University doctoral (PhD) dissertation thesis

USE OF INNOVATIVE INFORMATION TECHNOLOGIES IN TOURISM MANAGEMENT

Gergely Gábor Ráthonyi

Supervisor:

Dr. László Várallyai

associate professor

University of Debrecen

Károly Ihrig Doctoral School of Management and Business

Debrecen, 2016

1. RESEARCH BACKGROUND, RESEARCH GOALS AND INTRODUTCTION OF HIPOTHESES

Despite the extraordinary growth of the practical importance of tourism researches related to its theory have been started in the beginning of the 1900s. Noted national and international experts conducted research how to define tourism, typologies and motivations of tourists and the system and effects of tourism (BERNECKER, 1962; SMITH, 1989; LENGYEL, 1992; PUCZKÓ – RÁTZ, 2002; TASNÁDI, 2002; MICHALKÓ, 2012; ROBINSON ET AL., 2013). In recent years researchers started to focus on a new, dynamically improving area – the use of information and communication technologies (ICT) in tourism. In spite of large number of international researches related to the relationship between tourism and information technologies are available, in Hungary few relevant publications can be found (GROTTE, 2010).

This perceived shortcoming inducted the selection of the topic of my dissertation. According to this, my research is focusing on the role of modern information and communication technologies in tourism, in a consumer point of view. During processing the available literature my goal was the further specification of the topic. My dissertation analyses two actual trends, the role of social media and mobile services in tourism.

My dissertation focuses on interdisciplinary approach. During the final specification of my research topic the aim was to fulfil the requirements of Károly Ihrig Doctoral School in Business and Management Studies and to connect to the scientific work of Institute of Applied Informatics and Logistics.

In my dissertation the following research goals were defined (the chapters of my dissertation are following this structure):

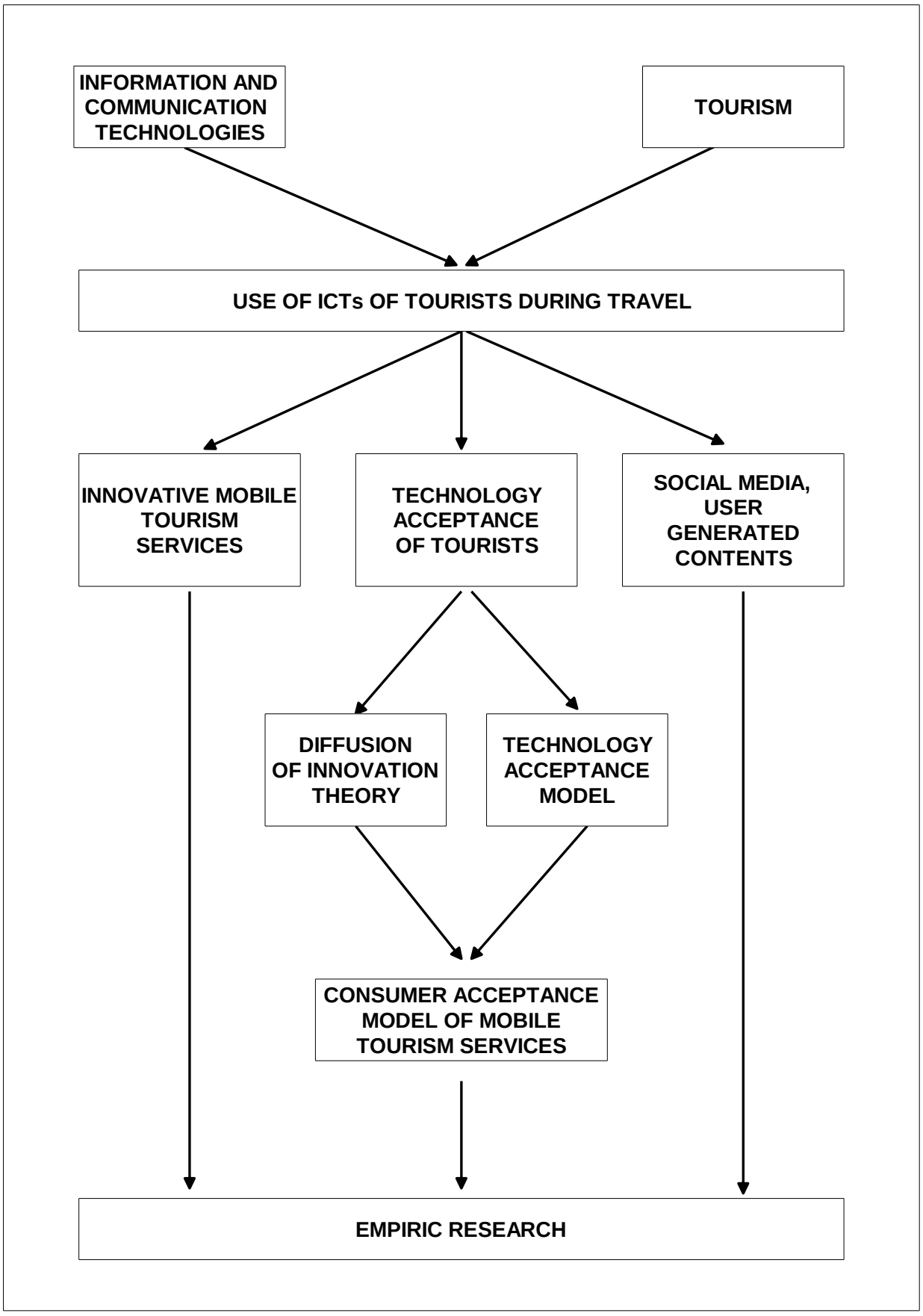
1. Objective 1: Main objective of the dissertation is to examine the used information sources during leisure travels focusing especially the analysis of the role of social media pages (user generated contents).
2. Objective 2: The aim of the dissertation is to collect, introduce and systemize the most important trends of ICT use in tourism based on international literature, in consumer point of view.

3. Objective 3: Collecting and systemizing innovative mobile services and introducing their use in tourism.
4. Objective 4: The dissertation focuses on the technology acceptance of users. Main objective is to build up a model that is applicable to demonstrate the user acceptance of mobile tourism services.
5. Objective 5: Evaluate the use of social media (user contents) and mobile devices of adult internet user community during leisure travels based on empiric data – with the use of country level query.

Corresponding to my objectives the following hypotheses were defined:

- Hypothesis 1: The innovative mobile services of recent years – mobile applications, mobile codes, near field communication, augmented reality – contribute to the realization of high level, effective information management in tourism.
- Hypothesis 2: The integration of the technology acceptance model and the Roger's diffusion of innovation theory is applicable to build up a model working in tourism and representing consumer acceptance of mobile tourism services.
- Hypothesis 3: In the prevention of future mobile tourism services perceived ease of use is the most affective factor.
- Hypothesis 4: The available online user generated contents related to tourism during travel planning are more important than the traditional advertising tools (travel agencies, official web pages).
- Hypothesis 5: The main role of social media during travel-planning appears in the first phase (before travel) during the search of travel information.

Figure 1.: Research model



Source: Own edition

2. INTRODUCTION OF DATABASE AND APPLIED METHODOLOGY

2.1. Research process

During research either primary or secondary data collection was fulfilled. The overview of the given topic and the establishment of research were started with secondary information and data. Through this, a complex overview of related results and actual scientific point of view was given with the help of relevant national and international publications. After that, I defined the objectives and related hypotheses of my research and elaborated my questionnaire.

