Univerza v Mariboru
Fakulteta za organizacijske vede

35. mednarodna konferenca
o razvoju organizacijskih znanosti
16. - 18. MAREC 2016 | PORTOROŽ, SLOVENIJA
Kongresni center Portus, Hotel Slovenija

35th International Conference on
Organizational Science Development
16th - 18th MARCH 2016 | PORTOROŽ, SLOVENIA
Congress Centre Portus, Hotel Slovenija

TRAJNOSTNA ORGANIZACIJA

SUSTAINABLE ORGANIZATION

Proceedings of Selected Papers
of the 35th International Conference
on Organizational Science Development

Foreword
Contents
Alphabetical Index

Executive Committee
Programme Committee
Reviewers Committee
Organizational Committee

Colophon
Sponsors
Help

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Foreword

From 16th to 18th March 2016, the University of Maribor, Faculty of Organizational Sciences hosted its 35th International Conference on Organizational Science Development called “Sustainable Organization”, which took place in Portorož, Slovenia. We accepted 143 papers and 6 posters from 266 authors and co-authors, coming from Slovenia and the following foreign countries: Austria, Albania, Bosnia and Herzegovina, China, Colombia, Croatia, Czech Republic, Germany, Kosovo, Macedonia, Montenegro, Poland, Portugal, Russia, Serbia, Spain, Switzerland and the Netherlands.

In order to strengthen the Conference’s scientific flavour, increase its recognition, and give an extra reward to the best submitted papers, we have decided to publish Selected Papers, a special issue of the Conference Proceedings. This publication contains 21 papers in English, which have been carefully selected among all the accepted conference papers by the Conference Review Committee.

I congratulate the authors of all 21 selected papers, and thank the members of the Review Committee for their efforts. I hope that the Selected Papers issue will achieve its aims.

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Univerza v Mariboru

Fakulteta za organizacijske vede

Contents 1/2

Manuel Benazić
Business Cycle Synchronization between Slovenia and the Euro Area: the Markov Switching Regression Model Approach

Desimir Bošković, Ana Težak Damijanić, Tatjana Zanini Gavranić
TripAdvisor in Organising a Vacation: Tourists' Characteristics and Types of Information

Tina Gogova, Uroš Rajkovič, Saša Kadivec, Marko Novaković
Telemonitoring Overweight Patients

Yves Hertig, Stephanie Teufel
Prosumer Involvement in Smart Grids: the Relevance of Energy Prosumer Behaviour

Miha Marič, Maja Djurica
Educational Achievements as a Determinant of an Individual's Informal Power

Sanja Marinkovic, Vesna Tornajnski, Verica Mihajlovic
Evaluating Priorities in New Technology Adoption – The Case of Banking Services

Aleksandar Marković, Sava Čavoški, Andrej Novović
Agent-Based Model for Analysis of Stakeholders Behaviour on B2C E-Markets

Marjeta Marolt, Damjan Maletič, Mirjana Kljajić Borštnar, Gregor Lenart, Andreja Pucihar
Comparative Analysis of Business Model Ontologies

Jovana Milenković, Nataša Petrović, Nemanja Milenković, Boris Delibašić, Marko Ćirović
Analysis of Professional Interests of Elementary School Students

Lea Nedomova, Petr Doucek
How are ICT Professionals´ Wages Influenced by Economic Development in the Czech Republic?

Bladimir Osorio-Munoz, Paulo Louro, Luis Cavique, Fredy Mauricio Gutierrez-Alvarez
Using the "Big Data" and Real-Time Support Systems in the Municipal Management

Anita Pavković, Josip Britvić, Katarina Marošević
The Development of Counties (Regions) and Financial Exclusion: the Example of the Republic of Croatia

Contents 2/2

Judita Peterlin, Vlado Dimovski
Sustainable Organization of Knowledge and Skills in the Work Environment: Empirical Evidence of the Slovenes Returning from Abroad

Jasna Petković, Jelena Andreja Radaković
Postgraduate Students' Attitudes about Sustainable Development Goals: a Case Study of Delphi Method

Primož Pevcin, Veronika Petkovšek
Management of Selected Local Public Utilities: a Review of Current Practices

Andrej Srakar, Rok Hren, Valentina Prevolnik Rupel
Health Services Utilization in Older Europeans: an Empirical Study

Andrej Srakar, Marilena Vecco
Culture as a Fourth Dimension of Sustainable Development – a Statistical Analysis and Indicators' Proposal

Andrej Škraba, Vladimir Stanovov, Eugene Semenkin, Davorin Kofjač
Stochastic Search Optimization in Strict Hierarchical Manpower System Modelled by System Dynamics

Daniel Tomić, Marija Pičuljan
Segmenting Terms of Trade; the Case of Croatia

Kalina Trenevska Blagoeva, Marina Mijoska
User Adoption Analysis of the E-Government Services in the Republic of Macedonia with Technology Acceptance Model (TAM)

Harald Wipfler
Sustainable Organizations through Dynamic Capabilities - Comparing Conceptions

Alphabetical Index 1/2

Benazić Manuel
Bošković Desimir
Britvić Josip
Cavique Luis
Čavoški Sava
Ćirović Marko
Delibašić Boris
Dimovski Vlado
Djurica Maja
Doucek Petr
Gogova Tina
Gutierrez-Alvarez Fredy Mauricio
Hertig Yves
Hren Rok
Kadivec Saša
Kljajić Borštnar Mirjana
Kofjač Davorin
Lenart Gregor
Louro Paulo
Maletič Damjan
Marinkovic Sanja
Marković Aleksandar
Marolt Marjeta
Marošević Katarina
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Mihajlovic Verica
Mijoska Marina
Milenković Jovana
Milenković Nemanja
Nedomova Lea
Novaković Marko
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Osorio-Munoz Bladimir
Pavković Anita
Peterlin Judita
Petković Jasna
Petkovšek Veronika
Petrović Nataša
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Pičuljan Marija
Prevolnik Rupel Valentina
Pucihar Andreja
Radaković Jelena Andreja
Rajkovič Uroš
Semenkin Eugene
Srakar Andrej
Stanovov Vladimir
Škraba Andrej

Alphabetical Index 2/2

Teufel Stephanie
Težak Damijanić Ana
Tomić Daniel
Tornajnski Vesna
Trenevska Blagoeva Kalina
Vecco Marilena
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Additional copies may be ordered from: Publishing House 'Moderna organizacija', Faculty of Organizational Sciences, University of Maribor, Kidričeva cesta 55a, 4000 Kranj, Slovenia.

CIP - Kataložni zapis o publikaciji
Narodna in univerzitetna knjižnica, Ljubljana

005.7(082)(0.034.2)

MEDNARODNA konferenca o razvoju organizacijskih znanosti (35 ; 2016 ; Portorož)
Trajnostna organizacija [Elektronski vir] = Sustainable organization : proceedings of selected papers of the 35th International Conference on Organizational Science Development / 35. mednarodna konferenca o razvoju organizacijskih znanosti, 16.-18. marec 2016, Portorož, Slovenija = 35th International Conference on Organizational Science Development, 16th-18th March, Portorož, Slovenia ; uredniški odbor Petr Doucek, Aleš Novak, Björn Paape. - El. knjiga. - Kranj : Moderna organizacija, 2016

ISBN 978-961-232-289-2 (pdf)
1. Gl. stv. nasl. 2. Vzp. stv. nasl. 3. Doucek, Petr
286380032

Title

Sustainable Organization
Proceedings of Selected Papers
of the 35th International Conference
on Organizational Science Development
Slovenia, Portorož, 16th - 18th March 2016

Publishing House

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Contents

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Colophon

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Back to home page

Go to previous page

Go to next page

Domov | Home — Back to home page

Nazaj | Back — Go to previous page

35th International Conference on Organizational Science Development
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Business Cycle Synchronization between Slovenia and the Euro Area: the Markov Switching Regression Model Approach

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Abstract
It is well known that economic activity moves differently during periods of expansion compared to periods of recession. Monitoring of these developments became an indispensable part of the business cycle analysis, which is very important for policy makers especially when decisions between countries are made jointly. The idea and introduction of a single European currency has increased interest for business cycle analysis in the euro area countries. Therefore, the aim of this paper is to model and compare business cycles between Slovenia and the euro area 19 countries (EA19). Consequently, Markov Switching regression model and cross correlation analysis are applied within a research domain. The main advantage of the Markov Switching regression model is that it allows nonlinear modeling, which is particularly useful in the analysis of macroeconomic nexus that is subjected to regime changes. Obtained results indicate a relatively high degree of business cycle synchronization in terms of estimated regression coefficients, transition probabilities and expected durations of the cycles, regime probabilities, etc.

Keywords: switching regression, regime changes, cross correlation analysis, business cycle synchronization

1 Introduction

Economic fluctuations are usually studied within the business cycles theory. Tipically, economic activity increases during expansion while it abates during recession. Monitoring of these developments became an integral part of the business cycle analysis, which is very important for policy makers especially when decisions between countries are made jointly. Although business cycles are studied for a number of years, in European Union (EU) and its Member States interest for them increased with the introduction of the common European currency, i.e. the euro and related Economic and Monetary Union (EMU) (Bengoechea & Quirós, 2004). EMU involves the coordination of economic and fiscal policies, a common

[1] This work has been fully supported by the Croatian Science Foundation under the project number 9481 Modelling Economic Growth - Advanced Sequencing and Forecasting Algorithm. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of Croatian Science Foundation.

monetary policy, and a common currency between EU countries. Although all EU Member States take part in the economic union, not all adopted the euro as their national currency (EC, 2016). EU Member States that have adopted the euro as their common currency and sole legal tender make up the euro area (EA). More specifically, EA is a monetary union of 19[2] of the 28 EU Member States (ECB, 2016).

In order to achieve the final economic and monetary policy goals (such as price stability, full employment and balanced economic growth) between the EA countries, their business cycles have to be synchronized. Namely, in the absence of synchronization, common economic and monetary policy decisions would have asymmetric effects on their economies (Artis, Krolzig & Toro (1999), Lavrač & Zumer (2003)). For example, an increase in the key interest rates under the control of the common central bank would have different effects on countries that are currently in expansion in relation to those that are currently in a recession. Economic growth in those countries that are currently in expansion would certainly slow down while in other countries recession would be even more profound.

In order to achieve convergence and synchronization, EU Member States must first fulfill the convergence criteria, also known as the Maastricht criteria. The fulfilment of the convergence criteria is not a precondition for EU accession, but is a precondition for the adoption of the euro as a national currency. The Maastricht convergence criteria include price developments, fiscal developments, exchange rate developments, long-term interest rate developments and are partially based on the theory of optimum currency areas and costs-benefits analysis of the creation of a single currency area as the EMU (ECB, 2016a). However, it should be stressed that fiscal criteria allow some flexibility which may influence the business cycle synchronization. For example, government budget deficit-to-GDP ratio and government debt-to-GDP ratio must not exceed the allowable limits. However, they will be accepted if they decline substantially and continuously approaching the reference values at a satisfactory pace or are temporary and exceptional. Because of the possible negative consequences, these criteria are later tightened.

The realization of EMU began in June 1998 when European Council confirmed the objective of realization and mandated a committee composed of the governors of the European Community (EC) national central banks to study and propose stages that would lead to EMU. It resulted in Delors Report that proposed that EMU should be achieved within three steps as is shown in the following table (ECB, 2016b).

[2] These countries are Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia, and Spain.

Stage One (starting 1 Jul 1990)	Complete freedom for capital transactions; Increased co-operation between central banks; Free use of the ECU (European Currency Unit, forerunner of the euro); Improvement of economic convergence;
Stage Two (starting 1 Jan 1994)	Establishment of the European Monetary Institute (EMI); Ban on the granting of central bank credit; Increased co-ordination of monetary policies; Strengthening of economic convergence; Process leading to the independence of the national central banks, to be completed at the latest by the date of establishment of the European System of Central Banks; Preparatory work for Stage Three;
Stage Three (starting 1 Jan 1999)	Irrevocable fixing of conversion rates; Introduction of the euro; Conduct of the single monetary policy by the European System of Central Banks; Entry into effect of the intra-EU exchange rate mechanism (ERM II); Entry into force of the Stability and Growth Pact;

Table 1: Stages of Economic and Monetary Union (EMU)

Beside a common currency, EMU involves a creation of the single monetary policy. As seen from the table above, the euro was launched on 1 January 1999 (Stage Three) and since then the European Central Bank (ECB) has been responsible for conducting monetary policy in the EA. In the beginning, the euro was used only for accounting purposes (in electronic payments). However, on January 1 2002 the euro fully replaced, at fixed conversion rates, the banknotes and coins of the national EA countries' currencies (ECB, 2016).

Slovenia is a EU member since May 1 2004, was included in the ERM II on June 28 2004 whereby adopted the euro and became a member of the EA on January 1 2007. Ditto, the purpose of this paper is to model and compare business cycles between Slovenia and the euro area 19 countries (EA19) using the Markov Switching regression model. Although there are many methods for the analysis of business cycles, the main advantage of the Markov Switching regression model is that it allows nonlinear modeling, which is particularly useful in the analysis of macroeconomic nexus that is subjected to regime changes. In addition to providing a description of the state of the economy in the past, it provides information about the current state of the economy that is crucial for forecasting future economic activity.

The rest of the paper is structured as follows. Section 2 provides literature review, Section 3 presents the methodology and results while Section 4 gives the concluding remarks.

2 Literature review

A brief overview of papers related to the data and methodology, as well as European and Slovenian business cycles perspective is presented in the following lines.

Artis, Krolzig & Toro (1999) analyzed the existence of a common European growth cycle using univariate Markov switching autoregressions (MS-AR) and cross correlation analysis for individual countries in order to detect changes in the mean growth rate of industrial production and GDP. In addition, they estimated a Markov switching vector autoregressive (MS-VAR) model to identify the common European business cycle. Estimated models confirmed the existence of such cycle.

Jagrič (2002) analyzed cyclical patterns for Slovenia by applying multivariate wavelet analysis. By using monthly data of industrial production index for Slovenia and Germany (as a proxy for the EU cycle) in the period from 1994 to 2002, he found a high degree of synchronization between Slovenian and German business cycle. This could be attributed to the increased openness of Slovene economy since independence and rising share of EU in Slovenian foreign trade.

Artis (2003) analyzed the existence of a common European business cycle by using a band-pass filter version of the Hodrick-Prescott filter, clustering techniques and classical multidimensional scaling applied to cross-correlations and other measures of cyclical sympathy. Using data on quarterly real GDP in the period from 1970 to 2001, he concluded that it is quite hard to discern a homogenous or developing European cycle with these data.

Lavrač & Zumer (2003) analyzed and compared the business cycle in Slovenia with four major Slovenia's trade partners and with the EMU. By using correlation analysis and data on real GDP in the period from 1992 to 2001, they found that business cycles in Slovenia are well correlated with its major trade partners and EMU.

Bengoechea & Quirós (2004) investigated the identification and dating of the European business cycle using the Markov switching (MS) model and the classical approach proposed by the National Bureau of Economic Research (NBER). Using monthly data of the euro area industrial production index (IPI) and the European Commission industrial confidence indicator (ICI), they found that ICI is very useful in providing information about the European business cycle.

Camachoy, Perez-Quiros & Saiz (2006) proposed a comprehensive methodology to characterize the business cycle co-movements across European economies and some industrialized countries. By developing a novel method, they showed that there is no evidence of a European economy that acts as an attractor to the other economies of the area pointing that the distances across business cycles are related to the structure of the economy, to the directions of trade, and to the size of the public sector. In addition, they indicated that EMU has not significantly increased the level of co-movements across EA economies.

Levasseur (2008) investigated business cycle synchronization between CEECs and the EA including Slovenia by using quarterly data of real GDP in the period from 1996 to 2006. Obtained results indicate that the former split of CEECs in terms of business cycle synchronization with the EA does not hold as soon as the recent period is taken into account. Furthermore, results indicate that Slovenia is a suitable EMU member due to high – and growing – GDP co-movements with the EA.

Minka, Jacobsa & de Haan (2008) investigated similarity of business cycles in the EA (including Slovenia) and the US by using Christiano-Fitzgerald filter and data on quarterly real GDP in the period from 1970 to 2006. Obtained results indicate that the business cycles of several countries exhibit little similarity with the EA reference cycle whereby for the EA as a whole, differences between business cycles have gradually declined since the 1990s. In addition, results suggest that business cycles in the EA exhibit more similarities than regional business cycles in the US.

Rodrigues (2008) investigated the degree of business cycle synchronization between the Central and Eastern European Countries (CEECs) EU Member States (which at that time were not EMU members) and the EA using various Markov Switching regimes models and data of real GDP and the industry production index. Obtained results showed a weak synchronization between the CEECs ante the EA.

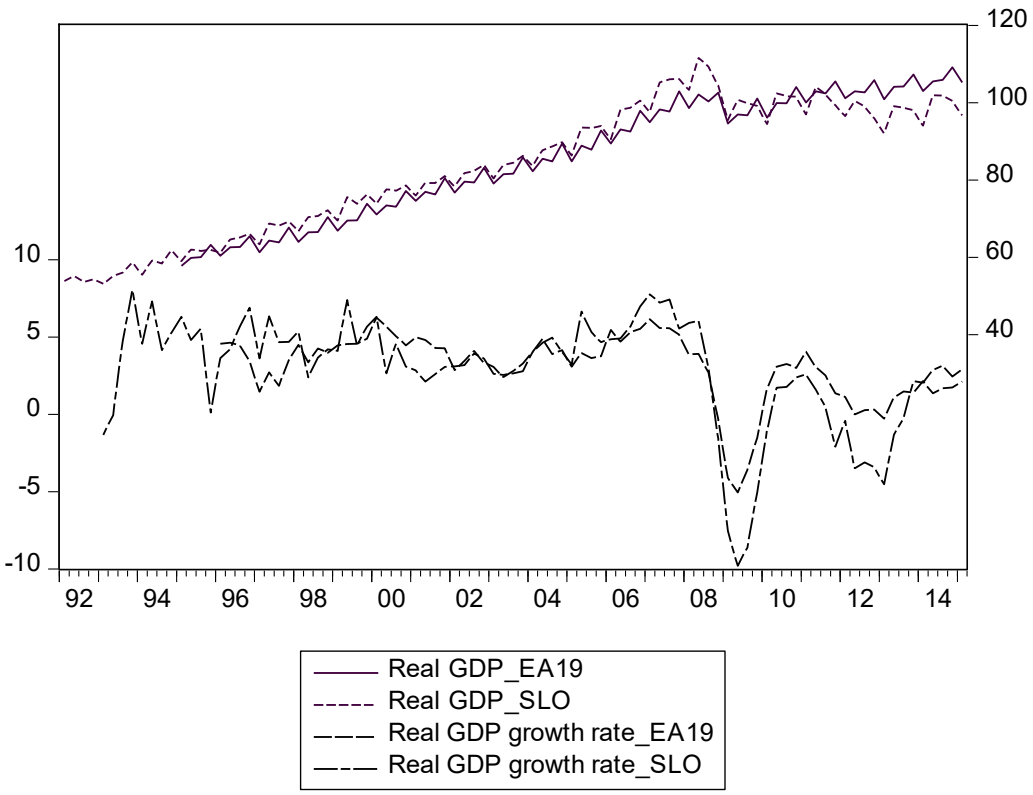
Male (2010) examined the business cycle characteristics and synchronicity for thirty-two developing countries including Slovenia using various econometric methods. By using data on industrial production index as a proxy of the aggregate business cycle in the period from 1992 to 2005, he found that business cycles of developing countries are not significantly shorter than those of the developed countries while the amplitude of expansion and contraction tends to be greater in the developing countries. In addition, he found no clear pattern of concordance within regions or between developed and developing country business cycles.

Gächter, Riedl & Ritzberger-Grünwald (2013) analyzed business cycle convergence in the EU by focusing on the decoupling vs. convergence hypothesis in the CESEE countries and the EA (including Slovenia) by using Hodrick-Prescott filter, several synchronization measures and data on real GDP in the period from 1999 to 2012. The results indicate that business cycles in CESEE countries have decoupled considerably from the EA during the financial crisis mainly because smaller countries seem to have larger cyclical swings as they are more dependent on external demand. On the other side, results point that this does not necessarily affect business cycle synchronization. Namely, there is a high correlation between CESEE countries with the EA business cycle after their EU accession, but trend growth rates continue to decoupling until the onset of the financial crises.

Tomić & Kenjereš (2015) analyzed the business cycle coherence between Slovenia and the EU by calculating two measures of coherence i.e. synchronicity and similarity in order to capture co-movement and amplitude of the Slovenian growth. By using quarterly macroeconomic data in the period from 1992 to 2013, they found that synchronicity and similarity increased within analyzed period. However, the last crisis has had a negative impact on calculated coherence measures.

3 Methodology and results

The main goal of this paper is to model and compare business cycles between Slovenia and the EA19 countries by using the Markov Switching regression model and cross correlation analysis. For the purpose of the analysis, business cycles are approximated using data on real GDP. Namely, reference series that usually represents aggregate economic activity are real GDP or the industrial production index (Bengoechea & Quiros, 2004) but can also be approximated using different macroeconomic series like unemployment, retail sales or by constructing indicators of business cycle movements. Data on real GDP for Slovenia are observed on a quarterly basis in the period from March 1992 to March 2015 while data on real GDP for the EA19 countries are observed on a quarterly basis in the period from March 1995 to March 2015. Data are expressed as indices (2010=100) and are taken as seasonally unadjusted since some studies show that the use of seasonally adjusted data can affect business cycles turning points (Maddala & Kim, 1999). Graph 1 shows their movement.



Graph 1: Real GDP (2010=100, right) and real GDP growth rates (in %, left) for the EA19 countries and Slovenia[3]

It is visible that both series achieved strong upward trend until 2008 while after that they began to fall due to the spillover effect of global crisis on their economies. In addition, it is noticeable that after 2008 the real GDP of the EA19 countries began to rise again, while Slovenian real GDP almost stagnated.

Recently, and as shown in the literature review, Markov Switching regressions are becoming increasingly popular as they are useful in the analysis of macroeconomic relationships that are subject to regime change, i.e. they allow nonlinear modeling. The analysis in this paper is based on Hamilton's (1989) MSAR(4) specification for United States (US) real gross national product (GNP). In order to measure the US business cycle (expansions and recessions), Hamilton specifies a two-state Markov switching model in which the mean growth rate of the US real GNP is subject to regime switching, and where the errors follow a regime-invariant AR(4) process. These two states actually represent phases of expansion and recession, i.e. the fast and slow (negative) growth rates of the US real GNP. Therefore, the switching model actually assumes that there is a different regression model associated with each regime.

For the purpose of the analysis, two Markov Switching regression models will be evaluated i.e., first model for the EA19 countries and second model for Slovenia. The data for both models consists of the series real GDP containing (100 times) the log difference of quarterly real GDP. The equation specification consists of a two-state Markov switching model with a single switching mean regressor *C* and the four non-switching AR terms wherein the error

[3] Data taken from the European Central Bank (ECB, 2015) and the International Financial Statistics (IFS, 2015) databases.

variance is assumed to be common across the regimes. The only probability regressor is the constant *C* since regime transition probabilities are time-invariant. For both models, the number of regimes is tested using the likelihood criteria that confirmed the number of two regimes. In other words, models with three regimes are not acceptable.

Before proceeding, the presence of unit roots in the data is tested using the ADF test (Dickey & Fuller, 1979), PP test (Phillips & Perron, 1988) and KPSS test (Kwiatkowski, Phillips, Schmidt & Shin, 1992) The results of the unit root tests are showed in the next table[4].

Variable and test	*Level*		*First difference*	
	Constant	*Constant and trend*	*Constant*	*Constant and trend*
ADF test	*t-stat.*			
LRGDP_EA19	-1,519004	-1,709320	-3,004087	-3,460265
LRGDP_SLO	-2,495522	-1,762227	-2,883405	-3,521535
PP test	*Adj. t-stat.*			
LRGDP_EA19	-2,173702	-4,702466	-22,36542	-47,80723
LRGDP_SLO	-2,021275	-2,284745	-17,41124	-22,69143
KPSS test	*LM-stat.*			
LRGDP_EA19	1,226741	0,286534	0,488028	0,103889
LRGDP_SLO	1,176780	0,266142	0,367905	0,130297

Table 2. Unit root tests[5]

It can be concluded that both series are integrated of order *I(1)*, i.e. they are stationary in their first differences.

The following table displays the coefficients for the regime specific mean and the invariant error distribution coefficients for the EA19 countries including the parameters of the transition matrix and summary statistics for the estimated equation.

[4] In the analysis, Gretl (Cottrell & Lucchetti, 2007) and EViews (IHS Global Inc., 2015) econometric software were used.

[5] Note: "*L*" indicates logarithm of the variable. For the implementation of ADF test the Schwarz information criterion has been implemented. ADF test critical values (MacKinnon, 1996); constant: 1% level (-3,52), 5% level (-2,90), 10% level (-2,59); constant and trend: 1% level (-4,08), 5% level (-3,47), 10% level (-3,16). PP test critical values (MacKinnon, 1996): constant: 1% level (-3,51), 5% level (-2,90), 10% level (-2,59); constant and trend: 1% level (-4,08), 5% level (-3,47), 10% level (-3,16). KPSS asymptotic critical values (Kwiatkowski, Phillips, Schmidt & Shin, 1992); constant: 1% level (0,739), 5% level (0,463), 10% level (0,347); constant and trend: 1% level (0,216), 5% level (0,146), 10% level (0,119).

Dependent Variable: DLRGDP				
Variable	*Coefficient*	*Std. Error*	*z-Statistic*	*Prob.*
Regime 1				
C	0,790310	0,174896	4,518735	0,0000
Regime 2				
C	-1,541405	0,620189	-2,485377	0,0129
Common				
AR(1)	-0,140765	0,069553	-2,023865	0,0430
AR(2)	-0,106477	0,069161	-1,539548	0,1237
AR(3)	-0,117862	0,068116	-1,730315	0,0836
AR(4)	0,828352	0,067487	12,27432	0,0000
LOG(SIGMA)	-0,291257	0,088570	-3,288433	0,0010
Transition Matrix Parameters				
P11-C	4,264097	1,099348	3,878752	0,0001
P21-C	-0,719566	1,318180	-0,545878	0,5851
Summary statistics				
Mean dependent var	0,730707	S.D. dependent var	3,760951	
S.E. of regression	0,899154	Sum squared resid	55,78501	
Durbin-Watson stat	1,858211	Log likelihood	-91,83713	
Akaike info criterion	2,653609	Schwarz criterion	2,929616	
Hannan-Quinn criter.	2,763915			
Inverted AR Roots	0,86	-0,00-0,98i	-0,00+0,98i	-0,99

Table 3: Markov Switching regression model (MSAR(4)) estimates for the EA19 countries[6]

Instead of focusing on the transition matrix parameters, the transition probabilities matrix and the expected duration of regimes are examined. According to the results, it is visible that the growth rate differs depending on the state of the business cycle. In the expansion phase growth rate equals to 0,79% quarterly or 3,16% annually whereby in the recession phase it equals to -1,54% quarterly or -6,16% annually.
The following table shows the probability of regime change, i.e. it shows the estimated transition probabilities.

