms that are located in a similar geographic area in Nur-Sultan (capital of Kazakhstan). Audio-recording was used to record information, since the degree of complexity of the questions was paramount and the time span of the intreviews took around one hour. The participants did not confront with the audio-recorder usage on the mobile phone. The answers were transcribed based on the audio recordings, afterwards agreed with the participants (the participants had a chance to read the transcriptions, confirm their accuracy, and give permission for their use). The overall structure of the questions were formulated and the interviews were conducted in Kazakh and Russian languages in order to enable interviewees to respond in their own language. The content of all interviews were transcribed and the researcher translated the content into English. Also, the researcher introduced the proposed conceptual model to the participants. The determinants were reviewed to ensure relevance of the conceptual model in the Kazakhstani context. "Interpreting questions" proposed by Kvale (1996) were involved in the interview to ensure that the participants have demonstrated their thoughts and feelings regarding the usage of e-commerce applications.

5.3.2 e-Mail Questionnaire Method for the Main Survey

There are several reasons behind the selection of the mail questionnaire method in the present study as a survey tool. It is the most cost-efficient and practical way to gather quantitative data from a large number of people over a short span of time; quantified information is required concerning a specific population and farmers' behaviour and attitudes that are acceptable as a source of information; mail-in questionnaires also allow respondents to maintain anonymity and privacy which maximizes comfort for those answering (Ticehurst & Veal, 2000). This anonymity puts interviewees at ease and encourages them to answer truthfully. Questionnaires were administered by a freeware email service (Mail.ru) and messaging applications (Whatsapp, Messenger), with a cover letter to all farmers that the information would be strictly handled in consideration of issues of anonimity and privacy. The questionnaire was distributed to 568 respondents in the wheat-oriented farms of Kazakhstan,

approximately 452 questionnaires were received back for a response rate of 79%, and only 384 valid questionnaires were processed for analysis. In order to design the questionnaire for the main survey, in the present study preliminary information collection was conducted through semi-structured interviews according to the information from a literature survey.

The interviews were held between June 1, 2018 and June 25, 2018 within five farms of Nur-Sultan (in the capital of Kazakhstan). At the first stage of the interview, participants were interviewed through a list of predefined open-ended questions in order to examine the working environment of farmers connected with the usage of the e-commerce applications. The information obtained from interviewees provided more details about concrete constructs of interest with supplementary insights of possible constructs that may play a crucial role in the present research and it helped to design the theoretical framework and formal questionnnaire (Ticehurst & Veal, 2000). Main constructs from the literature review were merged with the obtained information from farmers in order to develop an effective questionnaire. The content of the questionnaire is based on information associated with the background of e-commerce usage, profiles of farmers, management support at organizational and governmental levels, etc.

The present study followed Frazer & Lawley's (2000) procedures to develop a well-fitted instrument that consists of 3 phases: instrument content development by selection, categorization, scaling and coding of items; item wording; development of the questionnaire. After identifying and validating measures, the structured questionnaire for the farmers was developed. The questionnaire was designed in an ordinary way to avoid confusing, double-barrelled questions and to stimulate the farmers to respond in a short time and with little effort (Malhotra & Birks, 2003). The developed questions were used to measure the research model that are based mostly on items used in measurements by Venkatesh et al. (2003), Venkatesh & Davis (1996, 2000). The questions were structured and categorized into six sections, from A to F. Sekaran (2000) classified two main groups of scales, i.e. rating and ranking scales in order to measure individual’s behaviour. As a scaling method, the items were chosen for different determinants in the present study. Likert scales were used with seven classified answers, ranging from "strongly disagree" to "strongly agree". Weiers (1988) stated that "respondents may encounter difficulties in answering 9-point scales due to cognitive limitations"; therefore, this study adopted a 7-point Likert scale format.

The general appearance of the questionnaire was designed following Malhotra (2004) in order to stimulate the farmers’ collaboration and emphasize the significance of the current research. The lengh of the questionnaire was relatively moderate in order to increase the response rate (Malhotra & Birks, 2003). The questionnaire fit on five pages, including the

cover letter. The cover letter introduced farmers to the study and explained the research aim, brief contents of the questionnaire, the confidentiality of responses and importance of participation. A brief summary of the questionnaire follows (see Appendix A - Survey Questionnaire):

- **Section A** is comprised of three subsections focused on Demographic variables and Background of farmers' e-commerce usage. Part I consists of six questions (1 to 6) measured on a nominal and ordinal scales to collect background information on the respondents: gender, age, position, farming experience, educational level, type of farm. Part II consists of seven questions (7-13) which are related to farmers' experience and opinion regarding e-commerce usage activities, measured on nominal and ordinal scales. Part III contains four questions (14 to 17) adopted from the study of Venkatesh et al. (2003) that collect information about the circumstances of using e-commerce, which might be the individuals' choice or top-management requirements, i.e. voluntariness (measured on a 7-point Likert scale).
- **Section B** consists of nine questions (adopted from the study of Venkatesh, Morris & Ackerman (2000)) to measure Perceived Usefulness, which are intended to investigate whether farmers consider that e-commerce usage would increase their job performance, and Perceived Ease of Use, which are intended to investigate whether farmers consider e-commerce usage to be effort-free (measured on a 7-point Likert type rate).
- **Section C** consists of eleven questions focused on groups of predictors or constructs: Social Influence (adopted from the study of Lewis et al., 2003), Facilitating Conditions (adopted from the study of Taylor & Todd., 1995) and Compatibility (adopted from the study of Rogers, 1995) towards e-commerce usage (measured on a 7-point Likert scale).
- **Section D** consists of eight questions (adopted from the study of Venkatesh & Bala (2008)) that are related to the farmers' cognitive processes (thinking, feeling, etc.) related to their intention to adopt and use e-commerce. The questions on Behavioural Intention and Use Behaviour are measured on a 7-point Likert scale. BI and BU are the most important determinants of the current research.
- **Section E** consists of ten questions (adopted from the study of Lewis et al., 2003) that related to management support for promoting e-commerce usage within farmers.
- **Section F** consists of nine questions (adopted from Kripanont, 2007) that focus on whether e-commerce usage affects the farmer's professional practice, personal practice, and quality of working life.

DOI: 10.14750/ME.2022.014

5.4 Sampling Methods and Data Collection

- A sample is defined by Kothari (2004) as "a part or subset of elements that are previously selected from a population to conduct a study". It is a technique that offers the same possibility to the elements of being selected, because they are taken at random. Roscoe (1975) proposed the following principles for designating sample size: "sample sizes should be more than 30 and less than 500 are suitable for most studies; sample size should be minimum 30 for each sub-samples; in multivariate research, the sample size should be 10 times or more as large as the number of variables in the study". The respondents of this study were chosen by means of stratified probability sampling method. This sampling method was chosen in order to increase precision and representation of the current study. The population size is individuals (farmers) who were selected from wheat-oriented farms. In this case, the researcher considered 14,813 individuals, based on the number of email addresses provided on the database of Kazakhstani farms (*https://agrobiz.kz/ru/catalog/fermery_12/*). The population was divided into several heterogeneous strata (each stratum consists of around 600 farmers). The selected sample size of the present study was considered as a homogeneous stratum consisting of S=568 individuals (farmers) who were selected from each stratum randomly by their experience in using e-commerce applications and were considered representatives of the population. Moreover, the final sample size of S=384 (only 384 valid questionnaires were received from 568 individuals) is suggested at 95% confidence level and 4.94% margin of error which was calculated on *https://www.surveysystem.com/sscalc.htm*.
- The data collection is defined as "the technique by which the opinions of the interviwees from the targeted population on a concrete topic are collected" by Zikmund (2003). The questionnaire method can be conducted through mail surveys and self-administered surveys (Sekaran, 2000). In the current research, the survey questionnaire method is selected for data collection, which is determined as "a predefined set of written closed structure or open-ended items filled by the respondents" by Sekaran (2000). Particularly, the self-administered survey questionnaire was adopted as the primary source of data collection with the support of e-mailed surveys. Zikmund (2003) and Sekaran (2000) defined the rationales behind selecting the self-administered questionnaire method for data collection, which are (1) it embraces the whole population and a large territory: the targeted population are farmers in wheat-oriented farms in

Kazakhstan, which are spread geographically across fifteen provinces (oblasts) of Kazakhstan. Therefore, to reach individually every farmer for interview seems to be impractical; (2) inexpensive and time-saving: much time and money can be saved in comparison with the interview method since the researcher does not need to sit with the respondent and fill in the data in by him/herself: additional time is gained compared to the delay in the postal service, the costs of printing are saved if an electronic format of the questionnaire is included for distribution, there are no travel expense; (3) respondent's convenience: unlike the interview method, with the self-administered survey method (i.e., mail or e-mail) the respondent is free to think about replies and complete it whenever a convenient time is available to him/her: respondents will not be biased by the researcher's opinion, or by time hassle requirements.

5.5 Data Analysis

The research's statistical analysis consists of two phases. The first phase involved data screening, such as missing data and treatment, outliers examination, normality, homoscedacity, and multicollinearity in order to verify the validity of the data for further analysis. After the data screening, the descriptive statistics represented the farmers' demographic characteristics and their background of personal e-commerce usage. The Statistical Package for the Social Science Version 23 (SPSS) was applied in the first phase. The second stage involved testing the developed model measurements and research hypotheses via the Structural Equation Modelling (SEM). In this phase the measurement model was validated through Confirmatory Factor Analysis (CFA), then the assessment of the structural model with the set of relationships was explained. AMOS Version 21 (Analysis of Moment Structures) was employed for the second phase.

SEM is a family of related statistical techniques that examines the relationships between multiple independent and dependent variables, correlations, error terms in a simultaneous way. SEM is very similar to multiple regression but is much more robust and has greater flexibility in the analysis. The main advantages of SEM are: it helps to examine the impact of independent variables on dependent variables simultaneously; it accounts for measurement error in each variable; it is capable of testing the whole model rather than testing each relationship separately (Collier, 2020). SEM techniques are used in AMOS, LISREL, EQS, MPLUS software programmes. There are two main steps included in SEM: measurement model validation and fitting the structural model. CFA is a statistical technique that is used to test the measurement

model by examining how well indicators measure latent variables. Factor loadings (represented in standardized and unstandardized formats) are the indicators that are used to estimate the impact of latent variables on their indicators should be > 0.70 (we obtain the explained variance by squaring factor loading). After the measurement model is established, path analysis examines the relationships between latent variables via composite variables (Collier, 2020).

5.6 Pilot Study

A pilot study should be conducted to examine the study instrument's feasibility in terms of reliability and validity before the main data collection process (Zikmund, 2003). The recommended size for the pilot study may range from 25 to 100 (Cooper & Schindler, 1998). For the pilot study, 45 questionnaires were distributed to farmers in Nur-Sultan (the capital of Kazakhstan) via e-mail during the month of February, 2019. In total, 31 responses were received from farmers. The participants involved into the pilot study should not be engaged to participate in the final survey, as Haralambos & Holborn (2000) stated "it may influence the later behaviour of the respondents if they have already been involved in the pilot study".

5.6.1 Reliability Analysis

The reliability was defined as "the extent to which a scale produces consistent results if repeated measurements are made on the characteristic" by Malhotra (2004). Reliability was tested through Cronbach's α values which are measured and whose values exceed the cut-off value 0.7 (Hair et al., 2006). The reliability coefficients that are < 0.6 are considered to be poor and > 0.8 are considered to be good (Sekaran, 2000). Table 8 shows the Cronbach's α values for the pilot study with 31 cases.

Table 8: Reliability test of separate constructs measures

Constructs	Number of Items	Cronbach's α	Inter-Item Correlation	Item-to-total Correlation
Use Behaviour	4	0.868	0.385-0.921	0.571-0.785
Behavioural Intention	4	0.817	0.432-0.944	0.504-0.912
Perceived Usefulness	5	0.935	0.728-0.835	0.820-0.890
Perceived Ease of Use	4	0.902	0.547-0.828	0.748-0.853
Social Influence	4	0.824	0.518-0.887	0.751-0.865
Facilitating Conditions	4	0.755	0.301-0.562	0.534-0.674
Compatibility	3	0.814	0.238-0.719	0.347-0.784

Source: Own edition

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Cronbach's α values were > 0.7 and were considered to be acceptable.