2.2. Secondary information and data collection

During secondary data process the main goal was to collect and systemize the national and international publications to get a holistic and relevant picture to the primary research. Based on national and international databases (KSH, UNWTO, WTTC) statistical data, scientific publications and books were processed.

Papers related to ITCs were collected from national and international publication databases (ScienceDirect, Emerald Management, Sage Journal, Matarka).

Due to the objective, that the most relevant and up-to-date papers should be collected, the search were limited to publications published between 2005 and 2015.

2.3. Forming the questionnaire

The query of the questionnaire was preceded by small sample screen (N=75) in 2014 spring, among university students with the aim of finalizing questions, correcting mistakes and for higher validity.

For the query of the finally questionnaire (December 2015) CAWI method (online questionnaire) was used. The representative query was ensured by the online surface of eNET market research company. The research did not want to examine the whole population only focused on the internet user age-group, they gave the base multitude. The questionnaire was filled precisely by 636 people, this multitude represented the internet user population over 18 according to gender, age and region. The data thanks to the online research did not need manual input, coding was realized with the cooperation of eNET market research

company. The statistical analyses were fulfilled with SPSS 22.0 and AMOS 22.0 software. The figures for more proper visualization were done with Microsoft Office Excel and RFFLOW.

The questionnaire includes question from the following areas: socio-demography questions, internet use, social media use, travel habits, use of mobile devices during travel, role of social media and user content during travel, questions related to the build model.

2.4. Statistical evaluation methods

The used methods during the evaluation of the questionnaire due to their wide reputation will not be presented in my dissertation. During the process of research results the following statistical analyses were use (SAJTOS – MITEV, 2007):

- average, standard deviation, frequency
- Pearson's chi-square test,
- Analysis of variance.

The statistical analysis related to the model will be presented in the following chapter.

2.4.1. Basics of structural equation modelling

The built model was based on structural equation modelling (SEM) and was used for testing the presumed model, confirmation of hypotheses, testing the applied scales and describing the relationships between the relevant variables used in the research. The SEM model can be traced back to path analysis that describes the connection between cause and effect with regression equations. The SEM essentially an improved version of this model (improved with equations with hidden variables) where the structural relationship between the variables is also analysed and taken into consideration. This evaluation method is mainly used for data analysis on the field of sociology, economy, and behavioural sciences (BOLLEN, 1989; KOLTAI, 2013).

The variables of SEM model can be perceptible, quantitative so called manifest variables, or directly not perceptible not quantitative so called latent variables that can be determined by the process of manifest variables. The most expressive form of the model is the space-diagram that contains all variables of the model and the connections between them (HAIR et al., 2010; KOLTAI, 2013).

The model can be divided into two parts a measurement model and a structural model. The measurement model part is a validating factor model in which the measurement of latent variables with manifest variables takes place. The validating factor analysis is the first step to determine an applicable model in the frame of structural equation modelling. We would not move to the next step in model building until the validity of our measurement model is not realized. In the structural part the cause and effect relations among the variables are estimated (NEUMANN-BÓDI, 2013). The two parts are not separated of course the estimation of the full model is realized in the same time. The difference between the SEM and validity factor analysis is that in the factor analysis there are no assumed one-way relations between the latent variables that means there are no cause and effect relationships between the factors while the SEM determines these connections as well (NEUMANN-BÓDI, 2013).

The most important scientific conclusion of McDONALD – HO (2002) is the quality of fit of the structural equation model is not applicable if the requirement related to the quality of the fit of the two part (measurement model and structural model) is not fulfilled. A model can be handled as applicable if first we fit the measurement model as fit the structural model (KLINE, 2010).

In the case of latent variable modelling the structural equation modelling is frequently used. The two most common types of this model is the covariance based structural equation modelling - CB-SEM and the partial least squares structural equation modelling - PLS-SEM (HAIR et al., 2010).

Because in my dissertation the objective was to test a model that is based on theories and the PLS model is not applicable to validate the applicability of the complex model (HAIR et al., 2010) I used the CB-SEM model and latent variables and scales (according to the international literature).

During structural equation modelling the estimation methods that are used in covariance analysis (Maximum-Likelihood and Generalised-Least-Square) assume the normal distribution of the variables which was tested with two different statistical method Kolmogorov-Smirnov, Shapiro-Wilk (SAJTOS – MITEV, 2007). Frequently appears that

the used scales do not show normal distribution because the tests are strict to the requirements.

The examination of Mahalanobis-distance makes possible to filter the variety between each cases to ensure the multi-normal distribution. During my research there was no case when the given value was higher than it was required in the literature (NEUMANN-BÓDI, 2013).

Before starting the analyses it is important to check and clean the collected data and handle the missing values. The largest problem is given by the missing elements but in my case all of the people filled the questionnaire completely.

2.4.2. Analysis of measurement model

During the analysis of the measurement model the following validity and reliability indices were taken into consideration based on the work of HENSELER et al., (2009); HAIR et al., (2010); NYÍRŐ, (2011); GASKIN, (2012); NEMANN-BÓDI, (2013).

- Examination of direct standardised weights related to reflective indicators (expected value above 0.7) and explained variance (expected value above 0.5).
- Examination of composite reliability of latent concept(expected value above 0.7).
- Examination of average variance extracted of latent variable (expected value above 0.5).
- Examination of discriminate validity with the analysis of the difference between AVE and CR.

2.4.3. Analysis of structural model

The examination of the fit of models demonstrates that the assumed model is applicable to explain the correlation between the variables. The fit of model and the quality of the model can be determined by several measures. The literature is concerned with the use and evaluation of fitting tests (GOFFIN, 2007; HAYDUK et al., 2007; HOOPER et al., 2008; BYRNE, 2010; HAIR et al., 2010).

During the analysis of the fit of structural models - in the case of validity factor analysis as well - the following fit indices were examined based on HOOPER et al., (2008), HAIR et al., (2010) and BYRNE (2010):

- Chi-square,
- GFI (Goodness-of-Fit Index),
- AGFI (Adjusted Goodness-of-Fit Index),
- RMSEA (Root Mean Square Error of Approximation),
- SRMR (Standardized Root Mean Square Resudial),
- NFI (Normed Fit Index),
- NNFI (Non-Normed Fit Index,),
- CFI (Comparative Fit Index),
- IFI (Incremental Fit Index).

Based on the proposals of literature, I summarize the used criteria in the case of each fit index in table 1.

Table 1.: Considered fit indices in the case of measurement and structural models

Fit indices	Recommended value
v^2/d.f.	<5,00
GFI	>0,90
AGFI	>0,80
RMSEA	<0,06
SRMR	<0,08
NFI	>0,90
NNFI	>0,90
CFI	>0,90
IFI	>0,90

Source: Own edition based on HOOPER et al., (2008), BYRNE (2010) and HAIR et al., (2010)

3. THE MAIN OBSERVATIONS OF THE DISSERTATION

The main observations and conclusions of my dissertation are demonstrated through the hypotheses:

3.1. Possibilities of mobile technologies in tourism

Hypothesis 1: The innovative mobile services of recent years - mobile applications, mobile codes, near field communication, augmented reality - contribute to the realization of high level, effective information management in tourism.

QR code in tourism

The number of examples in tourism related to the open source innovative QR code and Smart-QR code, which ensures dynamic content is continuously increasing:

- Museums, exhibitions,
- Accommodations,
- Restaurants,
- Airlines,
- Sights.