Constant transition probabilities		
	1	*2*
1	0,986131	0,013869
2	0,327489	0,672511
Constant expected durations		
	1	*2*
	72.10069	3.053541

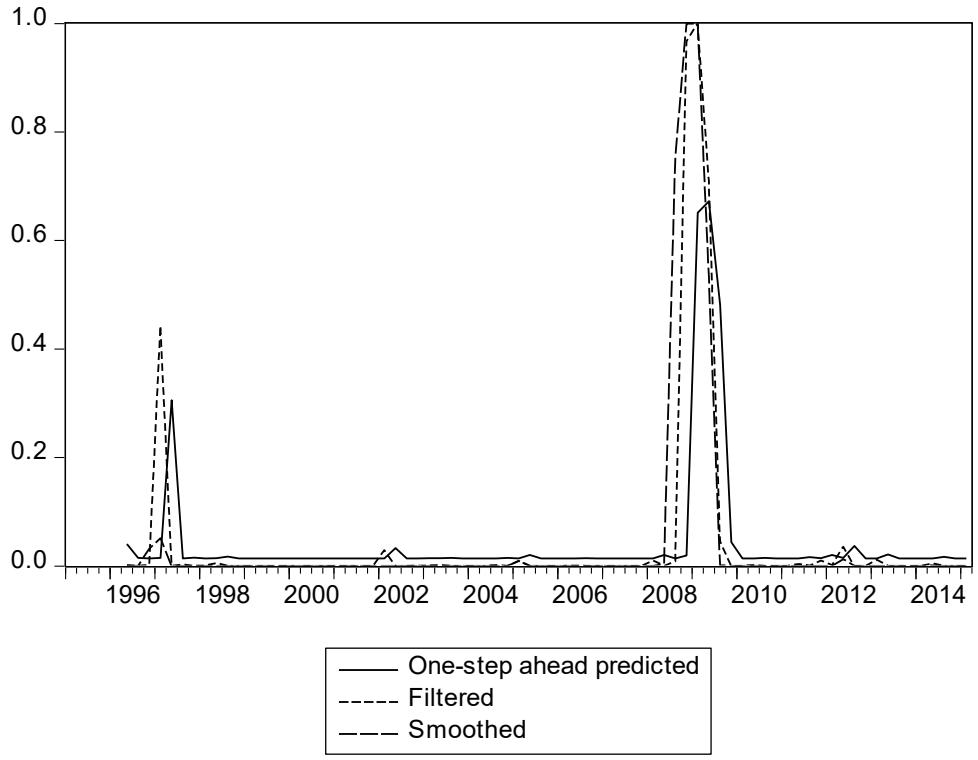
Table 4: Constant Markov transition probabilities (P(i, k) = P(s(t) = k | s(t-1) = i), (row = i / column = j)) and expected durations for the EA19 countries

The probability of transiting from state 1 (expansion phase) to state 1 (expansion phase) is 0,99 suggesting that once in state 1 (expansion phase) the process tends to stay there. With probability of 0,014 the process transits to state 2 (recession phase). Therefore, state 2 (recession phase) is not as persistent. With probability of 0,33 the process reverts from state 2

[6] Notes: Initial probabilities are obtained from ergodic solution. Standard errors and covariance are computed using observed Hessian. Random search: 25 starting values with 10 iterations using 1 standard deviation (rng=kn, seed=727723962). Convergence achieved after 12 iterations. Optimization method: BFGS (Broyden, Fletcher, Goldfarb and Shanno). Step method: Marquardt steps.

(recession phase) to state 1 (expansion phase) in the next time period. The corresponding expected durations in a regime are approximately 72,1 (expansion phase) and 3,1 quarters (recession phase), respectively.

According to Hamilton (1989), turning points are determined at the time when smoothed regime probability exceeds the value of 0,5. The following graph shows one-step ahead predicted, filtered and smoothed regime probability. One-step ahead predicted regime probability stands for the optimal inference on the regime at time *t* using all available information at time *t-1*. Filtered regime probability stands for the optimal inference on the state variable at time *t* using only information up to time *t*. Smoothed regime probability stands for the optimal inference on the regime at time *t* using full sample information.



Graph 2: One-step ahead predicted, filtered and smoothed regime probability (P(S(t)=2) for the EA19 countries

It is noticeable that smoothed regime probability exceeded the value of 0,5 in September 2008. Applying the same rule, turning points can be determined using filtered regime probabilities. In that case, filtered regime probability exceeded the value of 0,5 in December 2008. Additionally, it is evident that smoothed and filtered regime probabilities indicate that the bottom of the recession was reached in March 2009.

The following table displays the coefficients for the regime specific mean and the invariant error distribution coefficients for Slovenia including the parameters of the transition matrix and summary statistics for the estimated equation.

Dependent Variable: DLRGDP				
Variable	*Coefficient*	*Std. Error*	*z-Statistic*	*Prob.*
Regime 1				
C	0,893736	0,184802	4,836174	0,0000
Regime 2				
C	-2,852492	0,683266	-4,174793	0,0000
Common				
AR(1)	-0,262687	0,093860	-2,798707	0,0051
AR(2)	-0,224900	0,097822	-2,299063	0,0215
AR(3)	-0,198372	0,100373	-1,976348	0,0481
AR(4)	0,728264	0,096293	7,562991	0,0000
LOG(SIGMA)	0,370058	0,097951	3,777992	0,0002
Transition Matrix Parameters				
P11-C	3,355796	0,788855	4,254010	0,0000
P21-C	-0,471935	1,058644	-0,445792	0,6557
Summary statistics				
Mean dependent var	0,681851	S.D. dependent var	4,017824	
S.E. of regression	1,834192	Sum squared resid	272,5052	
Durbin-Watson stat	2,188347	Log likelihood	-170,0522	
Akaike info criterion	4,069368	Schwarz criterion	4,322732	
Hannan-Quinn criter.	4,171442			
Inverted AR Roots	0,76	-0,02+0,98i	-0,02-0,98i	-0,99

Table 5: Markov Switching regression model (MSAR(4)) estimates for Slovenia[7]

It is visible that the growth rate differs depending on the state of the business cycle. In the expansion phase growth rate equals to 0,89% quarterly or 3,56% annually whereby in the recession phase it equals to -2,85% quarterly or -11,4% annually.
The following table shows the probability of regime change, i.e. it shows the estimated transition probabilities.

Constant transition probabilities		
	1	*2*
1	0,966294	0,033706
2	0,384158	0,615842
Constant expected durations		
	1	*2*
	29,66841	2,603093

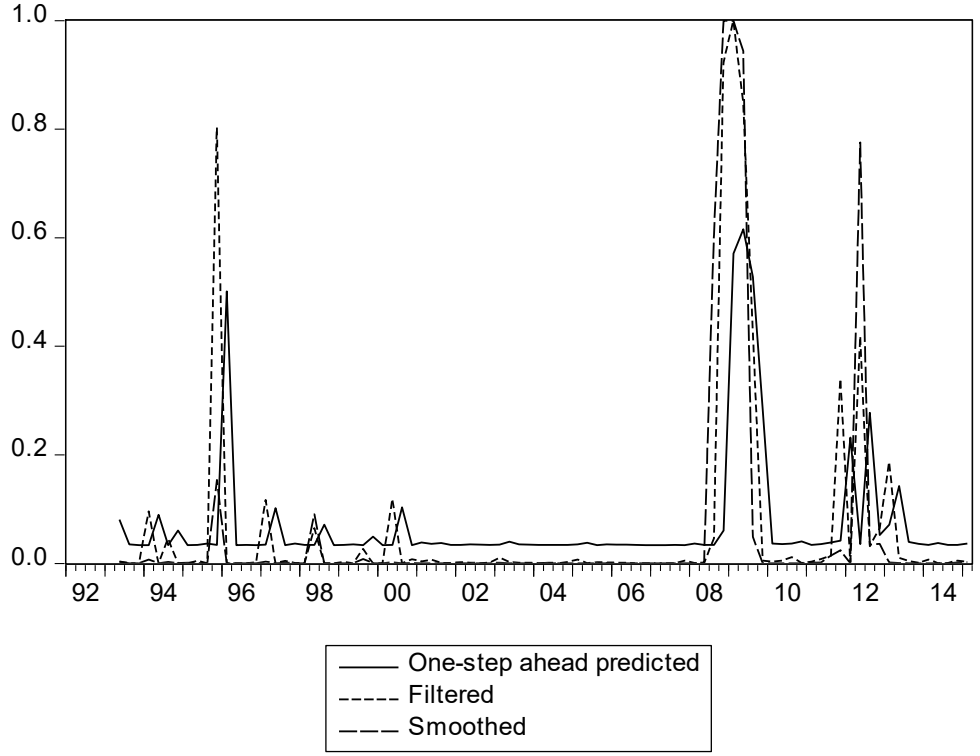
Table 6: Constant Markov transition probabilities (P(i, k) = P(s(t) = k | s(t-1) = i), (row = i / column = j)) and expected durations for Slovenia

The probability of transiting from state 1 (expansion phase) to state 1 (expansion phase) is 0,97 suggesting that once in state 1 (expansion phase) the process tends to stay there. With probability of 0,034 the process transits to state 2 (recession phase). Therefore, state 2 (recession phase) is not as persistent. With probability of 0,38 the process reverts from state 2 (recession phase) to state 1 (expansion phase) in the next time period. The corresponding expected durations in a regime are approximately 29,7 (expansion phase) and 2,6 quarters

[7] Notes: Initial probabilities are obtained from ergodic solution. Standard errors and covariance are computed using observed Hessian. Random search: 25 starting values with 10 iterations using 1 standard deviation (rng=kn, seed=430343560). Convergence achieved after 16 iterations. Optimization method: BFGS (Broyden, Fletcher, Goldfarb and Shanno). Step method: Marquardt steps.

(recession phase), respectively. Obtained results differ from those obtained by Male (2010) who calculated that average business cycle duration for Slovenia in the expansion phase lasts for 12,4 quarters while in the contraction phase it lasts for 4 quarters. However, there is a difference in the measure of the aggregate business cycle, applied methodology and estimated period.

Again, turning points are determined at the time when smoothed regime probability exceeds the value of 0,5. Therefore, the following graph shows one-step ahead predicted, filtered and smoothed regime probability.



Graph 3: One-step ahead predicted, filtered and smoothed regime probability (P(S(t)=2) for Slovenia

It is visible that smoothed regime probability exceeded the value of 0,5 in September 2008 and in June 2012. On the other side, filtered regime probabilities exceeded the value of 0,5 in December 1995 and in December 2008. Additionally, it is evident that smoothed regime probabilities indicate that the bottoms of the recessions were reached in March 2009 and in June 2012 while filtered regime probabilities indicate that the bottoms of the recessions were reached in December 1995 and in March 2009.

Regarding business cycle synchronization between Slovenia and the EA19 countries, the Markov Switching regression models results indicate few facts. The transition matrix parameters for the EA19 countries and Slovenia show different growth rates that depend on the state of the business cycle. In the expansion phase annual growth rates are relatively simmilar, but in the recession phase they differ significantly. Namely, negative growth rate in the recession phase is almost twice as high for Slovenia in relation to the EA19 countries. Transition probabilities show that the probability of transiting from state 1 (expansion phase) to state 1 (expansion phase) and to state 2 (recession phase) are simmilar for the EA19

countries and Slovenia whereby the corresponding expected durations in a regime differ signifficantly. Althoug they are simmilar in the recession phase, the expected duration in the expansion phase is more than twice as high for the EA19 countries. Turning points, which are determined using smoothed and filtered regime probabilities, showed that smoothed regime probability exceeded the value of 0,5 in September 2008 for the EA19 countries and Slovenia whereby for Slovenia exceeded the value of 0,5 once again in June 2012. On the other side, filtered regime probability exceeded the value of 0,5 in December 2008 for the EA19 countries and Slovenia whereby for Slovenia exceeded the value of 0,5 also in December 1995. Furthermore, smoothed regime probabilities indicate that the bottom of the recession for the EA19 countries and Slovenia was reached in March 2009 whereby for Slovenia indicated another bottom in June 2012. Finally, filtered regime probabilities indicate that the bottom of the recession for the EA19 countries and Slovenia was reached in March 2009 whereby for Slovenia indicated another bottom in December 1995. Another thing to note is the difference in volatility of obtained probabilities between Slovenia and the EA19 countries, especially in the time after the crisis, which confirms that crises has a negative impact on business cycle synchronization.

In addition to Markov Switching regression models results, and in order to analyze the synchronization, the following table shows the cross-correlations of the smoothed probability of being in a recession between the EA19 countries and Slovenia.

i	*Lag*	*Lead*
0	0,8865	0,8865
1	0,6203	0,8074
2	0,2987	0,4935
3	0,0367	0,1760
4	-0,0672	-0,0565

Table 7: Cross-correlations of the smoothed probability of being in a recession between the EA19 countries and Slovenia (-*i*, +*i*)

High cross-correlation coefficient at displacement zero and around the first lag and lead indicate a relatively high degree of business cycle synchronization between the EA19 countries and Slovenia thus confirming the results from previously estimated Markov Switching regression models.

Finally, although estimated models indicated certain differences, it is possible to conclude that the degree of business cycle synchronization between the EA19 countries and Slovenia is relatively high. As pointed by Gächter, Riedl & Ritzberger-Grünwald (2013) this differences may arise because smaller countries such Slovenia seem to have larger cyclical swings as they are more dependent on external demand. However, and as already stated by other authors, it is possible to expect that the degree of business cycle synchronization between the EA19 countries and Slovenia will be even higher in the future considering the fact that Slovenia is an EU member only since 2004 whereas it adopted the euro and became a member of the EA in 2007. This analysis was primarily focused on the business cycle synchronization between Slovenia and the EA19 countries, but future research could explore business cycle synchronization between Slovenia and its main foreign trade partners such as Germany, Italy, Austria, Croatia etc.

4 Conclusion

Monitoring economic fluctuations as phases of expansions and recessions became an integral part of the business cycle analysis, which is very important for policy makers especially when decisions between countries are made jointly. In the EU, interest for them increased with the introduction of the euro and related EMU. Slovenia is an EU member since 2004 whereby adopted the euro and became a member of the EA in 2007. Considering that, the purpose of this paper was to model and compare business cycles between Slovenia and the EA19 countries using the Markov Switching regression model and cross correlation analysis. The main advantage of the Markov Switching regression is that it allows non-linear modeling which if often used in the analysis of macroeconomic relationships that are subject to regime change.

Obtained results indicate a relatively high degree of business cycle synchronization in terms of estimated regression coefficients, transition probabilities and expected durations of the cycles, regime probabilities, etc. which is further confirmed by analyzing the cross-correlations.

Despite this, it is necessary to point out some facts. The transition matrix showed that in the expansion phase annual real GDP growth rates between the EA19 countries and Slovenia are simmilar, in the recession phase they differ significantly. Namely, negative real GDP growth rate in the recession phase is almost twice as high for Slovenia in relation to the EA19 countries. Furthermore, transition probabilities showed that the expected duration in the expansion phase is more than twice as high for the EA19 countries in relation to Slovenia while in the recession phase they are simmilar.

Notwithstanding some doubtful facts, it is possible to conclude that the degree of business cycle synchronization between the EA19 countries and Slovenia is relatively high and will be even higher in the future bearing in mind that Slovenia is a relatively new EU and EA member. However, in the future it would be interesting to explore business cycle synchronization between Slovenia and its main foreign trade partners.

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35th International Conference on Organizational Science Development
March 16th – 18th 2016, Portorož, Slovenia

TripAdvisor in Organising a Vacation: Tourists' Characteristics and Types of Information

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Abstract
For decades printed information sources have been used in information gathering process in tourism and personal contact with tourism providers in the process of organizing a vacation was needed. This trend began to change with the introduction of computers, in particular with the development of Internet and social networking web sites. Internet can be used for many different purposes that include promotion of tourism destination, creation of tourism destination image, but it is also an excellent tool in organising a vacation. The main purpose of this paper is to examine the characteristics of tourists who visited Istria County, Croatia in 2015 from the aspect of using TripAdvisor as a tool in organising their vacation. Data was collected through self-complete questionnaire on a sample of tourists staying in hotels and camping sites in nine tourism towns. This study was conducted from July through September in 2015. A total of 1554 responders were taken into analysis. Based on the descriptive results a little bit less than 30% of responders used TripAdvisor for organising their vacation. First time visitors relayed more on TripAdvisor compared to repeat visitors and country of origin also played important part in using TripAdvisor for organising vacation. Information about beaches, cultural heritage and restaurants in Istria County, Croatia were the most commonly searched types of information about the destination.

Keywords: tourists' characteristics, types of information, TripAdvisor, vacation organisation

1 Introduction

The number of Internet users is constantly increasing. Currently it is estimated that more than 3 billion people use Internet and it is forecasted that more than 4 billion people will use

Internet in 2020. ICT and Internet are becoming a part of our everyday life (Kotler and Armstrong, 2010). Internet is used for many different activities like entertainment, on-line sales, and information collection. In marketing, Internet can be used for many different purposes: promotion of different commodities and services, creating company image, public relations, e-sales (Ozretić Došen and Previšić Škare, 2003). Currently, Internet and social networking web sites present a great opportunity for promotion and sales of goods and services (Kotler and Caslione, 2009) because they enable direct contact with customer. Through Internet and especially social networking web sites customers obtain information in an easy and quick manner. They can also find different types of information, see their occupancy, book services, write their comments and desires, make payments etc.

Social networking websites are becoming more and more popular in recent years. In 2009 the social networking web sites with the highest number of users were: Facebook (123 million), YouTube (85.1 million), MySpace (54 million) (Hollensen, 2011). In 2015 Facebook is still number one regarding active users (The Statistics Portal, 2016) with 1.550 millions of users. In general the number of social networking web sites users increased from 0.97 billion in 2010 to 1.96 billion in 2015 and further growth is projected to 2.44 billion in 2018 (The Statistics Portal, 2016).

Through different tool, social networking web sites connect different individuals that have common interests forming a certain type of community. These virtual communities connect their users in different manners. Virtual communities like Facebook, YouTube, Linkedin, Pinterest, Google +, Instagram, Tumbir, VK, Flickr, Vine, Meetup Netlog, MySpice.com and Twiter offer different connection and types of information that are shared on them. Different manners of communications are available like messages, discussion forums, photographs, videos, blogs etc. Users can easily become a part of the community and share their experiences. This is especially important for tourism because the main focus of tourism lies on the creation of experiences (Andersson, 2007).

On social networking web sites, tourists can express and share their tendencies for certain tourist destinations, opinions, preferences and experiences. More and more people join social networking web sites daily, so these sites are fast gaining on importance and should be explored and used in marketing tourist destinations. Social networking websites provide tourist destinations and enterprises with a very efficient way for promoting their products and services compared to “classic” communication channels. They also enable direct promotion and may decrease promotion costs.

Tourists that had a satisfactory and fulfilling experience with a tourist destination may become powerful promoters of the tourist destination and its services and products. On the other hand, Internet and social networking web sites may provide different benefits to tourism enterprises especially in the form of cost reduction. Rumours and bad experiences shared through social networking web sites spread very quickly to other users and may have bad influence on tourist destinations and tourism enterprises.

There are different web sites related to travel and tourism. TripAdvisor is one of the most popular and largest travel sites. It enables travellers to plan and book their trip by offering advices from different travellers. This site covers more than 5.2 million accommodations, restaurants, and attractions in more than 26,000 destinations and operates in 47 countries worldwide (TripAdvisor, 2015). It is in part similar to a social networking web sites, a virtual

community and a blog, its primary function is collecting and disseminating user-generated content about travel, including comments, ratings (reviews), photos and videos (Limberger et al., 2010). Previous research is mostly focused on examining TripAdvisor taking into consideration different aspects related to their users like ranking (Jeacle and Carter, 2011), satisfaction (Limberger et al., 2010), reviews (Tuominen, 2011) etc. The main purpose of this paper is to examine the characteristics of tourists who visited Istria County, Croatia in 2015 from the aspect of using TripAdvisor as a tool in organising their vacation.

2 Methodology

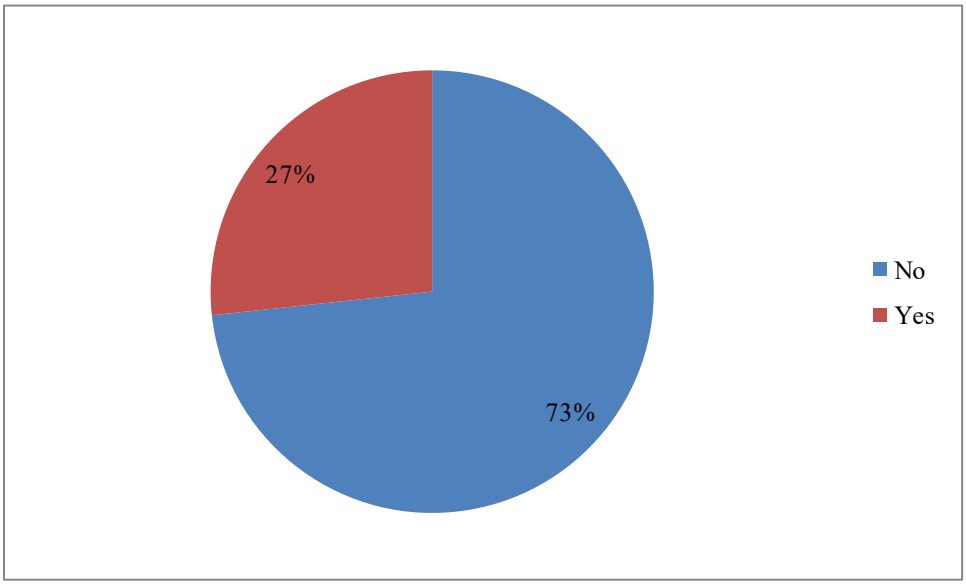
A study focused on tourists' usage of Internet and social networking web sites in tourism context was conducted from July to September 5 In this study the target population included those tourists who visited nine seaside tourist resorts in the Istria tourist destination: Umag, Novigrad, Poreč, Vrsar, Funtana, Rovinj, Pula, Medulin and Rabac. The survey was carried out in 20 hotels and six camping sites through a self-completed questionnaire. Tourists were approached by trained researchers and asked to participate in the survey. The researcher explained the purpose of the survey, said that the survey was anonymous and handed out a questionnaire in the appropriate language. In the process of on-site data collection in hotels, researchers were stationary while responders were mobile while in the case of camping sites researchers were mobile while responders were stationary (Veal, 2006). A convenient sample was used. Hotels and camping sites were preselected based on location i.e. they were located in seaside tourists resorts and hotels' capacity was from 100 to 500 rooms while camping sites' capacity varied between 1,000 and 5,000 people.

For the purpose of data gathering, the questionnaire was constructed. It consisted of 16 questions which were divided into six sections: 1) general usage of Internet, tourist web sites and social networking web sites, 2) usage of Internet and social networking web sites for the purpose of organising vacation, 3) benefits and obstacle in using social networking web sites for tourism purposes, 4) usage of Internet and social networking web sites during vacation, 5) usual usage of Internet and social networking web sites after returning home and 6) respondents' socio-demographic characteristics (country of origin, age, gender, income level, occupation, size of settlement, travelling party) and trip characteristics (number of visits, length of stay and sources of information). It was originally designed in Croatian and then translated into the following languages: English, German, Italian and Slovene.

A total of 2500 questionnaires were prepared and 1554 questionnaires were taken into analysis. Data was processed using univariate statistics (general description of sample) and bivariate statistics, namely chi square test, for determining differences between those responders who used TripAdvisor as a source of information when they organized their current vacation based on their personal characteristics.

3 Results and discussion

A bit less than 30% of responders used TripAdvisor web site as a source of information when they organized their current vacation (Graph 1).



Graph 1: Usage of TripAdvisor in organising current vacation

The proportion of female responders (54.0%) was slightly higher than that of male (Table 1). Most of the responders were between 35 and 54 years of age (53%). The majority of responders obtained some kind of higher education level (58%). The responders had different backgrounds and occupations, most of the responders stated that they were employees (56%), while 13% were self-employed or freelance. Most of the responders were from Austria (23%), about 18% were from Italy and 17% from Germany. Most of the responders stated that their monthly net income was between €1,000 and €2,000 (31%). They mostly stayed in the accommodation facility for the first time (82%) but most of them have already visited Istria County as a tourist destination (52%).

Variable	Usage of TripAdvisor.com		Total
	No	Yes	
Gender			
Male	34,5	11,5	46,0
Female	38,1	15,9	54,0
Age (M; SD)	40,07 (12,538)	39,19 (12,075)	39,83 (12,417)
16-24	8,9	3,5	12,4
25-34	15,7	6,4	22,2
35-44	19,7	7,7	27,4
45-54	19,1	6,3	25,5
55+	9,5	3,1	12,6
Education level			
Elementary school	5,1	0,6	5,6
Secondary school	27,4	9,2	36,6
College or Bachelor's Degree	19,6	8,0	27,6
University or Master's Degree	17,2	8,6	25,7

Ph.D.	3,1	1,3	4,5
Profession			
Self-employed/freelance	9,7	3,3	13,1
Manager	7,8	3,9	11,8
Employee (full time)	33,0	12,2	45,2
Employee (part time)	8,6	2,0	10,7
Student	6,0	2,7	8,6
Retired	3,1	0,8	3,9
Other	4,7	2,1	6,8
Income			
Up to € 500	4,5	1,5	6,0
€ 500 – € 1,000	9,0	2,6	11,6
€ 1,000 – € 2,000	21,6	9,2	30,9
€ 2,000 – € 3,000	16,8	5,4	22,2
€ 3,000 – € 4,000	7,7	3,3	11,0
€ 4,000 – € 5,000	4,2	2,0	6,2
€ 5,000 – € 6,000	2,8	0,5	3,3
Over € 6,000	5,8	3,1	8,9
Country of origin			
Austria	20,9	2,6	23,5
Italy	11,5	6,9	18,4
Germany	14,0	2,9	17,0
UK	4,8	8,2	13,0
The Netherlands	4,3	1,0	5,3
Slovenia	4,1	0,7	4,8
Other	13,3	4,8	18,1
First/repeat visitation (accommodation)			
Repeat visitor	15,9	2,3	18,2
First time visitor	57,4	24,4	81,8
First/repeat visitation (destination)			
Repeat visitor	42,4	9,9	52,3
First time visitor	31,2	16,5	47,7

Table 1: Characteristics' of responders (in %)

Education level (χ^2 = 20,789; df = 4; sig. = 0,000), first/repeat visitation (accommodation) (χ^2 = 33,281; df = 1; sig. = 0,000) and first/repeat visitation (destination) (χ^2 = 44,391; df = 1; sig. = 0,000) were significant related to usage of TripAdvisor for the purposes of organising their current trip. Those responders who obtained University or Master's Degree were more likely to use TripAdvisor while those with Elementary school were less likely to use TripAdvisor for the purposes of organising their current trip. The responders who visited accommodation facility for the first time were more likely to use TripAdvisor compared to repeat visitors. Likewise, those responders who previously visited Istria County were more likely not to use TripAdvisor compared to first time visitors.