5.6.2 Validity of the Instrument

Malhotra (2004) stated that validity refers to the "extent to which the data collected truly reflect the phenomenon being studied. Any scale or measuring instrument that precisely measures what was intended to be measured is said to have validity". The content validity, criterion-related validity, construct validity are the main 3 types of validity instruments for testing goodness of measures.

Hait et al. (2006) stated that content validity "assesses the correspondence between the individual items and the concept through ratings by expert judges, and pre-tests with multiple sub-populations or other means". The content validity of this study was achieved through (1) asking senior experts who have capacious knowledge related to the e-commerce research field to provide their judgements on the questionnaire and to verify whether items corresponded with the concept of the study, and (2) pre-testing with the group of farmers and one pilot study conducted within farmers. Hair et al. (2006) determined the construct validity as "a degree to which a set of items which are quantitatively calculated by observing the correlation between theoretically underpinned set of measurement items". Construct validity can be established through convergent validity, discriminant validity and nomological validity (Peter, 1981). Convergent validity signifies that measuring items of specific construct should converge or share a high proportion of variance in common (Hair et al., 2006; Zikmund, 2003). It is suggested that item-to-total-correlation should be > 0.50 (50%) and inter-item correlation should be > 0.30 (30%) (Robinson et al., 1991). Moreover, Cohen (1988) classified correlations as the small correlation (r) = 0.10 to 0.29, the medium correlation (r) = 0.30 to 0.49 and the large correlation (r) = 0.50 to 1. The results of the inter-item correlation values in each construct (Perceived Usefulness, Perceived Ease of Use, Social Influence, Facilitating Conditions, Use Behaviour, Behavioural Intention) were in both medium and high levels (higher than 0.30, and most of them higher than 0.50), and the item-to-total correlation values were also at a high level (higher than 0.50) (except inter-item and item-to-total correlation values in Compatibility), as shown in Table 8.

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CHAPTER VI: RESEARCH RESULTS AND DISCUSSIONS

6.1 Missing Data and Treatment

The missing data, or missing values is defined by Hair et al. (2006) as "a common occurrence and can have a significant effect on the reduction of the sample size due to the missing data reduces statistical power; any empirical results obtained from a non-random missing data process could be biased and lead to erroneous results". Hair et al. (2006) suggested 4 phases in diagnosing and employing treatments: to identify the type of missing data, to identify the extent of missing data, to examine the randomness of missing data, and to apply the treatment e.g. imputation method.

Missing data can be categorized as ignorable and non-ignorable. Ignorable missing data do not require any specific treatment procedures, whilst non-ignorable missing data require certain steps of applying treatments on data. In the current study the missing data could not be categorized as ignorable because the incomplete data cannot fit the saturated model during using AMOS. Hair et al. (2006) suggested identifying the extent of missing data by tabulating the percentage of variables with missing data for each case(s) and for each variable(s). The table was generated by SPSS missing data analysis (see Appendix B - Univariate Statistics). In the current study missing data ranged from 0.3% to 1.8%. During the analysis the missing data can not be neglected due to the fitting of the saturated model being one of the AMOS's main requirements. Tabachnick & Fidell (2001) stated that "the extent of missing data 5% or fewer in random patterns is considered moderate and almost every treatment gives the same results".

Listwise, Pairwise, EM (Expectation Maximisation), Regression techniques can be used in terms of identifying the randomness of the dataset. In the current study, EM (Expectation Maximisation) technique was applied to diagnose the randomness of the dataset, showing that Little's MCAR test was insignificant, i.e. χ^2 = 2283.614, *df* = 2241, *sig.* = .260. A large *p*-value (> 0.05) is usually interpreted as weak evidence against the null hypothesis, thus fails to reject the null hypothesis, in this case the null hypothesis is that the data is MCAR. Randomness of the missing data was approved by the statistically insignificant results (Tabachnick & Fidell, 2001). Hair et al. (2006) stated that "the lower presence of missing data percentage in the research can be treated with any available imputation method". There are 4 imputation methods which are proposed by Hair et al. (2006): imputation methods using only valid data, imputation methods using known replacement values, imputation by calculating replacement values, and model-based methods for missing at random (MAR) data processes. The missing data were

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replaced by estimating replacement values (with the median of nearby points method). According to SEM requirements, the dataset should be free of missing data. Once the dataset was completed and free, the variables could be employed in SEM analysis. The data were ready for further examination.

6.2 Outliers Examination

The outlier examination is considered as "the observation that is substantially different from the other observations (i.e. has an extreme value) on one or more characteristics (variables)" by Hair et al. (2006). The outliers can represent a danger for the analysis and seriously distort statistical results (Tabachnick & Fidell, 2001). The outliers were categorized as univariate and multivariate outliers. Hair et al. (2006) defined the univariate outlier as "a case of an extreme value on one variable, multivariate outlier is a combination of unusual scores on at least two variables". Identifying univariate outliers can be done by calculating the standardized scores (*z*-scores). The recommended cut off value to examine univariate outliers is $z < \pm 3$, while the recommended cut off value for large sample size is $z < \pm 4$ (Hair et al., 2006; Tabachnick & Fidell, 2001). In the current research, the data values of each observation were transformed into *z*-scores for the investigation of the univariate outliers. The results revealed that dataset involves a few univariate outliers as shown in Table 9.

Multivariate outliers can be calculated by the Mahalanobis (D^2) measure which is defined by Tabachnick & Fidell (2001) as "the distance of a certain case from the centroid of the remaining cases, where the centroid is the point created by the means of all the variables. The recommended threshold levels for the D^2/df measure should not exceed of 2.5 in small samples, $D^2/df < 3$ or 4 in larger samples".

In the current study, the D^2/df measure was equal to 3.09 and did not exceed the threshold value of 4 (maximum $D^2 = 61.92$, $df = 20$, $D^2/df = 3.09$). Despite some cases showing the characteristics of outliers, they did not exceed the standard value. Thus it was unnecessary to eliminate outliers from the given dataset.

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Table 9: Univariate outliers

No.	Variable	Case(s) of outlier	z-scores > ±3
1	vol (voluntrariness)	no case	--
2	pu (perceived usefulness)	no case	--
3	peou (perceived ease of use)	no case	--
4	si (social influence)	no case	--
5	fc (facilitating conditions)	no case	--
6	comp (compatibility)	no case	--
7	bi (behavioural intention)	no case	--
8	bu (use behaviour)	bu1-4 cases	-3.06304
9	gs (government support)	gs2-4 cases gs4-2 cases	-3.22726 -3.21838
10	os (organizational support)	os1-1 case	-3.62957
11	profpr (professional quality)	no case	--
12	perpr (personal practice)	no case	--
13	qual (quality of working life)	qual1-10 cases qual2-25 cases	3.05033 3.01279

Source: Own edition

6.3 Normality Examination

Most statistical procedures require researchers to verify the normality along with other assumptions. The normality is the hallmark of the multivariate analysis. Normality is considered as "the degree to which the distribution of the sample data corresponds to a normal distribution" by Hair et al. (2006). The assumptions of normality can be investigated at univariate level (i.e. distribution of scores at an item-level) and at multivariate level (i.e. distribution of scores within combination of two or more items). There are two categories of methods used to check the normality assumption: numerical and graphical methods. Within the numerical method of examination, the normality of data can be assessed by Skewness and Kurtosis (value < ±2.58); Kolmogorov-Smirnov and Shapiro-Wilk (K-S) test ($p > 0.05$). Within the graphical method of examination, the normality of data can be verified by inspecting the histogram of the variable, which requires a symmetrical, bellshaped curve and has higher frequency of scores in middle and lower on peaks (Pallant, 2007). The Q-Q plot (known as the normal probability plot) and P-P plot are well-known graphical methods in assessing the normality of data, where the points are clustered around a straight line (Field, 2006).

In the current study, all the variables were within the normal range of Skewness and Kurtosis, with only one variable showed a positive kurtosis value qual2 = 3.120 (see Appendix C - Normality). Hair et al. (2006) claims that "the existence of univariate normality does not guarantee the assumption of multivariate normality".

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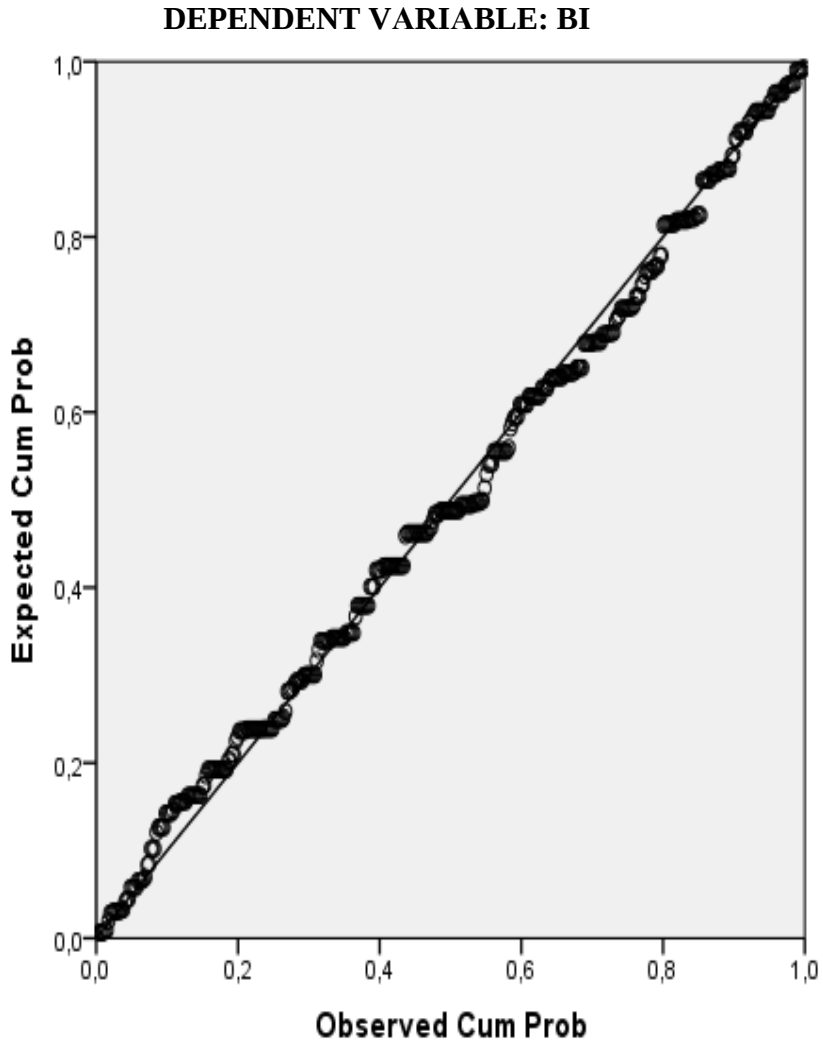

Figure 17: Multivariate normal P-P plot of regression standardized residual
Source: Own edition

Furthermore, the normal probability plot was used to examine multivariate normality in order to satisfy the assumption of univariate normality (see Fig. 17). The dissemination of values shows that all variables were clustered around the straight line through multivariate normal P-P plot of regression standardised residual shows. Therefore, observation within sample does not require any modifications.

6.4 Homoscedacity

According to Tabachnick & Fidell (2001), the homogeneity is considered as "the assumption of normality related with the supposition that dependent variable(s) display an equal variance across the number of independent variable (s)". The assumption of equal variation between variables is a compulsory prerequisite in multiple regressions (Field, 2006). In

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comparison with the homoscedacity, the heteroscedasticity leads to erroneous calculations of the standard errors (Hair et al., 2006). In the present research, Levene's test of equal variance was applied to assess the homoscedacity using gender as a non-metric variable. The results revealed that most of the items were insignificant, only PU (Perceived Usefulness), BI (Behavioural Intention) and PROFPR (professional quality) were significant i.e. $p < 0.05$, which suggest that variance for all the variables was equal within groups of male and female, and had not violated the assumption of homogeneity of variance. Results are shown in Table 10.