The correct use of QR codes may give and advantage to the tourist suppliers against their competitors and may increase the quality of services. It is worth to concentrate to the QR codes because the use of smart phones is increasing and active tourists are open minded to these devices and require the fast and effective availability of the services.

NFC in tourism

NFC is one of the newest information and communication technologies and give various possibilities for the tourism. Its application possibilities are the followings:

- Mobile payment (already available in Hungary),
- Information services, tourist guides (Museum of London, old city area of Sidney),
- Hotel services (check in system, room keys),
- Augmented reality in tourism,
- Mobile ticket validation (Barcelona, T-CityPass, Szolnok city card for mobile devices),

- Local based services (Modern and Contemporary Gallery, Nice).

Augmented reality in tourism

In my dissertation I concern the broader representation of augmented reality based on the definition of KAJOS - BÁNYAI (2011) which says augmented reality is the observed reality (generally observed with our eyes) filled with virtual information (generally visual information but it can be acoustic and tactile signs) in real time.

In various scientific areas (art of war, technology, medical science) augmented reality is not a new innovation but in tourism it is a novelty. Without completeness the technology can be noticed in the following areas:

- Printed handouts and brochures,
- Tourist guide applications supported with augmented reality,
- Museums,
- Restaurants,
- Navigation with augmented reality,
- Augmented reality translator applications.

As a summary, we can conclude that the mobile tourism services are very diverse, according to the complexity of tourism. Those new and innovative mobile services that appeared during recent years are introduced and used in tourism as well. By applying these services tourists can reach plus information easily and fast that contributes to the dynamic information flow.

The introduction of theory and practical importance of mobile tourism services confirmed my first hypothesis.

3.2. Analysis of acceptance of mobile services in tourism

During the analysis of my model I defined the following hypotheses:

Hypothesis 2: The integration of the technology acceptance model and the Roger's diffusion of innovation theory is applicable to build up a model working in tourism and representing consumer acceptance of mobile tourism services.

Hypothesis 3: In the prevention of future mobile tourism services perceived ease of use is the most affective factor.

The hypothetic model was examined with structural equation modelling which was executed in more steps. Basically the method is divided into two parts, a validity factor analysis and a structural modelling but based on the work of GASKIN (2012) primary I made an exploration factor analysis as well with aim of preparing the variables to a more precise structural equation modelling. Before starting the analyses it is important to check and clean the collected data and handle the missing values. The largest problem is given by the missing elements but in my case all of the people filled the questionnaire completely. The analysis of mobile services in tourism were examined in the case of smart-phone users. The population was representative concerning the genre but considering other parameters the values varied in each group. Examining age the youth became a part of the model. Comparing the regions, Middle Hungary gave the largest number and Middle Transdanubia gave the least.

3.2.1. Exploring factor analysis

Metric data is a basic requirement in factor analysis which was fulfilled in my case because of the Likert-scale that was used in my questionnaire. The requirement of the number of population, that is the data should be three times larger than the examined variables was also fulfilled (MALHOTRA – SIMON, 2008).

The following table summarizes the descriptive statistics of the scale items.

Table 2.: Descriptive statistics of scale items and indicators

Item	Minimum	Maximum	Mean	Std. Deviation
EHE1	1	7	4,29	1,807
EHE2	1	7	4,19	1,564
EHE3	1	7	4,00	1,578
EH1	1	7	4,36	1,693
EH2	1	7	4,57	1,670
EH3	1	7	4,50	1,705
EH4	1	7	4,54	1,683
EH5	1	7	4,32	1,698
EH6	1	7	5,10	1,550
ATT1	1	7	4,54	1,544
ATT2	1	7	4,46	1,521
ATT3	1	7	4,37	1,543
HSZ1	1	7	4,94	1,195
HSZ2	1	7	5,00	1,240
TEH1	1	7	4,22	1,758
TEH2	1	7	4,12	1,714
TEH3	1	7	4,12	1,776
BIZ1	1	7	4,02	1,399
BIZ2	1	7	4,51	1,334
BIZ3	1	7	4,29	1,184
KOMP1	1	7	4,18	1,586
KOMP2	1	7	4,14	1,599

Source: Own calculation

For the analysis of those parameters that affect the acceptance of tourism mobile applications. I used principal component analysis with Varimax rotation and Kaiser Normalisation. With the principal component analysis my main objective was to determine the smallest number of factors that explain the most variances. The most important value during the evaluation of the applicability of factor analysis is KMO value which quality can be determined with the following intervals (SAJTOS – MITEV, 2007):

- KMO>=0.9 excellent
- KMO>=0.8 very good
- KMO>=0.7 acceptable
- KMO>=0.6 medium
- KMO>=0.5 weak
- KMO<0.5 unacceptable

In my case the KMO value was 0.797 which indicates that my variables are applicable to realize the factor analysis. The significant result of Bartlett-test also confirms that the input

variables are applicable for factor analysis because there is correlation between them (Table 3.).

Table 3.: Results of Kaiser-Meyer-Olkin (KMO) criteria and Bartlett-test

Kaiser-Meyer-Olkin Measure of Sampling		,797
Bartlett's Test of Sphericity	Approx. Chi-Square	5540,445
	df	231
	Sig.	,000

Source: Own calculation

With the aim of forming the factor-matrix more comprehensive I used varimax rotation. The variance rate, explained by the given seven factors, was 83.96% (Table 4.) which is higher than the required 60% (SAJTOS – MITEV, 2007). The statistical requirements were fulfilled by all factors (communality > 0.5) which indicated the following factor matrix (Table 5.).

Table 4.: Factor-weight-matrix

Total Variance Explained

Factor	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Comulative %	Total	% of Variance	Comulative %	Total	% of Variance	Comulative %
1	6,663	30,285	30,285	6,663	30,285	30,285	5,169	23,497	23,497
2	3,254	14,789	45,074	3,254	14,789	45,074	2,767	12,577	36,074
3	2,525	11,475	56,550	2,525	11,475	56,550	2,432	11,054	47,128
4	2,042	9,284	65,833	2,042	9,284	65,833	2,291	10,412	57,539
5	1,558	7,080	72,913	1,558	7,080	72,913	2,281	10,369	67,908
6	1,374	6,246	79,160	1,374	6,246	79,160	1,814	8,243	76,151
7	1,057	4,803	83,963	1,057	4,803	**83,963**	1,719	7,812	83,963
8	,522	2,372	86,335						
9	,476	2,163	88,498						

Source: Own calculation

Table 5.: Results of varimax rotation

	Component						
	1	2	3	4	5	6	7
EH2	**,926**						
EH1	**,923**						
EH4	**,908**						
EH3	**,908**						
EH5	**,872**						
EH6	**,746**						
EHE1		**,944**					
EHE3		**,936**					
EHE2		**,925**					
TEH2			**,944**				
TEH3			**,923**				
TEH1			**,807**				
BIZ3				**,896**			
BIZ2				**,835**			
BIZ1				**,807**			
ATT1					**,891**		
ATT2					**,862**		
ATT3					**,705**		
KOMP2						**,920**	
KOMP1						**,902**	
HSZ2							**,900**
HSZ1							**,898**
Principal Component Analysis, Varimax with Kaiser Normalization, 6 iterations							