Information about accommodations (71%), beaches (51%) were the two types of information that responders searched for the most in general (Table 2). Information

about Cultural heritage (21%), restaurants (20%) and Suggestions on one-day individual trips (20%) were of interest for about 1/5 of the responders. Some of the responders used TripAdvisor in order to obtain this information. Although over 70% of responders searched for information about accommodation through Internet, only 1/5 of the responders used TripAdvisor for those purposes. The same pattern is present for other types of information.

Variable	Usage of TripAdvisor.com		Total
	No	Yes	
Accommodation			
Not searched	23,9	5,2	29,2
Searched	49,4	21,5	70,8
Restaurants			
Not searched	62,0	18,5	80,5
Searched	11,3	8,2	19,5
Beaches			
Not searched	38,4	11,1	49,4
Searched	34,9	15,6	50,6
Cultural and historical heritage			
Not searched	61,0	18,4	79,4
Searched	12,3	8,3	20,6
Natural Heritage			
Not searched	65,0	21,0	86,0
Searched	8,3	5,7	14,0
Events			
Not searched	66,0	22,1	88,1
Searched	7,3	4,6	11,9
Traditional food and drink			
Not searched	67,6	21,5	89,1
Searched	5,7	5,2	10,9
Trails (e.g. walking, cycling trails)			
Not searched	67,2	23,8	91,0
Searched	6,1	2,9	9,0
Suggestions on one-day individual trips			
Not searched	61,1	19,4	80,5
Searched	12,2	7,3	19,5

Table 2: Types of Information (in %)

Based on the results certain implications can be drawn. In general, only 1/3 of responder used TripAdvisor in order to obtain information about Istria County as a tourist destination. This may be due to the age factor. Namely, tourists that stayed in Istria County were mostly older than 35 years of age, with almost 40% 45 or older. Responders who used TripAdvisor for the purposes of organising their current trip are more likely to have a higher level of education. TripAdvisor as a source of information is more likely to be used by first time visitors. First time visitors of a certain accommodation facility used TripAdvisor more frequently compared to tourists to visiting Istria County for the first time. This is probably due to the fact that TripAdvisor offers more information regarding accommodation in Istria County. This is

supported by the fact that most of the tourists used Internet to find information about accommodation. Although only 1/5 of the responders used TripAdvisor for those purposes, it was still the most frequently sought information in the case of TripAdvisor. Since many tourist destinations are present on TripAdvisor, it is advisable to reinforce efforts in promoting Istria County through this site, as well as other sites.

4 Conclusion

Internet and social networking web sites present a great opportunity for promotion of tourist destination and enterprises. They may also be a good tool in the process of planning a vacation. There are many different sites that collect and disseminate user-generated content about travel. TripAdvisor is one of such tools.

Although TripAdvisor offers information about thousands of tourist destination and lists a few million accommodation facilities, only about 1/3 of tourists staying in Istria County have used this site to get information about the destination. This is probably related to age of tourist. Those responders that have used TripAdvisor to get information about the destination, were usually first time visitors (accommodation facility and Istria County) and have obtained higher education level. The most commonly sought information was about accommodation facilities. Information regarding beaches was of interest to one half of the tourists which is directly related to the main motive for visiting Istria County i.e. sun and sea.

There are some limitations to this study. These results are based on a sample of tourists who stayed in selected hotels and resorts and the responders either used or not used TripAdvisor for planning their vacation so the results may not be generalized to the overall Istria County's tourism market or to user of TripAdvisor in general. The sample included commercial accommodation users only, so tourists not staying in commercial accommodation were omitted from the study.Future research regarding Internet and social networking web sites may focus on differences and similarities among different accommodation facilities. Since only 1/3 of responders used TripAdvisor in planning their vacation, future research may focus on reasons why tourists do not use TripAdvisor and similar sites while they are planning and organising their vacation.

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35. mednarodna konferenca o razvoju organizacijskih znanosti
16.–18. marec 2016, Portorož, Slovenija

Spremljanje prekomerno težkih pacientov na daljavo

Telemonitoring Overweight Patients

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Povzetek
Debelost je vedno večji javno zdravstveni problem, predvsem zaradi naraščajoče prevalence, stroškov in posledic, ki jih ima na zdravje in kakovost življenja posameznika. Rezultati nedavne študije kažejo na trend naraščanja debelosti v Sloveniji. Na Univerzitetni kliniki za pljučne bolezni in alergijo Golnik obravnavamo čedalje več prekomerno težkih pacientov, ki imajo težave z dihanjem. Uvedli smo program za hujšanje zaradi pozitivnega vpliva redukcije telesne teže na pacienta, njegovo zdravstveno stanje in kakovost življenja. Treba je vzpostaviti hitro, učinkovito in redno spremljanje teh pacientov. Z vedno večjim številom pacientov, obstoječi proces spremljanja njihovega napredka ni bil več ustrezen, zato smo vzpostavili sodobno informacijsko podporo in ustvarili spletno storitev, ki omogoča aktivno sodelovanje pacienta ter redno spremljanje pacienta na daljavo s strani zdravstvenega osebja. Glavne prednosti oddaljenega nadzora so večja motivacija pacientov, poenostavljen delovni proces, hitrejša komunikacija in odzivnost, časovno manjša obremenitev tako za paciente kot zdravstveno osebje, nižji stroški tako za bolnišnico kot pacienta. Prepričani smo, da je razvoj in implementacija nove tehnologije bistvenega pomena za izboljšanje zagotavljanja zdravstvenega varstva in optimizacijo pacientovih izidov.

Ključne besede: debelost, pacient, oddaljen nadzor

Abstract
Obesity is a growing health problem, mainly due to the increasing prevalence, costs, consequences on health and quality of life of the individual. The results of recent studies indicate a rising trend of obesity in Slovenia. At the University Hospital Golnik we treat more obese patients with a consequent difficulty in breathing than ever before. We have started a weight loss program due to its positive influence on the patient, his health status and his quality of life. It is necessary to establish a fast, efficient and regular monitoring of such patients. With a growing number of patients, existing process of monitoring their progress is no longer adequate. We have established a modern IT support and created a web service that allows active participation of a patient and regular telemonitoring by medical staff. The main advantages are greater patient motivation, simplified work process, faster communication and response, less time load for medical staff and patients, lower costs for both the hospital and a patient. We believe that the development and implementation of new technology could be essential for improving the delivery of healthcare and optimizing patient outcomes.

Keywords: obesity, patient, telemonitoring

1 Introduction

Overweight and obesity are increasing worldwide health problem, mainly due to the increasing prevalence, costs, consequences on health and quality of life of the individual. Obesity represents an epidemic that is spreading throughout the world, both in developed and in developing countries. The disease is categorized by body mass index (BMI) greater than 30 kg/m2. According to the World Health Organization (WHO) from 2014, approximately 1.9 billion adults older than eighteen years are overweight, and more than 600 million people are obese. In most countries of the world people die more due to overweight and obesity, than due to malnutrition (WHO, 2015).

In the University clinic of pulmonary and allergic diseases Golnik, we have detected that the number of obese people is constantly increasing. Since weight loss has a positive impact on their quality of life, we began to implement a program of weight loss in obese patients. Our main goal is to help overweight or obese patients to achieve maximum independence and improve their quality of life by maintaining weight loss. We want to achieve this goal by means of health education.

At the beginning, we had a follow up service with regular phone calls to patients every two weeks, but we have soon noticed that the number of patients in a weight loss program was increasing and we have less and less time for their follow-ups. We saw the solution of this problem in using contemporary ICT. We have created a web application that allows active participation of patients in the weight loss program. Patients' self-monitoring is controlled by medical staff.

Monitoring overweight patients by a website lies in the field of telehealth. Firstly because it covers protection, preservation and strengthening of their health. Secondly, as with the help of interactive electronic technology in the medical purposes, transfer of information and data is done through phone, computer, e-mail or through interactive video transmission (Bertalanič, 2010, povzeto po Barraza, 2009). For us, the most important aspects of our web application

are regular communication and exchange of information, irrespective of time and location of a patient, the possibility of preventive action to maintain body weight, regular assessments of patient health condition and changing their habits. Our web application also offers continuous monitoring of the effectiveness of the program.

2 Overweight and obesity

From WHO data for year 2014 it is estimated that more than 1.9 billion US adults were overweight and over 600 million of them were obese. The statistics show that about 13% of the world's adult population (11% of men and 15% of women) were obese (WHO, 2015). According to recent data for year 2014 in Slovenia, 37.2% of the population are overweight with BMI above 25, while 17.4% are obese. There is a rise in number of obese and very obese people (with a BMI over 35), mostly men (Tomšič et al., 2014).

Obesity is the result of disturbed energy balance over time. The consequences of obesity are different and they range from anxiety, depression, lack of self-esteem, poor body image, feelings of stigmatization with effects on the physical health of an individual, type 2 diabetes mellitus, arterial hypertension, cardiovascular disease, elevated cholesterol, sleep-disordered breathing, various gastrointestinal diseases, orthopedic complications, cancer, etc (Tomšič et al., 2014). Evidence indicates that a weight loss of 5% to 10% can drastically reduce the risk factors for some chronic diseases such as heart disease and diabetes, as well as some cancers (Steinberg et al, 2013).

The most common problem in the reduction of body weight of obese people is their accustomed way of living and lack of motivation. Overweight people must radically change their lifestyle in order for them to be successful in losing weight and this change requires persistence. Standard behavioral weight loss interventions that include frequent face-to-face interactions with a trained weight loss counselor, detailed self-monitoring of diet and physical activity behaviors produce on average about 7% to 10% weight loss after 6 to 12 months (Steinberg et al, 2013). For this reason, we started to regularly phone-call patients included in the weight loss program on average every 14 days, in order to assess their progress and raise or maintain their motivation.

Our activities focus on health education courses that educate, raise awareness and advise patients on healthy lifestyle and helping them changing bad habits.

The problem occurred when the number of patients enrolled in the weight loss program became too high for us to monitor them regularly. As today's technology allows simplification of work processes, it enables us to dedicate more time to patients. We have decided to create a web application that would support the process of monitoring patients and at the same time facilitate the work of employees, thus allowing higher quality of patient treatment in the reduction of body weight.

In addition, we wanted to allow greater involvement of patients in the process of weight loss and the possibility of greater motivation by providing regular access to their progress, which was not possible before.

We are aware that motivation is one of the most important factors that help maintain body weight. The higher the motivation prior to weight loss is, the greater the likelihood of long-term weight loss and maintenance of weight can be expected (Vornšek, 2010).

3 Web application

One of the most effective strategies within the majority of weight loss interventions are self-monitoring of diet and regular physical activity. Self-monitoring provides feedback that increases awareness, which can lead to greater self-efficacy, self-control and self-initiated reinforcement (Steinberg et al, 2013).

After a thorough analysis of the current state of the weight loss program, we planned a database and a prototype solution, which was tested on a group of patients and by our medical staff. Patients can access the web application regardless of their location and time.

With the help of the web application we want to enable faster communication between patients and medical staff (we had problems with busy telephone line, the desired person was not available, the phone of the patient is off, multiple repeated calls to establish contact with the patient and vice versa).

Patients can access the web application and see only their own data. Patients were asked to enter data at the beginning. These data include assessment of their health, lifestyle assessment, physical activity log and current weight. Patients were then asked to weight themselves at least once a week and input the results in the web application.

Self-weighing is a simple self-monitoring behavior that has been shown to be useful for self-regulation of body weight. Self-weighing provides feedback of how eating and exercise behaviors affects weight, and acts as a tool to allow individuals to make small adjustments to these behaviors to affect energy balance. Literature indicates that daily self-weighing is associated with greater weight loss compared to less frequent weighing reinforcement (Steinberg et al, 2013).

3.1 Web application for overweight patients

The medical staff and administrators (dietitian and registered nurse) have access to data of all users of the web application.

The information in the application must be available to a select group of users, so they must be protected. Because we want to have an application available regardless of time or location of the patient, we decided that the data is protected by the secure entry to the application. We created a login page on which the user needs e-mail address and password.

After successful registration, the user sees a general guide to a healthy weight loss, shown in Figure 1, written by nurse and dietitian. These instructions are written as multiple orientations in the process of healthy weight loss.

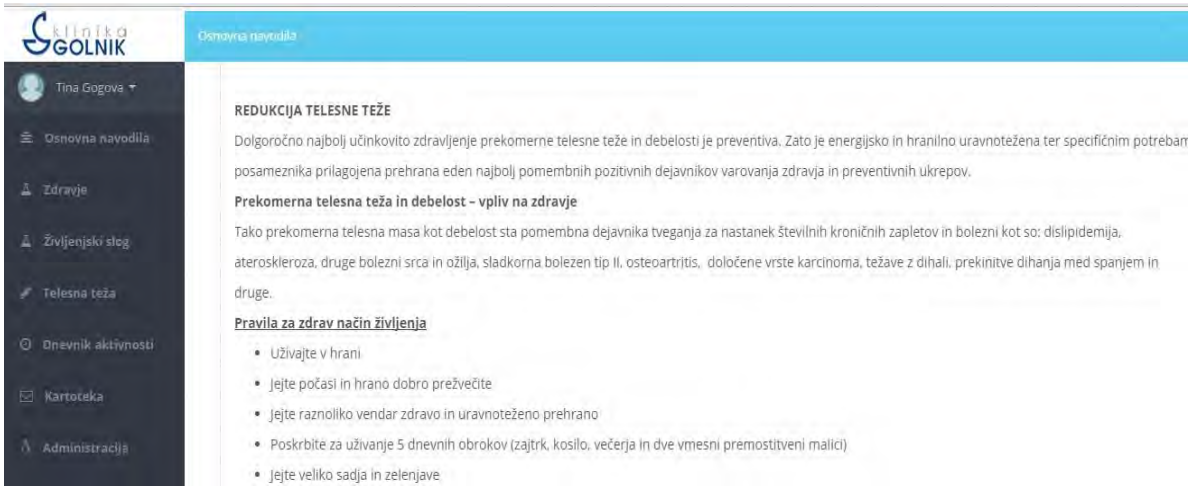

Figure 1: General instructions for reduction of body weight

Instructions are followed by an assessment of patient's health condition and his/her lifestyle, where patient is asked questions related to his/her physical activity and dietary habits. The answers give medical personnel detailed insight into the lifestyle of the individual. In this way it is easier to determine the cause of slow or failed weight loss.

Next is module for monitoring body weight, which is crucial for our program. Here, the application user enters the body weight and size of his waist. When entering data, the chart curve is plotted and by reducing body weight of the patient, this can be additional motivation for the patient to continue with the proper method of weight loss. With the growth curve of body weight of the patient this is a visual alert of the increase of body weight and therefore are required additional actions, or more precisely implementation of the weight loss program. The graph (Figure 2) shows how the weight and/or waist circumference change over time. It is desirable that users enter data applications on body weight and/or waist circumference once a week.
Next module is a diary of physical activity, where the user enters the approximate number of hours of certain activities daily, such as walking, household chores, exercises, etc. Furtherrmore, the patient must specify how long (in hours) about a day, he/she spends sitting, watching TV, sleeping, socializing with friends, etc. According to the data input of the patient, a pie chart model is drawn, which clearly shows to the patient his daily activities.

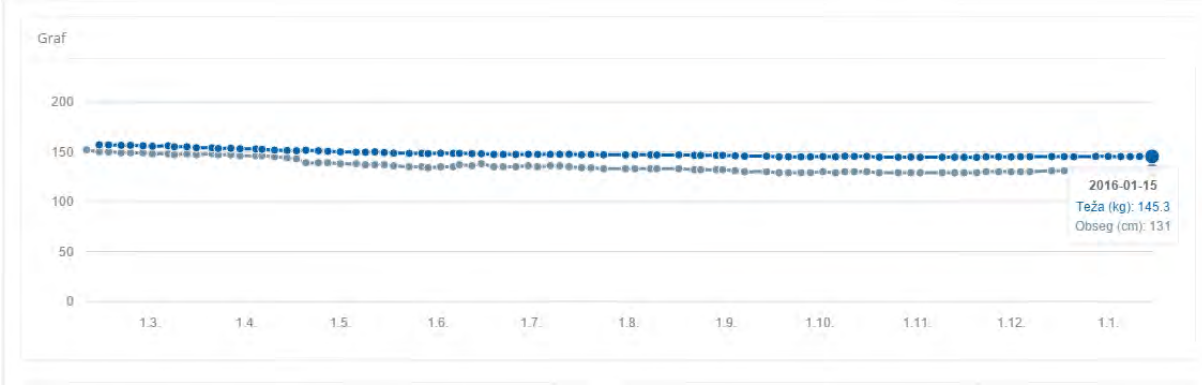

Figure 2: Patient weight and waist circumference monitoring

The last module contains patient medical information. The data is entered by the medical staff (a registered nurse and/or a dietitian), a patient cannot enter or modify data in this module.

The main purpose is to educate patients and their relatives with the aim of providing the best possible health care. Contemporary technology enables communication and collaboration of health personnel with patients and encourages their active participation and care of their own health.

3.2 Benefits of Web Application

Advanced technology in health care and medicine has an increasing role in maintaining health.

Our responsive designed web based application is widely applicable on large number of different devices with different screen sizes (mobile phones, tablet or PC) and different platforms (android, iOS, windows and desktop web browsers). Cloud based solution provides further advantage as user can access and manage their data through different devices.

The biggest advantage of the proposed web application is that with the use of such an information system healthcare professionals are able to monitor patients who are overweight, together with their active participation in the process of losing weight. If offers new possibilities for a constant motivation for both users and medical staff by observing the progress.

In particular, we believe that our web application provides consistent, better communication between medical staff and patients, which is crucial for the success in reducing body weight. Patients and their relatives have stated the following advantages of using web application:

- a sense of security due to the possible constant communication with the nurse,
- they feel responsible for their own health,
- they are pleased to have an active role in the program,
- they are pleased that regular checkups at health facility is not longer required, so consequently they have fewer expenses and more time,
- they are pleased when they see their progress on the computer screen.

A possible obstacle to the use of telehealth can be the lack of patient's knowledge to use equipment necessary for the provision of services at a distance. Patients may not be sufficiently informed about new technology. They may fear the use of certain software or they may not be able to learn the proper use of sophisticated equipment (Bertalanič, 2010, in Klingensmith et al, 2008), so it is important to establish a respectful and trustworthy relationship between medical staff, patients and their relatives, which starts from the very first contact. It is necessary to provide them with detailed instructions, both oral and written, and offer assistance via telephone or e-mail in case of problems with signing in and/or using the web application.

4 Conclusion

When working with obese people who have serious health consequences of obesity, we noted the need to introduce technical assistance in the form of a weight loss program, which included health education of patients by nurses and special dietary analysis and advice by dietitian. At the inception of the program, we found that the success in the reduction of body weight require regular monitoring and motivating patients. With the increasing number of patients included in the weight loss program, it has become increasingly difficult to monitor all patients. Therefore, we have developed a prototype web-based application that allows medical personnel efficient, streamlined process work, faster communication, faster response,

greater motivation of patients, lesser burden of time to both: medical staff and patients. It lowers costs for the hospital and patients as well by means of using contemporary ICT and a modern approach to active patient involvement in healthcare.

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35th International Conference on Organizational Science Development
March 16th – 18th 2016, Portorož, Slovenia

Prosumer Involvement in Smart Grids: the Relevance of Energy Prosumer Behavior

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Abstract
The traditionally centralized and vertical structure of electricity networks is changing to be more decentralized. By integrating bottom-up energy provision, the industry is undergoing drastic structural changes. Bottom-to-bottom electricity provision solutions via prosumer communities, such as Crowd Energy, will change the grid in a sustainable way and reinforce the paradigm shift affecting the electricity sector. The integration of energy-prosumer communities on a low voltage distribution level affects not only the structure of electricity supply in a grid but also its underlying framework. Current energy behavior research mostly focuses on understanding household energy consumption behavior in a traditional structure and is unable to express prosumer behavior in a decentralized and horizontal structure.

For the first time, this paper proposes a broader view of energy prosumer behavior in a prosumer-shaped electricity network. A prosumer behavior framework will highlight the changing and merging roles from a consumer to a prosumer and changing responsibilities in a decentralized and horizontal electricity market. It argues for broader behavioral research, both for network stability reasons and to consider its application for societal, political and economic perspectives on decentralized electricity networks.

Keywords: crowd energy, behavioral research, prosumer behavior, Energy behavior

1 Introduction

The energy sector is currently undergoing technological, structural and infrastructural changes which are fostering the emergence of a new actor: the energy prosumer. Households are slowly giving up their pure and passive consumption role within the energy system in favor of actively producing and consuming (i.e., prosuming) energy. In Switzerland in 2014, 0.8% of the electricity produced came from solar energy. While this may seem a vanishingly small amount, it is actually a huge increase relative to the 0.2% produced this way in 2011

(Bundesamt für Energie, 2012; Bundesamt für Energie, 2015). We interpret these figures as a sign of prosumers entering the Swiss market. Integrating this new actor into the electricity market would mean electricity generation, storage and distribution occurring under different circumstances and require a new organization of the electricity market and grid structure. One major challenge of integrating energy generation, storage and prosumer consumption is analyzing, understanding and predicting prosumers' energy-related behavior. Modern energy behavior research focuses a great deal on energy consumption reduction goals but is unable to express prosumer behavior, which extends well beyond energy consumption alone. While energy consumers have limited ways to interact with the grid, prosumers face different trade-offs; this in turn affects not only the grid, but also prosumer communities and households.

This paper begins by investigating current changes to the electricity grid structure, focusing on the changing roles and responsibilities as consumers transition to being prosumers. Based on this new role, Chapter 3 demonstrates the essential differences between consumption and prosumption behavior. Chapter 4 focuses on the Crowd Energy (Teufel & Teufel, 2014) concept, based on the new structural and behavioral paradigm of prosumption. Chapter 5 presents the first prosumer behavior framework based on the Crowd Energy concept and the electricity behavior paradigm. Chapter 6 concludes.

2 Current Paradigm Shift in the Electricity Network Structure

The traditional structure of energy supply is a one-to-many-structure, with electricity production provided by only a few suppliers (Fang, Misra, Xue & Yang, 2012; Gstrein & Teufel, 2015). The centralized structure clearly distinguishes between production and consumption of electricity and therefore clearly defines the roles of producer and consumer. The hierarchical one-to-many grid structure allows a clearly defined linear value chain from production, transmission and distribution to the eventual consumption of electricity (Grijalva & Tariq, 2011). Energy distribution occurs in a "top-down" vertical fashion, starting from a 220kV/380kV transmission grid into a 400V/230V local distribution network. Constant electricity supply and network stability are ensured by electricity producers and network operators. By activating additional peak load power plants during peak demand periods, the traditional structure embodies a "supply follows demand" mechanism.

Teufel and Teufel define the relationship between producer and consumer in a traditional structure as a one-directional "to you" relationship (Teufel & Teufel, 2014). The role of the consumer is limited to a pure consumption role and is treated as a "passive end user" or "captive consumer" by the system (Spaargaren & van Vliet, 2000). The consumer can only offer a passive contribution to network stability issues, for example by reacting to financial incentives.

Thanks to regulations, especially the decommissioning of nuclear power plants, and new technological possibilities, the energy sector and grid structure are currently in a transition phase. Distributed energy resources (DER) like small-scale solar power stations, wind farms and waste-to-energy facilities will lead to a more decentralized energy production structure. Furthermore, falling prices for solar panels will allow increasing numbers of consumers to produce their own energy, becoming energy prosumers and feeding electricity into the grid from the "bottom up". At the same time, small and medium distributed storage systems will form a distributed electricity storage structure (ESS) (Roberts & Sandberg, 2011), allowing prosumers to store electricity. In addition to technological advancement in the field of DERs,

the grid will be supported by a modern communication infrastructure, remote control, automation systems and sensing and metering technologies (Gungor et al., 2011; Teufel & Teufel, 2014). The combination of DERs, ESSs and the two-way flow of electricity and information will allow production, transmission, distribution, storage and consumption optimizations at both the grid and prosumer levels. This new "intelligent" grid, known as a "smart grid", is expected to address the major shortcomings of the traditional grid (Farhangi, 2010).

The role of households will change thanks to their new electricity production, storage and distribution capabilities. The "top-down" structure of the electricity sector's value chain will change into a value network with both a "top-down" and "bottom-up" structure. Prosumers will produce their own electricity and be less dependent on the grid. However, prosumer cells will still be reliant on a grid for individual electricity production shortfalls and also for feeding in produced electricity. With the changing household capabilities, prosumers will both compete with and complement electricity producers, which will allow new players to enter the market (Gstrein & Teufel, 2015). Incumbents and new players will have to adapt their relationship with these households from a "to you" to a "with you" strategy (Teufel & Teufel, 2014), where a "with you" strategy implies knowledge and understanding of unknown individual behaviors.

Given the new technological possibilities, the future of the electricity network will be shaped by many self-sufficient, highly reliable microgrids (Lasseter & Paigi, 2004). Microgrids herald a new energy generation and provision paradigm by clustering load and power in a defined local area (Lasseter, 2002). Microgrids will complement the vertical energy provision structure, the "backbone", with a horizontal "bottom-to-bottom" structure, allowing not only individual self-sufficiency goals but also collective ones. Individual prosumers' production shortfalls will be covered by other nearby prosumers rather than traditional suppliers. In addition to the proximity of electricity generation and consumption like in the transition stage, the bottom-to-bottom structure will reinforce the proximity concept by clustering prosumers. Clustering prosumers into prosumer communities will not only change the energy provision structure, it will also change the underlying understanding and framework of how the electricity will be provided to the grid and between prosumers. Electricity will no longer be provided by traditional producers alone, but also by prosumers with prosumption constraints, under which prosumers will provide electricity to others which cannot cover their demand with their own production capacities.