Table 10: Levene's test of homogeneity of variances

Items	Levene Statistic	df1	df2	Sig.
VOL (Voluntrariness)	0.253	1	382	.0615
PU (Perceived Usefulness)	5.293	1	382	0.022
PEOU (Perceived Ease of Use)	0.377	1	382	0.540
SI (Social Influence)	0.070	1	382	0.792
FC (Facilitating Conditions)	0.175	1	382	0.676
COMP (Compatibility)	2.969	1	382	0.086
BI (Behavioural Intention)	4.538	1	382	0.034
BU (Use Behaviour)	0.845	1	382	0.359
GS (Government Support)	0.637	1	382	0.425
OS (Organizational Support)	4.444	1	382	0.036
PROFPR (professional quality)	8.266	1	382	0.004
PERPR (personal practice)	3.510	1	382	0.062
QUAL (quality of working life)	0.585	1	382	0.445

Source: Own edition

"Levene's test is sensitive in regard to the sample size and can be significant for large sample" states Field (2006). Therefore, significance of a few constructs in Levene's test does not represent the presence of substantial non-normality within large sample.

6.5 Multicollinearity

Multicollinearity is the occurrence of high intercorrelations among two or more independent variables (correlations up around 0.8 or 0.9) to each other (Tabachnick & Fidell, 2001). For increasing the prediction, it is suggested to inspect the highly correlated variables and delete one of them (Tabachnick & Fidell, 2001; Hair et al., 2006). There are general techniques for inspecting the severity of multicollinearity: detecting the bivariate and

DOI: 10.14750/ME.2022.014

multivariate correlation matrix, and calculating the variance inflation factors (VIF) and tolerance impact (Tabachnick & Fidell, 2001). The required value of Pearson's correlation should be less than 0.8 and the required values of the variance inflation factors (VIF) should be less than 10, while tolerance should be greater than 0.1 (Pallant, 2007). If there is evidence of multicollinearity, then the affected variables should be deleted. Pearson correlation (Pearson *r*) was calculated between dependent variables ranging from 0.11 to 0.63 (see Appendix D - Correlation Matrix). There is no multicollinearity between the measured variables due to no correlation above 0.90 (Tabachnick & Fidell, 2007).

6.6 Demographic Data and Background of Personal e-commerce Usage

The characteristics of farmers within wheat-oriented farms were based on gender, age, regroup of age, education level, and position on the farm, as shown in Table 11. Demographic characteristics showed that the tally of male farmers was twice the tally of female farmers (male farmers = 66.1% and female farmers = 33.9%). The men hold primary power and predominate in agriculture in Kazakhstan due to its patriarchal society.

Table 11: Demographic characteristics of farmers

Characteristics	Group	Cases	Percentage (%)
Gender	Male	254	66.1
	Female	130	33.9
Age	18-29	80	20.8
	30-39	126	32.8
	40-49	109	28.4
	50 and above	69	18.0
Regroup of age	18-39	190	49.5
	40 and above	194	50.5
Educational level	Higher secondary school	166	43.2
	Bachelor's degree/Specialist degree	164	42.7
	Other	54	14.1
Farm position	Farm Worker	129	33.6
	Agronomist	89	23.2
	Farm Manager	94	24.5
	Other	72	18.8

Source: Own edition

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The majority of farmers were in the age range 30-39 years (32.8%), 40-49 years (28.4%), 18-29 years (20.8%), and 50 years up (18%). They were categorized into younger (18-39 years) and older subjects (40 years and above) in order to compare any differences between younger subjects and older subjects with the study of Venkatesh et al. (2003). It reveals that older subjects was the larger group (50.5%) compared to younger subjects (49.5%) showing that the ratio of older to younger farmers is almost 1:1.

The number of farmers who graduated from higher secondary schools (such as initial training schools, lycees, colleges) was 43.2%, followed closely by those with a Bachelor's degree/Specialist degree (42.7%), while 14.1% fit in the category of Other (Master's degree/Doctoral degree). The lack of Master's degree or Doctoral degree among farmers is clear. The highest percentage of farm positions were farm workers (in this case, farm workers perform daily tasks that involve wheat cultivation - 33.6%) compared to agronomists (in this case, scientists who specialize in wheat production, soil control and management - 23.2%), farm managers (in this case who manages duties associated with the daily and long-term management tasks - 24.5%) and other farm positions (18.8%). During the survey, farmers who had used e-commerce for about 1-5 years (57%) were in the majority, juxtaposed to farmers who had used e-commerce more than 6-10 years (24.2%), and those with less than 1 year (18.8%) of using e-commerce (see Table 12). People in the 6-10 year group started to use e-commerce when it became popular in Kazakhstan (in 2007-2012). The majority (1-5 years) started to use e-commerce when it reached its peak (in 2013-2017).

Table 12: Background of personal e-commerce usage of farmers

Characteristics	Group	Cases	Percentage (%)
Years in using e-commerce	less than 1 year	72	18.8
	1-5 years	219	57.0
	6-10 years	93	24.2
How often use e-commerce	Once each month	18	4.7
	A few times a month	141	36.7
	Once each week	12	3.1
	A few times a week	66	17.2
	Five to six times a week	36	9.4
	Several times a day	55	14.3
	Other	56	14.6
Self-assessment about using e-commerce	Basic skills	141	36.7
	Intermediate skills	202	52.6
	Advanced skills	41	10.7
	for personal use	125	32.6
	for business use	78	20.3

For what purpose do you use e-commerce	for both personal and business use	181	47.1

Source: Own edition

The highest frequency of e-commerce usage (36.7%) was "a few times a month", the second frequency (17.2%) was "a few times a week", the third frequency (14.6%) was "other", the fourth frequency (14.3%) was "several times a day", while the rest used e-commerce less than 10% (see Table 12). The frequency of e-commerce usage still lags behind the expectation showing that farmers are not fully involved in electronic commerce activities. The highest percentage of farmers (52.6%) considered themselves to have intermediate e-commerce skills, whereas 36.7% considered themselves to have basic e-commerce skills, and 10.7% considered themselves to have an advanced e-commerce skills (see Table 12). This reveals that the majority of farmers have experience in e-commerce usage. The majority of farmers use e-commerce for personal and business use (47.1%), others for personal use (32.6%) or for business use (20.3%) only. This shows that the most farmers use e-commerce applications for personal use, being an indicator to use them for business purposes in a higher speed. In conclusion, e-commerce is not new but it is still in its infancy among farmers.

6.7 Analysis of Measurement Model

Hair et al. (2010) defined Structural Equation Modelling (SEM) as a "multivariate technique combining aspects of factor analysis and multiple regressions that enables the researcher to simultaneously examine a series of interrelated dependence relationships among the measured variables and the latent constructs". SEM consists of a measurement model and a structural equation model. Byrne (2001) defined the measurement model as "the relations between the observed and unobserved variables. In other words, it provides the link between scores on a measuring instrument (i.e., the observed indicator variables) and the underlying constructs they are designed to measure (i.e., the unobserved latent variables)". According to Hair et al. (2010), Confirmatory Factor analysis (CFA) is considered as a way of testing how well the measured variables represent a smaller number of constructs. CFA is applied to test the measurement model and to assess the reliability/validity of the proposed conceptual model, which consists of seven latent constructs. Although latent constructs cannot be observed and measured directly, they are measured by one or more specific items retrieved from the responses to questions. These measured (observed) variables are used to measure latent constructs. In the

current study, the seven latent constructs include five exogenous latent variables (independent variables) and two endogenous latent variables (dependent variables). The exogenous latent variables are PU (Perceived Usefulness), PEOU (Perceived Ease of Use), SI (Social Influence), FC (Facilitating Conditions), and COMP (Compatibility) and the endogenous latent variables are BU (Use Behaviour) and BI (Behavioural Intention). The seven constructs are measured by 28 items (20 items for exogenous variables and 8 items for endogenous variables), which are based on literature (see Appendix E - Coding Sheet).

In the measurement model shown in Figure 18, ellipses represent measured latent variables, rectangles represent observed variables, single-headed arrows (→) represent the impact of one variable on another variable, small circles (O) are error terms that indicate the difference between observed and predicted values, and double-headed arrows (↔) represent covariances or correlations between pairs of variables, measurement errors associated with observed variables, residual errors. The software AMOS Version 21.0 (Analysis of Moment Structures) was employed for CFA.

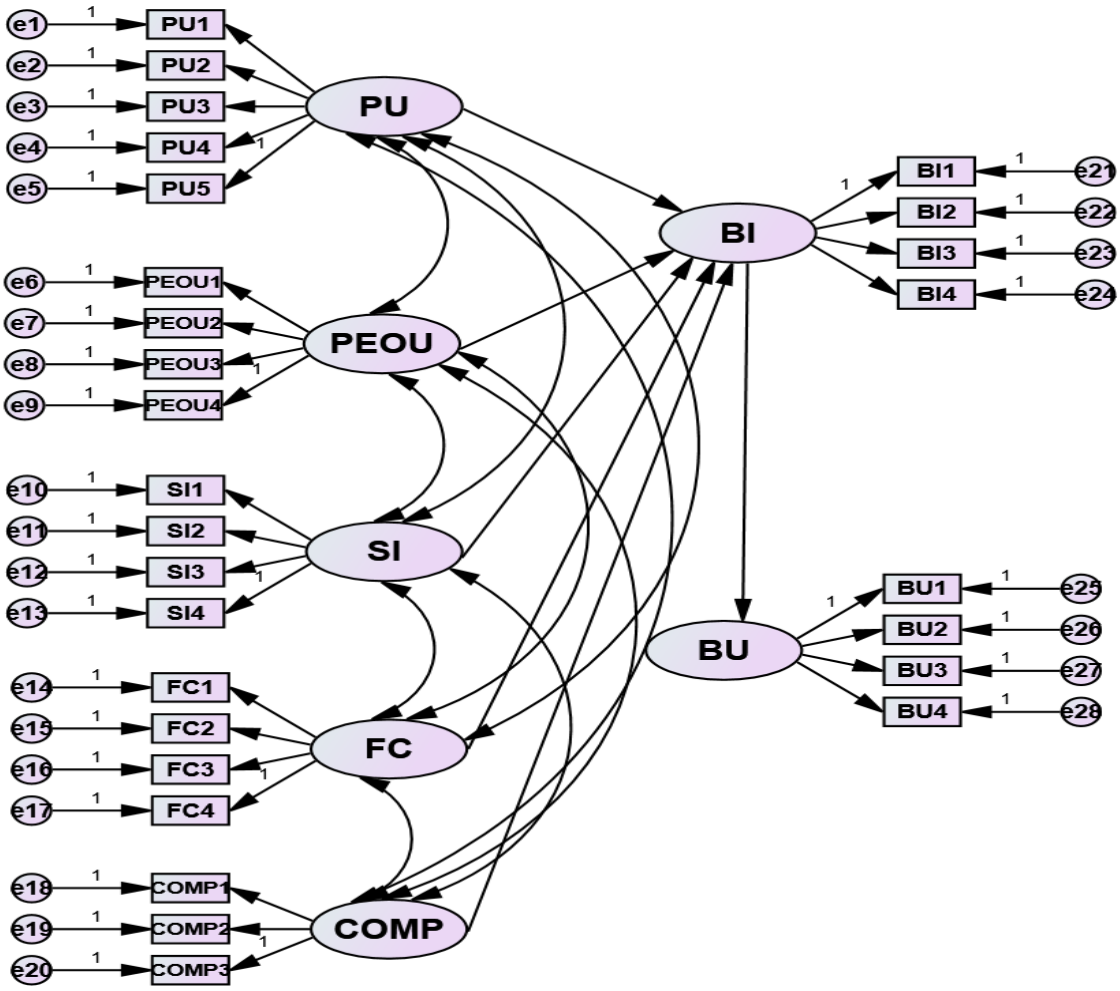

Figure 18: Measurement model representation in IBM AMOS

Source: Own edition

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6.7.1 Measurement Model Results

In the current study the measurement model was assessed by goodness-of-fit (further GOF) measures. GOF measures were defined as "how well the specified model reproduces the observed covariance matrix among the indicator items" by Hair et al. (2010). These measures are available to assess the overall fit of the hypothesized model. In the current study the absolute fit measures and incremental fit measures, such as Chi-square (χ^2) statistics, degree of freedom (*df*), relative Chi-square (χ^2/df) test, Comparative Fix index (CFI), Root Mean Square Error of Approximation (RMSEA), Goodness of Fit index (GFI), Tucker-Lewis index (TLI), and adjusted Goodness of Fit index (AGFI) were used to assess the measurement model. More details about these measures are summarized in Table 13.