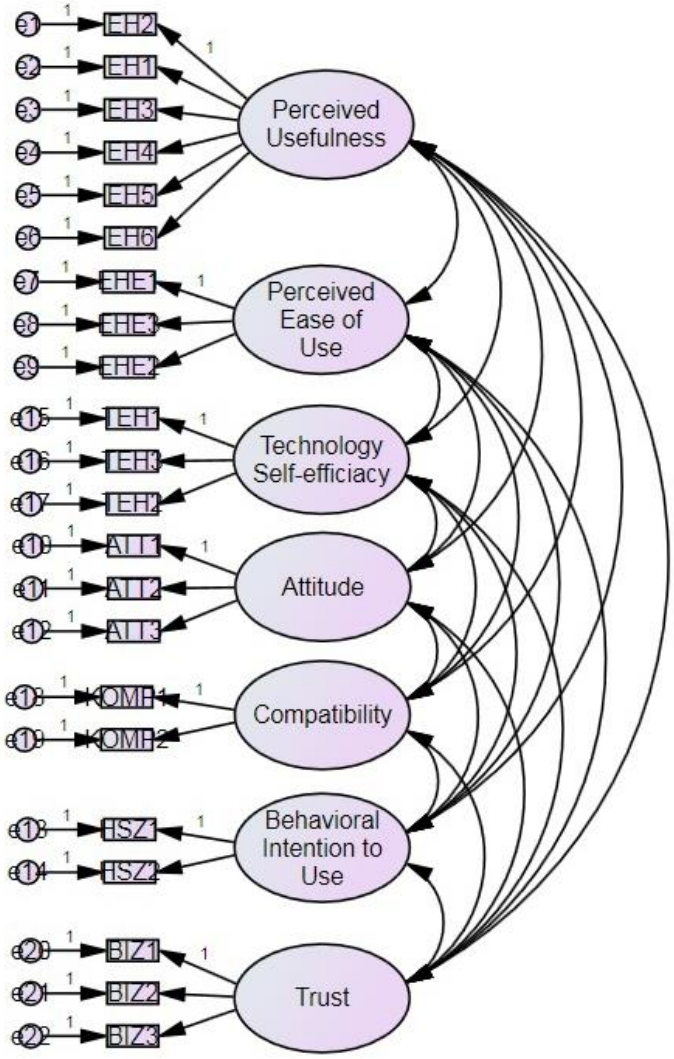
Source: Own calculation

To confirm the given results I used cross validity check method which's principle is the random separation of the population and afterwards factor analysis on both datasets (SAJTOS – MITEV, 2007). During cross validity the criteria of number if elements was also fulfilled after the bisection of data. Because of size limitation the detailed description of the two factor analyses is set aside. During the analysis there was no difference between the factor structure of the bisected and complete data whihc means that the results are validated.

3.2.2. Conformity factor analysis

With the aim of confirming the explored factor structure, testing my model and stricter evaluation of the reliability and validity of indicators and scales I realized conformity factor analysis (CFA) which's input and output factor weights (with standardised factor weights) are shown on the following figures.

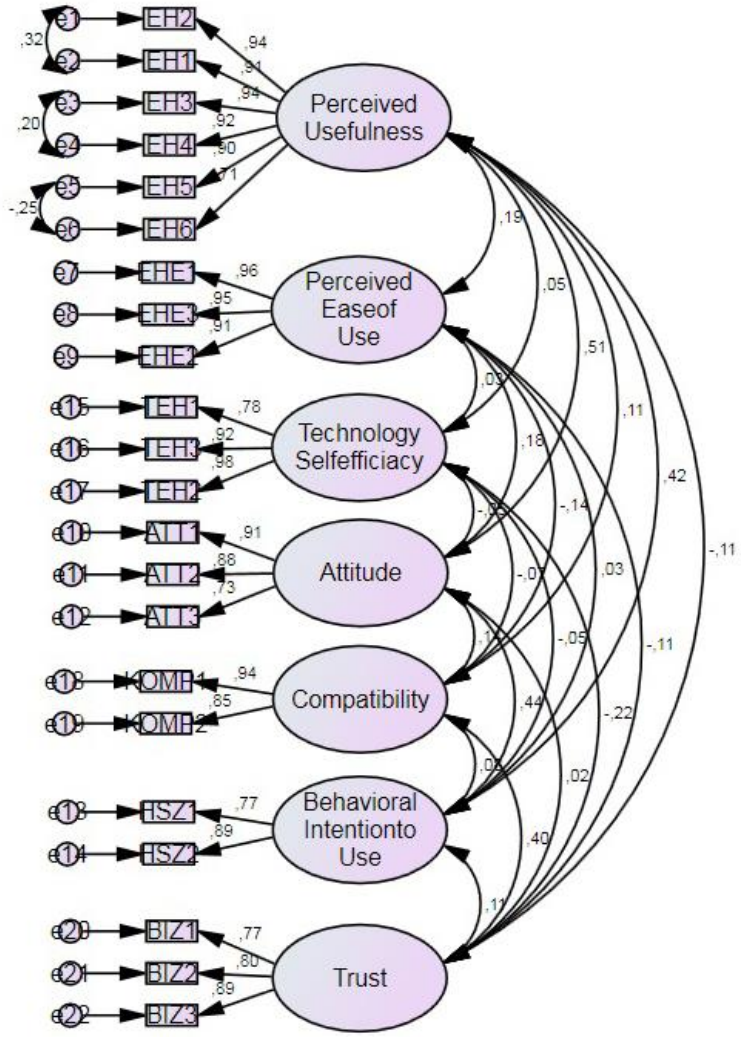
Figure 2.: Input factor structure



Source: Own edition

During factor analysis the factor weights that are lower than 0.5 are worth to be excluded but in my analysis all the values were acceptable. Because of this next to the continuous analysis of the fit of the model primarily I evaluated the extreme values indicated by the modification indices and I demonstrated the connection path (covariance) between two errors where it was necessary. During the draft of connection paths I fulfilled the basic requirement that the regression arrows should be drawn between errors connected to the same factor (GASKIN, 2012). After the continuous repetitive confirmation I process through the applicable fit of the measurement model with the aim that the reliability of the indicators should reach the required 0.7 value (HAIR et al., 2010).

Figure 3.: Output factor structure and standardised factor weights



Source: Own edition

The indices connected to the output factor structure are summarized in Table 6., where the values of acceptance criteria are also represented.

Table 6.: Fit indices of the measurement model

Model Fit Indices	Recommended Guidelines	Values
RMSEA	<0,07	0,058
CMIN/d.f	<5,00	1,898
NFI	>0,90	0,935
NNFI (TLI)	>0,92	0,960
CFI	>0,92	0,968
GFI	>0,90	0,894
AGFI	>0,90	0,855
IFI	>0,95	0,968

Source: Own calculation

The GFI and AGFI indices did not fulfil the required criteria but HAIR et al., (2010) and BYRNE (2010) do not suggest their use because of the sensitivity of the element number of population. According to this I did not take these indices into consideration as well. The criteria was fulfilled in the case of other indices.