While "demand follows supply" thinking is the new desired consumption paradigm, the energy provision paradigm is changing to "prosumption dependent energy provision" thinking: energy provision in a prosumer-shaped energy system results in feeding in unconsumed electricity from prosumer households into the grid. Providing electricity surpluses to a community changes responsibilities for supply security issues. While supply security is currently guaranteed by traditional suppliers, in future prosumer communities and prosumers will bear much more responsibility for their own supply security. Under the new electricity provision, increasing supply security can be achieved through different mechanisms: increased production capacities, increased storage capacities, decreased consumption and by "horizontal opening up" (Naus, van Vliet, Bas J.M. & Hendriksen, 2015), which will result in more electricity surplus being shared with the community. The final two mechanisms to achieve supply security are based on the acceptance, decision-making and behavior of prosumers and prosumer communities. The shift from a "by them"

management of supply security to “by us” thinking not only integrates prosumers into the issue; it makes them responsible for supply security. Energy behavior research will therefore contribute to network and supply security issues in a much larger capacity.

3 From Consumption Behavior to Prosumption Behavior

Human behavior patterns affect environmental quality. Turning environmentally harmful behavior into more aware and sustainable ones is crucial to reducing emissions and pollution and reaching climate goals. The oil shocks of the 1970s encouraged behavioral research and social science in broader energy research (Wilhite, Shove, Lutzenhiser & Kempton, 2003). These events highlighted the politically and economically unsustainable use of energy at the time and increased national interest in energy use and consumer behavior. With the advent of smart grids, energy behavior research is again receiving a lot of attention (Hammond & Pearson, 2013; Verbong, Beemsterboer & Sengers, 2013; Wolsink, 2012), this time with a much larger scope for sustainability, including ecological sustainability. The major focus of current energy behavior research is on the tail end of the value chain in an electricity structure: the consumer. The understanding and explanation of the human behavior linked to energy consumption is approached via different scientific disciplines (for a review, see: Sovacool, 2014; Wilson & Dowlatabadi, 2007).

The goal of sustainably reducing energy consumption can be achieved via different mechanisms, incentives or programs. These all cast energy consumers as decision-makers and thus key factors in successfully reducing consumption. Energy behavior research helps to analyze, understand and forecast customer response and consumption reduction through price incentives, energy prices and price strategies in such programs (Gottwalt, Ketter, Block, Collins & Weinhardt, 2011). An understanding of the link between consumption behavior and price sensitivity underpins the change from a “supply follows demand” to a “demand follows supply” paradigm (Dupont, Tant & Belmans, 2012). The use and choice of energy efficient technologies or the acceptance of energy efficient programs is based on results from energy efficiency behavior research (A. Greening, Greene & Difiglio, 2000; Binswanger, 2001; Gillingham, Newell & Palmer, 2009).

The deployment of a smart grid is based not only on technological progress but also on a deeper understanding of human decision-making and behavior. Understanding human actions, such as preferring one choice over another, also requires knowledge of the factors which influence human behavior. Identifying these factors provides a basis for theoretical and empirical work related to energy behavior. Different frameworks related to consumption behavior already exist (Kowsari & Zerriffi, 2011; Pothitou, Kolios, Varga & Gu, 2015; Stephenson et al., 2010; Wilson & Dowlatabadi, 2007).
The shift from a pure consumption role to a production, storage and consumption one will dramatically change the electricity market. Researchers with a stronger technical or ICT background already anticipated the advent of electricity prosumption, while researchers from wide-ranging social sciences and especially behavioral sciences missed this change.

Nevertheless, there is some effort to approach the more human-centric electricity system shaped by active prosumers (Rathnayaka, Potdar, Hussain & Dillon, 2011; Rathnayaka, Potdar & Ou, 2012). The prosumer framework from Lampropoulos, Vanalme and Kling is a promising attempt to map factors and their interactions that dominate prosumers’ behaviors and subsequently shape the system load profile (Lampropoulos, Vanalme & Kling, 2010).

However, this nascent research into energy prosumer behavior focuses mainly on individual behavior such as consumption or selling; it fails to integrate these particular behaviors into a broader framework or consider the technical potential of prosumers and the use of the electricity they produce. Analyzing, understanding, changing and predicting isolated prosumer behavior only make sense if there is no choice over the final use of produced energy. Traditional consumers have no rival use for energy "consumption" and can only adjust their level of consumption. Prosumers, however, have the technical capabilities to consume, sell, store or share the energy they produce (Figure 1, dotted lines). Prosumers face important trade-offs and will choose to use energy in the way which best suits their individual preferences, knowing that these choices are mutually exclusive (Figure 1, red lines). Energy consumption behavior research therefore retains its *raison d'être* in research into energy use behavior, but must consider other rival usage possibilities, such as storing, sharing or selling produced energy.

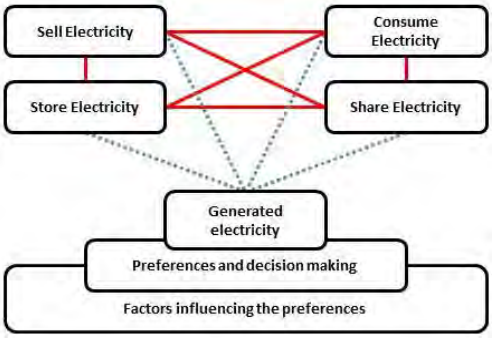

Figure 1: Prosumer Behavior

Integrated prosumer behavior understanding must consider a larger range of choices and actions where the prosumer faces different trade-offs between different choices. The final decision will depend on individual, utility maximizing preferences shaped by different factors.

4 The Crowd Energy Concept

Teufel and Teufel define Crowd Energy as:

> …the collective effort of individuals or profit or non-profit organizations, or both, pooling their resources through online information and communication technology applications (ICT applications) to help to implement the energy turnaround.
>
> Teufel & Teufel, 2014

The concept includes technical and scientific features by integrating decentralized electricity production and storage possibilities and information and communications technologies (ICT) in the utility sector. On the other hand, the concept has a strong human-centric nature by integrating "sharing economy" thinking. By sharing electricity with other prosumers, a sharing prosumer has no direct counterpart for the shared "good" as when selling electricity to a traditional purchaser. Prosumers are organized into prosumer communities, allowing "bottom-to-bottom" electricity supply. Members of the Crowd Energy community are connected through a low voltage grid, allowing distribution of electricity among members, and a Crowd Management communication line, allowing information distribution (Teufel & Teufel, 2014).

4.1 Crowd Energy Prosumption

The basic elements of Crowd Energy are intelligent generation-storage-load cells (iGSL cells). The structure and interaction of generation (G) and storage (S) units covers the electricity demand (L, Load) of the cells or at least increases the degree of self-sufficiency. The degree of self-sufficiency for a given period depends on current electricity generation and consumption. Individual self-sufficiency can be increased by storing electricity in surplus periods and using it in periods when production cannot cover consumption (Gstrein & Teufel, 2014). Therefore, whether an iGSL cell operates independently from a grid depends on its infrastructure, usage and application of it.

Depending on the utilization and arrangement of the iGSL structure, different "GSL situations" result. These characterize iGSL cells as grid-relieving, grid-neutral or grid-loading for a given period. Ritzer redefines production and consumption in the context of prosumption, stating, "There is no such thing as either pure production (without at least some consumption) or pure consumption (without at least some production)" (Ritzer, 2014, p.10). This leads to two different poles to characterize prosumption. We use Ritzer's notion of two different poles to characterize the role of prosumer cells in a prosumer community: "prosumption as production" or "prosumption as consumption". iGSL cells can switch from one role to the other in just a few hours (Figure 2). An iGSL cell can produce an electricity surplus when current electricity generation exceeds current consumption. This cell will be recognized by the community as a "prosumer as producer" and potentially share the surplus with the community. Conversely, when current consumption exceeds production, the iGSL cell potentially needs the community to cover the supply gap and shifts into a "prosumer as consumer" role.

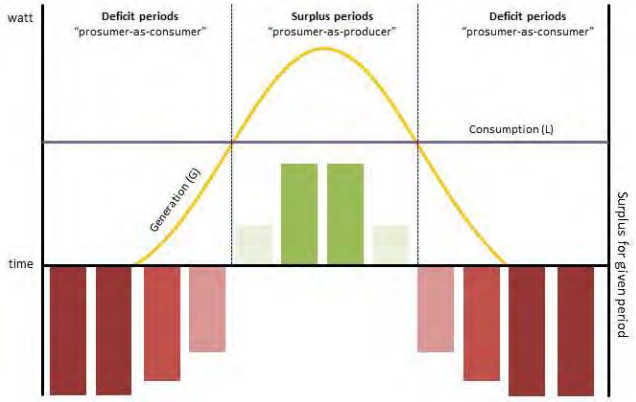

Figure 2: Role of iGSL cells

Prosumption involves both production and consumption (Ritzer, 2014). "Prosumption dependent energy provision" depends therefore not only on electricity production, which depends on technological, seasonal and meteorological factors, but also on individual and adjustable consumption and consumption patterns. Therefore, reducing consumption behavior in a prosumption model leads to different outputs (Figure 3): first, it reduces consumption (L') and thus electricity purchases from the grid. Second, a decrease in consumption increases the electricity surplus of prosumer cells for a given period. Third, the number of surplus periods will rise and therefore "prosumer as producer" thinking will become more important. Unlike the limited interaction possibilities between end-users in a vertical structure, "bottom-to-bottom" structures afford prosumers a much larger range of action and interaction.

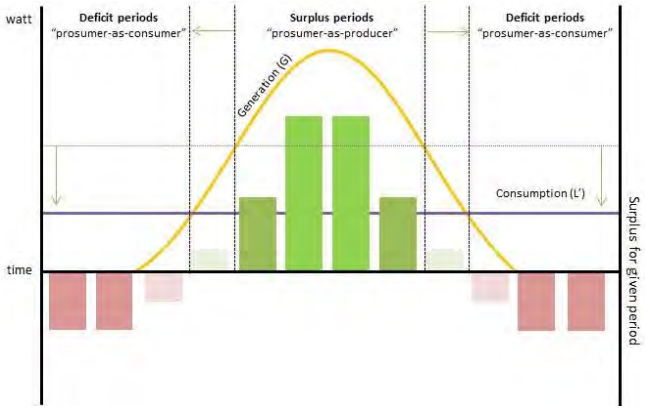

Figure 3: Role of iGSL cells, reduced consumption

4.2 Crowd Energy: action range

Different interaction possibilities allow prosumers to store share and sell electricity in surplus periods or obtain electricity in deficit periods through the individual storage unit, either from community members or from the "backbone". Intracellular interaction, interaction within the individual iGSL structure, allows storage of one's own generated electricity during surplus periods. Conversely, electricity can be obtained from the individual storage unit in deficit periods. This intracellular interaction allows an iGSL cell to increase its self-sufficiency over time. Intercellular interaction, via the "bottom-to-bottom" structure, allows an iGSL cell to share (receive) electricity with (from) crowd members during surplus periods (deficit periods). This intercellular interaction on a community level can facilitate collective self-sufficiency. Interaction possibilities with the "backbone" allow the sale (purchase) of electricity to (from) traditional suppliers.

In addition to these different possibilities to rebalance their household in surplus and deficit periods, prosumers also have different interaction ranges to charge and discharge the storage unit. As production and consumption do not always overlap, storage units can bridge the intermittent performance of renewable energy generation (Farhangi, 2010), relieve the traditional grid (Metzler, 2015) and thus play a crucial role in a smart grid (Farhangi, 2010; Roberts & Sandberg, 2011). Intracellular interaction allows a prosumer to charge a storage unit via their own electricity generation capabilities. This storage unit can be discharged by consuming stored electricity. Intercellular interaction also allows a storage unit to be charged through electricity produced by community members or stored electricity from community members. Conversely, stored electricity can be shared with community members. The interaction possibilities with the "backbone" allow the sale of stored electricity or the purchase of electricity to fill up the storage unit.

Technological advancement in electricity generation and storage possibilities and also in ICT will change the electricity sector dramatically. A "with you" design concept for the electricity sector needs clearer understanding of prosumers' preferences on the part of policymakers and business. Shifting grid stability responsibility from traditional suppliers in a vertical structure to prosumer and prosumer communities in a "bottom-to-bottom" supply structure will result in a "by us" perception of grid stability issues. This "by us" thinking is based on a "prosumption dependent energy provision" paradigm. Therefore, understanding and predicting prosumers and their behavior and acts as "prosumer as producers" and "prosumer as consumers" will be crucial in light of the current paradigm shift and must be further investigated both theoretically and empirically.

5 Prosumer Behavior Framework

There is currently no framework which integrates the various behaviors linked to prosumption and the factors influencing them. The following prosumer behavior framework (Figure 4) focuses on the individual usage form (consuming, storing, sharing, and selling) for produced electricity in a "bottom-to-bottom"-structure. The choice of a usage form depends on individual preferences shaped by different factors. Behavior-influencing factors can be found in both a personal and contextual domain (Stern, 1999). We previously distinguished factors occurring on an individual, collective and macro level. These different factors will influence individual prosumer's preferences, decision-making and choice of prosumer act. On the other hand, contextual factors will be shaped by individual behavior and individual prosumer acts. Each level uses different assets and measures to achieve goals and meet values, beliefs and norms: prosumers use their GSL structure; a Crowd Energy community pools prosumers' assets into an organization with rules; and the utility regime embeds different Crowd Energy communities in a structure to achieve goals and meet values, beliefs and norms.

"Behavior" in the prosumer behavior framework is represented by the variety of different prosumer acts (consumption, sharing, storing and selling) resulting from the iGSL structure. Preferring one act over others leads to a decrease in application and execution of the other acts. Pronounced consumption behavior, for example, lowers the possibilities to share, store or sell electricity. In the light of the current paradigm shift in the electricity sector, prosumer acts must be understood, and questions about how prosumers will behave must be solved for network stability (goal on a macro level) or community organization reasons (measure on a collective level), among others, and to allow adequate policy making, business opportunities and legal foundations. The prosumer behavior framework allows the mapping of both very specific and more general surveyed areas of a "bottom-to-bottom" system.

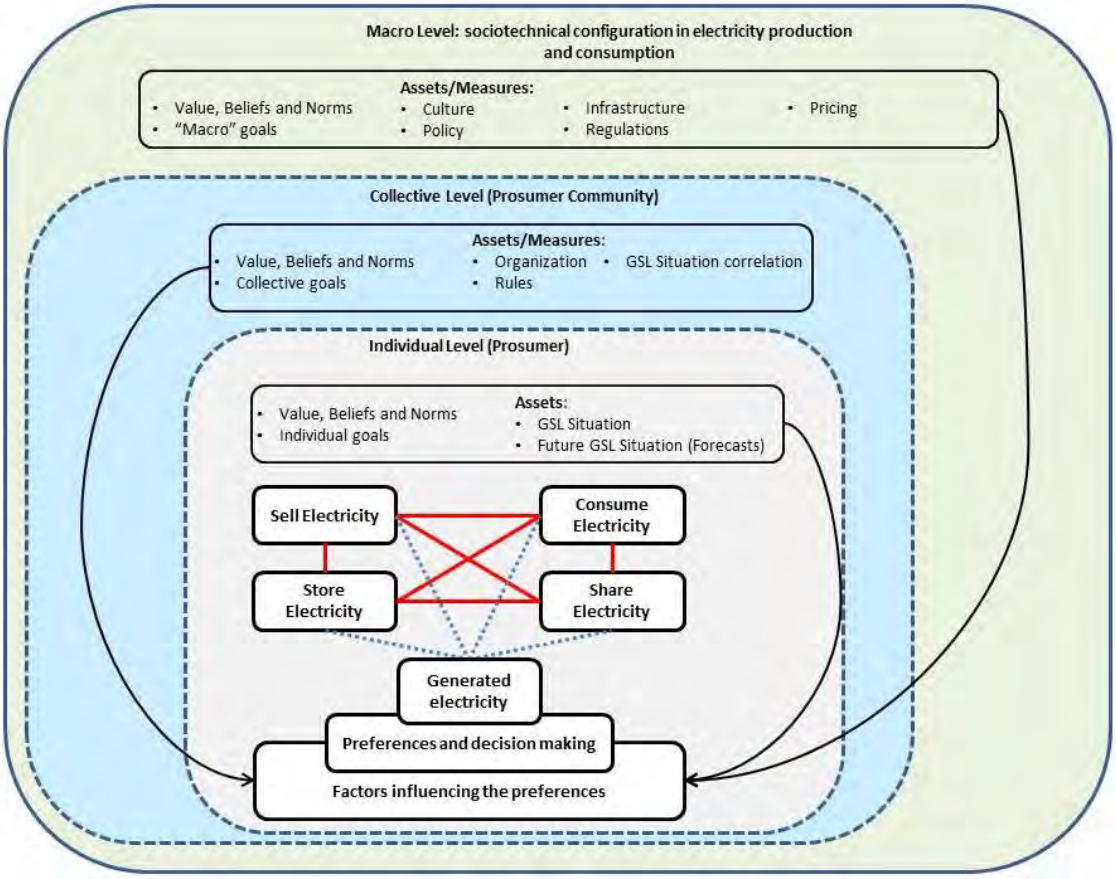

Figure 4: Prosumer Behavior Framework

5.1 The Individual Level

Individual prosumption behavior manifests itself in a preference for one action over others. For example, a prosumer with strong altruistic values would use the iGSL structure to share electricity with the community rather than selling it to an external purchaser. If a prosumer does not feel obliged to achieve community goals, intracellular interaction and interaction with the backbone might be preferred, while intercellular interaction possibilities would acquire secondary importance. A prosumer with monetary goals would use the iGSL structure to sell electricity rather than share it. These brief examples illustrate different forms of iGSL usage based on different individual values, beliefs, norms and goals. Therefore, it is essential to understand individual prosumer preferences to predict iGSL cell outputs.

Prosumer behavior could also be linked to technical characteristics. We do not yet know how generation and storage capabilities influence prosumer decision making: does an iGSL cell with higher electricity storage display different behavior than one with limited storage possibilities?

Distinguishing between different "GSL situations" would help to understand how prosumers behave in different roles. Individual preferences during a "prosumer as producer" period might be different from in "prosumer as consumer" period. Preferences might also change for different magnitudes and lengths of surplus and deficit periods. Forecasting "GSL situations" might also influence prosumer behavior. Additional information, especially concerning generation potential and consumption, for a subsequent period can influence a current choice.

5.2 The Collective Level

On a collective level, the community pools different iGSL structures to achieve collective values, beliefs, norms and goals. Individual acts are strongly products of their circumstances and contexts. Individual prosumer behavior will be influenced by how the community is organized and governed and which values, beliefs, norms and goals the community is trying to meet or to achieve. Embedding prosumers in a collective structure may lead to conflict if individual goals differ from community ones. A community goal to promote collective self-sufficiency by increasing individual contribution to the community (sharing behavior) conflicts with other prosumption behavior. Such a community goal, whether formalized or just experienced, may shift individual preferences and decision making.

Reciprocity, iniquity aversion and trust all influence individuals' sharing behavior (Fehr & Gächter, 2000; Gächter, Herrmann & Thöni, 2004) and therefore affect how individual values, beliefs, norms and goals match the collective ones. While research into general cooperation (sharing) behavior and individuals' energy consumption behavior in social contexts is quite advanced, we can find no similar efforts on issues surrounding storing and selling/buying. In addition, we do not know how strongly particular contextual behaviors (e.g., storage behavior of other community members) affect other individual behaviors (e.g., sharing behavior).

The GSL situation of other community members probably influences individual decision making. We do not know how individuals behave when their GSL situation differs from that of others. Therefore, the correlation between the individual's GSL situation and those of other members may affect individual decision making.

5.3 The Macro Level

Prosumers and prosumer communities are both embedded within a socio-technical regime. The application and concrete form of a Crowd Energy concept might differ when implemented within different electricity production-consumption regimes. Therefore, individual values, beliefs, norms and goals and the use of the iGSL structure will be influenced by the "sociotechnical configuration" (Geels, 2002). Cultural meanings, regulation, standards, taxes, policies, infrastructure or finance rules may influence individual values, beliefs, norms, goals and preferences. Electricity selling and purchase prices, as a result of different sociotechnical configurations, might strongly influence individual decision making.

6 Conclusion

"Bottom-to-bottom" electricity supply will change the electricity sector dramatically. The rise of electricity prosumers, households with generation, storage and consumption capabilities, appears inevitable. A prosumer-shaped electricity sector will lead to several new structural and organizational principles such as new underlying conditions for electricity provision or shifting responsibilities for network stability issues. The nucleus of the electricity sector will be a multitude of individual prosumers, who, thanks to new action and interaction possibilities, will have a much higher influence on the sector than traditional consumers. By putting prosumers into a "playmaker" position, knowledge of prosumer behavior seems mandatory. This article proposes the first prosumer behavior framework, based on integral prosumer behavior, to address urgent open questions linked to the behavior of prosumers in the new electricity sector. This framework provides a basis for understanding and forecasting prosumer behavior in a "bottom-to-bottom" structure.

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35th International Conference on Organizational Science Development
March 16th – 18th 2016, Portorož, Slovenia

Educational Achievements as a Determinant of an Individual's Informal Power

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Abstract
The scope of this study is to define how educational achievements of individuals in Slovenia define their "informal power" in the organizations where they work. The study is based on theoretical definitions of the concepts of informal power and education. A total of 509 people from Slovenia over 30 years of age participated in the study. We recognized a certain influence of educational achievements on the individual's informal power in an organization, which we measured through the value of an individual's opinions for their co-workers and theirs superiors. The main predictor of an individual's informal power in an organization is the individual's last achieved level of formal education. One of the most important practical implications is that education is one of the basic predispositions to having informal power but not necessarily always and not in every case.

Keywords: education, informal power, work, employees, HRM

1 Introduction

The basic definition of power would be: *"Power is the ability to implement one's will."* The study of power in organization has been interesting topic for many researchers. Power is consider by many as one of the most important factors in an organization. Some authors suggest that power lies in the potential, and others suggest that power is only present in its use. There is also an ongoing debate what makes individual powerful (Marič & Ferjan, 2011).

Despite the importance of an individual's formal and informal power in an organization, there is very little research on what gives power, formal or informal combined, to an individual in an organization. In this article, we will explore the effect of an individual's education on one's informal power in an organization. We suppose that the education one receives leads to principal differences in one's power later on in an organization that one is working in. We could also say that the duration of schooling determines one's informal power in an organization. Those who have higher education usually gain more power and amenities depending on their working positions in some cases even regardless of their abilities.

In his book "Organization, Power and Change" (1995), Borum Finn states that there is reason to believe that the narrow connection between educational and professional competence and pyramidal location plays an important role. It creates the impression that there is a connection between the length of education and the ability to make decisions also in relation to non-professional issues. The inflexibility of the educational system widens the individual pyramidal strata and thus reinforces the authoritarian nature of the system. Education is one of the identified factors that contribute to one's personal power (Rees, 1999). One could argue that the shift from a capital-based to a knowledge-based economy represents a fundamental shift in power dynamics (Lynn, 2000).

2 Literature Review

2.1 Individual's Education

The educational process offers individuals knowledge, skills and habits. Some describe it as the last level of education that one has achieved so far in their life (*Pogosta vprašanja in odgovori| Ministrstvo za visoko šolstvo, znanost in tehnologijo,* 2009). It could also be important how many years of education one has and what was their average grade during the last level of their education. Knowledge is the capacity to act on information… it implies learning (Lynn, 2000). We could say that education is one of the predispositions to having knowledge, but not in everyone's case. Being included in the educational process does not necessarily mean that the individual has really gained that knowledge. Organizations are employing the most educated workforce in the history of the world (Burke & Ng, 2006) because they do not need more people willing to blindly follow orders or to do repetitive work; they need people of courage and initiative (Pinchot, 1992).

Different styles of upbringing have their effect on children's will and capacity to learn, and on their adaptability to the requirements of the school (Ferjan & Jereb, 2008). Bowles and Gintis (2002) found that parental economic status is passed on to children in part by means of unequal opportunity, but that the economic advantages of the offspring of higher status families go considerably beyond the superior education they receive. Educational transformation also influences the social justice and the social status of the people (Unterhalter & Dutt, 2001). There are also various factors that influence the study progress (Jereb et al., 2009).

By the day more and more importance is given to lifelong learning (*European Commission - Education & Training - lifelong learning programme - A single umbrella for education and training programmes,* 2009) in which the formal education is in a way perceived a foundation for further lifelong work and education. It could easily be said that the higher level of formal education one has, the more involved in lifelong learning one has to have to keep up with everyday requirements of one's work (Ferjan & Jereb, 2005).

Lifelong learning (*European Commission - Education & Training - lifelong learning programme - A single umbrella for education and training programmes*, 2009) is sort of defined by additional learning per year, search for appropriate forms of additional education and of course not to forget, the training that is required by the employers or the organization in which one works. The learning process accompanies individuals in every phase of their life. The levels of education in the EU are also increasing with the following generations (*Stopnja izobrazbe v EU se z generacijami povečuje: Evropa.gov.si*, 2009).

2.2 Individual's Informal Power

Power is part of our lives, both private and organizational. Power is the ability to influence the desired outcomes. Power can be broadly defined as the ability to influence different outcomes, by pooling resources (human and material) to achieve the realization of certain things within the network of relationships (Rees, 1999) and at the same time to resist unwanted influence from others (Wagner & Hollenbeck, 2010). Individuals' who have power in the organizational environment often also have power even in their private lives and vice versa.

An individual's power in organizations can be best assessed with observations (Finn, 1995). However, on the other hand that is a long process, sometimes even subjective and would take a lot of man-hours to implement on a larger sample. That is why the power evaluating process takes part only on smaller samples at a time; for instance one company or one branch of a company at a time. Robbins (quoted in: Senior, 2002) argues: *"Power has been described as the last dirty word... People who have it deny it, people who want it try not to appear to be seeking it, and those who are good at getting it are secretive about how they got it."*

An individual's power is also very relative; one could have it one day and lose it on another (Mintzberg, 1983). Alternatively, one could have power in one group, and have none in another group of people simultaneously. Power is difficult to measure, since it can only be perceived (Marič & Ferjan, 2011). Power is difficult to measure, since it can only be perceived. From the social-psychological perspective, a person's behavior is affected by his or her behavioral intentions, which are in turn influenced by an attitude and set of perceptions. Behavioral intention is regarded as a key antecedent in determining one's future behavior (Wu et al., 2008). We could say that power concerns the capacity of individuals to exert their will over others.

In a company or in an organization there are basically two kinds of power: formal and informal power (Mintzberg, 1983). While formal power is defined, the informal power that is in many cases even more important is not so well defined. Here we will focus on individual's formal power within organizations.

Informal power is less defined and often more important than formal power. On the one hand, it is connected to formal power, but on the other, it is affected with the interpersonal connections with other employees and even the outside world. It resides in the individual, no matter what his position in the organization's hierarchy is (Moorhead & Griffin, 2010, str. 361). Informal power depends on how an individual is perceived by his environment and is effected by interpersonal links with other employees or coworkers and sometimes even with the outside world. Informal power consists of: expert power, reference power and charisma power (George & Jones, 2008, str. 431). Individuals with informal power can inspire their followers to greater loyalty in devotion than those who only have formal power.