Table 13: Measurement model assessment criteria

Fit Index	Recommended Value	References
Chi-square (χ^2)	Non-significant at $p < 0.05$	Hu & Bentler (1999)
Degree of freedom (*df*)	n/a	
Relative Chi-square (χ^2/df)	< 3	Byrne (2001)
Root Mean Square Error of Approximation (RMSEA)	< 0.08	Hair et al. (2006)
Comparative Fix Index (CFI)	> 0.90	Hair et al. (2006)
Goodness of Fit index (GFI)	> 0.90	Kline (2011)
Tucker-Lewis index (TLI)	> 0.90	Hair et al. (2006)
Adjusted Goodness of Fit index (AGFI)	> 0.80	Hair et al. (2006)

Source: Own edition

The first run of the model revealed the following results: relative Chi-square value indicated an acceptable fit between hypothesized model and sample data (χ^2 = 892.592, *df* = 329, χ^2/df = 2.7130); GFI and AGFI, absolute fit measures indicated the ability of the hypothesized model to reproduce the sample data, the proposed model did not achieve in GFI measure (GFI = 0.881, AGFI = 0.875); the discrepancy of RMSEA is less than 0.08, which indicates RMSEA is adjusted to the model complexity (RMSEA = 0.067); and incremental fit measures presented an acceptable level of fit (CFI = 0.921, TLI = 0.929). The validity of the proposed model was confirmed by AGFI, RMSEA, CFI, TLI (see Appendix F - Measurement Model (first run)). Measured variables less than 0.5 should be eliminated in order to improve GFI measure based on the SMC (Squared Multiple Correlations, i.e. communalities) and factor loadings (i.e. standardized regression weights) (Hair et al., 2010), as shown in Table 14.

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Table 14: Measurement model results

Variable	Measured Variable	Variable loading	SMC
Perceived Usefulness	PU1	0.753	0.731
	PU2	0.758	0.786
	PU3	0.807	0.735
	PU4	0.783	0.716
	PU5	0.486	0.294
Perceived Ease of Use	PEOU1	0.834	0.762
	PEOU2	0.972	0.746
	PEOU3	0.524	0.345
	PEOU4	0.533	0.328
Social Influence	SI1	0.869	0.630
	SI2	0.846	0.657
	SI3	0.512	0.234
	SI4	0.901	0.645
Facilitating Conditions	FC1	0.781	0.652
	FC2	0.469	0.381
	FC3	0.807	0.792
	FC4	0.526	0.257
Compatibility	COMP1	0.754	0.728
	COMP2	0.721	0.617
	COMP3	0.482	0.324
Use Behaviour	BU1	0.985	0.677
	BU2	0.879	0.735
	BU3	0.763	0.795
	BU4	0.582	0.367
Behavioural Intention	BI1	0.637	0.483
	BI2	0.824	0.696
	BI3	0.861	0.604
	BI4	0.521	0.391

Source: Own edition

The measured variables (PU5, PEOU3, PEOU4, SI3, FC2, FC4, COMP3, BU4, BI1, BI4) have to be removed from the initial model in order to achieve a good measurement model. The revised model gave better results over all of the goodness-of-fit measures: results of absolute fit measures (χ^2 = 289.176, *df* = 114, χ^2/df = 2.5366, GFI = 0.970, AGFI = 0.945, RMSEA = 0.063) and results of incremental fit measures (CFI = 0.988, TLI = 0.981). After refining the model, the reliability and validity should be evaluated to determine whether the psychometric properties of the developed model are adequate.

6.7.2 Reliability and Validity of Constructs

The assessment of the reliability and validity of constructs is an important phase before testing the hypotheses in the proposed model due to it may affect the results of the study (Hair et al., 2010). Reliability and validity refers to the quality of the model. Composite reliability,

convergent validity and discriminant validity were calculated by the researcher using the formulas given below. According to Cramer & Howitt (2004), construct validity is considered as "the extent to which a measure assesses the construct that it is intended or supposed to measure". In the current research, construct validity was examined by convergent validity and discriminant validity. The convergent validity refers to the extent to which measures of a specific construct should converge or share a high proportion of variance in common (Hair et al., 2010). The discriminant validity (also known as divergent validity) refers to the extent to which a construct or concepts is not unduly related to other similar yet distinct, constructs (Hair et al., 2010). The convergent validity is evaluated by using the average variance extracted (AVE). AVE refers to amount of variance extracted by a construct as compared to its measurement error. To be more precise, AVE of a construct is the average amount of variance extracted by a construct through its indicators. Indicators and error terms are competing with each other for extracting more variance. If the construct is powerful, it will extract more than 50% of variance (AVE > .5). AVE was calculated by the following formula:

$$\text{AVE} = \frac{\sum_{i=1}^{n} \lambda_i^2}{n}$$

where $\sum_{i=1}^{n} \lambda_i^2$ represents the sum of the squared standardized loadings and *n* represents the number of indicators (see Table 15).

DOI: 10.14750/ME.2022.014

Table 15: Calculations of AVE (Average Variance Extracted)

	Variable loading (λ_i)	Square of variable loading ($\lambda_i * \lambda_i$)	$\sum_{i=1}^{n} \lambda_i^2$	Number of indicators	AVE
PU1	0.753	0.567	2.405	4	0.601
PU2	0.758	0.574			
PU3	0.807	0.651			
PU4	0.783	0.613			
PEOU1	0.834	0.695	1.640	2	0.820
PEOU2	0.972	0.944			
SI1	0.869	0.755	2.282	3	0.760
SI2	0.846	0.715			
SI4	0.901	0.811			
FC1	0.781	0.609	1.261	2	0.630
FC3	0.807	0.651			
COMP1	0.754	0.568	1.088	2	0.544
COMP2	0.721	0.519			
BU1	0.985	0.970	2.325	3	0.775
BU2	0.879	0.772			
BU3	0.763	0.582			
BI2	0.824	0.678	1.420	2	0.710
BI3	0.861	0.741			

Source: Own edition

The discriminant validity was supported by maximum square variance (MSV). MSV was calculated by the squaring maximum covariance of a latent variable with another. In general, for a construct to be valid, it should explain more variance (AVE) than the maximum variance shared by it with any other constructs (AVE > MSV) shown in Table 16.

Table 16: Reliability and validity of constructs

Constructs	Reliability (CR)	Convergent validity (AVE)	Discriminant validity (MSV)
PU (Perceived Usefulness)	0.857	0.601	0.471
PEOU (Perceived Ease of Use)	0.900	0.820	0.705
SI (Social Influence)	0.905	0.760	0.739
FC (Facilitating Conditions)	0.773	0.630	0.518
COMP (Compatibility)	0.704	0.544	0.324
BU (Use Behaviour)	0.910	0.775	0.547
BI (Behavioural Intention)	0.830	0.710	0.656

Source: Own edition

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Internal consistency of the measurement items is crucial to maintain the quality of the results of the study (Sekaran, 2003). Homogeneity of the measurement items is indicated by the internal consistency of measures. Reliability which measures the consistency of the measured variables, was assessed by Composite Reliability (CR). CR was calculated by the following formula:

$$CR = \frac{(\sum_{i=1}^{n} \lambda_i)^2}{(\sum_{i=1}^{n} \lambda_i)^2 + (\sum_{i=1}^{n} \sigma_i)}$$

where $\sum_{i=1}^{n} \lambda_i$ represents the sum of the squared standardized loadings and $\sum_{i=1}^{n} \sigma_i$ represents the sum of measurement errors (ME = 1-squared of standardized loadings) (see Table 17).

Table 17: Calculations of CR (Composite Reliability)

	Variable loading (λ_i)	**Square of variable loading** $(\lambda_i * \lambda_i)$	**ME** $(\sigma_i = 1 - \lambda_i * \lambda_i)$	$\sum_{i=1}^{n} \sigma_i$	$\sum_{i=1}^{n} \lambda_i$	$\left(\sum_{i=1}^{n} \lambda_i\right)^2$	$\left(\sum_{i=1}^{n} \lambda_i\right)^2 + \left(\sum_{i=1}^{n} \sigma_i\right)$	**CR**
PU1	0.753	0.567	0.432	1.594	3.101	9.616	11.210	0.857
PU2	0.758	0.574	0.425					
PU3	0.807	0.651	0.348					
PU4	0.783	0.613	0.386					
PEOU1	0.834	0.695	0.304	0.359	1.806	3.261	3.621	0.900
PEOU2	0.972	0.944	0.055					
SI1	0.869	0.755	0.244	0.717	2.616	6.843	7.560	0.905
SI2	0.846	0.715	0.284					
SI4	0.901	0.811	0.188					
FC1	0.781	0.609	0.390	0.738	1.588	2.521	3.260	0.773
FC3	0.807	0.651	0.348					
COMP1	0.754	0.568	0.431	0.911	1.475	2.175	3.087	0.704
COMP2	0.721	0.519	0.480					
BU1	0.985	0.970	0.029	0.674	2.627	6.901	7.576	0.910
BU2	0.879	0.772	0.227					
BU3	0.763	0.582	0.417					
BI2	0.824	0.678	0.321	0.579	1.685	2.839	3.418	0.830
BI3	0.861	0.741	0.258					

Source: Own edition

CR values were calculated for each determinants of the model, as shown in Table 17; alpha values with the threshold value higher than 0.7 are acceptable (Hair et al., 2006).

6.8 Structural Model Assessment

After the assessment of the measurement model and having established convergent validity, discriminant validity, and reliability of constructs, the next step is to evaluate the structural model in order to test hypotheses (Hair et al., 2010). Unlike Confirmatory Factor Analysis, the structural model assists in differentiation of causal relationship(s) between exogenous and endogenous variable(s). Byrne (2001) defined the structural model as "the relations among the unobserved variables. Accordingly, it specifies the manner by which particular latent variables directly or indirectly influence (i.e., cause) changes in the values of certain other latent variables in the model". Direct Path hypotheses were tested due to the main objective of the structural model being to identify the regression relationships that are hypothesized to exist among the latent constructs:

H1: Behavioural Beliefs (Perceived Usefulness, Perceived Ease of Use) positively impacts on BI (Behavioural Intention)

H2: Normative Belief (Social Influence) positively impacts on BI (Behavioural Intention)

H3: Control Beliefs (Facilitating Conditions, Compatibility) positively impacts on BI (Behavioural Intention)

H4: BI (Behavioural Intention) has a positive impact on BU (Use Behaviour)

The final model is presented with coefficient estimates for 384 cases with standardized regression weights, Squared Multiple Correlations as shown in Figure 19.