After determining the sufficient fit I examined the reliability and validity which is represented on the following table. The table demonstrates that next to the factor weight the Cronbach-alpha and the Composite Reliability indices were over the required 0.7 value while the criteria was also fulfilled in the case of AVE (AVE > 0.5)

Table 7.: Results of reliability and validity calculations

Construct	Item	Loading	Cronbach-alfa	Composite Reliability (CR)	Average Variance Extracted (AVE)
Behavioral Intention to Use	HSZ1	0,78	0,72	0,73	0,58
	HSZ2	0,74			
Attitude	ATT1	0,92	0,87	0,88	0,71
	ATT2	0,87			
	ATT3	0,73			
Perceived Usefulness	EH1	0,92	0,96	0,96	0,80
	EH2	0,94			
	EH3	0,94			
	EH4	0,92			
	EH5	0,90			
	EH6	0,71			
Perceived Ease of Use	EHE1	0,96	0,95	0,96	0,89
	EHE2	0,91			
	EHE3	0,95			
Trust	BIZ1	0,77	0,83	0,86	0,68
	BIZ2	0,80			
	BIZ3	0,89			
Technology Self-efficacy	TEH1	0,78	0,88	0,93	0,81
	TEH2	0,98			
	TEH3	0,92			
Compatibility	KOMP1	0,92	0,90	0,89	0,80
	KOMP2	0,87			

Source: Own calculation

Based on the cross weight validity analysis (Table 8.) the correlation of the indices was higher than their own latent variable in every case. This criteria was also fulfilled.

Table 8.: Results of cross weight validity

	KOMP	EH	EHE	ATT	HSZ	TEH	BIZ
KOMP	0,894						
EH	0,111	0,893					
EHE	-0,148	0,185	0,940				
ATT	0,147	0,504	0,177	0,843			
HSZ	0,271	0,475	0,088	0,683	0,758		
TEH	-0,066	0,048	0,035	-0,054	-0,062	0,900	
BIZ	0,404	-0,110	-0,113	0,017	0,252	-0,214	0,820

Source: Own calculation

As a summary we can conclude that based on the conformance of the fit indices and the reliability and validity tests my measurement model is applicable. In the next chapter I will give an overview of the result of structural model tests and the evaluation of related hypotheses.

3.2.3. Analysis of structural model and related hypotheses

I examined the fit indices in the case of structural model as well which is summarized in the following table.

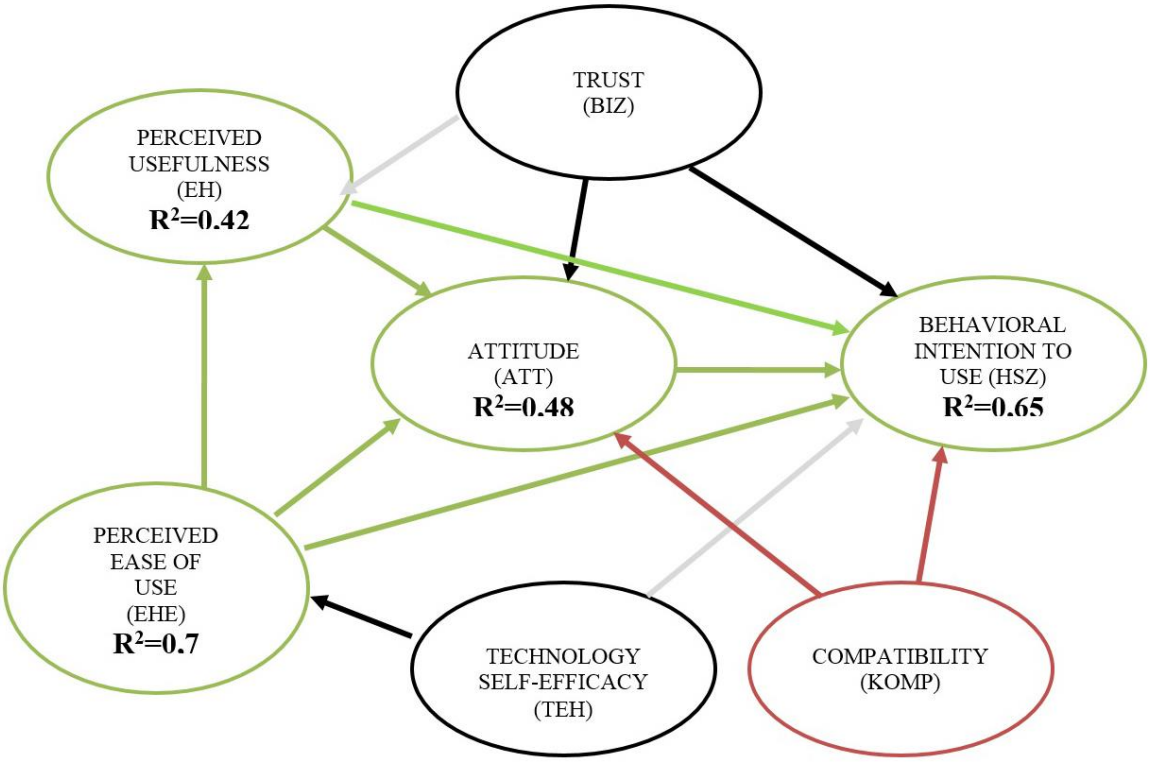
Table 9.: Fit indices of the structural model

Model Fit Indices	Recommended Guidelines	Values
RMSEA	<0,07	0,069
CMIN/d.f	<5,00	2,292
NFI	>0,90	0,920
NNFI (TLI)	>0,92	0,941
CFI	>0,92	0,953
GFI	>0,90	0,886
AGFI	>0,90	0,844
IFI	>0,95	0,953

Source: Own calculation

The GFI and AGFI indices also did not fulfil the required criteria but based on HAIR et al., (2010) and BYRNE (2010) I did not take them into consideration. According to the fit quality I accept my model which is shown on Figure 4.

Figure 4.: Acceptance model of tourism mobile services and the significant paths



Source: Own edition. The grey lines are not significant paths.

The results represent that the assumed connections of trust did not realized in one situation (H8: 0.01) and there was no significant conformation in the case of direct connection between the purpose of use and technological self-efficiency (H10: 0.00).

The own technology using ability (technological self-efficiency) of the person positively affects the perceived ease of use of mobile tourism services (H11: 0.25).

The perceived ease of use of mobile tourism services on the one part increases its sense of usefulness (H4: 0.65) on the other part there was significant relationship between the given attitude to the use (H3: 0.39) and the forming of intention to use (H5: 0.21). The perceived use of mobile tourism services increase the attitude to their use (H1: 0.25) and directly the intention of use as well (H2:0.16) Compatibility shows significant relationship with the tow examined variable: attitude (H13: 0.22), intention of use (H12: 0.16). The perceived reliability of the use of mobile tourism services positively affect the attitude to their use (H7: 0.30) and the future intention of use (H9: 0.25). Positive relationship can be found between the attitude and the intention of use (H6: 0.44).

As a summary, my model explains 65% of the variance of the intention of use which is given by the direct relationship among perceived usefulness, trust, compatibility and attitude variables. The explained variance of attitude is 48% which demonstrates direct effect of ease of use, perceived usefulness, trust and compatibility. The explained variation of perceived usefulness is 42% which is indicated by the effect of ease of use variable. The explained variance of perceived ease of use is 7% which is given by the relationship with the technology self-effectiveness.

I examined the direct and indirect relationships and the complex effects between the variables which is summarized in Table 10. The standardized values are always given in the dimension of two variables (dependent and independent). The significance levels are also noticed.

To determine the significance level Bootsrapping method was used which process is based on the standard errors of estimation functions and return sampling which is used to estimate confidence-intervals (MARTON, 2005).