3 Research Questions

Below we will explore the influence of one's formal level of education with respect to an individual's informal power in an organization. Higher level of formal education is considered as a way of getting everything that one wants in life (often climbing the hierarchical ladder) and the thing that many consider as the cover of it all is power. There are several ways to gain power, and one of the most commonly perceived ways is education. For instance, when one introduces himself as PhD, the all, at least the vast majority of people around him think that he knows everything. Hogan (2005) claims that people respect someone who has a higher position

(M.D. vs. orderly), more extensive education (Ph.D. vs. high school), and more experience (20 years of work experience vs. just out of school). That brings us to our research questions.

- R1: What kind of effect do individual's educational achievements have on the value of individual's opinions for their coworkers?
- R2: What kind of effect do individual's educational achievements have on the value of individual's opinions for their superiors?

4 Methodology

Participants in this study were selected randomly. The sample consisted of 232 men and 277 women (N=509). The age range of the respondents was between 30 and 61 years. The average age of the respondents was 41.35 years, the average level of education was 5.26 (a little above completed high school), and the average place in the organization's hierarchy was 3.50 (middle administrative staff).

The questionnaire contained closed questions referring to: (i) general data (age, gender), (ii) education, (iii) an individual's formal power within an organization. An individual's informal power was measured through the *"value of an individual's opinions for their co-workers"* (Table 1) where individuals were asked if their colleagues ask for their opinion and "v*alue of an individual's opinions for their superiors"* (Table 2) where individuals were asked if their superiors ask for their opinion, both of which basically represent the individuals influence on their surroundings.

Opinion for Co-workers	*1- Never*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10 – Always*	*Total*
Frequency	*33*	*33*	*52*	*40*	*65*	*41*	*66*	*73*	*58*	*48*	*509*
Percent	*6.5*	*6.5*	*10.2*	*7.85*	*12.8*	*8.05*	*13.0*	*14.3*	*11.4*	*9.4*	*100*

Table 1: Value of an Individual's Opinions for their Co-workers (how often are they asked for their opinion) (n=509)

Mean = 5.96; Median = 6.00; Std. Deviation = 2.696;

Opinion for Superiors	*1- Never*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10 – Always*	*Total*
Frequency	*56*	*65*	*75*	*44*	*57*	*49*	*52*	*53*	*35*	*23*	*509*
Percent	*11.0*	*12.8*	*14.75*	*8.65*	*11.2*	*9.6*	*10.2*	*10.4*	*6.9*	*4.5*	*100*

Table 2: Value of an Individual's Opinions for their Superiors (how often are they asked for their opinion) (n=509)

Mean = 4.91; Median = 5.00; Std. Deviation = 2.695;

The individual's *final level of formal education* was measured through the achieved degree of education. The following scale was used: (1) did not finish basic school, (2) finished basic school (8 years), (3) secondary school (2 years), (4) secondary school (3 years), (5) secondary school (4 years), (6) two year study, (7) higher education, and (8) master's degree, doctorate degree. The final formal educational structure of the sample is shown in Table 3. In Slovenia, the education classification from 1980 is used and has eight degrees (Ferjan & Jereb, 2008).

Education degree	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*Total*
N	*6*	*41*	*20*	*74*	*159*	*60*	*112*	*37*	*509*
%	*1,2*	*8,1*	*3,9*	*14,5*	*31,2*	*11,8*	*22,0*	*7,3*	*100*

Table 3: Formal educational structure (n=509)
Mean = 5.26; Median = 5.00; Std. Deviation = 1.67;

The *educational success at the last level of formal education* (presented in Table 4) was measured on a grading scale from 6 to 10, where: (6) sufficient, (7) good, (8) very good, (9) almost excellent and (10) excellent which is in use by Slovenian universities. Primary and secondary schools in Slovenia use a grades scale from 1 to 5; because of which the grades from 1 to 5 were converted into grades ranging from 1 to 10 as follows: 1 converted into 5; 2 converted into 6; 3 converted into 7; 4 - 4,5 converted into 8; 4,5 - 4,75 converted into 9; 4,75 – 5 converted into 10.

Average grade	6 – Sufficient (6,00-6,99)	7 – Good (7,00-7,99)	8 – Very Good (8,00-8,99)	9 – Almost Excellent (9,00-9,49)	10 – Excellent (9,50-10,00)	*Total*
Frequency	*48*	*199*	*181*	*53*	*28*	*509*
Percent	*9,43*	*39,10*	*35,56*	*10,41*	*5,50*	*100*

Table 4: Average Grade at the Last Educational Level (n=509)
Mean = 7.7055; Median = 8.00; Std. Deviation = 0.96477;

Self-initiative regarding the search for additional training (Table 5) was measured through surveying the respondents about how often they search for appropriate additional forms of education and training. A grading scale from 1 to 5 was used, where: (1) never, (2) very rarely, (3) occasionally, (4) often and (5) permanently.

Self-initiative Regarding Education	*1 - Never*	*2 - Very Rarely*	*3 - Occasionally*	*4 - Often*	*5 - Permanently*	*Total*
Frequency	*126*	*130*	*149*	*76*	*28*	*509*
Percent	*24,8*	*25,5*	*29,3*	*14,9*	*5,5*	*100*

Table 5: Self-initiative Regarding the Search of Appropriate Education or Training Contents (n=509)
Mean = 2.51; Median = 2.00; Std. Deviation = 1.173;

5 Results and Discussion

We can see that there are positive correlations between all of the variables in Table 6. All the variables were measured on an increasing scale. As seen in the table below there is a correlation between the achieved level of education and all of the dependent variables are above 0.454. Thus, we can conclude that the variables that represent informal power in this study are dependent on the achieved level of education.

	Achieved level of education	Average grade at the last level of education	Self-initiative regarding the search for additional education or training	Value of individual's opinions for his co-workers
Average grade at the last level of education	*0.332**			
Self-initiative regarding the search for additional education or training	*0.488**	*0.235**		
Value of individual's opinions for his co-workers	*0.482**	*0.270**	*0.343**	
Value of individual's opinions for his superiors	*0.454**	*0.299**	*0.433**	*0.669**

Table 6: Pearson R Correlation Coefficients (n=509)

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

Furthermore, the regression analysis between the independent variables achieved level of formal education, average grade at the last level of formal education and self-initiative regarding the search for additional education or training and the dependent variables value of individual's opinions for his co-workers (Table 7) and value of individual's opinions for his superiors (Table 8) were made.

Predicators	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-.455	.833		-.546	.585
Achieved Level of Education	.614	.073	.381	8.398	.000
Average Grade at the Last Level of Education	.316	.114	.113	2.772	.006
Self-Initiative Regarding Education	.300	.101	.131	2.963	.003

Table 7: Regression Analysis for the Dependent Variable "Value of an Individual's Opinions for their Co-workers" (n=509)

$R=0.509$; $R^2=0.259$; Adjusted $R^2=0.255$

Dependent Variable: Value of an Individual's Opinions for their Co-workers

With the predictors "Achieved Level of Formal Education", "Average Grade at the Final Level of Formal Education", "Self-Initiative Regarding the Search for Additional Education and Training" 25.5% variance of values of individual's opinion for their co-workers is explained. The achieved level of formal education ($\beta=0.381$, $p=0.000$) has the most influence, which answers our research question 1.

Predicators	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-2.078	.819		-2.537	.011
Achieved Level of Education	.446	.072	.277	6.202	.000
Average Grade at the Last Level of Education	.405	.112	.145	3.618	.000
Self-Initiative Regarding Education	.606	.100	.264	6.087	.000

Table 8: Regression Analysis for the Dependent Variable "Value of an Individual's Opinions for their Superiors" (n=509)

$R=0.532$; $R^2=0.283$; Adjusted $R^2=0.279$

Dependent Variable: Value of an Individual's Opinions for their Superiors

With predictors "Achieved Level of Formal Education", "Average Grade at the Final Level of Formal Education", "Self-initiative Regarding the Search for Additional Education and Training" 27.9% variance of value of individual's opinion for their superiors is explained. The achieved level of formal education ($\beta=0.277$, $p=0.000$) has the most influence, closely followed by the self-initiative regarding the search for additional education and training ($\beta=0.264$, $p=0.000$), which answers our research question 2.

Of course, characteristics do not fit every single individual but we still think that people who have achieved higher levels of formal education have better possibilities of achieving higher positions. Educational achievements are therefore valued as well as by individual's co-workers as by their superiors. Research confirmed that educational achievement led by the achieved formal level of education give individuals informal power within a company or organization.

6 Conclusion

An individual's power is an always-important factor in one's personal as well as business life. Education is a factor in one's power yet the mere presence of formal education will not give you power, as many believe. This study provides basic insights into the connection between individual's formal education and informal power and it can be summarized as follows: an individual's formal education is one of many things that compose into individual's informal power. However, it does not explain the whole concept of informal power because there is an infinite number of variables that influence it and we can only explain them in parts.

Several limitations of this study need to be considered before interpretations of the results can be explored. First; the discussed findings and implications were obtained from a single study; generalizing the results should be done with caution. Second, the whole research was focused mostly on how an individual's education affects individual's informal power. We have had that in mind already in the beginning when we were defining the goal of the study so that it is relatively simple with a concept that is influenced by many other variables that are not included in this study.

We can all agree that there is a lot more to informal power that just these variables that we used in our study to determine it but still even this simple study shows that there are some basic predispositions to having informal power in an organization and that one of them is formal education. Maybe in a way the findings are area specific because formal education is so emphasized in this study. However, it is still an interesting way for simplistically evaluating one's potential informal power depending on formal education. According to the findings, the perceptions and the "size" of an individual's informal formal power in an organization depends on one's level of formal education.

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35th International Conference on Organizational Science Development
March 16th – 18th 2016, Portorož, Slovenia

Evaluating Priorities in New Technology Adoption – The Case of Banking Services

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Abstract
The banking industry has been a conservative industry, very resistant to change. The past was characterized by stable environment and industry structure, clear business models and defined boundaries that made linear and predictable business and business environment resulting in the slower pace of innovation, compared to other industries. Today, environment is characterized by strong competition, rapid technological evolution, economic and regulatory pressure and changing nature of demand. In such conditions, only banks that can constantly innovate would be able to achieve growth, profit and efficiency. The research of this study was conducted using PATTERN forecasting method in order to determine priorities for further adoption of e-banking in Serbia. Twenty-two (22) experts from ten (10) banks took part in this research. The results show that the highest priority in adoption of e-banking, should be given to ICT advancement by introduction of new enhanced solutions, followed by improvements of infrastructure.

Keywords: new technology, technology adoption, services, banking

1 New Technology Adoption

Today's highly competitive marketplace, characterized by global economic integration into volatile business environment, shorter innovation and product life cycles, rapid growth of information technologies and electronic communication, puts pressure on companies to innovate constantly. Development and application of new ideas in order to commercialize new technologies is a challenge that contemporary organizations face in different industries. Innovativeness based on new technologies is not a characteristic of manufacturing industries, as the development of services is under the influence modern ICT that enable more efficient and effective approaches in providing existing services and also in the emergence of entirely

new services. Innovation is viewed as a process that begins with the idea, e.g. by introduction of modern ICT, and which, through various stages brings a new product/service to the end user.

Product or service diffusion is the process by which a product or service is communicated and accepted through certain channels among the members of a social system over time (Rogers, 1983). Main concepts and models related to adoption of new technologies, are: Technology Acceptance Model (Davis, 1989), Diffusion of Innovation (Rogers, 1983), Unified Theory of Acceptance and Use of Technology (Venkatesh et al, 2003, 2012, Il Im et al. 2011). Rogers (2002) identified five characteristics that affect the adoption of a particular innovation: the relative advantage of the new product (the degree to which users see the innovation as being better than previously existing products), compatibility (how the innovation is consistent with the existing habits and values of consumers), complexity (assesses the ease of use of the innovation), trialibility and observability (ability that consumers have to, respectively, try and observe the innovation). These characteristics are seen as determinants of the successful adoption of the innovation. Rogers' model of technology adoption life cycle recognizes five groups that are distinguished from each other by their characteristic response to innovation based on a new technology: innovators, early adopters, early majority, late majority, laggards. (Rogers, 2003). The model was further analysed and developed by Moore (2014) focusing on high tech market. The industry, culture and other aspects are relevant in technology adoption process. In introduction of new technology, marketers will have to focus on different aspects of a technology, having in mind the culture of the country where the technology is marketed (Il Im et al. 2011)

2 Case study: New Technologies in Banking Services

Banking industry represents the main part of financial services (Fasnacht, 2009) and ‘banks play a vital role in the economy of any country’ (Mihailovic, 2009). According to Singh and Arora (2011) ‘banks play a role of considerable economic significance as intermediaries in mobilizing public savings and channelizing the flow of funds for productive purposes, keeping with the process of the economic growth of the country’. Pakravan (2011) stated that banking and its function in the financial system is an 'intermediation through pooling of risks, maturity transformation through its balance sheet, the provision of liquidity and trenching risk-return through tiring of liabilities'. In Serbia, banking sector dominates in the financial system and accounts for 92.4% in the total financial sector. As such, it represents the main contributor to Serbian financial system stability (NBS, 2011).

The banking industry has been a conservative industry, very resistant to change. The past was characterized by stable environment and industry structure, clear business models and defined boundaries that made linear and predictable business and business environment resulting in the slower pace of innovation, compared to other industries. Yet, the conditions have changed over the last 20 years, which has led to significant changes in the banking industry (Fasnacht, 2009). It is undergoing a period of transformation and consolidation due to technological and market changes. ‘In the past 30 years innovation processes in banking industry resulted in tremendous developments of services and products due to digitalization era. This developing process is a never ending story, innovations underlie the success. Apart from the benefits that banking sector gained in this era, IT gained a lot, since banking industry was in the driving seat in many segments. Fasnacht (2009) stated that ‘progressive developments have led to an industry with ambiguous structure, blurred boundaries, open business models, and new market entrants and intermediaries, where speed, flexibility, reliance, and efficiency have all

become equally important factors of success'. The reasons for such a change are the uncertainty and volatile external environment characterized by strong competition, rapid technological evolution, economic and regulatory pressure and changing nature of demand. In such conditions, only banks that can constantly innovate would be able to achieve growth, profit and efficiency.

'Where innovation is flourishing, there is evidence of an increased customer focus on the innovation process, made possible by new tools and techniques to involve customers directly. Having an innovation department is not essential, but it can be a catalyst and provide a point of coordination for innovation activities' (Future banking, 2013). Adoption of technological innovation in banking services has been the topic in many recent studies (e.g. (Berger, & Gensler, S., 2007, Cheng et al., 2006, Lassar et al., 2005, Martinsa et al, 2014, Matila et al., 2003, Mauro anad Alfonso, 2007) considering nor only determinants of success, but also the obstacles in new technology adoption (Kondabagil, 2007, Rotchanakitumnuai & Speece, 2003). However, not so many banks made innovation as a strategic priority, nor did they make a clear link between the role of innovation and strategic priorities (Future banking, 2013).

Overall, sustainable growth in the banking industry can be achieved only through constant monitoring the risks connected to growth strategies and innovation. Direct drivers for growth in banking are innovations in services, products and processes. 'Where product innovation generates high quality and service, process innovations support production, logistics, marketing and sales. Both affect the efforts to win clients through an attractive offer and quick and reliable services' (Fasnacht, 2009). Innovation into these disciplines results in higher margins and economies of scale; further, it leads to increasing profit. Furthermore, reciprocal dependence of innovation, knowledge and growth open up the opportunities to a creation of an open innovation model in the banking industry (Fasnacht, 2009; Cooke, 2013, Tornjanski et al., 2015).

Due to competitive pressures banks always seek to achieve greater productivity and efficiency improvements with the aim of sustaining profitability. The process of automation of operations in banking sector through electronic channels leads to increase in cost and efficiency gains. This is achieved through the combined effects of reduction and better utilization of the workforce, equipment, and more economic usage of space, operational savings and conduction of business activities with greater flexibility (Jayawardhena & Foley, 2000). Electronic banking (e-banking) technology represents a variety of different services, ranging from the common automatic teller machine (ATM) services and direct deposit to automatic bill payment (ABP), electronic transfer of funds (EFT), and computer banking (PC banking). (Kolodinsky et al, 2004) 'The 'Innovation in Retail Banking' report looked closely at the role of IT for innovation and found it to be a critical factor in most banks. Innovative banks like Capitec Bank in South Africa have made IT a central feature of their strategy. When asked about the challenges of implementing innovation, banks revealed that managing the relationship between IT and the business was just as or more important than the technology itself' (Future banking, 2013).

New technology adoption in banking can be analyzed from the perspective of provider staff and from the consumers' perspective. Simplicity/complexity is the extent to which consumers perceive a new innovation as easy to understand or use. For consumers without previous computer experience, or for those who believe that e-banking is difficult to use, adoption of

these innovations may be thwarted. (Kolodinsky et al, 2004) As a starting point for development of the research model, data provided by The Payment System Department of NBS for 2014 have been used. Number of banks clients by e-banking payment services used was analyzed.(NBS, 2014)

QUARTER	**I**	**II**	**III**	**IV**
Total number of clients[2)]	8,517,231	8,561,581	8,671,761	8,811,973
SERVICE				
Internet banking[3)]	1,019,637	1,061,917	1,085,998	1,153,611
Phone banking	82,260	88,806	87,778	98,901
Mobile banking	103,212	110,721	137,157	179,724
Standing order	258,220	270,024	270,127	279,006
Internet banking - payment card[4)]	1,902,405	1,935,622	1,977,729	2,046,054
Internet banking - internet card[5)]	70,197	72,326	76,070	80,074

Table 1: [Number of banks clients[1)] by payment services used]

1) Number of clients who agreed to use these services with the bank;
2) Total number of clients holding accounts with banks. A client having more than one account with the same bank is counted once in the total number of the clients of the bank, while a client having accounts with more than one bank is counted with each bank separately;
3) Service accessible via internet or PC banking applications (e-banking).
4) Buying goods or services over the internet by using payment card.
5) Buying goods or services over the internet by using "internet" payment card

Data from the year 2014 show that there is slight increase in the number of bank clients (0.97%), which is followed by increase in the number of users of e-banking services during the year. For the purpose of this study, most interesting data concern popularity of three standard channels of e-banking: internet banking, phone banking and mobile banking. The increase of number of users of internet banking expressed in percentage terms is 0.88%, phone banking 0.83% and mobile banking 0.57%. Total number of users of these services at the end of the fourth quarter shows that the most popular e-banking channel is internet banking with 13,09 % of clients using it, mobile banking is used by 2,04% , while the least number of users use services of phone banking, only 1,12%. It also shows popularity of internet use for the purpose e-commerce with 32,54% of clients using payment cards for payment over Internet. These results show that the pace of adopting e-banking services is slow and that there is large space available for increase of the number of users of e-banking services in Serbia.

3 Research method

Today, in the age of highly competitive economy and cut-throat competitions, where technology change plays a pivotal role, the forecasting is of paramount importance to predict changes in advance and achieve the set goals within specified time-frame so as to maintain the competitive advantage (Mishra, Deshrnukh, & Vrat, 2003). There are two basic categories of technology forecasting methods: exploratory and normative methods. The exploratory methods deal with the questions of what may, might or could possibly happen on the bases of currently available information. Normative forecasting is goal-oriented, which means that it reflects the needs of an organization. The forecasting model starts from the future with

formulation of future goals and tasks and then goes back to present in order to identify and evaluate technology barriers and deficiencies which must be overcome for achievement of predefined goals. Relevance trees, decision theories and decision trees are uded in this approach. The research of this study was conducted using normative forecasting method PATTERN in order to determine priorities for further adoption of e-banking in Serbia. Twenty-two (22) experts from ten (10) banks in Serbia took part in this research. Eight (8) managers and fourteen (14) specialists employed in various departments comprised the group of experts which took part in the research study.

3.1 Normative forecasting

PATTERN (Planning Assistance Through Technical Evaluations of Relevance Numbers) is a goal-oriented quantitative normative forecasting technique where one establishes a future need and recedes backwards to the present and the intermediate technology needs so as to achieve the objective of the future. It is based on relevance tree structure and has been initially used by the military and space science Departments of Honeywell Corporation for military, space and medical purposes (Mishra, et al., 2003).

Assigning numerical ranking provides help in forecasting which of the projects will most probably be realized, assuming that, from long-term perspective, the chosen project gives most benefits in fulfilment of predefined goal. Steps in implementation of PATTERN procedure are as follows: 1. Verbal problem model (scenario) formulation; 2. Relevance tree formulation; 3. Criteria definition; 4. Relevance numbers determination (with participation of experts); 5. Data processing and final results (Levi Jaksic et. al, 2015). Implementation of the PATTERN method consists of determining the significance of the defined goals in relation to the established criteria by experts and establishing the appropriate weighting coefficients according to the importance of each criterion for all others.

Criteria	α	β	…	X	…	V
Weights	W_α	W_β	…	W_X	…	W_V
Goals	Contribution marks of goals to criteria – Element weights					
A	$S_A{}^\alpha$	$S_A{}^\beta$	…	$S_A{}^X$	…	$S_A{}^V$
B	$S_B{}^\alpha$	$S_B{}^\beta$	…	$S_B{}^X$	…	$S_B{}^V$
C	$S_C{}^\alpha$	$S_C{}^\beta$	…	$S_C{}^X$	…	$S_C{}^V$
…	…	…	…	…	…	…
j	$S_J{}^\alpha$	$S_J{}^\beta$	…	$S_J{}^X$	…	$S_J{}^V$
…	…	…	…	…	…	…
N	$S_N{}^\alpha$	$S_N{}^\beta$	…	$S_N{}^X$	…	$S_N{}^V$

Table 2: [Primary Matrix]

Levi Jaksic et al. (2015) present the methodology of PATTERN method. Based on the significance and assessment of the experts, the primary matrices are formed for each case from which the final primary matrices on the second and third level of the tree of significance in this model are gained. On the basis of the final primary matrix the secondary matrix is formed, which as the last type, contains the local numbers of significance for individual topics of the *i*-th level. In order to understand the basic elements of the PATTERN method, the basic principal terms of the primary matrix are provided below: Based on the relevance tree, for each expert primary matrix – Table 2 is formed (Levi Jaksic, Marinkovic, & Petkovic, 2015).

Experts make estimations of relevance of goals to criteria by application of intuitive methods (using their knowledge, intuition and available data).

- Goals: A, B, C...j...N
- Levels: 1, 2, 3...i...n
- Criteria: α, β, …, x, …, v
- Criteria weights: W_α, W_β, …, W_x, …, W_v
- Contribution marks of the goal j to criteria x - element weights: S_j^α, S_j^β, …, S_j^x, …, S_j^v
- Relevance marks of the goal j to criteria x - Partial relevance numbers: PRN_j^X
- Relevance of goal j at level i - Local relevance numbers: r_i^A. r_i^B, …, r_i^J,…r_i^N
- Relevance of goal j for main goal (whole relevance tree) - Cumulative direct relevance numbers: R_j

Elements of final primary matrix are calculated as arithmetic mean of elements from individual primary matrices of experts. For the elements of the primary matrices as well as of the final primary matrix, the following specified conditions must be met:

- Sum of criteria weights is 1:

$$\sum_{x=\alpha}^{v} W_x = 1 \tag{1}$$

- Sum of contribution marks of goals to each criteria is 1:

$$\sum_{j=A}^{N} S_j^x = 1 \tag{2}$$

On the basis of final primary matrix Table 3: Secondary Matrix is formed, which contains local relevance numbers for individual goals at level i (Levi Jaksic, Marinkovic, & Petkovic, 2015):

		GOALS						
Criteria	Weights	A	B	C		j		N
α	W_α	S_A^α	S_B^α	S_C^α	…	S_J^α	…	S_N^α
β	W_β	S_A^β	S_B^β	S_C^β	…	S_J^β	…	S_N^β
…	…	…	…	…	…	…	…	
X	W_X	S_A^X	S_B^X	S_C^X	…	S_J^X	…	S_N^X
…	…	…	…	…	…	…	…	
V	W_V	S_A^V	S_B^V	S_B^V	…	S_J^V	…	S_N^V
		r_i^A	r_i^B	r_i^C	…	r_i^J	…	r_i^N

Table 3: [Secondary Matrix]

- Partial relevance numbers (relevance of goal j for criteria x):

$$PRN_j^x = W_x \cdot S_j^x \tag{3}$$

- Local relevance numbers (relevance of goal j at level i):

$$r_i^j = \sum_{x=\alpha}^{v} W_x S_j^x$$

(4)

- Sum of local relevance numbers at one level has to be 1:

$$\sum_{j=A}^{N} r_i^j = 1 \tag{5}$$

- Cumulative direct relevance number – Relevance of goal j for main goal, whole relevance tree:

$$R = \prod_{i=1}^{n} r_i \tag{6}$$

4 Method implementation and research findings

In accordance with the above data, further adoption of e-banking services is set as the main goal in the hierarchically structured relevance tree presented in Figure 1. As shown in Figure 1, the authors have recognized that adoption of e-banking services can be achieved through advancement of Information and communication Technologies – ICT, education of users and legal framework development as sub-goals on the second level in the tree. The sub-goals on the third level in the tree are new enhanced solutions and better infrastructure; raising consciousness of users about benefits of e-banking and education of users concerning security of e-banking operations; enactment of new laws and regulations enabling full scope of electronic transactions and enactment of laws and regulations concerning protection from cyber crime.

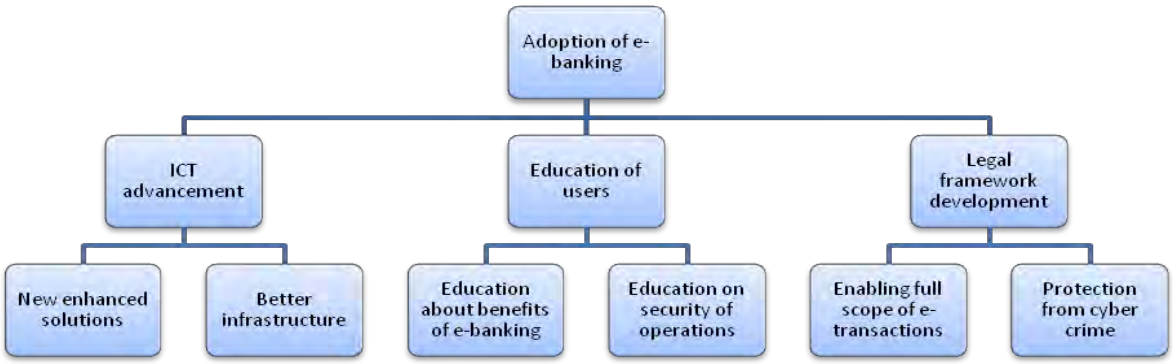

Figure 1: [Developed forecasting model]

The tree model presented by Figure 1 shows the levels of significance which are used for calculations based on enter values by the selected experts. In the text provided below the elements of the model representing goals and sub-goals on different levels of significance within the tree of the PATTERN method are given, as well as the criteria for the second and third level that experts have to take into consideration during the process of decision making through prioritizing of goals.