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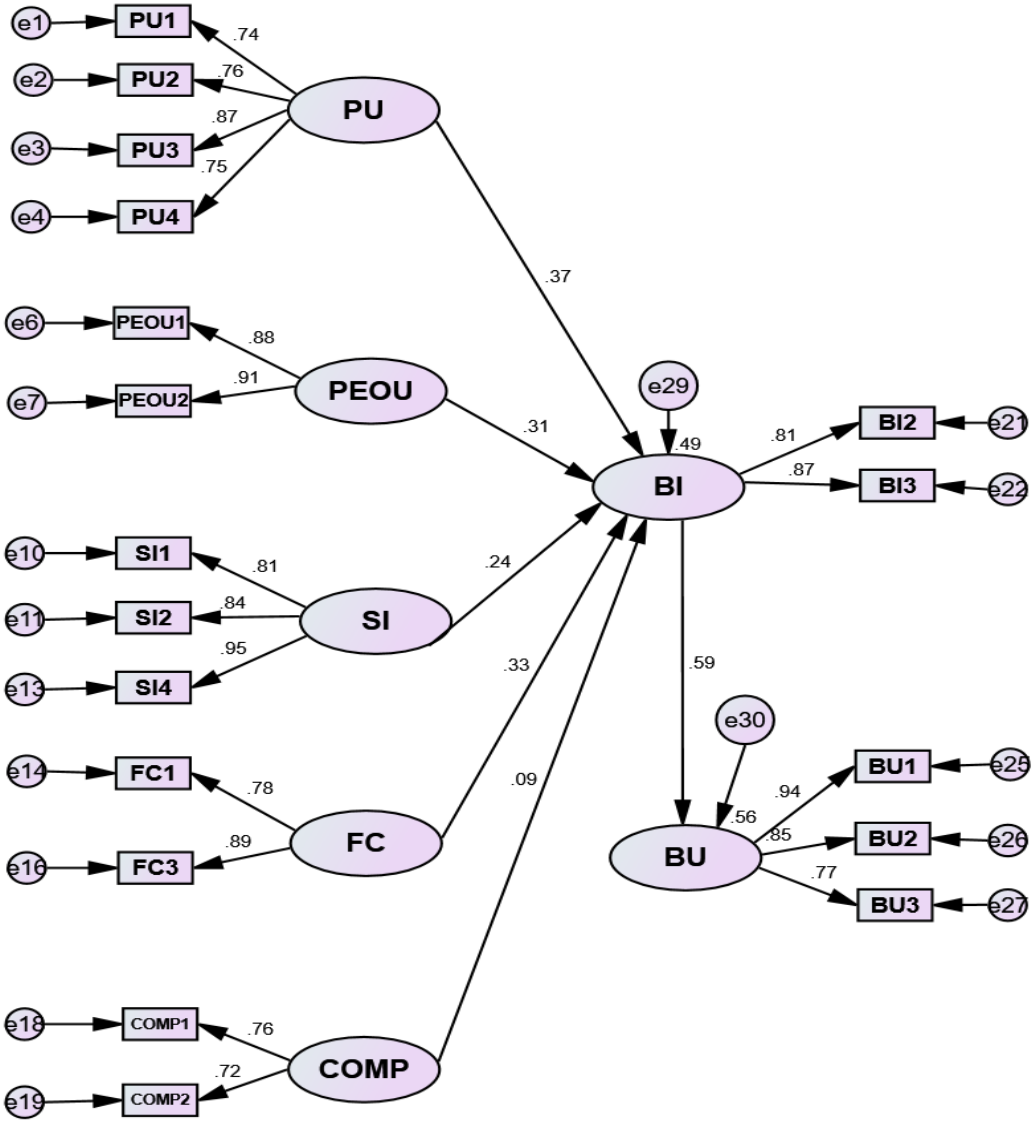

Figure 19: Results of the developed model
Source: Own edition

Table 18: Regression weights

Paths	Estimate	S.E. (standard error)	C.R. (critical ratio)	p value
BI <---PU	.424	.092	4.608	***
BI <---PEOU	.337	.061	5.524	***
BI <---SI	.263	.044	5.977	***
BI <---FC	.367	.085	4.317	***
BI <---COMP	.063	.043	1.465	.391
BU <---BI	.627	.064	9.796	***

Source: Own edition
Note: *** p value is statistically significant at the 0.05 level

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Regression weights are the unstandardized coefficient estimates generated from maximum likelihood procedure (see Table 18). Ho (2006) explained that the standard error (S.E.) of the coefficients represents the expected variation of the estimated coefficients. The critical ratio (C.R.) is a test of the significance of the path coefficients. Each C.R. value is obtained by dividing that parameter estimate by its respective standard error, and it is distributed approximately as *z*. As such, a critical ratio that is more extreme than ±1.96 indicates a significant path ($p \leq .05$). Based on this criterion, the four paths between independent variables and BI (Behavioural Intention) are statistically significant, the path between BI (Behavioural Intention) and BU (Use Behaviour) is also statistically significant (see Table 18). Ho (2006) explained Squared Multiple Correlation as "an index of the proportion of the variance of the endogenous variable (E1) that is accounted for by the exogenous or predictor variables. It can be assumed that the higher the value of the squared multiple correlation, the greater the explanatory power of the regression model, and therefore the better the prediction of the dependent variable".

The results of SMC (Squared Multiple Correlation) shows that the exogenous variables (Perceived Usefulness, Perceived Ease of Use, Social Influence, Facilitating Conditions, Compatibility) account for 49% of the variance of BI (Behavioural Intention) and 56% of the variance of BU (Use Behaviour). Thus, the results explain that the exogenous variables account for the variance of endogenous variables with an acceptable level of interpretation for BI (Behavioural Intention) and a high degree of interpretation for BU (Use Behaviour). Standardized regression weights (β and γ) are standardized coefficient estimates, and are independent of the units in which all variables are measured. These standardized coefficients (β) allow the researcher to compare directly regression relationship between each independent variable and the dependent variable.

Perceived Usefulness had the strongest influence towards BI (Behavioural Intention) with standardized coefficient and probability values of ($\beta = 0.372$, $p \leq 0.05$). Perceived Ease of Use had the third strongest influence towards BI (Behavioural Intention) with standardized coefficient and probability values of ($\beta = 0.314$, $p \leq 0.05$). Perceived Usefulness and Perceived Ease of Use significantly affect the intention of farmers to use e-commerce applications, thus indicating that farmers perceive e-commerce as a beneficial and easy-to-use tool that might enhance their work tasks. In previous research, Alalwan et al. (2018), Lian & Yen (2014), Weerasinghe & Peramunugamage (2014) empirically investigated the significant influence of Perceived Usefulness on intention to use e-commerce by individuals. Likewise, Perceived Usefulness showed that Kazakhstani farmers appraise well designed, user-friendly, useful e-

commerce applications and this might enhance the usage of the extensive version of e-commerce applications in the future. Dutot et al. (2019) and Shuhaiber & Mashal (2019) empirically investigated the significant influence of Perceived Ease of Use on intention to use e-commerce by individuals. Similarly to their findings, it might be concluded that Kazakhstani farmers are eager to use e-commerce applications with the minimum effort. Facilitating Conditions had the second strongest influence towards BI (Behavioural Intention) with standardized coefficient and probability value of ($\beta = 0.331$, $p \leq 0.05$). In the studies of Chong (2013) and Venkatesh et al. (2012), it was proven that this construct significantly influence on the behavioral intention to use e-commerce. Therefore, this might imply that Kazakhstani farmers find it important to have the necessary support and help while using e-commerce applications. Social Influence had the fourth strongest influence towards BI (Behavioural Intention) with standardized coefficient and probability value of ($\beta = 0.247$, $p \leq 0.05$). Social Influence was found to be one of the strongest determinants in e-commerce applications usage by farmers, thus indicating that their views, thoughts, and beliefs regarding e-commerce conform to social customs and trends, and this finding indicated that external pressure (from the government, colleagues, friends, etc.) influence on farmers' behavioural decision to accept e-commerce applications (Shen, 2012). Generally, referent opinions in Kazakhstani society affect on perceptions regarding technology adoption and usage. Therefore, it can be concluded that the higher the level of Perceived Usefulness, Perceived Ease of Use, Social Influence, and Facilitating Conditions contributing to the intention of farmers to use e-commerce applications, the greater the extent of e-commerce usage in the future. However, the relationship between Compatibility and BI (Behavioural Intention) was insignificant ($\beta = 0.096$, $p = 0.391$).

The standardized coefficient (γ) allow the researcher to compare directly the regression relationship between the dependent variables. Behavioural Intention (BI) had a positive influence towards Use Behaviour (BU) with standardized coefficient and probability values of ($\gamma = 0.596$, $p \leq 0.05$). These may suggest that the higher the level of intention to use e-commerce applications by farmers, the higher the level of usage of extensive version of e-commerce applications by farmers in the future. This finding is consistent with previous research in the IT e.g., (Venkatesh & Davis, 2000; Venkatesh et al., 2003) and e-commerce adoption contexts (Park, 2009; Liu et al., 2010; Walker & Johnson, 2008).

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CHAPTER VII: CONCLUSIONS, SUGGESTIONS, LIMITATIONS, CONTRIBUTIONS

7.1 Use Behaviour and Behavioural Intention on Average

The UTAUT model has been applied as a theoretical model in explaining farmers' usage behaviour and behavioural intention in e-commerce adoption. It has been found that farmers actually use e-commerce for tasks related with the farming less than they intend to use e-commerce for tasks related with the farming (the mean for "I use e-commerce in my farming tasks" was 5.35, while the mean for "I intend to use e-commerce in my farming tasks" was 5.77). This is also true for non-farming tasks: farmers use e-commerce at a lower level than they intend to it for nonfarming tasks (the mean for "I use e-commerce to use it in my nonfarming tasks" was 4.68, while the mean for "I intend to use e-commerce in my nonfarming tasks" was 5.05). In case of potential access problems, farmers who are sure they would use e-commerce if they had access to it are fewer than those who predict that they would use it (the mean for "Given that I had access to e-commerce, I would use it" was 4.64; the mean for "Given that I had access to e-commerce, I predict that I would use it" was 5.60). The pattern of lower use whenever possible than intention to use whenever possible continues (the mean for "Whenever it is possible to me, I use e-commerce in my farming tasks" was 4.96; the mean for "Whenever it will be possible to me, I plan to use e-commerce in my farming tasks" was 5.40).

In conclusion, as seen from these results, the mean of the farmers' intention to use e-commerce technologies and applications in their farming tasks was the highest of these values, indicating that farmers are willing to contribute in the traceable and environmentally responsible supply chain. Moreover, the mean of the prediction in e-commerce technologies and applications usage by farmers if they had access to e-commerce was the second highest indicating that access to e-commerce technologies and applications would accelerate the practice of usage of such technologies. The mean of the farmers' e-commerce usage in their nonfarming tasks was the lowest, indicating that farmers are mostly involved in their work and their vision of e-commerce usage is related mainly to farming tasks. The mean of the farmers who would use e-commerce if they had access to e-commerce was the lowest, indicating that at the survey time many farmers were reluctant to use e-commerce technologies and applications.

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7.2 Voluntariness, Professional practice, Personal practice, Quality of working life on Average

In the present study, voluntariness plays a measure to understand the choice that is being made from a farmers' willingness to use e-commerce technologies and applications. It has been found that the expectation and the requirement of the farms' management in e-commerce technologies and applications usage by employees is low. This appears to be due to the fact that most farms are led by Generation X (who were born in 1965─1979), farmers, who are mostly technologically illiterate and do not have experience in using certain technologies (the mean for "My superiors expect me to use e-commerce" was 4.37; the mean for "My boss does not require me to use e-commerce" was 4.40). The voluntariness of e-commerce technologies and applications usage is high: at the time of the survey time there was no obligation or decree from the government to use e-commerce technologies (the mean for "My use of e-commerce is voluntary" was 4.86). The highest mean of the last item relates to the intimidation about acceptance of certain technologies (the mean for "Although it might be helpful, using e-commerce is certainly not compulsory in my job" was 4.97).

Farmers agreed that using e-commerce helped in improving their professional practice: in improving administrative tasks (the mean for "Using e-commerce helps improving my administrative tasks" was 4.57), in improving farming practice (the mean for "Using e-commerce helps improving my farming practice" was 4.33), but farmers were less convinced that using e-commerce helped to improve their professional practices generally (the mean for "Overall, using e-commerce helps in improving my professional practices" was 4.18). Farmers agreed that using e-commerce helped in improving their personal practice: in improving their personal knowledge (the mean for "Using e-commerce helps in improving my personal knowledge" was 4.61), in improving personal development generally (the mean for "Overall, using e-commerce helps in improving my personal development" was 4.56), but farmers were less convinced that using e-commerce helped to improve their farming knowledge (the mean for "Using e-commerce helps in improving my farming knowledge" was 4.24). Farmers agreed that using e-commerce helped improve their quality of working life: in improving their quality of working life generally (the mean for "Overall, using e-commerce helps in improving my quality of working life" was 5.95), particularly in helping them to have more time for leisure (the mean for "Using e-commerce helps me to have more time for leisure" was 3.90), but farmers were less convinced that using e-commerce helped them have more time to focus on

farming (the mean for "Using e-commerce helps me have more time to focus on farming" was 3.80).

