UNIVERSITY OF MISKOLC

HANTOS ELEMÉR DOCTORAL SCHOOL OF BUSINESS, MANAGEMENT AND REGIONAL SCIENCES

E-COMMERCE USAGE BY WHEAT-ORIENTED FARMERS IN KAZAKHSTAN

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Thesis statements of Doctoral Dissertation

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Contents

1. Introduction, rationale of the research

I began my Ph.D. studies as a full-time Ph.D. student at Institute of Management, University of Miskolc from 2017. My research interest 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.

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.

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.

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.

2. Purpose and methodology of the research

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 1.

Figure 1: 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 2.
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.

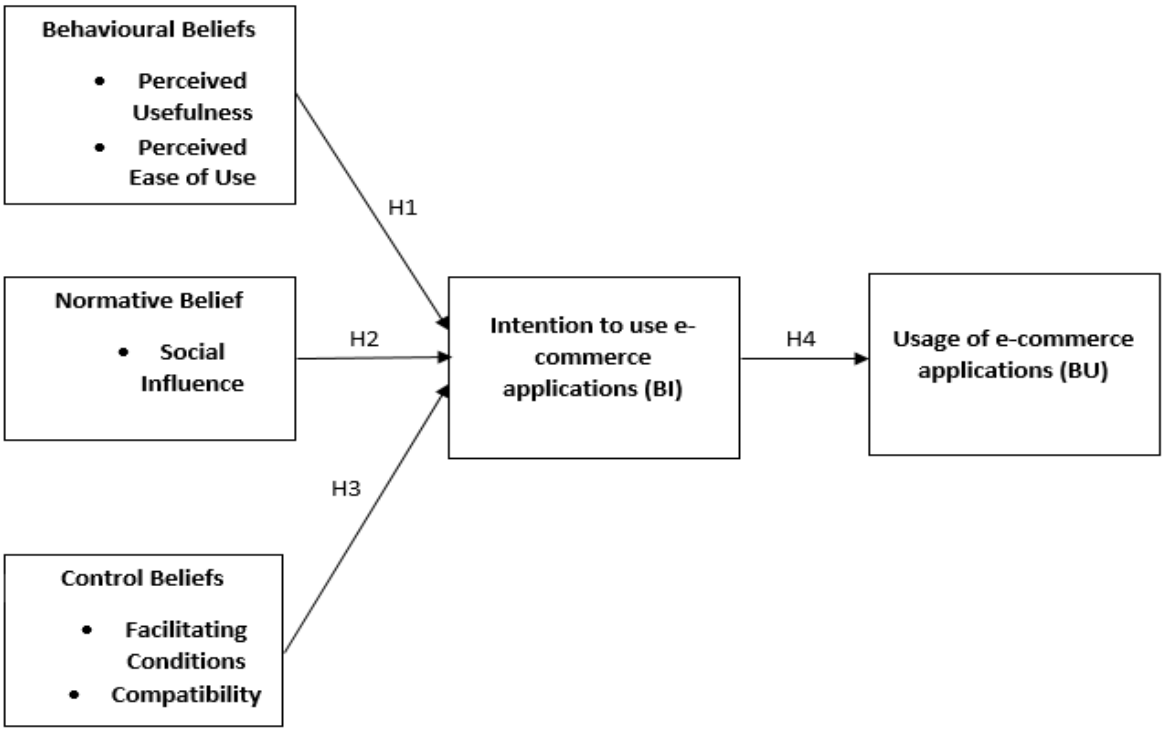

Figure 2: Proposed research model
Source: Based on Venkatesh et al. (2003)
*Note: BU=Use Behaviour, BI=Behavioural Intention

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". 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)

3. Results of empirical tests

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.
In the measurement model shown in Figure 3, 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.