Table 10.: Analysis of the complex, direct and indirect affects between the

Dependent variable	Independent variable	Direct effect	Indirect effect	Total effect
Future intention of use	Attitude	0,438		0,438
	Trust	0,252	0,135	0,387
	Perceived usefulness	**0,156**	0,109	0,265
	Perceived ease of use	**0,207**	0,345	0,551
	Compatibility	**0,134**	0,098	0,232
	Technology self-efficacy	~~-0,001~~	0,141	0,146
Attitude	Trust	0,301	~~0,003~~	0,304
	Perceived usefulness	0,248		0,248
	Perceived ease of use	0,393	0,162	0,554
	Compatibility	0,223		0,223
	Technology self-efficacy		0,141	0,141
Perceived usefulness	Trust	~~0,11~~		~~0,11~~
	Technology self-efficacy		0,166	0,166
	Perceived ease of use	0,651		0,651
Perceived ease of use	Technology self-efficacy	0,255		0,255

*Source: Own calculation ($p<0.01$; **$p<0.05$**.; ~~not significant~~)*

The technology self-efficacy has a significant indirect effect on the perceived usefulness (R^2=0.166), on the attitude (R^2=0.141) and the future intention of use (R^2=0.141). There was low significant indirect effect between compatibility (R^2=0.098) and the future intention of use.

There was also significant indirect effect between the perceived ease of use (R^2=0.345) and the intention of use and in the case of attitude to use (R2=0.345). The ease and complexity of is a deterministic affective factor of intention of use, as it is written in the preliminary literature. We can conclude that the effect of perceived ease of use on the intention of use is partly influenced by the perceived usefulness and attitude variables. The largest indirect affect on intention of use was performed by the ease of use variable (R2=0.345).

I accept the fit of the model with the 65% explaining power. It explains the use of mobile tourism services during travel with 48% in the case of attitude, 42% in the case of perceived usefulness and 7% in the case perceived ease of use. Summarizing, we can conclude that the integration of diffusion of innovation theory into the model and the implementation of trust variable into the model that analyzes the consumer's acceptance of mobile tourism services are reasonable.

Based on the results given by the structural model we can conclude that the described two hypotheses (Hypothesis 2 and Hypothesis 3) are justified. It is confirmed that the diffusion of innovation theory and the TAM model is applicable to predict the future use of mobile tourism services. It is also confirmed that the perceived ease of use is the most affective factor during the individual acceptance of mobile tourism services considering the examined variables.

The results of hypotheses connected to each factor are demonstrated in Table 11. that contains the results of direct relationships.

Table 11.: The results of hypotheses that were applied in the model

Hypothesis ID	Hypothesis	Verified/Not verified
H1	The perceived usefulness of mobile tourism services positively affects their attitude to use during travel.	✓
H2	The perceived usefulness of mobile tourism services positively affects their future intention of use during travel.	✓
H3	The perceived ease of use of mobile tourism services positively affects their attitude to use during travel.	✓
H4	The perceived ease of use of mobile tourism services positively affects their perceived usefulness during travel.	✓
H5	The perceived ease of use of mobile tourism services positively affects their future intention of use during travel.	✓
H6	The attitude of use of mobile tourism services positively affects their future intention of use during travel.	✓
H7	The perceived trust of mobile tourism services positively affects their attitude to use during travel.	✓
H8	The perceived trust of mobile tourism services positively affects their perceived usefulness of use during travel.	×
H9	The perceived trust of mobile tourism services positively affects their future intention of use during travel.	✓
H10	The technology self-efficacy of mobile tourism services positively affects their future intention of use during travel.	×
H11	The technology self-efficacy of mobile tourism services positively affects their perceived usefulness of use during travel.	✓
H12	The compatibility of mobile tourism services positively affects their attitude to use during travel.	✓
H13	The compatibility of mobile tourism services positively affects their future intention of use during travel.	✓

Source: Own edition

3.3. Information sources during travel planning

The aim of this chapter was to find out that the importance of mediums primarily based on user generated content is how large comparing with the situation of traditional media sources in Hungarian adult internet users. Related to this I defined the following hypothesis.

Hypothesis 4: The available online user generated contents related to tourism are more important than the traditional advertising tools (travel agencies, official web pages).

First, I analysed that respondents how plan their travel and holiday. 93.4% of respondents answered that they planning their travel by their own and only 18.1% uses the services of travel agencies. The second question was if the respondents use the Internet during the organization of their travel. 91.2% of the respondents answered that they are searching on the Internet and 8.8% does not use this possibility. This data also represents that the main information source during travel planning is Internet (KSH, 2013).

The importance of the various information sources during the planning phase of travel is very diverse. In my dissertation the use of Internet and social media next to traditional information sources if emphasized. The respondents had to evaluate each medium according to their importance during travel planning in a 1-5 scale Likert-scale. The results confirms that the role of traditional information sources is still deterministic but the importance of social media pages and user generated content has increased during recent years. Primary source is the information of family members and friends but printed media, such as travel magazines, brochures, travel books, is still an important information source. However the second most important source is the widely used form of user generated content - user reviews and opinions, social media pages and travel blogs could not squeeze out official travel pages and travel magazines. Online photo and video sharing pages and traditional media sources are the least important information sources during leisure travel planning (Table 12.).

Table 12.: Importance order of used information sources during travel planning

Information sources	**Average**	**Standard deviation**
Information of friends and family members	4,09	0,93
Reviews of other travellers (e.g. Tripadvisor)	3,50	1,05
Official travel pages	3,39	1,16
Travel books, brochures, travel magazines	3,35	1,12
Social media pages (e.g. Facebook)	3,29	1,14
Blogs, travel blogs (e.g. Origo travel head	3,01	1,20
Travel agency	3,00	1,24
Online photosharing pages (e.g. Instagram travel photos)	2,80	1,24
TV, radio, newspaper	2,78	1,06
Online videosharing pages (e.g. Youtube travel videos)	2,78	1,18

Source: Own edition

Summarizing we can conclude my hypothesis partly realized. From the table it turned out that the use of traditional information sources is still deterministic during travel organizing. In the same time, the importance of travel agencies and mass media is lower than the social media pages and blogs. Only one form of the user generated content, the travel related reviews received higher evaluation score than the traditional information sources.

The detailed analysis of these results is very important which indicates the data analysis with variance analysis (KIM et al., 2007).

Primarily I was curious if there was any difference between the importance of various information sources in the case of representative demography data (especially genre and age).

There was no difference between genres but considering the age there was significant difference in the case of several information sources. It is worth to analyse the differences in each age group. To realize this from the post hoc analyses I used Tukey HSD and Tamhane methods. From the results we can conclude that there was significant difference in the age group 18-29 and older than 50 (except travel agencies).

- Online photo sharing pages (<0,05, F= 3,105)
- Blogs, travel blogs (<0,05, F= 5,477)
- Travel agencies (<0,05, F= 2,704)

Travel agencies as information sources during organizing leisure travel are more important for age group 30-39 than for age group 18-29.

After that I examined what are the differences during inland and foreign travel planning. There were significant differences during inland and foreign travel planning in the case of following elements:

- Reviews of other travellers (p<0,05, F= 12,656)
- Online photo sharing pages (<0,05, F= 4,560)
- Blogs, travel blogs (<0,05, F= 7,534)
- Travel agencies (<0,05, F= 7,531)

Examining values and the answers of respondents, we can conclude that these information sources are more important during organizing foreign travels.

3.4. Importance of social media during travel

In the previous chapter I concerned the role of social media (user generated content) during organizing travel. In this chapter I examine the role of social media during the whole process of travel. My hypothesis is related to this.