The helpfulness of e-commerce in improving the quality of the working life of the farmers showed the highest indicator which means that farms' operational and managerial processes were improved by reducing costs and time. As a result, e-commerce technologies and applications usage allowed farmers to enhance the quality of their work without sacrificing the value of production and time. The helpfulness of e-commerce usage in improving farmers' personal knowledge showed the second-highest indicator, which means that information technologies have contributed to developing farmers' strategic thinking and knowledge enhancement. The third-highest indicator was helpfulness in using e-commerce improves farmers' administrative tasks, which means that operational and managerial processes accomplishing by farmers were running smoothly. E-commerce technologies and applications usage make it easier to carry out administrative tasks in a coherent and time-efficient manner. The helpness of e-commerce usage to have more time to focus on farming showed the lowest indicator, probably due to the role of most information technologies in relieving farmers from accomplishing extra tasks.

7.3 Government Support, Organizational Support on Average

There is a limited amount of empirical research where organizational and environmental factors were applied. An analysis of the moderators might reveal trajectories for where to concentrate effort and resources in order to implement technology adoption model by farmers appropriately. Institutional-level and government-level support are the main determinants in new technologies acceptance by employees (Igbaria & Chakrabarti, 1990). Government support is determined as "the extent to which government promotes facilitating conditions in order to accept new technologies" (Calantone et al., 2006; Looi, 2005). It ranges from establishing e-commerce facilities through elaborate e-commerce usage rules for different organizations up to providing advice and information about the advantages of using e-commerce applications in business activities (Calantone et al., 2006; Looi, 2005).

Igbaria & Chakrabarti (1990) found that organizational support has a positive impact with increased conducive ratios. Information center support and management support are the key determinants of the organizational support. Management support indicates the adequate distribution of management resources, while information center support is determined as the development, guidance, and consultation in using e-commerce applications. I incorporated

environmental factors as moderating variables, since (1) environmental changes (opportunities and threats) encourage businesses to operate efficiently and optimize their processes; (2) environmental forces improve the organization in its services and products; (3) environmental forces can cause desirable yields and improve their performance (Salavou et al., 2004; Damanpour et al., 2009). Organizational factor as a moderating variable strengthens other factors in order to optimize business performance (Deshpande & Farley, 2004). Predicting technology acceptance behaviour will not be efficient without observing management support at a hierarchal level in the organisation. Observing the above-mentioned literature, I incorporated management moderators at a high level (i.e. government-support) and at a low level (i.e. organizational-support) into UTAUT model.

Results are as follows: the mean for "The government is committed to a vision of using e-commerce in farms" was 5.60; the mean for "The government strongly encourages the use of e-commerce for farming purpose" was 5.41; the mean for "The government strongly does not encourage the use of e-commerce for farming purpose" was 5.48; the mean for "The government recognize farmers efforts in using e-commerce for farming purpose" was 5.35; the mean for "The government does not recognize farmers efforts in using e-commerce for farming purpose" was 5.30 can be concluded the strongest indicator shows that the government of Kazakhstan is committed to setting attainable strategies in order to introduce e-commerce in farms, but at the same time the second strongest indicator shows that the government does not stimulate farmers' efforts in e-commerce usage. From the following results (the mean for "My organization is committed to a vision of using e-commerce in farming tasks" was 5.57; the mean for "My organization strongly encourages the use of e-commerce for farming purposes" was 4.40; the mean for "My organization does not encourage the use of e-commerce for farming purposes" was 4.62; the mean for "My organization recognize farmers efforts in using e-commerce for farming purposes" was 4.29; the mean for "My organization does not recognize farmers efforts in using e-commerce for farming purposes" was 4.43) it can be concluded that the strongest indicator shows that farms are committed to inculcate e-commerce applications, but at the same time the management of farms' does not stimulate farmers' efforts in using e-commerce for farming purposes.

The government should create additional market mechanisms that ensure the growth and development of e-commerce in the organizations (in this case farms), taking into account the projected external and internal conditions and the effective use of their resources and potential. It should do this through: ensuring the widest possible opportunities for the legal development of electronic commerce by increasing farming activities and expanding the private initiative of

farmers; lifting excessive prohibitions and eliminating legal conflicts for electronic commerce, which are absent in traditional trade; facilitating the implementation of an objective assessment of the state and planning directions for the development of electronic commerce by ensuring the availability and completeness of open data related to electronic commerce, as well as considering the possibility of using intelligent technologies that ensure the aggregation, processing and analysis of data in the field of electronic commerce; ensuring effective legal regulation of electronic transactions, improving payment systems in the field of electronic transactions, ensuring legal protection of participants in electronic commerce (sellers, buyers, third parties); and enhancing cybersecurity in the field of e-commerce in the domestic market and in the field of cross-border e-commerce.

7.4 Suggestions, Contributions and Limitations

The results in this study have revealed that respondents are satisfied with e-commerce applications usage in wheat-oriented farms of Kazakhstan. Moreover, the current study has bridged the gap of unknown factors that have a likelihood of determining e-commerce usage by confirming the five factors identified in the study as good determinants of the respondents' behavioural intention to use e-commerce in the future. Over time, peoples' perceptions towards the usage of newer technologies and approaches are inclined to change, and therefore it is important to take into account lessons learned through research of e-commerce usage behaviour and to implement them in practice, rather than just following established ─ but also outdated ─ practices.

Direct Path hypotheses were tested in the current research. Table 19 summarizes the results of Direct Path Hypotheses. The findings of this study suggest that Compatibility does not affect the farmers' intention to use of e-commerce applications, thus indicating e-commerce is perceived as not consistent with the farmers' existing work practice and work style. In contrary, Perceived Usefulness, Perceived Ease of Use, Social Influence, and Facilitating Conditions were significant determinants of the intention to use e-commerce applications, which means that easy-to-use, useful, reliable, flexible, user-friendly technologies and applications conform to farmers' expectations. It has been shown that the path between BI (Behavioural Intention) and BU (Use Behaviour) was significant in the current model. The results suggest that if farmers use e-commerce technologies and applications vigorously, then they will have a strong intention to use the extended version of e-commerce tools also. The

finding is consistent with previous research in IT e.g., (Venkatesh & Davis, 2000; Venkatesh et al., 2003) The generated model was well capable of explaining variances in Behavioural Intention – 49% and Use Behaviour – 56%.

Table 19: Summary of Direct Path hypotheses

Ho	**Exogenous Latent Constructs**	**Endogenous Latent Constructs**	**Hypothesis's results**	**Explanation**
H1	Perceived Usefulness, Perceived Ease of Use	BI (Behavioural Intention)	Accepted	Behavioural Beliefs (Perceived Usefulness, Perceived Ease of Use) positively impact on BI (Behavioural Intention)
H2	Social Influence	BI (Behavioural Intention)	Accepted	Normative Belief (Social Influence) positively impact on BI (Behavioural Intention)
H3	Facilitating Conditions, Compatibility	BI (Behavioural Intention)	Partially accepted	Control Beliefs (Facilitating Conditions, Compatibility) positively/negatively impact on BI (Behavioural Intention)
Ho	**Endogenous Latent Constructs**	**Endogenous Latent Constructs**	**Hypothesis's results**	**Explanation**
H4	BI (Behavioural Intention)	BU (Use Behaviour)	Accepted	BI (Behavioural Intention) has a positive impact on BU (Use Behaviour)

Source: Own edition

The findings of the present study carry significant limitations which are relevant for future research. The first limitation is that the findings can not be generalized for the entire population of farmers in Kazakhstan due to a non-probability convenience sampling method being applied in the study. For the present study, the chosen sample was targeted on farmers who work only in wheat-oriented farms and who use e-commerce applications to some extent. The second limitation is that the findings should be generalized with caution in the context of other countries. The Unified Theory of Acceptance and Use of Technology (UTAUT) may not produce satisfying results in other country's dimensions. The third limitation is that the findings cannot be generalized to a mandatory environment and other groups due to the impact of the relationships being examined in a voluntary environment and concrete user group (e.g. e-commerce technologies and applications users). The fourth limitation is the absence of qualitative research that can lead to thoroughgoing view of the phenomena being examined.

Cross-sectional and quantitative research was employed in the current research, where the data was collected in a short time of period and the questionnaires were distributed at one single time to the selected farmers of Kazakhstan due to the lack of time and resources. The fifth limitation is the respondents' answers might be biased due to misinterpretation of the self-administered questionnaires and questions.

This study suggests several recommendations for future research related to the adoption of e-commerce technologies and applications. The first suggestion is that the individual context, technological context, and cultural context dimensions should be considered in e-commerce technologies adoption; here the developed model of the present study was moderated only in the environmental and organizational context dimensions. The second suggestion is that the developed model can be replicated for countries in different geographical regions, especially in the Central Asian countries and Post-Soviet states. Such studies are considered to contribute significantly across different countries and nations. The third suggestion is that the present study is only limited to e-commerce technologies and applications, therefore future studies may replicate the developed model using different ICT tools and platforms. The fourth suggestion is that future studies should involve longitudinal data in order to acquire an in-depth and explicit picture of causality between variables. The fifth suggestion is the engagement of a field observation that leads to the acquisition of a clear picture from face-to-face data collection. This study suggests some recommendations to policymakers to reformulate its current e-agriculture policy in order to further support the nationwide goal of agrarian digitalization.

The current research has a significant theoretical, methodological and practical contributions. From the theoretical point of view, the developed model provides a better understanding of the relationships between the core constructs and Use Behaviour, as well as between Use Behaviour and Behavioural Intention. The first theoretical contribution of the current study was empirically confirmed by incorporating the UTAUT model into the study of e-commerce applications acceptance by farmers in wheat-oriented farms of Kazakhstan. This is novel due to the fact that the UTAUT model has not been widely tested outside of the North American and European context (Alsajjan & Dennis, 2010; McCoy, Galletta & King, 2007; Al-Gahtani, Hubona & Wang, 2007), especially in the Central Asian country context. The second theoretical contribution is that the current study was tested in a new organizational scenario ─ in wheat-oriented farms ─ by contradicting Venkatesh, Thong & Xu (2012)'s statement that the "UTAUT model has served as a baseline model and has been applied to the study of a variety of technologies in both organizational and non-organizational settings". The third theoretical contribution is that the main predictors examined in the current research are influenced by

perception of the farmers and their farm-related tasks. Thus, examining farmers working in a farm context contributes to the IT adoption literature in the agricultural sector. The fourth theoretical contribution is that the empirical findings derived from examining of the key predictors within one social group (e.g. farmers of wheat-oriented farms). The examination within one social group helps to extend behaviour acceptance research to a wider range of workplaces at the micro-level context.

In terms of methodology, the objectives of the present study were achieved through the verification of the developed model by quantitative methods. The first methodological contribution is that the email questionnaires were distributed to wheat-oriented farms which are scattered within Kazakhstan. The cutting edge technologies, such as Mail.ru, Whatsapp, Messenger were used to collect information from farmers, thus saving time and money compared to distribution through conventional mail services. The second methodological contribution is that the measurement items of the key predictors were rigorously purified and checked through statistically testing their reliability and validity in the context of the Central Asian country. Previously the core constructs were elaborated in the North American and European context, where the environment of organizations is different from the Central Asian country context. The third methodological contribution is the examination of the developed model using Structural Equation Modelling (SEM) as a method of analysis, as there is a lack of research within the Central Asian context with employing SEM. This technique enables a single precise model of e-commerce applications acceptance by farmers to be created. The present study may play the role of guidance to other researchers of how AMOS and SEM can be used in agricultural field research as a technique of analysis.

The first practical contribution is that the findings of the current research can be useful in the formation of the agricultural strategies and policies in promotion of e-commerce applications usage at the organizational level and at government level. The second practical contribution is the farmers' perceptions and attitudes related to new technology acceptance may play the role of indicators in creating technology adoption frameworks by research institutions.