The criteria at both the second and third level are:

1. improvement of quality of service (in terms of offering cheaper, faster transactions, ease of use, greater availability and more versatile offers),

2. improvement of security and trust (safety and realibility especially with regard to proper authorization and confidentiality of sensitive information transferred via the Internet),

3. efficiency improvement (in terms of enhancing business productivity, time savings, lowering operating costs).

Based on the developed model consisting of goals and sub-goals on three levels of significance, as well as the criteria on the second and the third level of the tree of significance, the PATTERN method was implemented using the standard implementation techniques for the PATTERN method. In Table 4 the opinions of the experts at the second level are shown. Considering the criteria and goals at the second level, experts from Serbian banks assigned the element weights calculated in the final primary matrices.

Criteria	service quality	security and trust	process efficiency
Weights	0.3152	0.4196	0.2652
Goals	Contribution marks of goals to criteria – Element weights		
B ICT advancement	0.4537	0.2739	0.458
C Education of users	0.2688	0.4587	0.221
D Legal framework	0.2775	0.2674	0.321
r_2^B= 0.3794; r_2^C= 0.3358; r_2^D=0.2848, $r_2^B > r_2^C > r_2^D$			
Priority at second level: B – C – D			

Table 4: [Final Primary Matrix at Level 2]

After the analysis of the criteria weights and sub-goals at the Level 2, it is noticeable that for the adoption of e-banking primary focus and efforts should be given to ICT advancement. Education of users, as a factor in achievement of the main goal, is at the second place by priority degree, following ICT advancement, according to experts' opinion of the Serbian banks. On the other hand, legal framework development is placed on the third level of priority degree. Next steps show the analysis of the objectives and criteria weights at the Level 3. Moreover, in order to determine more precisely priorities and comprehensive analysis, it is necessary to compare activities at the Level 3 with the priority degree of objectives at the Level 2. The matrix shown in Table 5 represents the forecasting assessment of experts from Serbian banks for the objectives at Level 3.

Managers of the bank have recognized that the most important sub-goal is investments in new enhanced solutions, according to the results at the Level 3. Following new enhanced solutions, second priority at third level is given to raising consciousness of users about benefits of e-banking. According to the experts' opinion, the third place of priorities degree is given to enactment of laws and regulations concerning protection from cyber crime. Next, enactment of new laws and regulations enabling full scope of electronic transactions, better infrastructure and education of users concerning security of e-banking operations have lower priority degree in adoption of e-banking.

Criteria	service quality	security and trust	process efficiency
Weights	0.3261	0.413	0.2609
Goals	Contribution marks of goals to criteria – Element weights		
E New solutions	0.2634	0.1385	0.2639
F Infrastructure	0.1648	0.1104	0.192
G Benefits of e-banking	0.3142	0.2165	0.1224
H Security of operations	0.1189	0.2056	0.0985
I E-transactions	0.1648	0.145	0.1812
J Cyber crime	0.1539	0.184	0.142
r_3^E= 0.212; r_3^F= 0.1494; r_3^G=0.1651; r_3^H= 0.1494; r_3^I= 0.1609; r_3^J=0.1632 $r_3^E > r_3^G > r_3^J > r_3^I > r_3^F > r_3^H$			
Priority at second level: E – G – J – I – F – H			

Table 5: [Final Primary Matrix at Level 3]

The matrix shown in Table 6 shows the results obtained at the second level in correlation to the results from the third level. The given analysis represents the cumulative results with cumulative relevance numbers at level 3. .

Cumulative Matrix				
LEVEL 2	r_2	LEVEL 3	r_3	R
B ICT advancement	0.3794	E New solutions	0.212	0.0804
		F Infrastructure	0.1494	0.0567
C Education of users	0.3358	G Benefits	0.1651	0.0554
		H Security	0.1494	0.0502
D Legal framework	0.2848	I E-transactions	0.1609	0.0458
		J Cyber crime	0.1632	0.0465
Priority in Cumulative Matrix: $R_E > R_F > R_G > R_H > R_J > R_I$ Final priority: E – F – G – H –J – I				

Table 6: [Cumulative Matrix, final priority]

According to the experts' opinion, the analysis of the given results in the cumulative matrix shows that the highest priority of sub-goals in adoption of e-banking is given to ICT advancement by introduction of new enhanced solutions. It shows that the banks should put key emphasis to development of new products and services in order to keep up with the changes in the contemporary society. Second priority should be given again to ICT advancement by investments in better infrastructure. Since the quality of the Internet connection is an essential component of e-banking solutions, increased availability of broadband connection would contribute significantly to to the achievemnt of the main goal. Next priority goes to the education of users by raising their consciousness about benefits of e-banking, while education of users concerning security of e-banking operations is on the fourth

place. Familiarity with e-banking services and its benefits, as well as with safety of electronic operations could ease consumers' reluctance to use electronic channels of delivery provided by banks. The experts have given lower degree of priority to enactment of laws and regulations concerning protection from cyber crime and enactment of new laws and regulations enabling full scope of electronic transactions in the accomplishment of the main goal.

5 Conclusion

Despite the fact that banks make a lot of efforts to offer better-quality service through electronic channels in comparison to traditional branch-banking model, this market is still insufficiently developed. Data provided by The Payment System Department of NBS for 2014 show that the pace of adopting e-banking services is slow and that there is large space available for increase in the number of users of e-banking services in Serbia.

The results of the implementation of the PATTERN method, based on determining the significance of the defined goals in relation to the criteria established by the experts from banking industry in Serbia showed that the highest priority in achieving the main goal, i.e. adoption of e-banking, is given to ICT advancement by introduction of new enhanced solutions, followed by improvements of infrastructure. Next priority goes to education of users by raising their consciousness about benefits of e-banking, while: education of users concerning security of e-banking operations, enactment of laws and regulations concerning protection from cyber crime, and enactment of new laws and regulations enabling full scope of electronic transactions, have lower degree of priority in the accomplishment of the main goal.

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35th International Conference on Organizational Science Development
March 16th – 18th 2016, Portorož, Slovenia

Agent-Based Model for Analysis of Stakeholders Behaviour on B2C E-Markets

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Abstract:
This paper addresses the behavior of consumers and business policies of sellers in B2C e-commerce systems by applying agent based simulation (ABMS). The continuous development and dynamics in the field of e-commerce requires application of advanced decision-making tools. These tools must be able to process, in a short time period, a large amount of data generated by the e-commerce systems and enable the use of acquired data for making quality business decisions. By linking the areas of modelling based on agents and electronic commerce, this paper addresses the new opportunities for a quality of assessment of consumer behaviour and reasons explaining this behaviour in e-commerce. Models developed for this paper aim to make a change in using practical tools for the evaluation of the B2C online sale systems by allowing the evaluation of the consequences of consumer behavior and different policies in management of e-commerce sites, frequency of site visits, scope of sale and achieved income. One of the aims of the paper is to examine how consumer habits influence the complexity of their habits in buying online.

Keywords: ABMS, B2C, e-commerce, website, customer behavior

1 Introduction and literature review

Electronic commerce has been expanding rapidly in the last decade or so and is now present in almost all industry branches and in a majority of developed countries' markets. In order that e-commerce business be successful, it is necessary that quality strategies of entrance on the market should be developed and implemented and that additional services should be offered that grant the customers better purchasing conditions, a possibility of service adapting and additional value for customers (Hyung, 2010).

The approach used in this paper is to consider the possibility of applying agent-based simulation models as a basis in B2C business models evaluation for the purpose of improving existing e-commerce strategies and obtain data that can be used in business decision analysis. Modelling and simulation based on autonomous agents and interactions among them are some of the more recent approaches in complex system simulation modelling (Miller and Page, 2007;Prokopenko et.al 2009). In the applications of models based on agents in the social processes people are modelled as agents, while their social interactions and social processes are modelled as interactions among these agents (Gilbert and Troitzsch, 2005).

The development of the electronic commerce model has for long been a subject of numerous research attempts. The scientific literature often states the implementation of regression analysis as one of the most common approaches in recognizing the impact of key factors upon the success of a selected model of electronic commerce (*Kim et.al*, 2008; *Zhu et.al*, 2009; Wang et.al, 2010). Besides, neural network based models are increasingly developed (Poh *et.al*, 1994; Russell and Norvig, 2003). To improve the existing solutions and explore new means to support better business decisions, research has in recent years increasingly implemented agent-based models in the analysis of e-commerce business models. Railsback, Grimm (Railsback and Grimm, 2012) have shown that the agent-based simulation model can successfully add a larger number of characteristics of a realistic system to modelling. They have also shown that agents can adapt their behaviour as regards the current conditions of the environment and of other agents. Grimm, Berger et al. (2008) have proven that adaptive behaviour is one of the most vital properties of agents. Hence, complex and dynamic environments such as on-line markets can be successfully modelled and simulated using this methodology. One of the best-known models used in practice was developed by North and Macal (2010) for the needs of the Procter & Gable company . Tao and David Zhang (2007) used the agent-based simulation model to present the effect of introducing a new product on the market to serve as decoy.

The authors confined themselves to only explaining the application of the mentioned effect, however, the model itself is far more comprehensive and deals with psychological mechanisms that govern customers in choosing a particular product. Okada and Yamamoto (2009) used the agent-based simulation model to investigate the impact of the eWOM effect upon the habits of customers purchasing on B2C websites. Special attention is paid to the exchange of knowledge (useful information on the product) among customers. Furthermore, literature describes a large number of agent-based simulation models used in customer behaviour studies (Schramm *et.al*, 2010; Roozmand 2011). An interesting example is the CUBES simulator (Customer Behaviour Simulator) (Said *et.al*, 2002), which studies mechanisms of customer interactions and their effect on different economic phenomena. Liu, Tang *et. al. (2013)* used the agent-based simulation model to investigate into the nowadays common continual price reductions on online markets. In recent years this methodology is successfully used in simulating customer behavuour on social networks and research into the effect of social networks on viral marketing (Hummel *et.al.*, 2012; Zutshi *et.al.*, 2014).

2 Simulation model of consumer behaviour

The study of the consumer population, their habits and behaviour serves as basis for the B2C electronic commerce analysis. This analysis is of vital importance for B2C shareholders and managers, marketers, sales people, but also for the consumers themselves. The consumer analysis is to analyse their needs – what, why and how they purchase. Consumer behaviour can be described as a set of activities prospective customers undertake in searching, selecting, valuing, assessing, supplying and using of products and services in order to satisfy their needs

and wants. These also include decision-making processes that both precede and follow the above-mentioned activities (Belch 1998; Schiffman et al., 2009; Solomon, et. al 2009). In making their decisions to purchase a product, online shopping consumers go through different phases. The phases are similar to those present in traditional shopping, however, the manner in which they are carried out differs. Generally speaking, in their decision-making process, consumers go through the following stages (Engel J et.al, 1994): problem awareness, information search, evaluation of alternatives, decision on purchase and post-purchase evaluation.

The aim of the model is to link consumers, on one side, and the sellers (Internet sales sites) on the other and to determine the manner in which they communicate. Hence, in this model we observe consumers with their social and cultural characteristics, on the one hand, and the market, namely online shops and intermediaries in sales with their e-business and e-marketing strategies, on the other. The model also takes into account the impacts of the on-line community and social networks on forming consumer decisions in online purchase, whose influence increases daily. The model treats the consumer's decision on purchasing as the outcome variable.

When building a model, attention was paid that it should be really applicable and also that it should include as many impact factors as possible. The model is by nature dynamic and models a complex purchasing process in an online environment. It is characterised by a flexible structure that can be adjusted to individual needs and to specific phenomena.

The model shown in Figure 1 focuses on three segments: the seller segment, the consumer segment and the communication channel segment. The seller is the Internet site dealing in B2C sales of products and/or services. The most important site characteristics contained in the model are the technical characteristics: infrastructure, software support, website design and the quality of information on the products offered via the website. The consumer segment observes online consumers. The model monitors the impact factors concerning their attitudes, goals and beliefs. The communication channels are the online (Internet) and traditional channels of communication. The model under consideration is confined only to the effects of online communication channels application. In addition to the three described segments, the model includes business strategies created by the seller, whose aim is to increase sales and build consumer trust. The model allows for varying the input variables that simulate the effects of implementation of different business strategies, primarily those referring to price changes and product quality attributes. The model also helps track the effects of Internet marketing as a business strategy segment.

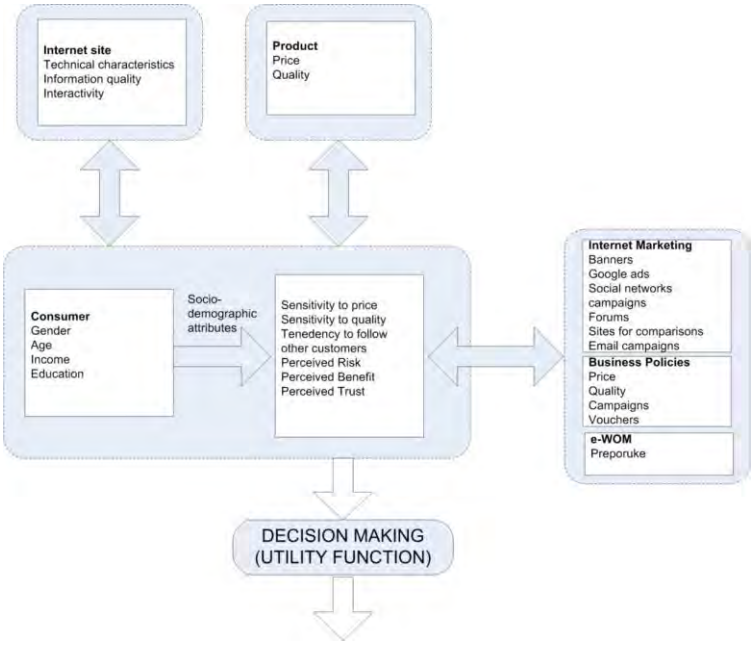

Figure 1: Consumer decision-making model in B2C electronic commerce

In the observed simulation model, the prospective consumers go through all the stages of online purchase. They first find the B2C online shops of interest, then they search for information on the products, form their own opinion of the product and/or service (utility function) and finally make a decision to buy (regardless of whether these are consumers that buy only once or consumers that remain loyal after their first purchase).

Figure 2 shows the basic steps in the simulation model, blue boxes represent the basic simulation flow. In the first step the simulation model forms a virtual market by generating agents: consumers (ConsumerAgents), sellers-Internet sites (SellerAgents), suppliers (SuppliersAgents) and advertisement agents (BannerAgents), on the basis of input variables.
The Consumer Agent models an individual consumer and his/her purchasing habits. The model can observe the behaviour of each individual consumer or a group of consumers. It is of key importance that we identify consumers with similar behaviours and needs and segment them for the purpose of targeted marketing campaigns (Klever, 2009). Agents that represent consumers in the model are generated by categories (on the basis of classification in (Moe 2003; Moe, Fader, 2002), and depending on their intention when visiting an online sales site:

1. **Direct consumers:** they visit the website with the intention to purchase a particular product; they rarely leave the website without having purchased.
2. **Consumers who search/reason:** they generally intend to buy a product from a certain category; it is possible that they make their purchase after several visits and comparisons with other websites and shops.
3. **Hedonic browsers:** initially, they do not intend to purchase a product; if made, a potential purchase is exclusively the result of stimuli from the site.
4. **Information gathering visitors:** visit website to gather information without any intention of buying.

   The ConsumerAgents are assigned colours so that their behaviour in the model should be tracked separately. In generating ConsumerAgents, each agent is assigned characteristics shown in Table 1.

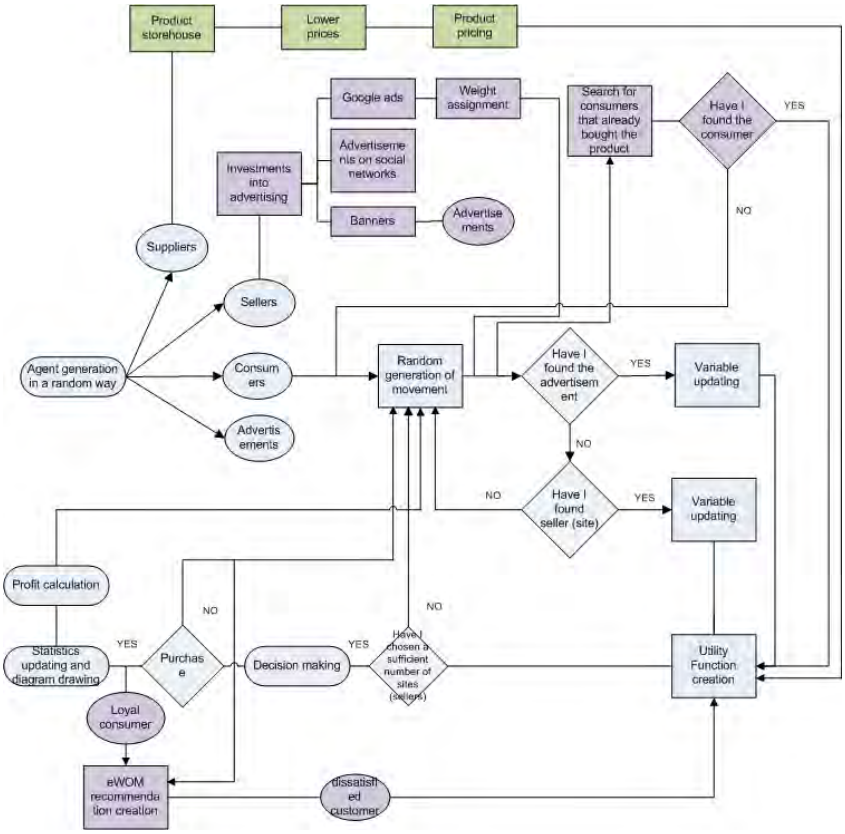

Figure 2: Graph of online purchase flow process in the simulation model

Label	Definition	Value	Distribution
G_i	i-th ConsumerAgent gender	input variable	Random 50%
A_i	i-th ConsumerAgent age	input variable	(18 + random 60)
I_i	i-th ConsumerAgent income	input variable	(5 + random 10)
RS_i	i-th ConsumerAgent sensitivity to website rating	input variable	Random (0-1)
K_i	i-th ConsumerAgent sensitivity to product price	input variable	Depends on I_i – wealthier consumers are less sensitive to price
W_{ij}	i-th ConsumerAgent sensitivity to a particular product attribute	input variable	Random (0-1)
ADS_i	i-th ConsumerAgent sensitivity to advertisements	input variable	Random (0-1)
Ft_i	i-th ConsumerAgent sensitivity to other agents – consumers' decisions	input variable	Random (0-1)

Table 1: ConsumerAgents input parameters

The Internet sellers (B2C e-commerce websites) are modelled as SellerAgents. The model presumes that each sales website sells one brand, and the seller is assigned a particular colour for the purpose of identification and visual tracking in the model during the experiment. When generating at the beginning of the simulation, agents are randomly assigned attributes shown in Table 2.

Label	Definition	Value	Distribution
brand_seller	type of brand sold by SellerAgent		Random
cbrand-price	initial product price	input variable	Random(0-100)
sales-volume	number of sales	output variable	
R_i	site rating	site rating by consumers +1 = positive, -1 = negative	
Find me	initial search weight	input variable	Random(0-100)

Table 2: SellerAgents input parameters

In addition to consumers and sellers, the model includes SupplierAgents, which are also generated at the beginning of the simulation, under the assumption that they have an unlimited storage of products. One supplier is generated for every brand and is assigned the same colour as the respective SellerAgent.

The fourth type of agents are BannerAgents. They serve to model the effect of Internet advertisements (banners) on purchase decision-making. When they are generated, they are assigned the colour on the basis of which they are tracked in the simulation experiment.

Upon generating agents and forming a virtual market, ConsumerAgents start searching for and evaluating products. The search is carried out via agents' random surfing through virtual market where they interact with other ConsumerAgents, SellerAgents and BannerAgents. With the proposed model it is possible to observe the effects of different strategies of SellerAgents on the effects of Internet sales. By expanding the model, it is possible to observe the effects of business strategies related to Internet advertising (purple boxes on Figure 2) and/or related to product prices (green boxes on Figure 2).

Purple boxes on Figure 2 together with the basic model show the model that takes into consideration different business strategies of Internet advertising. The development of social networks and Google services resulted in B2C e-commerce companies predominantly using these channels to market their products today. Customers with previous experience with online purchases display a tendency to share both positive and negative experiences about the purchase they made (eWOM effect) (Godes, Mayzlin, 2004). The model employs the following marketing tools:

- eWOM (interaction with other agents).
- Search weight (weights on the basis of which agents search the websites);
- Advertisements with banners (BannerAgents);

During their surf through virtual market, ConsumerAgents "look for" BannerAgents in a certain radius surrounding them (input variable with the semantics of number of banners the ConsumerAgent sees during his search), thus simulating the impact of different marketing strategies upon consumers' attitudes when choosing a product on the Internet. Bearing in mind that not every consumer reacts to banners in the same manner, one input parameter of each ConsumerAgent is sensitivity to marketing campaigns. Thus the consumer's inner sensitivity (perception) to the offered product is modelled. Each ConsumerAgent "memorises" a number of reviewed BannerAgents, that is, brands they represent.

Surfing on, the ConsumerAgent randomly finds Internet websites (SellerAgents). Finding different sellers may be entirely random or affected by search weight on certain SellerAgents to which the ConsumerAgent react. The number of websites browsed in this manner makes the input variable set at the beginning of the simulation experiment. The model also allows for simulating a better "visibility" of the website on the Internet by generating the larger number of ConsumerAgents of a particular colour. The larger number of ConsumerAgents of a particular colour, the higher likelihood of finding a website selling a particular type of product.

Apart from finding SellerAgents and BannerAgents, ConsumerAgents can conduct interactions among themselves in a given radius while surfing through a virtual market. As mentioned above, it is in this manner that consumers' tendency to imitate (follow) the behaviours of other consumers and their recommendations (eWOM effect) is modelled. ConsumerAgents' interactions can be classed into two types: direct communication of ConsumerAgents and ConsumerAgents' recommendations on websites. ConsumerAgents' recommendations (positive or negative) as regards some SellerAgents and/or brands are conveyed at the end of the purchasing process.

The basic model presented in Figure 2 (blue boxes) can be expanded for the purpose of observing a business strategy related to promotional price reduction of product prices (green boxes on Figure 2). Promotional prices are among the most important attributes affecting a consumer's decision to purchase online. Promotional campaigns increase sales significantly and, as a rule, result in an increased profit of the company. The business strategy of reducing prices in turn results in an increase in online sales by attracting a larger body of consumers. Price reduction is a key attribute affecting the consumer decision to purchase and it significantly increases the volume of online sales (Liu *et.al*, 2013).

3 Components of utility function

The consumer's utility function is created on the basis of information the ConsumerAgent collects on a product and in interactions with other consumers. At the beginning of a simulation it is possible to define the lowest utility function value below which the ConsumerAgent never makes a pro-purchase decision. Suppose that N brands were present at a virtual market. If we view incentives as independent variables, and character traits as coefficients of these independent variables, we can define the function in the following manner:

$$U_i = P_i + A_i \qquad (1)$$

where:
U_i - function of ConsumerAgent as regards product i (i = 1 to N).
P_i - ConsumerAgent rating of the i-th product price and quality.
A_i - effect of i-the product marketing campaign on ConsumerAgent.

In product rating consumers usually compromise between what they get by purchasing the product and how much money they give in return. The model observes price as one product attribute and product quality as the other, integrating all the aspects of product quality.

$$P_i = C_i + EQ_i \qquad (2)$$

where:
P_i - ConsumerAgent's rating of the i-th product price and quality.
C_i – ConsumerAgent's sensitivity to the i-th product (brand) price.
EQ_i – ConsumerAgent's sensitivity to the i-thproduct (brand) quality.

The value of coefficient C_i shows the effect of product price on the ConsumerAgent's attitude towards purchasing the given product. As a rule, higher prices tend to have a negative effect on consumers' motivation to buy a certain product. The distributed model of sensitivity to price (Kim et.al 1995) suggests that a lower price of a product generates a lower sensitivity to product price in a ConsumerAgent. Sensitivity to price can be expressed as follows (Zhang T, Zhang D, 2007):

$$C_i = -\alpha P_{ri} - P_{ei} + k \qquad (3)$$

where:
α - consumer's rating (α > 1) versus the real price of the observed product;
P_{ri} - price of the *i*-th product;
k - constant for ConsumerAgent which depends on socio-economic attributes (better-off consumers are less price-sensitive);
P_{ei} – expected price of *i*-th product; this parameter is difficult to define so it will be replaced by a mean value of all the products in the observed category P_{ave}

$$P_{ei} = P_{ave} = \frac{1}{N}\sum_i^N P_{ei} \qquad (4)$$

So that after the replacement we obtain:

$$C_i = -\alpha P_{ri} - P_{ave} + k \qquad (5)$$

The next key attribute the consumer-agent rates is the product quality. The coefficient Q_{ij} denotes the coefficient of *i*-th consumer-agent sensitivity to *j*-th product price. Sensitivity to quality is a multidimensional variable since the brand, that is, the product may have a number of quality aspects. Assuming that product *i* has *m* quality aspects, and on the basis of model shown in (Jager, 2008), ConsumerAgent's rating of *i*-th brand can be calculated as follows:

$$EQ_i = \sum_{j=1}^{m} \beta_{ij} Q_{ij} \qquad (6)$$

where:
Q_{ij}- *j*-th quality aspect for brand *i*;
β_{ij} - weight of *i*-th quality aspect for brand *j* (value ranging between 0 and 1).

The next element of utility function regards the consumer-agent sensitivity to eWOM effect as well as sensitivity to marketing campaigns. Analytically, it can be expressed as:

$$A_i = \alpha_i W_i + \beta_i B_i \qquad (7)$$

where:
A_i – effect of *i*-th product marketing campaign on ConsumerAgent.
α_i – ConsumerAgent's sensitivity to eWOM effect for product *i*;
W_i – effect of other ConsumerAgents on decision to purchase *i*-th product.
β_i – ConsumerAgent's sensitivity to brand *i* marketing (value ranging between 0 and 1);
B_i – number of banners for brand *i* ConsumerAgent sees during his Internet surf.