Hypothesis 5: The main role of social media during travel-planning appears in the first phase (before travel) during the search of travel information.

On the whole, we can conclude that the respondents are using social media pages during all process of travel planning but for various reasons and in various extents. In the planning phase before travel most of the respondents use social media pages to collect ideas but there is a large part who visit these contents during the selection of accommodation. Only tierce part of users visit social media pages to confirm if they chose the right destination for holiday.

During the travel the respondents collect information of a certain sight or certain program on the social media pages and use as a tool for contact and communicate. Only a few writes about his experience on forums and there were also a few who visited the social media pages with a different reason than their travel. After travel every fourth respondent visits social media pages for example to share photos or experience or write online reviews. These results lag behind the international trends where most of travellers used that opportunity to write their opinion about their experience (for example write a review of the accommodation).

As a part of my earlier research (in 2012, population with 221 elements) I used a questionnaire in young university students (18-29). According to the results we can conclude that primarily the respondents visit social media pages during the selection of destination (59%). During holiday 56% of the respondents used social media for contacting.

COX et al. (2009) concluded that social media pages are primarily visited before travel which confirms my results but it also confirms the continuous spread of the use of these contents. FOTIS e al. (2012) received reverse results who says these pages are visited after the travel to share their experience and photos.

Table 13.: Use of social media during travel

Travel period	Statement	Percentage of respondents
Before travel/holiday	Collecting ideas where to travel	67,8%
	Selecting possible travel destinations	46,5%
	If it has to be confirmed that good destination was selected	32,3%
	Collecting ideas and information during search for accommodation	62,3%
	Collecting ideas and information during search for various leisure programmes	49,5%
During travel/holiday	During travel collect information about a e.g. sight of programme	52,6%
	During travel share my experience on various forums	9,3%
	During travel share my photos or videos with others (other travellers, friends, acquaintances)	29,6%
	Contacting with friends/family members	47,3%
	Use these pages not related to my travel	12,3%
After travel/holiday	After travel, share photos/videos taken during travel with others (other travellers, friends, acquaintances)	25,9%
	Write a review about the accommodation or other services	25,8%

Source: Own edition, adapted from Cox et al., (2009) and Fotis et al., (2012)

I examined if there was any significant difference between various stages considering genre and age as well. Considering genre it is interesting that it is a characteristic of women to share photos, videos on social media pages after travel. Search for various leisure programs on social media pages is a characteristic of men.

Considering age there was difference in the case of sharing photos and videos after travel which is typical in the age group 18-29.

As a summary we can conclude that the results justified the role of social media during the first phase of travel which confirmed my hypothesis.

4. NEW AND NOVEL SCIENTIFIC RESULTS OF DISSERTATION

1. I consider as an important result of my dissertation that I collected and systemized the most important and emphasized international trends that related to the use of information and communication technologies in tourism in consumer point of view.

2. I consider the analysis of application of social media and user generated contents during the whole process of travel as a new result of my dissertation.

3. I consider the introduction of the theory and practical use of innovative mobile services that appeared in recent decade and ensure professional and effective information management as a novel result of my dissertation.

4. I consider the establishment of a model that is based on the integration of technology acceptance model and Roger's diffusion of innovation theory and applicable to demonstrate the consumer acceptance of mobile tourism services as a novelty.

5. I suppose the questionnaire survey of my dissertation carried out among adult internet users in Hungary and the results from it via statistic methods are authentic and new; with the help of representative sample they reflect the use of social media (user generated content) and mobile devices during leisure travel.

5. PRACTICAL USE OF RESULTS

Thanks to the dynamic environment of tourism system (e.g. economical and demographical changes, environmental questions and sustainability) the tourism is continuously facing with challenges. The technological innovations of the past two decades also force the suppliers of tourism sector to keep step with the changes of the technological environment. Technologies that are part of our daily life have a great role in the formation of society. Tourists, by these technologies became, more informed and more sophisticated and started to use more and more ICT devices (smartphones, tablets, etc.).

Tourism is business sector that is filled with information and includes various and diverse processes. Thanks to this, selecting relevant and useful information from all the available information mass is a great challenge for companies and consumers. It is not a coincidence that the researches connected to tourism sector are focusing on new and modern technological solutions that can solve the problem mentioned above. The diverse characteristics of new mobile tourism services, social media and user generated contents that were analysed in the dissertation give a great opportunity to the spread of these technologies and probably give a breakthrough for the effective information flow.

As far as organizations are concerned it can be said that information and communication technologies mainly affect the levels of operation, structure and strategy and decrease the cost of communication and other processes and increase effectiveness, productivity and competitiveness in the same time. The role of innovative ICT devices considering the decision making of consumers during the whole process of travel is obvious because the availability of adequate qualitative and quantitative information is required for the new type of sophisticated consumers to make their decisions.

Tourism companies have to aspire for being aware of the latest technological trends and changes. There are several new technological innovation in the tourism industry which appeared or going to appear in the near future such as new mobile technologies, tracking technologies, new smart devices, new social media tools, new sensors (NFC, RFID). In the following years "Smart World" (smart cities, smart destinations, smart hotels), "Internet of Things" and different cloud-based solutions (cloud computing) more and more come to the front.

It was confirmed that the integration of TAM model and Rogers' diffusion of innovation theory is applicable for the prediction of future use of mobile tourism services.

In the case of my model the predictive role and the reason of existence of the basic TAM model was also verified. According to the prior assumption the relationships between the variables connected to the traditional TAM model (perceived ease of use, perceived usefulness, attitude, future intention of use) were verified. Further the basic variables of the model I implemented the diffusion of innovation theory (compatibility) the technology self-efficacy and trust variables. During the test of the model I found significant relationship between the examined variables except two cases. Contrast my expectations there was no significant relationship between the perceived usefulness and perceived trust. There was also no significant direct relationship between the technology self-efficacy and future intention of use but the indirect effect between them was significant. This means that the technology self-efficacy affects the future acceptance of mobile tourism services through the perceived usefulness and attitude. The ease or difficulty of use substantially influence the intention of use as it was set in the literature. We can conclude that the effect of perceived ease of use on intention of use is indirectly influenced by the perceived usefulness and attitude variables. The largest direct and indirect effect on intention of use was given by the ease of use variable (R2=0.345). This means that those mobile tourism services should be used by the suppliers that use is easy to learn and obvious.

I handle the fit of the model as acceptable and accept it with 65% explaining power. Attitude gives 48%, perceived usefulness gives 42% and the perceived ease of use gives 7% explanation to the use of mobile tourism services during travel. As a summary, we can conclude that the fusion of diffusion of innovation theory and the integration of trust is reasonable in the model that analyses the consumer acceptance of mobile tourism services. However, for more accurate demonstration of the effects it would be more advantageous if not just the intention but the actual use would be traced. Implementation of other variable is also reasonable with which the acceptance of mobile tourism services can be determined more precisely. These variables are for example the perceived value of pleasure or the costs.

The results of my questionnaire related to the used information sources during travel are similar to the result of national and international researches. We can say that in the planning period of travel the main information source is the information and experience of friends

and family members. The importance of traditional information sources is declining after the appearance of user generated contents. These trends were confirmed by the results of my research.