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APPENDIX A

SURVEY QUESTIONNAIRE

Section A: Demography and Background of your e-commerce usage

PART I: Questions 1 to 6 are related with your *Background Information*: please circle only one option

1. Gender: **a.** Male **b.** Female

2. Age (years): **a.** 18-29 **b.** 30-39 **c.** 40-49 **d.** 50 and above

3. Position: **a.** Farm Worker **b.** Agronomist **c.** Farm manager **d.** Other

4. Farming Experience: **a.** < 1 year **b.** 1-5 years **c.** 6-10 years **d.** 11-15 years **e.** 21 and more

5. Educational level: **a.** Higher Secondary school (training schools, lycees, colleges)
b. Bachelor's degree/Specialist degree **c.** Other

6. Type of Farm: **a.** small-sized farms **b.** middle-sized farms **c.** large-sized farms

PART II: Questions 7 to 14 are related with *e-commerce Usage Experience*: please rate the extent to which you agree with each statement (circle only one option)

7. How long have you been using e-commerce (years):
a. < 1 year **b.** 1-5 year **c.** 6-10 years **d.** > 10 year

8. How will you self-assess yourself about e-commerce usage (experience level)?
a. Basic skills **b.** Intermediate skills **c.** Advanced skills

9. At present, overall how often do you use e-commerce?
a. Once each month **b**. A few times a month
c. Once each week **d.** A few times a week
e. Five to six times a week **f.** Several times a day
g. Other …….

10. For what purpose do you use e-commerce?

a. For personal use **b.** For business use **c.** For both personal and business use

11. Mostly, where do you use e-commerce in doing your farming tasks?
a. At farm **b.** At home **c.** Both at farm and at home

12. Currently, do you think that you use e-commerce enough or not enough or too much?
a. Not enough **b.** Enough **c.** Too much

13. Do you agree that e-commerce as commercial means has its advantages over the traditional commercial methods?
a. Agree **b.** Disagree **c.** Don't know

PART III: Question 14 to 17 are related with the *Voluntariness* use of e-commerce: please rate the extent to which you agree with each statement (circle only one option)

1= Strongly Disagree 2= Quite Disagree 3= Slightly Disagree
4= Neutral 5= Slightly Agree 6= Quite Agree 7= Strongly Agree
14. My superiors expect me to use e-commerce: *1 2 3 4 5 6 7*
15. My use of e-commerce is voluntary: *1 2 3 4 5 6 7*
16. My boss does not require me to use e-commerce: *1 2 3 4 5 6 7*
17. Although it might be helpful, using e-commerce is certainly not compulsory in my job: *1 2 3 4 5 6 7*

Section B: *Perceived Usefulness* and *Perceived Ease Of Use* towards e-commerce usage: please rate the extent to which you agree with each statement (circle only one option)
1= Strongly Disagree 2= Quite Disagree 3= Slightly Disagree
4= Neutral 5= Slightly Agree 6= Quite Agree 7= Strongly Agree

B1. Perceived Usefulness about e-commerce usage.
1. Using e-commerce enables me to accomplish tasks more quickly: *1 2 3 4 5 6 7*
2. Using e-commerce improves the quality of my work: *1 2 3 4 5 6 7*
3. Using e-commerce makes it easier to do my work: *1 2 3 4 5 6 7*
4. I find e-commerce useful in my work: *1 2 3 4 5 6 7*
5. Using e-commerce gives me greater control over my work: *1 2 3 4 5 6 7*
B2. Perceived Ease Of Use about e-commerce usage.
1. Learning to use e-commerce is easy for me: *1 2 3 4 5 6 7*
2. I find it easy to use e-commerce to do what I want to do: *1 2 3 4 5 6 7*
3. I find it easy for me to become skilled in using e-commerce: *1 2 3 4 5 6 7*
4. I find e-commerce easy to use: *1 2 3 4 5 6 7*

Section C: *Social Influence, Facilitating Conditions and Compatibility* towards e-commerce usage: please rate the extent to which you agree with each statement (circle only one option)
1= Strongly Disagree 2= Quite Disagree 3= Slightly Disagree
4= Neutral 5= Slightly Agree 6= Quite Agree 7= Strongly Agree

C1. Social Influence about e-commerce usage.
1. Management of my organization thinks that I should use e-commerce:
1 2 3 4 5 6 7
2. The opinion of my organizational management is important to me: *1 2 3 4 5 6 7*
3. Government management thinks that I should use e-commerce: *1 2 3 4 5 6 7*
4. The opinion of government management is important to me: *1 2 3 4 5 6 7*

C2. Facilitating Conditions about e-commerce usage.
1. The resources necessary (e.g. new computer hardware and software, internet etc.) are available for me to use e-commerce effectively: *1 2 3 4 5 6 7*
2. I can access e-commerce very quickly within my farm: *1 2 3 4 5 6 7*
3. Guidance is available to me to use e-commerce effectively: *1 2 3 4 5 6 7*
4. A specific person (or group) is available for assistance with e-commerce usage difficulties: *1 2 3 4 5 6 7*

C3. Compatibility about e-commerce usage.
1. Using e-commerce is compatible with all aspects of my work: *1 2 3 4 5 6 7*
2. I think that using e-comerce fits well with the way I like to work: *1 2 3 4 5 6 7*
3. Using e-commerce fits into my work style: *1 2 3 4 5 6 7*

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Section D: individual's *Behavioural Intention* and *Use Behaviour* towards e-commerce usage: please rate the extent to which you agree with each statement (circle only one option)
1= Strongly Disagree 2= Quite Disagree 3= Slightly Disagree
4= Neutral 5= Slightly Agree 6= Quite Agree 7= Strongly Agree

D1. Behavioural Intention
1. I intend to use e-commerce in my farming tasks: *1 2 3 4 5 6 7*
2. I intend to use e-commerce in my nonfarming tasks: *1 2 3 4 5 6 7*
3. Given that I had access to e-commerce, I predict that I would use it:
1 2 3 4 5 6 7
4. Whenever it will be possible to me, I plan to use e-commerce in my farming tasks: *1 2 3 4 5 6 7*
D2. Use Behaviour
1. I use e-commerce in my farming tasks: *1 2 3 4 5 6 7*
2. I use e-commerce to use it in my nonfarming tasks: *1 2 3 4 5 6 7*
3. Given that I had access to e-commerce, I would use it: *1 2 3 4 5 6 7*
4. Whenever it is possible to me, I use e-commerce in my farming tasks:
1 2 3 4 5 6 7

Section E: *Management Support*: please rate the extent to which you agree with each statement (circle only one option)
1= Strongly Disagree 2= Quite Disagree 3= Slightly Disagree
4= Neutral 5= Slightly Agree 6= Quite Agree 7= Strongly Agree

E1. Government Support (GS)
1. The government is committed to a vision of using e-commerce in farms:
1 2 3 4 5 6 7
2. The government strongly encourages the use of e-commerce for farming purposes: *1 2 3 4 5 6 7*
3. The government strongly does not encourage the use of e-commerce for farming purposes:
1 2 3 4 5 6 7
4. The government recognize farmers efforts in using e-commerce for farming purposes: *1 2 3 4 5 6 7*
5. The government does not recognize farmers efforts in using e-commerce for farming purposes:
1 2 3 4 5 6 7
E2. Organizational Support (OS)
1. My organization is committed to a vision of using e-commerce in farming tasks:
1 2 3 4 5 6 7
2. My organization strongly encourages the use of e-commerce for farming purposes: *1 2 3 4 5 6 7*
3. My organization does not encourage the use of e-commerce for farming purposes:
1 2 3 4 5 6 7
4. My organization recognize farmers efforts in using e-commerce for farming purposes:
1 2 3 4 5 6 7
5. My organization does not recognize farmers efforts in using e-commerce for farming purposes:
1 2 3 4 5 6 7

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Section F: *E-commerce Usage Affects Farmers' Professional Practice, Personal Development and Quality of Working Life*: please rate the extent to which you agree with each statement (circle only one option)
1= Strongly Disagree 2= Quite Disagree 3= Slightly Disagree
4= Neutral 5= Slightly Agree 6= Quite Agree 7= Strongly Agree

F1. Professional Practice
1. Using e-commerce helps in improving my farming practices: *1 2 3 4 5 6 7*
2. Using e-commerce helps in improving my administrative tasks: *1 2 3 4 5 6 7*
3. Overall, using e-commerce helps in improving my professional practices:
1 2 3 4 5 6 7

F2. Personal Practice
1. Using e-commerce helps in improving my farming knowledge: *1 2 3 4 5 6 7*
2. Using e-commerce helps in improving my personal knowledge: *1 2 3 4 5 6 7*
3. Overall, using e-commerce helps in improving my personal development:
1 2 3 4 5 6 7

F3. Quality of Working Life
1. Using e-commerce helps me have more time to focus on farming:
1 2 3 4 5 6 7
2. Using e-commerce helps me have more time for leisure: *1 2 3 4 5 6 7*
3. Overall, using e-commerce helps in improving my quality of working life: *1 2 3 4 5 6 7*

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APPENDIX B

MISSING DATA ANALYSIS

Univariate Statistics

	N	Mean	Std. Deviation	Missing		No. of Extremes[a]	
				Count	Percent	Low	High
vol1	379	4,3773	1,30834	5	1,3	0	0
vol2	380	4,8789	1,61493	4	1,0	0	0
vol3	377	4,4138	1,38327	7	1,8	0	0
vol4	380	4,9737	1,56793	4	1,0	0	0
pu1	379	4,6570	1,19236	5	1,3	5	42
pu2	380	4,9184	1,59192	4	1,0	0	0
pu3	378	4,7566	1,69694	6	1,6	0	0
pu4	379	3,9578	1,29644	5	1,3	0	76
pu5	377	4,9708	1,64275	7	1,8	0	0
peou1	380	5,1079	1,64580	4	1,0	0	0
peou2	381	3,9475	1,30883	3	,8	0	72
peou3	379	4,9208	1,66478	5	1,3	0	0
peou4	380	5,1421	1,56168	4	1,0	0	0
si1	383	4,5770	1,30191	1	,3	0	0
si2	383	4,9504	1,44901	1	,3	0	0
si3	382	5,6361	1,49752	2	,5	0	0
si4	383	4,9426	1,62984	1	,3	0	0
fc1	383	5,9478	1,39272	1	,3	5	0
fc2	383	4,8251	1,45732	1	,3	0	0
fc3	384	4,5208	1,38420	0	,0	0	0
fc4	383	5,0757	1,45149	1	,3	4	0
comp1	384	4,9401	1,48590	0	,0	0	0
comp2	383	5,2872	1,72630	1	,3	0	0
comp3	382	4,8298	1,59883	2	,5	0	0
bi1	382	5,3508	1,65930	2	,5	0	0
bi2	383	4,6867	1,56064	1	,3	0	0
bi3	382	5,6047	1,55166	2	,5	0	0
bi4	381	5,4016	1,51272	3	,8	0	0
bu1	382	5,7723	1,56167	2	,5	0	0
bu2	383	5,0574	1,53556	1	,3	0	0
bu3	383	4,6475	1,44300	1	,3	0	0
bu4	382	4,9607	1,66673	2	,5	0	0
gs1	382	5,5995	1,69275	2	,5	0	0
gs2	383	5,4151	1,37002	1	,3	4	0
gs3	384	5,4844	1,24106	0	,0	38	0
gs4	383	5,3655	1,35834	1	,3	47	0
gs5	383	5,3003	1,40909	1	,3	0	0

DOI: 10.14750/ME.2022.014

os1	384	5,5729	1,25990	0	,0	42	0
os2	383	4,3943	1,50694	1	,3	0	0
os3	383	4,6214	1,53502	1	,3	0	0
os4	382	4,2932	1,26653	2	,5	0	0
os5	383	4,4282	1,11367	1	,3	0	6
profpr1	384	4,3307	1,29772	0	,0	0	0
profpr2	384	4,5781	1,49119	0	,0	0	0
profpr3	384	4,1875	1,21619	0	,0	0	0
perpr1	381	4,2467	1,23204	3	,8	0	0
perpr2	384	4,6146	1,39465	0	,0	0	0
perpr3	384	4,5651	1,59664	0	,0	0	0
qual1	384	3,8021	1,04838	0	,0	9	35
qual2	384	3,9036	,69582	0	,0	0	0
qual3	381	5,9580	1,33113	3	,8	80	0

a. Number of cases outside the range (Q1 - 1.5*IQR, Q3 + 1.5*IQR).