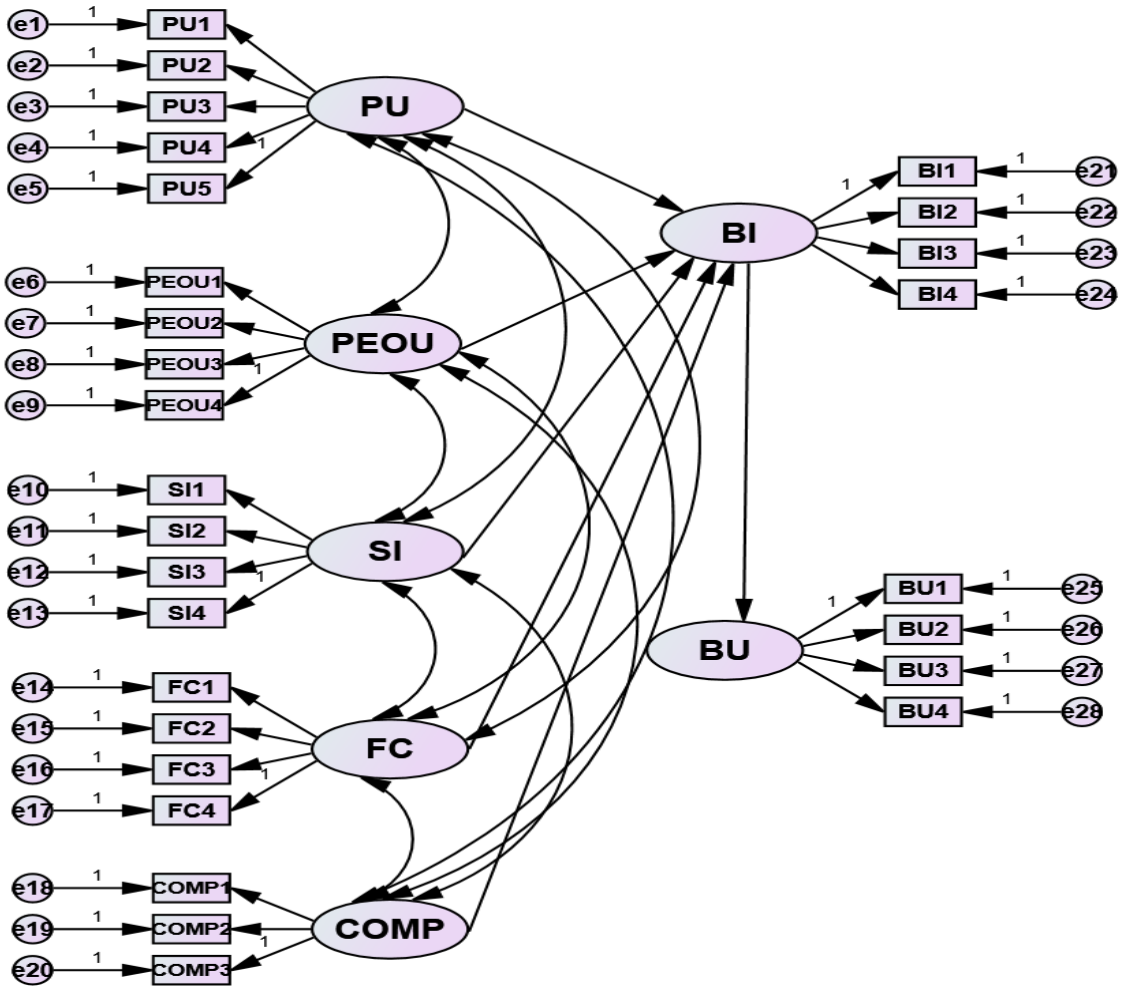

Figure 3: Measurement model representation in IBM AMOS

Source: Own edition

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 1.

Table 1: 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. 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 2.

Table 2: 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.

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 3).

Table 3: 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 4.

Table 4: 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

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 5).

Table 5: 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 5; alpha values with the threshold value higher than 0.7 are acceptable (Hair et al., 2006).

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 4.

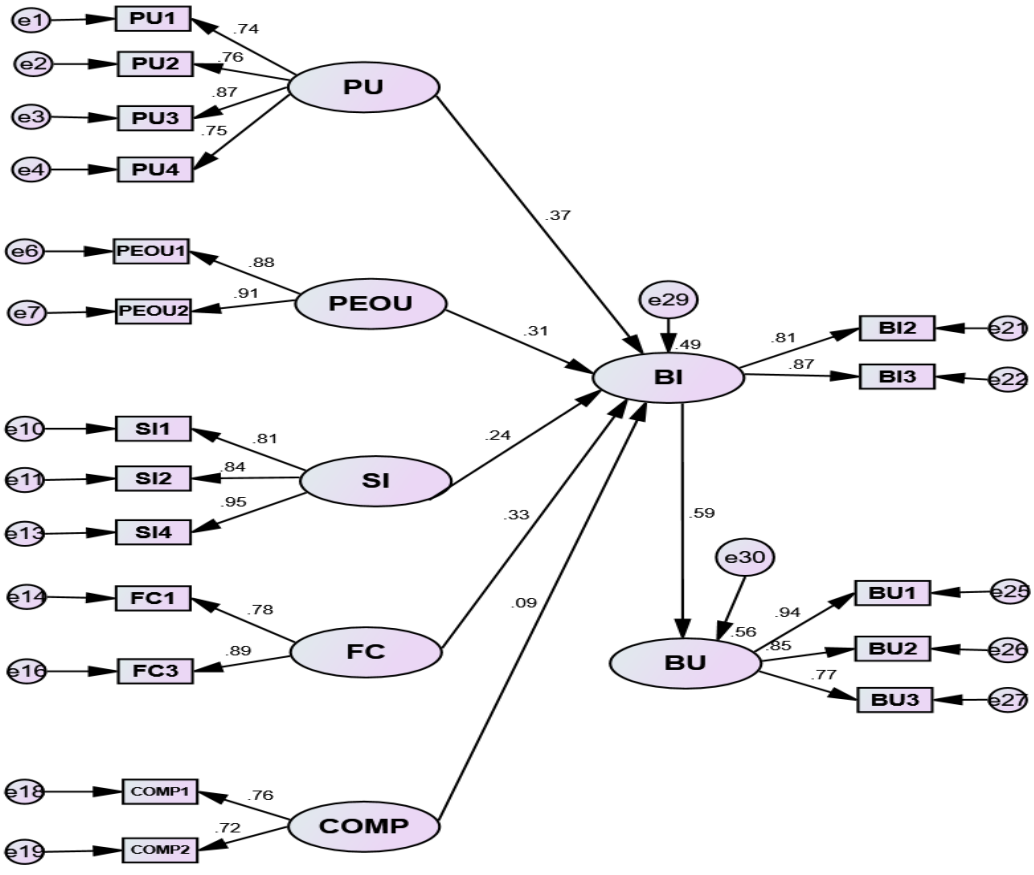

Figure 4: Results of the developed model

Source: Own edition

Table 6: 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

Regression weights are the unstandardized coefficient estimates generated from maximum likelihood procedure (see Table 6). 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 6). 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).

4. Conclusions, suggestions, limitations and contributions

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 7 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 7: 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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