Effect of eWOM on ConsumerAgent can be calculated in the following way (Aggarwal et.al. 2012):

$$\text{b) } W_i = \frac{{E_p}^2 - E_p E_n}{\left(E_p + E_n\right)^2} \qquad (8)$$

where:
E_p – number of positive rates of interaction.
E_n – number of negative rates of interaction.

ConsumerAgents rate their interaction with seller-agents following each purchase made. The percentage of negative comments is an input parameter into a simulation model and is a subject of calibration in the simulation experiment.

The model also observes the interaction between ConsumerAgents and BannerAgents that represent banners on the Internet. ConsumerAgent's sensitivity to marketing campaigns (banners) can be determined as follows:

$$B_i = \frac{R_i}{R} \qquad (9)$$

where:
R_i - number of BannerAgents of brand *i* in the BannerAgent's surroundings.
R - total number of BannerAgents in the ConsumerAgent's surroundings.

Simulation model uses utility function as basis for the purchase decision making. All the incentives in the model are viewed as variables that can be changed with every other experiment. The process of evaluation of all impact parameters and their ranking for the purpose of purchase decision making is modelled by the utility function. In the simulation experiment it is possible to consider or exclude each of the four members of the utility function. In this way it is possible to test all influential factors separately or in any mutual interaction

4 Simulation experiment

The observed simulation model is implemented in the NetLogo software. It was subjected to a number of experiments and data are collected for an analysis of the behaviour of B2C *online* sales system. The basic indicators of B2C sales site business that were observed are market share and the number of visits on the website (surf share). At the beginning of simulation ConsumerAgents, ConsumerAgents and BannerAgents are generated, as described earlier in the paper. The simulation ensures that impact factors from the utility function, which affect the consumers' behaviour, are observed separately.

In the initial simulation experiment all types of products are assigned the same price in the amount of 100 monetary units, as well as the same quality level. Thus all the Internet sites have the same initial conditions for business. For every purchase the ConsumerAgents contact four websites (SellerAgents) in their surroundings. This number is an input parameter and can be changed depending of the scenario we wish to test. After an initial oscillation, the SellerAgents' market share stabilizes and that both visits and sales are almost evenly distributed across SellerAgents. This is an absolutely expected result given equal initial business conditions set in the model and, in a certain way, may be used in model verification.
In the next stage of the simulation experiment we observed the effect of eWOM on the output variables of the model. The graph in Figure 3-a shows that the sales of, in that time, best-sold products (yellow and green) increased most rapidly. The price of the products remains the same and so does the quality, however, consumers most often "comment" the best selling products, which further improve their sales. The intensity of the eWOM effect, depending on

the selected scenario, can be adjusted through the "choice-neighbours-buyers" input parameter that determines the radius in which ConsumerAgents follow other ConsumerAgents who have already purchased the observed product. The broader the radius, the more powerful the eWOM effect on the utility function. In case of eWOM effect on increase of surf share, it can be concluded that this effect is of minimum importance, as shown in the graph in Figure 3-b.

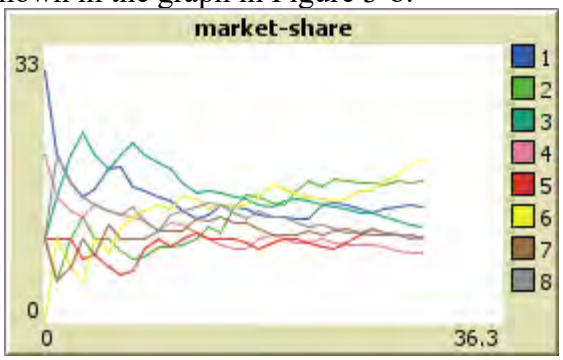

Figure 3-a. Graph: eWOM effect on market share

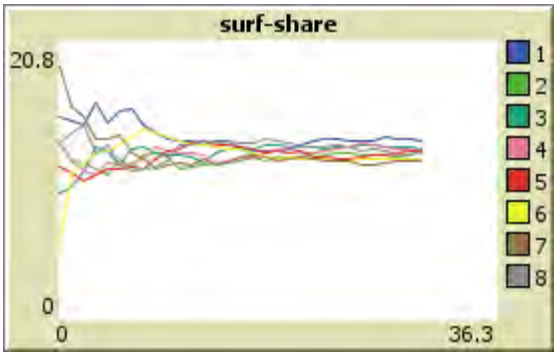

Figure 3-b. Graph: eWOM effect on surf share

In the following stage of the simulation experiment we include the effects of product marketing through BannerAgent generation. In this iteration, 20 banners were generated for pink and red products, and the click-through-rate (CTR) was set at 10%. The 10% coefficient for CTR is unrealistically high (in practice, this coefficient normally amounts to 4%), however, we did this to illustrate the sensitivity of the model to an abrupt rise of this coefficient (Figures 4-a and 4-b).

Now we notice that the surf share on websites that sell the "pink" and the "red" products has increased significantly in comparison with the competition (Figure 4-b). However, even though the sales of the "red" product increased slightly, this type of advertizing had no effect on the increase in the "pink" product sales. This can be explained by the fact that the "pink" product has so far had the smallest market share (Figure 5-a), hence the eWOM effect on it was modest, and the applied level of marketing has not been powerful enough to alter the situation to a more significant extent. In this way it is possible to test different business policies related to the effects of internet marketing by way of banners.

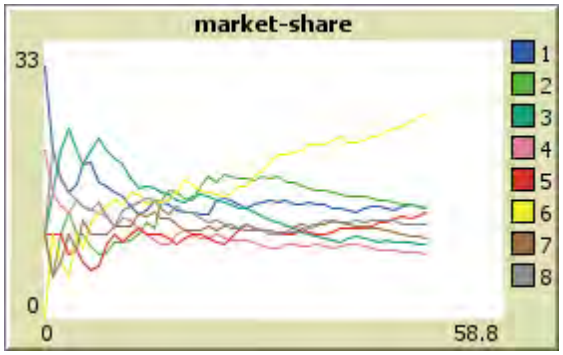

Figure 4-a. Graph: BannerAgent effect on market share

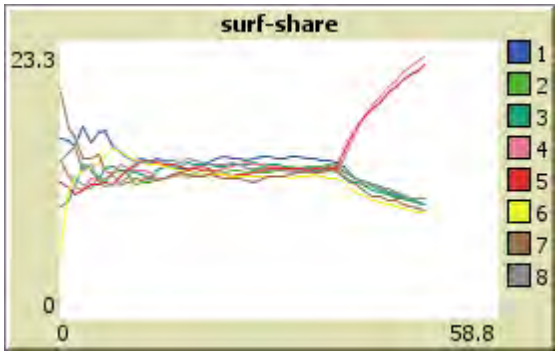

Figure 4-b. Graph: BannerAgent effect on surf share

Upon discontinuing the simulation, the experiment continues to test the effect of increasing the "visibility" of the website through increasing the ratings on the browsers. We will increase the "visibility" of SellerAgents by assigning weights for their search. At the same time we define the number of websites randomly searched with these weights. We will now assume that a majority of consumers browsing the Internet will check a certain number of top-ranked sites from the list of offered sites (in this experiment we will choose three), while in further browsing they choose the remaining sites randomly. The number of websites browsed on the basis of search weights and of those browsed randomly are input variables into the simulation model.

Figures 5-a and 5-b show that in this case, again, the number of visits to sites increases, as well as their sales after a certain time. We can draw a conclusion that investment into a better visibility of a site on the Internet increases the number of visits and sales to a larger extent in comparison with marketing via banners, which should be taken into consideration when planning the site promotion costs.

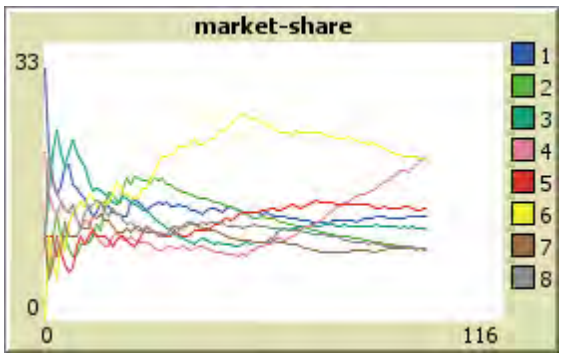

Figure 5-a. Graph: SellerAgent search weights effect on market-share

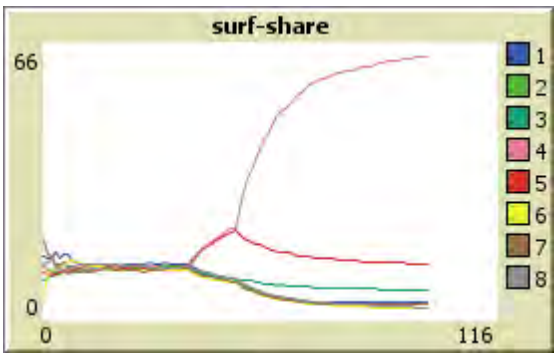

Figure 5-b. Graph: SellerAgent search weights effects on surf-share

In the final stage of the observed simulation experiment we test the effect of the product price and quality change on the online sales. The prices of the best-selling "pink" and the second best, "yellow" products increased by 5% and 3%, respectively, whereas the price of the worst-selling, "grey" brand decreased by 5%. Simultaneously, the quality of the "blue" product improved by 5%, and that of the "red" product improved by 3%. Effects of these changes can be seen in the graphs in Figures 6-a and 6-b.

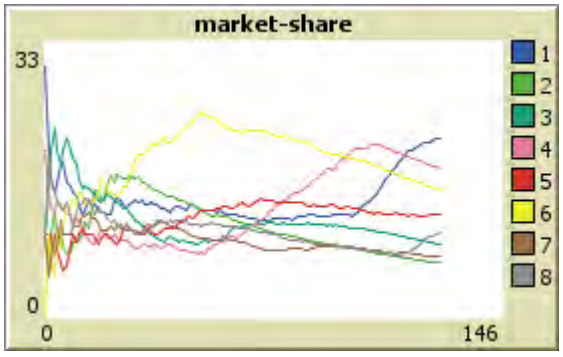

Figure 6-a. Graph: Effect of price and quality change on market share

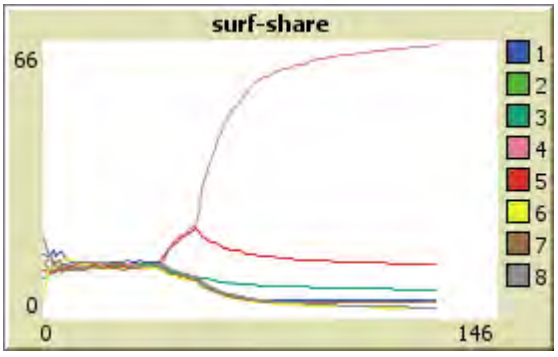

Figure 6-b. Graph: Effect of price and quality change effect on surf-share

We can see from the graphs in Figures 6-a and 6-b that these relatively small changes in prices and quality do not have an immediate effect on the sales of the product, however, sales still improve over time. The increase in sales of the "red" product on the basis of improved quality is somewhat slower, though. This may be a result of relatively slack marketing activities of the observed Internet seller, but also of the time required that the improvement of the product quality on the market should have a beneficial effect on sales.

The analysis of the obtained results proves that the model is capable of simulating various business policies and market effects on online B2C sales. We began the first simulation experiment with equal conditions of sale for all online shops, whereby we achieved a market balance with similar numbers of visits and sales for all SellerAgents. We continued the experiment to test the business policies of on-line promotion, product price variations, product quality variations and variations in the quality of the Internet site

5 Conclusion

The research proves that the methodology of agent-based simulation and modelling can be successfully implemented in modelling and simulation of processes on online markets. It also shows that the results obtained can be successfully used to analyse the behaviour of such markets and monitor the effects of different business strategies of online sellers on generated sales, site visits and other success indicators in doing business in the e-commerce domain.

For the needs of this research a simulation model was developed in the NetLogo, software that enables us to monitor the key interactions of the core players on the online market. The generated agents who present the dynamic entities of the model are assigned attributes based on empirical and theoretical data retrieved from the B2C online market. Thus the online market managers are provided with the tool to investigate into the impacts and effects of implementing their own business strategies and strategies to the market flows.

The rules of behaviour and interactions included into the model stress the complexity of the decision-making process in product evaluation and purchase in the B2C e-commerce segment. The observed simulation model includes a broad range of impact variables whose aim is to model all the relevant aspects of consumer behaviour and explain their method of decision making when purchasing on-line.

We can conclude that the designed e-commerce simulation model is a tool that ensures a better insight into the question of consumer behaviour on the Internet, and the companies engaged in e-commerce in the B2C segment now have a tool that can help them better understand their consumers, improve market segmentation, improve the business profitability and test their business strategies. As shown in the above discussions, consumer decision making on the Internet is the subject of continual study, therefore, new insights and approaches are certainly out there, waiting to be explored, which opens a broad area for further study.

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35th International Conference on Organizational Science Development
March 16th – 18th 2016, Portorož, Slovenia

Comparative Analysis of Business Model Ontologies

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Abstract
Business models are typically used to explain how companies create and capture value from innovations. A number of tools and techniques are available to support companies to define, evaluate or plan the implementation of business models. This study undertakes a critical and comprehensive review of the literature to identify the tools most widely used for managing business model innovation. In this regard, this study provides insights about the usefulness of tools for business development and business model innovation. The characteristics of individual tools are presented and discussed as well.

Keywords: business, model, tools, innovation, value

1. Introduction

Since the 1990s business models have received a lot of attention from managers, entrepreneurs, IT professionals as well as journalists, and academics. According to Teece (2010), the emerging knowledge economy, the outsourcing and offshoring of many business activities and the growth of Internet and e-commerce are the main factors that influence this growing attention. Prior research on business models has provided definitions of the concept, ontologies of generic components that constitute business models, conceptual models, design methods and tools, taxonomies, change methodologies, evaluation models, and adoption factors (Pateli & Giaglis, 2004). According to Teece (2010), business model concept lacks theoretical grounding which

has resulted in the fact that academics often define business model differently (Al-Debei & Avison, 2010). A review of the literature using the term business model shows two different viewpoints. Some authors use this term to simply refer to the way a company does business (e.g. Gebauer & Ginsburg, 2003) while other authors use this term to emphasize the model aspect (e.g. Osterwalder, 2004). These two viewpoints differ because the former generically refers to the way a company does business, whereas the latter refers to a conceptualization of the way a company does business in order to reduce complexity to an understandable level (Osterwalder, Pigneur, & Tucci, 2005).

Business model research has matured over the years, from definitions, taxonomies to frameworks and practical applications and tools (Osterwalder et al., 2005). Most of business model definitions are focused on value creation (Osterwalder & Pigneur, 2010; Teece, 2010), customer value (Osterwalder & Pigneur, 2010), customer and the company value (Bouwman, Faber, Haaker, Kijl, & De Reuver, 2008) or on the economic value (Gordijn & Akkermans, 2001). The business model definitions are closely related to the business model elements. Many researchers (e.g. Afuah, A., & Tucci, 2000; McGann, S., & Lyytinen, 22AD) have focused on business model elements, such as service and product innovation, the actors involved, the relationships between the actors, information and application architectures, and information and value exchange. As such, the business model frameworks and ontologies consist of defined business model elements and defined relationship between the elements. So far the different business model approaches have existed relatively independent from each other (Gordijn, Osterwalder, & Pigneur, 2005). Although little research has attempted to compare different business model approaches, Gordijn et al. (2005) presented a valuable work in this field. Authors developed a framework that allows comparison between different business model ontologies. In addition, they applied this framework to Business Model Canvas and e3-value to evaluate their similarities and differences. The purpose of this paper is to extend this comparison by adding additional business model ontology. Therefore, the main objective of this study is to provide the comparison between three well-known and widely used business model ontologies, namely, Business Model Canvas (Osterwalder & Pigneur, 2010), the STOF model (Bouwman, Faber, Haaker, et al., 2008) and e3-value (Gordijn & Akkermans, 2001).

The paper is organized as follows. We begin by providing the theoretical background of the above mentioned business model ontologies. Next, we outline the comparison of these business model ontologies on the basis of a set of parameters. Finally, we describe the outcomes of the comparison and outline similarities and differences.

2. Business model ontologies

2.1. Business Model Canvas

Business Model Canvas is one of most widely used tool for innovating business models by the business practitioners around the globe. Business Model Canvas was downloaded more than 5 million times and associated book Business Model Generation was sold in more 1 million copies (Strategyzr, 2015). Business Model Canvas was originally created in 2007 by Alexander Osterwalder and Yves Pigneour.

The Business Model Canvas is a strategic management and entrepreneurial tool. It enables description, design, challenging, invention, innovation and pivoting of business model.

Business model canvas consists of 9 building blocks arranged into four segments (Osterwalder and Pigneour, 2010): infrastructure, offering, customers, and finances.

Infrastructure segment defines:

- **"key activities"** for executing a company's value proposition,

- **"key resources"** that are necessary to create value for the customer; and
- **"key partners"** – buyer-supplier or ecosystem partnership.

Offering segment is focused to:

- **"value proposition"** – the collection of products and services a business offers to meet the customers' needs. Value proposition is defined as what distinguishes company from competitors. It can be defined as quantitative (price and efficiency) or qualitative – overall customer experience and outcome.

Customers segment is focused on following customers viewpoints:

- **"customer segments"** - organization must identify which customers it tries to reach and segment them based on different criteria.
- "**channels**" are ways through which value proposition could be delivered to different customer segments, and
- "**customer relationship**" defines what kind relationships a company would like to build with its customers.

Finances segment is focused to definition of:

- **"cost structure"** that will occur as a result from operating under different business models and
- **"revenue streams"** as a way a company makes income from each customer segment have to be defined.

To define each of building blocks, several questions have to be answered. Business Model Canvas provides questions for each building block which guides entrepreneurs to design business model.

The corner store of Business Model Canvas methodology is iterative use of visual tool (see figure 1) in a group setting (usually in form of workshop) which spark discussion on how to improve and innovate initially designed business model. The business model is improved by testing and examining ideas generated during group discussion.

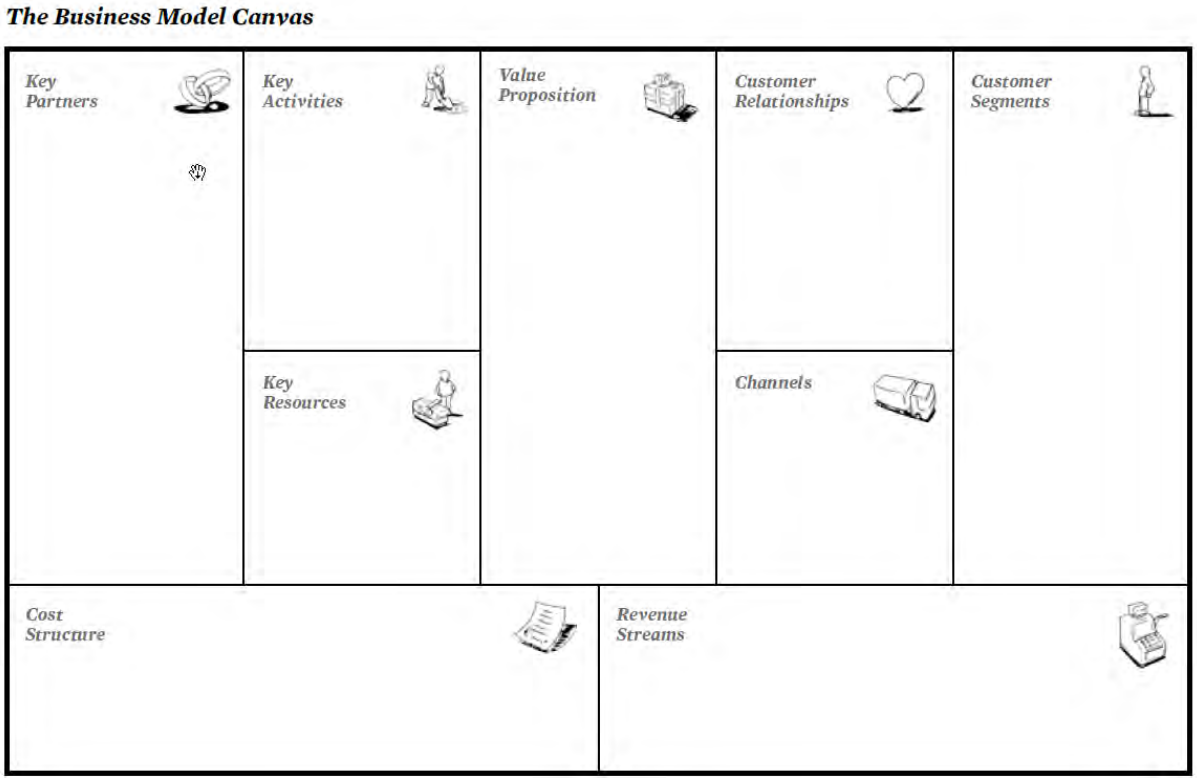

Figure 1: Business Model Canvas (Osterwalder & Pigneur, 2010)

As reported by Strategyzer report (2015) the main reasons for widespread usage of Business Model Canvas (BMC) are:

- BMC is visual tool
- BMC Facilitates group discussion on how to innovate business model
- BMC has practical simple interface
- BMC in intuitive to use

For advanced use of Business Model Canvas further toolset is available from Strategyzer website.

2.2. STOF model

The STOF model is a framework that provides a 'holistic' view on business models. This framework was developed in 2003 (Faber et al., 2003) and consists of four interrelated perspectives: service, technology, organization and finance perspective (see Figure 2). Besides the consideration of relevant design variables in each perspective, the STOF model also elaborates on critical design issues. According to Bouwman, de Vos, & Haaker (2008) critical design issues are those issues that can be expected to have a large impact on business model success (e.g. market dynamics, technological advancements, regulation). In other words the STOF model can be viewed as a tool for designing business models.

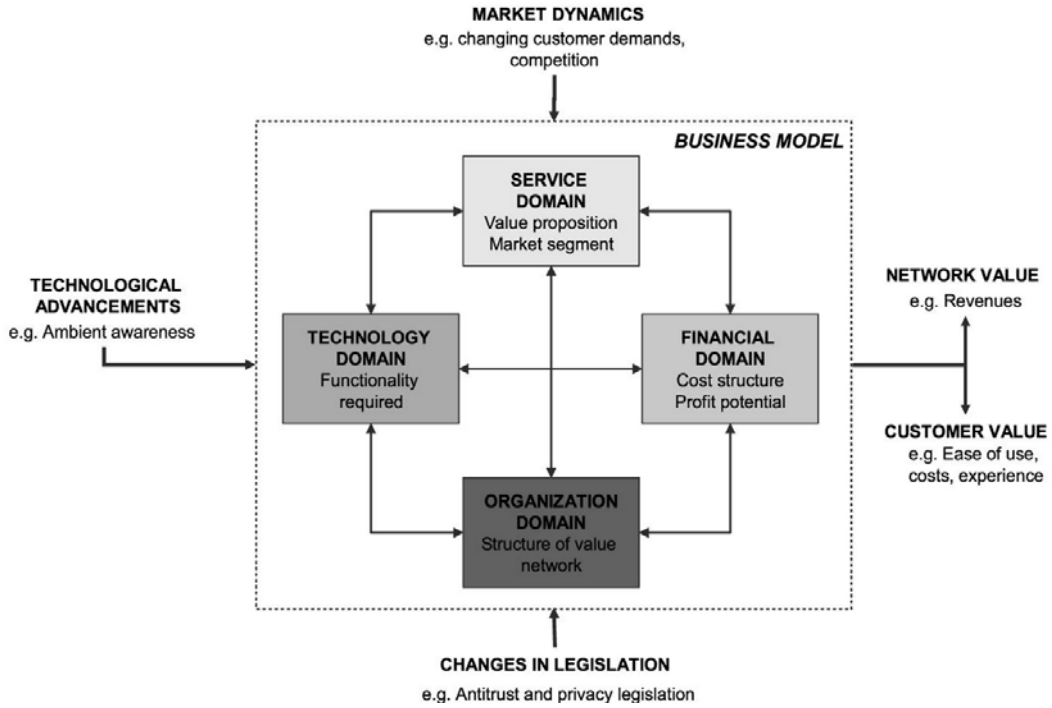

Figure 1: STOF model (Bouwman, Zhengjia, Duin, & Limonard, 2008)

According to Bouwman, de Vos, et al. (2008) the starting point for any business model is customer value. An individual company or network of companies needs to offer products or services which will satisfy customer demands. Therefore when using the STOF model it is important to focus first on service perspective, specifically on service definition and value proposition. After requirements in the service perspective are defined the technology design variables (e.g. technical architecture, backbone infrastructure, access networks, service platforms, devices, applications, data) can be determined and specified. After service and technology perspectives are addressed, the organization perspective is discussed. This involves

issues around the resources and capabilities that are mainly related to technology, marketing and finance availability in order to support service perspective. The financial perspective is the last of the four perspectives. There are two main issues in financial arrangements: investment decisions and revenue model (Bouwman, Faber, Fielt, Haaker, & De Reuver, 2008). Each of these four perspectives interact with the others and is affected by critical design issues (Bouwman, Zhengjia, Duin, Limonard, 2008).

The STOF model has been used for designing the business model in a number of cases, including mobile services (De Reuver, Stein, Hampe, & Bouwman, 2010; Faber et al., 2003; Haaker, Faber, & Bouwman, 2006; Maitland, Kar, Montalvo, & Bouwman, 2005), eHealth services (Menko, Visser, Hettinga, & Haaker, 2013) insurance Intermediaries (Bouwman, Faber, & Van der Spek, 2005), on-demand video service using the Internet protocol (Bouwman, Zhengjia, Duin, et al., 2008), near field communication mobile ticketing services (Juntunen, Luukkainen, & Tuunainen, 2010), gaming as service (Moreno, Tizon, & Preda, 2012) , the analysis of e-commerce business models (Bouwman, MacInnes, & De Reuver, 2006) and description of critical design issues and success factors (De Reuver, Bouwman, & Haaker, 2006) among others. Bouwman et al. (2008) identified several critical design issues based on case studies that involved the business models of mobile series (e.g. Faber et al., 2003; Haaker et al., 2006; Maitland et al., 2005). The identified critical design issues in each perspective are (Bouwman et al. (2008):

- Service perspective (targeting, creating value elements, branding and customer retention),
- Technology perspective (security, quality of service, system integration, accessibility for customers, management of user profiles),
- Organization perspective (selection, network openness, network governance and network complexity),
- Finance perspective (pricing, division of investment, division of cost an revenues, valuation of contributions and benefits).