b. Little’s MCAR test: Chi-Square=2283.614, DF=2241, Sig.= .260

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APPENDIX C

NORMALITY

Skewness and Kurtosis results

	N	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Std. Error
vol1	384	,565	,125	-,808	,248
vol2	384	,266	,125	-1,546	,248
vol3	384	,582	,125	-,618	,248
vol4	384	-,081	,125	-1,419	,248
pu1	384	,463	,125	-,303	,248
pu2	384	,121	,125	-1,460	,248
pu3	384	,107	,125	-1,650	,248
pu4	384	,749	,125	-,133	,248
pu5	384	-,182	,125	-1,606	,248
peou1	384	-,275	,125	-1,477	,248
peou2	384	,808	,125	,031	,248
peou3	384	-,124	,125	-1,572	,248
peou4	384	-,270	,125	-1,368	,248
si1	384	,060	,125	-,774	,248
si2	384	,269	,125	-1,282	,248
si3	384	-,578	,125	-1,150	,248
si4	384	-,108	,125	-1,144	,248
fc1	384	-1,202	,125	,195	,248
fc2	384	,020	,125	-,970	,248
fc3	384	,340	,125	-,853	,248
fc4	384	-,241	,125	-,883	,248
comp1	384	-,031	,125	-1,337	,248
comp2	384	-,444	,125	-1,215	,248
comp3	384	-,082	,125	-1,164	,248
bi1	384	-,476	,125	-1,146	,248
bi2	384	,069	,125	-1,242	,248
bi3	384	-,751	,125	-,836	,248
bi4	384	-,400	,125	-1,213	,248
bu1	384	-,968	,125	-,369	,248
bu2	384	-,162	,125	-1,246	,248
bu3	384	,353	,125	-1,188	,248
bu4	384	-,318	,125	-,760	,248
gs1	384	-,965	,125	-,156	,248
gs2	384	-,770	,125	-,042	,248
gs3	384	-,776	,125	-,100	,248
gs4	384	-,612	,125	-,317	,248
gs5	384	-,503	,125	-,859	,248

DOI: 10.14750/ME.2022.014

os1	384	-1,044	,125	,397	,248
os2	384	,211	,125	-,862	,248
os3	384	,360	,125	-1,420	,248
os4	384	,624	,125	-,715	,248
os5	384	,276	,125	-1,040	,248
profpr1	384	,520	,125	-1,073	,248
profpr2	384	,387	,125	-1,346	,248
profpr3	384	,809	,125	-,410	,248
perpr1	384	,495	,125	-,862	,248
perpr2	384	,247	,125	-1,025	,248
perpr3	384	,084	,125	-,963	,248
qual1	384	,553	,125	2,274	,248
qual2	384	1,301	,125	3,120	,248
qual3	384	-1,173	,125	,026	,248

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APPENDIX D

CORRELATION MATRIX

	PU	PEOU	SI	FC	COMP	VOL	GS	OS	PROFPR	PERPR	QUAL	BI	BU
PU	1												
PEOU	,539**	1											
SI	,451**	,548**	1										
FC	,422**	,408**	,502**	1									
COMP	,364**	,351**	,278**	,559**	1								
VOL	,113*	,270**	,361**	,441**	,621**	1							
GS	,407**	,384**	,304**	,334**	,428**	,597**	1						
OS	,183*	,336**	,350**	,380**	,489**	,188**	,601**	1					
PROFPR	,376**	,146**	,319**	,428**	,376**	,259**	,359**	,505**	1				
PERPR	,341**	,308**	,200**	,412**	,463**	,201**	,250**	,363**	,535**	1			
QUAL	,138**	,247**	,286**	,334**	,442**	,347**	,462**	,444**	,167**	,609**	1		
BI	,107*	,248**	,391**	,400**	,334**	,131*	,119*	,428**	,327**	,178**	,487**	1	
BU	,205**	,222**	,354**	,370**	,388**	,402**	,471**	,337**	,493**	,539**	,544**	,632**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

DOI: 10.14750/ME.2022.014

APPENDIX E

CODING SHEET

Code	Quest. No.	Description	Values	Options	Measure
Number		Case number (Numeric)	1…384	1-384	Scale
gender	A1	Gender	Male; Female	2 opts	Nominal
age	A2	Age (years)	18-29; 30-39; 40-49; 50 and above	4 opts	Nominal
position	A3	Position at farm	Farm Laborer; Agronomist; Farm Manager; Other	4 opts	Nominal
experience	A4	Farming experience	Less than 1 year; 1-5 years; 6-10 years; 11-15 years; 21 and above	5 opts	Nominal
education	A5	Educational level	Higher secondary school; Bachelor's degree/Specialist degree; Other	3 opts	Nominal
farmtype	A6	Type of farm	Small sized farm; Middle sized farm; Large sized farm	3 opts	Nominal
year1	A7	How long have you been using e-commerce (years)	Less than 1 year; 1-5 years; 6-10 years; More than 10 years	4 opts	Nominal
selfass2	A8	How will you self-assess yourself about e-commerce usage (experience level)	Basic skills; Intermediate skills; Advanced skills	3 opts	Nominal
oftuse3	A9	At present, overall how often do you use e-commerce	Once each month; A few times a month; Once each week; A few times a week;	7 opts	Nominal

DOI: 10.14750/ME.2022.014

			Five to six times a week; Several times a day; Other		
purpose4	A10	For what purpose do you use e-commerce	For personal use; For business purpose; For both personal and business use	3 opts	Nominal
whereuse5	A11	Mostly, where do you use e-commerce in doing your farming tasks	At farm; At home; Both at farm and at home	3 opts	Nominal
enough6	A12	Currently, do you think that you use e-commerce enough or not enough or too much	Not enough; Enough; Too much	3 opts	Nominal
agree7	A13	Do you agree that e-commerce as commercial means has its advantages over the traditional commercial methods	Agree; Disagree; Do not know	3 opts	Nominal
vol1	A14	My superiors expect me to use e-commerce	Strongly disagree; Quite disagree; Slightly disagree; Neutral; Slightly agree; Quite agree; Strongly agree (***)	7 opts	Scale
vol2	A15	My use of e-commerce is voluntary	***	7 opts	Scale
vol3	A16	My boss does not require me to use e-commerce	***	7 opts	Scale
vol4	A17	Although it might be helpful, using e-commerce is certainly not compulsory in my job	***	7 opts	Scale
pu1	B1(1)	Using e-commerce enables me to accomplish tasks more quickly	***	7 opts	Scale
pu2	B1(2)	Using e-commerce improves the quality of my work	***	7 opts	Scale

pu3	B1(3)	Using e-commerce makes it easier to do my work	***	7 opts	Scale
pu4	B1(4)	I find e-commerce useful in my work	***	7 opts	Scale
pu5	B1(5)	Using e-commerce gives me greater control over my work	***	7 opts	Scale
peou1	B2(1)	Learning to use e-commerce is easy for me	***	7 opts	Scale
peou2	B2(2)	I find it easy to use e-commerce to do what I want to do	***	7 opts	Scale
peou3	B2(3)	I find it easy for me to become skilled in using e-commerce	***	7 opts	Scale
peou4	B2(4)	I find e-commerce easy to use	***	7 opts	Scale
si1	C1(1)	Management of my organization thinks that I should use e-commerce	***	7 opts	Scale
si2	C1(2)	The opinion of my organizational management is important to me	***	7 opts	Scale
si3	C1(3)	Government management thinks that I should use e-commerce	***	7 opts	Scale
si4	C1(4)	The opinion of government management is important to me	***	7 opts	Scale
fc1	C2(1)	The resources necessary (e.g. new computer hardware and software, internet etc.) are available for me to use e-commerce effectively	***	7 opts	Scale
fc2	C2(2)	I can access e-commerce very quickly within my farm	***	7 opts	Scale
fc3	C2(3)	Guidance is available to me to use e-commerce effectively	***	7 opts	Scale
fc4	C2(4)	A specific person (or group) is available for assistance with e-commerce usage difficulties	***	7 opts	Scale
comp1	C3(1)	Using e-commerce is compatible with all aspects of my work	***	7 opts	Scale

DOI: 10.14750/ME.2022.014

comp2	C3(2)	I think that using e-comerce fits well with the way I like to work	***	7 opts	Scale
comp3	C3(3)	Using e-commerce fits into my work style	***	7 opts	Scale
bi1	D1(1)	I intend to use e-commerce in my farming tasks	***	7 opts	Scale
bi2	D1(2)	I intend to use e-commerce in my nonfarming tasks	***	7 opts	Scale
bi3	D1(3)	Given that I had access to e-commerce, I predict that I would use it	***	7 opts	Scale
bi4	D1(4)	Whenever it will be possible to me, I plan to use e-commerce in my farming job	***	7 opts	Scale
bu1	D2(1)	I use e-commerce in my farming tasks	***	7 opts	Scale
bu2	D2(2)	I use e-commerce to use it in my nonfarming tasks	***	7 opts	Scale
bu3	D2(3)	Given that I had access to e-commerce, I would use it	***	7 opts	Scale
bu4	D2(4)	Whenever it is possible to me, I use e-commerce in my farming job	***	7 opts	Scale
gs1	E1(1)	The government is committed to a vision of using e-commerce in farms	***	7 opts	Scale
gs2	E1(2)	The government is committed to support farmers efforts in using e-commerce for farming purposes	***	7 opts	Scale
gs3	E1(3)	The government strongly encourages the use of e-commerce for farming purposes	***	7 opts	Scale
gs4	E1(4)	The government will recognize farmers efforts in using e-commerce for farming purposes	***	7 opts	Scale
gs5	E1(5)	The use of e-commerce for farming purposes is important for government	***	7 opts	Scale
os1	E2(1)	My organization is committed to a vision of	***	7 opts	Scale

		using e-commerce in farming tasks			
os2	E2(2)	My organization is committed to support farmers efforts in using e-commerce for farming purposes	***	7 opts	Scale
os3	E2(3)	My organization strongly encourages the use of e-commerce for farming purposes	***	7 opts	Scale
os4	E2(4)	My organization will recognize farmers efforts in using e-commerce for farming purposes	***	7 opts	Scale
os5	E2(5)	The use of e-commerce for farming purposes is important for my organization	***	7 opts	Scale
profpr1	F1(1)	Using e-commerce helps in improving my farming practices	***	7 opts	Scale
profpr2	F1(2)	Using e-commerce helps in improving my administrative tasks	***	7 opts	Scale
profpr3	F1(3)	Overall, using e-commerce helps in improving my professional practices	***	7 opts	Scale
perpr1	F2(1)	Using e-commerce helps in improving my farming knowledge	***	7 opts	Scale
perpr2	F2(2)	Using e-commerce helps in improving my personal knowledge	***	7 opts	Scale
perpr3	F2(3)	Overall, using e-commerce helps in improving my personal development	***	7 opts	Scale
qual1	F3(1)	Using e-commerce helps me have more time to focus on faming	***	7 opts	Scale
qual2	F3(2)	Using e-commerce helps me have more time for leisure	***	7 opts	Scale
qual3	F3(3)	Overall, using e-commerce helps in improving my quality of working life	***	7 opts	Scale

Note: *** ─ Strongly disagree; Quite disagree; Slightly disagree; Neutral; Slightly agree; Quite agree; Strongly agree

DOI: 10.14750/ME.2022.014

APPENDIX F

MEASUREMENT MODEL (first run)

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	89	892.592	329	.000	2.7130
Saturated model	241	.000	0		
Independence model	19	5473.384	356	.000	15.374

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.064	.881	.875	.712
Saturated model	.000	1.000		
Independence model	.902	.251	.124	.142

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.938	.924	.939	.929	.921
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.879	.790	.812
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	167.592	129.851	235.179
Saturated model	.000	.000	.000
Independence model	5312.483	5092.495	5568.768

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	1.186	.685	.501	.912
Saturated model	.000	.000	.000	.000
Independence model	20.078	20.435	19.514	21.312

DOI: 10.14750/ME.2022.014

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.067	.062	.061	.000
Independence model	.214	.238	.219	.000

AIC

Model	AIC	BCC	BIC	CAIC
Default model	425.328	432.564	630.234	654.758
Saturated model	380.000	410.426	1049.982	1239.412
Independence model	5547.452	5551.637	5608.279	5614.361