We can conclude that the respondents are using the social media pages during the whole planning process of travel but for various reasons and with various extent. In the planning phase before travel most of the consumers visit these social media sites to collect information but there is a large number of users who use these sites during the selection of accommodation. Only third of users visit social media sites to confirm the correct selection of holiday destination. During travel the respondents collect information about a certain sight or programme and use social media sites for contacting. After travel every fourth user visits social media pages for example to share their experience and photos or write reviews. These results mean lower numbers comparing with the international trends where most of the users make the best of sharing their opinion and experience (e.g. phrasing critics related to the accommodation.

Over the past decade, ICT used for or during travel has become much faster, smaller, more intelligent, and more embedded in the user's environment.

This change is particularly noticeable when travellers are equipped with today's cutting-edge mobile technology characterized by smartphones and their apps. The fast adoption of new mobile technologies generates a tremendous impact on travel and will very likely transform the behavioural patterns of tourism consumption and the tourism experience itself.

By the wide spread of smartphones the number of smartphone applications has substantially increased. The innovation make possible for tourism enterprises to reach the consumers more personally. Tourism enterprises have to take the last technological trends into consideration to be able to contact with the tourists in mobile environment and to be active participants of their digital life by developing a mobile application or a webpage optimised for smartphones.

Thanks to the characteristics of smartphones tourists more frequently visit the best offers during their travel (where to eat dinner?, where to go shopping?, which is the best social club in the area?, what are the hiking possibilities?, etc.). This gives the possibility of location based, real-time interaction (personalized offers and suggestions). Related to the

statements mentioned above connected to my research results we can conclude that the respondents during their travel further general applications (communication, making photos and videos) primarily use their smartphones for navigation and information search. Third part of the respondents booked or bought with his phone during travel. The use of mobile tourism services has not become a part of the daily activities of tourists which is indicated by only 20% of respondents have ever downloaded a mobile application related to tourism.

6. PUBLICATIONS RELATED TO THE DISSERTATION

UNIVERSITY OF DEBRECEN
UNIVERSITY AND NATIONAL LIBRARY

Registry number: DEENK/104/2016.PL
Subject: Ph.D. List of Publications

Candidate: Gergely Ráthonyi
Neptun ID: EHHNCT
Doctoral School: Ihrig Károly Doctoral School of Management and Business Administration
MTMT ID: 10015655

List of publications related to the dissertation

Article(s), studies (6)

1. **Ráthonyi, G.**, Ráthonyi-Ódor, K.: Analysing sporting goods manufacturers' environmental management tools.
   Apstract. 9 (1-2), 23-30, 2015. ISSN: 1789-221X.

2. **Ráthonyi, G.**, Várallyai, L., Nagyné, I.P., Pető, K.: Educational experiences of a tourism software (front office system) at the University of Debrecen.
   Journal of Ecoagritourism. 10 (1), 160-168, 2014. ISSN: 1844-8577.

3. **Ráthonyi, G.**: Influence of social media on tourism: Especially among students of the University of Debrecen.
   Apstract. 7 (1), 105-112, 2013. ISSN: 1789-221X.

4. **Ráthonyi, G.**, Várallyai, L.: Travel 2.0 and Hungarian tourism.
   In: The Economies of Balkan and Eastern Europe Countries in The Changed World. Department of Accountancy Kavala Institute of Technology, Kavala, 120-133, 2011. ISBN: 9789603630388

5. **Ráthonyi, G.**, Várallyai, L.: Web 2.0 and tourism.
   In: Proceedings of the International Conference on Information and Communication Technologies for Sustainable Agri-production and Environment (HAICTA 2011), Skiathos, 8-11 September, 2011 : [elektronikus dokumentum]. Ed.: M. Salampasis, A. Matopoulos, Rheinisch-Westfaelische Technische Hochschule Aachen Lehrstuhl Informatik V, Aachen, 27-39, 2011.

Address: 1 Egyetem tér, Debrecen 4032, Hungary Postal address: Pf. 39. Debrecen 4010, Hungary
Tel.: +36 52 410 443 Fax: +36 52 512 900/63847 E-mail: publikaciok@lib.unideb.hu, ¤ Web: www.lib.unideb.hu

6. **Ráthonyi, G.**: Information and communication technologies in tourism.
Agrártud. közl. 44, 49-53, 2011. ISSN: 1587-1282.

Conference presentation(s) (4)

7. **Ráthonyi, G.**: Social media applications in tourism.
In: "Ifjúsági sport és tehetséggondozás - a 21. század kihívásai" : II. Nemzetközi Turizmus és Sportmenedzsment Konferencia : Debrecen, 2012. szeptember 5-6. : konferencia kötet. Szerk.: ... Perényi Szilvia, DE Gazdálkodástud. és Vidékfejleszt. Kar, Debrecen, 276-281, 2013. ISBN: 9786155183812

8. **Ráthonyi, G.**, Várallyai, L., Herdon, M.: GIS in the agricultural economy and the business applications.
In: Digital divide in Debrecen and perspectives : Eger, Magyarország, 2010.01.27-2010.01.30. Szerk.: Bakó Mária, [S. n.], Eger, 119-128, 2011. ISBN: 978963989472

9. **Ráthonyi, G.**: Using possibilities of GIS in tourism.
In: Agricultural Informatics 2010 : Summer University and Conference on Information Technology in Agriculture and Rural Development and Advanced Information Technologies in Agriculture and Related Sciences From Research to Practice Workshop : Proceedings. Ed.: by Alexander B. Sideridis, Miklós Herdon, László Várallyai, Hungarian Association of Agricultural Informatics, Debrecen, 107-112, 2010. ISBN: 9789638736635

10. **Ráthonyi, G.**, Várallyai, L., Herdon, M.: GIS in tourism.
In: International Conference on Tourism and Sports Management : Debrecen, Magyarország, 2010.05.27-2010.05.28. Debreceni Egyetem AVK, Debrecen, 1-6, 2010. ISBN: 9789634733782

List of other publications

Article(s), studies (3)

11. Ráthonyi-Ódor K., **Ráthonyi G.**, Borbély A.: Sportolni jó: Felelősen a sport népszerűsítéséért. *Agrártud. Közl. 67*, 71-76, 2016. ISSN: 1587-1282.

12. **Ráthonyi G.**, Várallyai L., Kovács B.: Molibdén vizsgálata a tápláléklánccban statisztikai módszerekkel. *Acta agrar. Kvár. 14* (3), 323-333, 2010. ISSN: 1418-1789.

13. **Ráthonyi, G.**, Várallyai, L., Herdon, M.: Best practices of GIS applications in the Hungarian agriculture. *Agris on-line Papers in Economics and Informatics. 2* (2), 55-62, 2010. ISSN: 1804-1930.

Conference presentation(s) (2)

14. **Ráthonyi, G.**: GIS adaptations and their experience in the Hungarian agriculture. In: Sbornik z konference ISZL. Future Farm 2010, Česká zemědělská univerzita, Praha, 90-97, 2011. ISBN: 9788021320871

15. Várallyai, L., Kovács, B., **Ráthonyi, G.**: Methods for usability of point samples of the soil protection information and monitoring system. In: Agricultural Informatics 2010 : Summer University and Conference on Information Technology in Agriculture and Rural Development and Advanced Information Technologies in Agriculture and Related Sciences From Research to Practice Workshop : Proceedings. Ed.: by Alexander B. Sideridis, Miklós Herdon, László Várallyai, Hungarian Association of Agricultural Informatics, Debrecen, 10-17, 2010.

The Candidate's publication data submitted to the iDEa Tudóstér have been validated by DEENK on the basis of Web of Science, Scopus and Journal Citation Report (Impact Factor) databases.

25 April, 2016