Furthermore, Bouwman et al. (2008) identified critical success factors for customer and network value. The identified requirements for creating customer value are compelling value proposition, clearly defined target groups, unobtrusive customer retention and acceptable quality of service. The identified requirement when it comes to creating network value are acceptable risks, acceptable profitability, sustainable network strategy, acceptable division of roles (Bouwman et al., 2008).

2.3. E3-Value

The e3-value was conceptualized by Gordijn & Akkermans (2001) in order to "help define how economic value is created and exchanged within a network of factors" (Gordijn & Akkermans, 2001, p. 11). This framework provides three important perspectives: business value perspective focuses on economic value creation, exchange and consumption in a multi-actor network; business process perspective focuses on how business value perspective is represented in terms of business processes; and the system architecture perspective focuses on how e-business is supported by information system and infrastructure (Gordijn & Akkermans, 2001). Particularly, they have developed the e3-value ontology and conjunct this ontology with the use case maps adopted from Buhr (1998).

The e3-value ontology provides concepts that help to visualize a networked business models. The basic e3-value concepts are (Gordijn & Akkermans, 2001):

- Actor (an independent economic, often also legal, entity)

- Value object (service, product, money, or even customer experience that is valuable for one or more actors)
- Value port (through value port actor shows that it wants to provide or request value objects)
- Value interface (value ports are grouped into a value interface which shows for which value object an actor is willing to exchange for another value objects)
- Value exchange (connection between two value ports and represents one or more potential trades of value)
- Market segment (set of actors that share common value interfaces, value objects)
- Composite actor (several actor that decided to work together in order to provide a particular service)
- Value activity (activities assigned as a whole to actors in order to increase utility or gain profit)

Additionally, they added the adopted use case maps. Some of the most important adopted concepts are (Gordijn & Akkermans, 2001):

- Scenario path (consists of one or more segments related by connection elements and start-and-stop stimuli and indicates which value interfaces objects of value must be exchanged as a result of start stimulus or results of exchanges through other value interfaces)
- Stimulus (scenario path starts with a start stimulus and ends with a stop stimulus)
- Segment (relate value interfaces to each other to show that an exchange on one interface cause exchange on another value interface)
- Connection (relate individual segments: AND fork, AND join, OR fork, OR join and direct connection)

The above concepts are mentioned only briefly. e3-value is extensively presented by authors (Gordijn, Akkermans, & Van Vliet, 2001; Gordijn & Akkermans, 2001). For better understanding of e3 value model an illustration of e-business project, where Gordijn, Petit, & Wieringa (2006) successfully applied their approach, will be presented. This e-business project is about a publisher of news titles. Figure 3 illustrates the situation as it is. There are readers that buy a newspaper from a title they select. There are also advertisers who want to publish their ads in the physical newspaper of a title. The amount of money that advertisers need to pay depends on the number of readers. Furthermore, all the titles obtain services and pay a fee in return (Gordijn, Petit, et al., 2006).

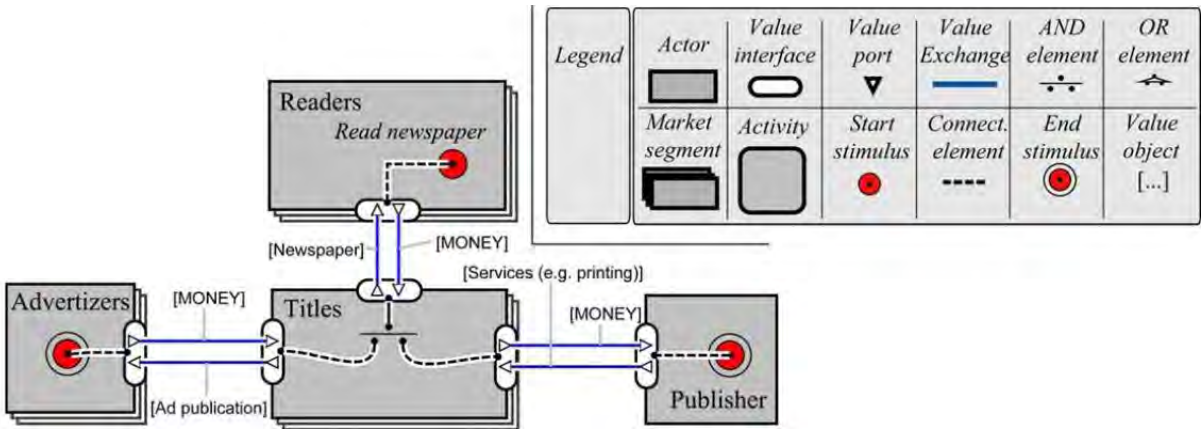

Figure 2: e3-value model example (Gordijn, Petit, et al., 2006)

The e3-value model has been used for designing the business model in a number of cases, including news service (Gordijn et al., 2001; Gordijn, Petit, et al., 2006; Gordijn & Akkermans, 2001), organization and performance of a scientific conference (Weigand et al., 2007b), internet radio service (Gordijn, Yu, & van der Raadt, 2006), mobile app store (Müller, Kijl, & Martens, 2011), cloud computing (Deng, Chen, & Yao, 2015; Leimeister, Böhm, Riedl, & Krcmar, 2010), internet of things environment (Glova, Sabol, & Vajda, 2014) and IT outsourcing (Kutsikos & Sakas, 2014) among others. According to Bouwman et al. (2012) e3-value is very useful in combination with quantitative scenarios. Quantitative scenarios can be used to describe future scenarios in detail. On the other hand although the e3-value models value exchange (does support a basic financial analysis functionality), it does not have concept to model anything related to the control aspect of value exchange (Kartseva, Gordijn, & Tan, 2005). Therefore Kartseva et al. (2005) proposed an extension to e3-value with features for modelling controls named e3-value/control. Similarly, Weigand et al. (2007a) argue that e3-value models "may provide more abstract and stable description of what business processes aim at" (175c) and therefore they proposed the extension of the e3-value model in such a way that the various aspects of strategic analysis are supported. They named their approach c3-value.

3. Research methodology

For the purpose of this research a systematic search of the literature related to business model ontologies was conducted. This literature search was performed using, among others, the following electronic databases: Emerald, ScienceDirect, InformaWorld, and SpringerLink. In addition, another search was conducted in an attempt to include related conference proceedings and other research outlets. The search was conducted from January 2016 to February 2016, using different combinations of keywords, such as Business Model Canvas, STOF method and e3-value methodology. Identified business models ontologies are compared using different parameters identified in Section 3.1.

3.1. Research parameters identification

In this paper a comparison between three different business models ontologies is carried out. Several previous studies (e.g. Gordijn et al., 2005; Souza, Beest, Huitema, Wortmann, & Velthuijsen, 2014) have dealt with the comparison of different business model approaches. Various approaches for analysing and comparison of business models were developed and used in the aforementioned studies. For instance, Gordijn et al. (2005) presented a framework that allows the comparison of different conceptual approaches to business models. Their ontology comparison framework is mainly based on the work of Uschold & Jasper (1999) and Pateli & Giaglis (2003). The parameters used in these studies consist of various ontology characteristics and the applications of the ontologies (Table 1). These parameters were also adopted to our study.

Derived from	Parameters of comparison	Description of the parameters of comparison
(Uschold & Jasper, 1999)	Purpose of the ontology	Explains the motivation to use ontologies in the business model domain. This parameter serves as a first significant indicator to understand the differences and overlaps between different approaches. Purposes can be, but are not limited to, improved communication, interoperability, system engineering aspects such as re-usability, searching, reliability, specification, knowledge representation and acquisition.

	Business model definitions	Definitions are used to capture the scope and interpretation of a business model approach. Business model definitions vary considerably according to the different authors.
	Focus of the ontology	The focus of attention differs from approach to approach. Some have an enterprise centric view, others focus on value constellations. Some concentrate on strategy, others on operational aspects. Some pay particular attention to technology, others to business innovation and some to both.
	Ontology content & components	Content refers the actual concepts, relationships, and rules/axioms the ontology uses to represent a business model.
	Ontological role	Ontologies generally have three different roles. They can contain operational data (L_0), concepts, relations and axioms for containing operational data (L_1), or they can be a language to express ontologies at level L_0 and L_1 (L_2).
	Ontology maturity & evaluation	The degree of maturity of an ontology refers to its evaluation and use. Evaluation can cover different indicators and forms of measurements. One important type of evaluation is how much an ontology has been applied and to what kind of problems (e.g. academic examples or real-world companies).
	Ontological representation	Comprises the amount of data represented and the degree of formality. With respect to the amount of data, there are light-weight ontologies that consist of a limited number of concepts, relations and axioms (order of magnitude tenths), and there are heavy-weight ontologies (order ten-thousands concepts, relationships and axioms). With respect to the degree of formality of the ontology, we can distinguish highly informal (natural language), structured-informal (a restricted form of natural language), semi-formal (using an ontology language like OntoLingua, RDF/S or OWL), or rigorously formal (formal semantics, theorems, and mathematical proofs of soundness and completeness).
(Pateli & Giaglis, 2003)	Tool support	This parameter describes tools developed on the basis of the analysed ontology to design, analyse, evaluate or otherwise manipulate business models.
	Visualization	Visualization concerns methods to represents the business model of a company graphically, textually, or both
	Evaluation method for business model instances	This parameter describes if there is a method to evaluate a company's business model, which was modelled with the ontology. Such a method may embrace the feasibility, coherence and economic viability of a business model or benchmark it against best practices or other business models.

Table 1: Parameters of comparison (Gordijn et al., 2005; Pateli & Giaglis, 2003; Uschold & Jasper, 1999)

4. Comparative analysis

Based on the parameters of comparison presented in previous section we will outline the actual comparison of the three ontologies presented in section 3.1.

Purpose of the ontology: Through the representation of a business model by explicit conceptualizations of the business model all three ontologies aim to improve communication, having different conceptualizations of business models. Regarding the inter-company interoperability all three ontologies want to improve a way companies work together. The Business Model Canvas reflects this in a form of the partnership concept, the STOF model reflect this in a form of value network and the focus of e3-value is on inter-company business models. Similarly, in the case of intra-company interoperability all three ontologies want to align business strategy with Information Systems. Among these tree ontologies only e3-value provides additional constructs known from process modelling (Unified Modelling Language). Overall all three ontologies provide a pre-defined terminology and have scientific intention.
Business model definition: All three ontologies have their own definitions. As shown below they vary considerably between authors:

- A business model is a conceptual tool that contains a set of elements and their relationships and allows expressing the business logic of a specific firm. It is a description of the value a company offers to one or several segments of customers and of the architecture of the firm and its network of partners for creating, marketing, and delivering this value and relationship capital, to generate profitable and sustainable revenue streams (Osterwalder et al., 2005, p. 17–18).
- A business model is a blueprint for a service to be delivered, describing the service definition and the intended value for the target group, the sources of revenue, and providing an architecture for the service delivery, including a description of the resources required, and the organizational and financial arrangements between the involved business actors, including a description of their roles and the division of costs and revenues over the business actors (Bouwman et al., 2008, p. 33)
- E-business models [...] a conceptual modelling approach to e-business—called e3-value—that is designed to help define how economic value is created and exchanged within a network of actors. Our e3-value method is based on an economic value-oriented ontology that specifies what an e-business model is made of. In particular, it entails defining, deriving, and analysing multi-enterprise relationships, e-business scenarios, and operations requirements in both qualitative and quantitative ways (Gordijn & Akkermans, 2001, p. 11).

Focus of the ontology
The Business Model Canvas is focused on the conceptualization of the way how a specific company does business, including the company's network of partners. In contrast the e3-value is focused on network of companies, while the STOF model is focused on both, individual company or network of companies.

Ontology content & components
These three ontologies conceptualizations are in some cases similar and in some cases they diverge. The Business Model Canvas and the STOF model are more similar, although Bouwman et al. (2012) argue that their approach differ from the Business Model Canvas. In comparison to the e3-value, they are also more simple to use because they consist of a fewer concepts, relations and axioms. All three ontologies are presented in the Section 2 and therefore further clarifications are not needed.

Ontological role
While all three ontologies contain concepts, relations and axioms to present a business model they are at level L_1.

Ontology maturity & evaluation
As already presented in Section 2 all three ontologies have been applied in different case setting as well as in a series of business development practices in various industries. They are also included in the courses at various universities. There are slight differences between ontologies regarding how much an ontology has been applied and to what kind of problems.
Figure 4 shows the appearance of these three models in scientific literature, according to Scopus[1]. As can be seen from Figure 4 e3-value was the most published method, followed by Business Model Canvas and STOF model in the last 10 years. However, in the past five years Business Model Canvas has a much larger number of result than e3-value and STOF model.

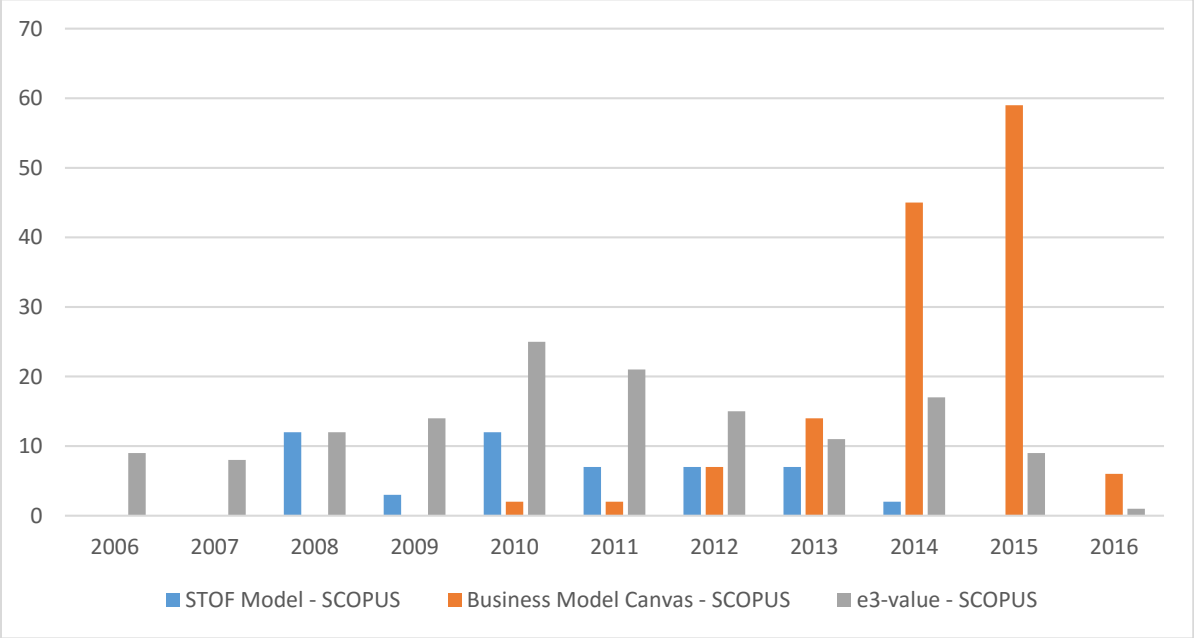

Figure 3: Publications on business model ontologies, according to Scopus

Ontological representation
With respect to the amount of data all three ontologies have limited number of concept, relations and axioms and are known as light-weight ontologies. As in term of formality BMO and e-value are semi-formal, because they are using ontology language (Business Model Canvas is described in Web Ontology Language and e3-value in Unified Modelling Language, while STOF model is structured-informal, with restricted form of natural language.

Tool support
There are differences regarding the maturity of the tools they supply. E3-values is the only one who provides a set of tools including a visual business modeller. For the BMO some practical tool is available as an app that runs on tablets and publicly available use cases. As concerns STOF model we were not be able to find any tools support.

[1] 1Query (TITLE-ABS-KEY ("stof method "OR " stof model "OR" stof ontology "OR" stof methodology"), ("Business model Canvas"OR"Canvas model"OR"Canvas model ontology"OR"Canvas model methodology"), "e3-value methodology"OR"e3-value"OR"e3-value ontology"OR"e3-value method"), search date February 10, 2016.

Visualization
All three ontologies represent the business model of a company graphically and textually. Their visualisations are used to explain a business model to a stakeholder, each of one using their own approach. The Business Model Canvas and STOF model approaches use the entity-relationship-type of representation, while e3-value uses a story telling approach.

Evaluation method for business model instances
As regards to the evaluation all three ontologies offer an evaluation method for business model instances. For the Business Model Canvas a so called Splash Evaluation template was designed, the STOF model is evaluated with critical success factors, while the e3-value allows evaluating exchange values captured by the stake-holders.

5. Conclusion

The literature review presented in this study examined three well known business model ontologies, namely, Business Model Canvas, the STOF model and e3-value. The main purpose of this study was to compare these three business model ontologies based on different parameters. The analysis shown in this paper discusses main similarities and differences between Business Model Canvas, the STOF model and e3-value. Based on the findings of this study, it is concluded that all three ontology approaches are useful, but are used for different purposes. Perhaps the most popular one is Business Model Canvas, because it leaves much room for interpretation. It is usually used when the focus is on strategic management and marketing in individual company. On the other hand the e3-value is focused on network of companies and the STOF model on individual company or network of companies. The STOF model provides in contrast to Business Model Canvas a more detailed and elaborated approach and is often focused on mobile services. The e3-value is especially appropriate approach when focus is on the economic and financial aspects of business models. Additionally, it supports modelling process flows and it is very useful in combination with quantitative scenarios.

Acknowledgement

This work was supported by the Envision - Empowering SME business model Innovation project. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 645791.

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35th International Conference on Organizational Science Development
March 16th – 18th 2016, Portorož, Slovenia

Analysis of Professional Interests of Elementary School Students

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Abstract

This paper refers to the issue of the application of professional orientation to assist elementary school students in the selection of the institution in which they will continue their education. The introductory part of this paper presents the concept of professional orientation which provides assistance in choosing a school, college or future profession. The aim of this paper is to propose a methodology that would help students in choosing the institution of their future education. Answers from the professional interests tests have been used in order to help students learn about themselves, their interests, abilities, skills and motivation. The study included 91 students of the eighth grade. Each of them answered 120 questions of the of professional interests test, based on which the proposed occupation for each student individually is formulated. At the end of this research paper, the similarities and differences with existing tests of professional interests are examined, and the possibilities of using this methodology in future studies and research papers are evaluated.

Keywords: professional orientation, professional interests test, factor analysis, statistical methodology

1 Introduction

Choosing the profession is one of the most important life decisions of every person. Job makes a huge and important part of human life, both because one spends a lot of time working, and because of the fact that work is a sphere where one realizes one's potentials. Professional life is part of human identity and partly determines human personality. To be able to love our job, enjoy it, be productive and successful, it is important that it fits our personality, preferences, interests and abilities. For people who are in a dilemma when deciding on the choice of their future schools, colleges or profession, professional orientation can be of a great help.

From a theoretical point of view, career orientation is presented in a broader conceptual sense as an organized system of social and professional efforts on continuous helping to individuals during their entire development with regard to free orientation and determination, in education and professional activities, all with the aim of achieving professional identity in accordance with personal characteristics on one hand, and labor market needs for particular occupations, on the other (Rymesova, 2012). Defined in this way, professional orientation is intended for all individuals who are on the professional turning point, i.e. at the moment when they should make a decision about their future vocation. In particular, this research is carried out among the eighth-grade students (final year of elementary school), defining a proposal for selection of appropriate secondary school as an output.

Professional orientation can be seen as an informal and disorganized impact of immediate social environment on the professional orientation of an individual (Dunjić-Mandić et al., 2005). In the literature, this term implies socially organized professional orientation. Seen as an organized social activity, professional orientation is a "complex and systematic activity of assisting individuals in solving problems related to vocational choice and their progress, and further professional development"(Korać, 2011). The assistance is especially important to young people in terms of their orientation in the diverse and varied world of occupations, but also in terms of their awareness of their own predispositions and professional aspirations.

Contemporary social development seeks an individual who is capable of making independent and adequate decisions about their interests in different periods of life. Therefore, there is a need for professional orientation to become an implicit activity of the entire educational process (Đurić, 1998). Schools should enable students to develop their interests, needs, and competencies in relation to the contents, conditions, and requirements of occupations, in order for students to successfully and independently predict and plan their course of professional development. Students often come to test their professional interests with unrealistic expectations, i.e. hoping that psychologists will give them a ready solution, make decision instead of them. Professional orientation is designed as an additional source of information to all students and adults undergoing a decision-making process about the future occupation. Due to the fact that the decision is highly consequential, it is clear that it is very complex as well.

There are a lot of scientific papers and literature which deal with the concept of professional orientation (Kostić & Vlajić, 2004). This paper has used books on psychology and statistics, as well as expert papers on professional orientation and professional interests published in national and international journals. The study includes 91 eighth-grade students. Each of them answered 120 questions posed in the professional interests test, based on which profiles of the proposed occupations for each student individually are formed.

This paper focuses on a detailed analysis of the students' responses, the presentation of similarities and differences with existing tests on professional interests, the assessment of the adequacy of the posed questions. The paper also proposes modifications to the test of professional interests. At the end of the paper, we explain the research results, advantages of the proposed methodology i.e. a modified professional interests test, as well as a brief overview of the possibilities of its use in testing primary school students.

The aim of this paper is to propose a methodology that would help students choose the institution in which to continue their education. Answers to questions from the professional interests tests are used to help students to learn about themselves, their interests, abilities, skills and motivation. The proposed test of professional interests includes certain similarities and differences compared to existing tests, and as such is unique in its structure.

The main objective of professional orientation is to give assistance and support in choosing an occupation (Hedrih & Šverko, 2007). Vocational guidance is of great importance in the formation of appropriate attitudes towards work, the creation of professional spirit and satisfaction in the future work. As such, professional orientation is very important for a successful future career. A successful career is closely linked to a well-chosen occupation. At the beginning of the process, professional orientation implies an interview with a psychologist about personal wishes, expectations, motives, interests, preferences and dilemmas. The interview is followed by the test of personality, abilities, interests, etc. Finally, the obtained results lead to a conversation about suitable alternatives.

Psychological tests are designed and created with the idea to help measure certain psychological phenomena in the most reliable way. Tests are assigned and interpreted solely by psychologists because this process requires specific knowledge and training. The tests are designed and interpreted based on the existing rules and standards. The tests make it possible to obtain a very large amount of information in a short period of time. During the process of professional orientation, the interests tests help in choosing a future profession that will be compatible with intellectual abilities, personality traits and occupational interests of the person being tested (Joksimović & Joksimović, 2007).

When it comes to elementary school students, there is a variety of activities as part of their educational process. In primary schools, in addition to professional orientation realized by school counselors and psychologists, the program of professional orientation is also enforced. Activities within professional services at school (educational and pedagogical services) are directed towards the use of tests and feedback to students. The professional orientation program enables students to attend trainings within their schools, which empowers them to independently decide on the basis of the insight of their own capacities, information about future occupations and career paths, as well as practical experience in real-life meetings with prospective occupations.

At the age of 14 or 18, a young person does not have an adequate picture about themselves, their abilities and capabilities, and does not recognize the situation on the labor market, types of jobs and the number of educational profiles that are offered (Bjekić & Dunjić-Mandić, 2007). It is highly recommended to seek help from a psychologist who specializes in professional orientation and provides assistance in these dilemmas. Parents or tutors, as essential interlocutors for their children, should be included in the phase of selecting school or

profession. As they know the strengths and talents of their daughters and sons, they have the unique ability to provide them support on their way to make a decision.

A large number of children show no preferences for a particular occupation although they are about to enroll secondary school (Štrbac, 2002). It is a kind of a child's defense and parents must provide assistance without any hesitation, but should not impose their will. In the program of professional orientation, parents are supported and reinforced through parent-teacher meetings to identify their children's interests and abilities in order to be able to help them examine the world of work and find themselves in it (Veen et al., 2001). Children without strong preferences are often advised to enroll comprehensive secondary school, which delays making a career decision. A well-done professional orientation is a form of prevention of future problems.

As a systematic and organized social action, professional orientation can be traced through the tasks that are implemented, i.e. the implementation phases. These are the following: career information, personality analysis, vocational counseling and professional monitoring (Mihailović, 2010).

- Career information is a process of introducing an individual with as many professions as possible so that the decision on future occupation would not be rushed. Information on professions and careers is implemented through education, upbringing, personal experiences, but also as an organized process of schools or psychologists. A lot of entities take part in career information: parents, family, friends, school, famous people, but also special social institutions dealing with employment and professional counseling (in the Republic of Serbia this institution is the National Employment Service).
  Effective career information should give a lot of objective information about as many different jobs as possible. This can be achieved in many ways, with the internet being the most popular one nowadays. In that, candidates for the future occupation must understand job description/ contents, the conditions in which the work is performed, performing methods, as well as other important features. As a long – term process, professional orientation is tailored to students' age and educational capacities. In this sense, professional information is often referred to as professional education
- Personality analysis helps students to get to know themselves, their capabilities and their professional interests. Young people of this age often cannot see an objective picture of themselves. Growing up and maturing, a person becomes aware of their options, preferences, and interests (Kostić & Vlajić, 2004). The process of self-awareness is part of the overall development of personality, where educational institutions can greatly help.
- Professional counseling is actually a professional orientation in a narrow sense. It implies a series of activities undertaken by a psychologist to gain insight into the abilities, personality traits, interests, and propensities of students, so that a psychologist could give a recommendation and advice related to a further career based on the obtained information.
  When it comes to eighth-grade students of primary schools, vocational counseling is an organized procedure of professional assistance to students who are faced with several possibilities for the selection of schools in which to continue their education. In this case, the entire procedure is realized by psychologist and pedagogue. In order

to ensure the success of this phase, it is necessary that the previous two phases, career information and personality analysis, are entirely carried out.

- Professional orientation is neither one act play, nor does it end with the school or occupation choice. It extends from the first school day until the end of the working career, but sometimes it extends beyond the end of active professional life. This phase verifies the adequacy of professional choice, i.e. correctness of career forecasting and validation of professional choice procedure.

2 Exploratory factor analyses

Exploratory factor analyses (EFA) is one of the methods of multidimensional analysis. One of the tasks of the EFA is the compression of a large number of original variables into a smaller number of common factors that will describe them and explain their interconnection. EFA is also applied to identify dimensions that are not immediately visible, to test defined hypotheses and research new areas. The assumption is that there is a linear correlation among the variables, and each extracted factor does not correlate with other factors, unless as a result of oblique angle rotation of factors. This is precisely one of the advantages of EFA - instead on a large number of correlated original variables, the analysis is conducted on uncorrelated factors and thus eliminates the problem of collinearity variables.

EFA assumes that there is a theoretical model that establishes relations between the observations of *n*-dimensional variable and a smaller number of common factors. In addition to assessing factor model parameters, we are also keen to determine the factor values for each observed unit i.e. factor scores, in order to facilitate interpretation of the analysis results as well as to use factor values in further analysis (Kovačić 1994).

EFA model assumes that X, the vector of observable variables, can be expressed by the set of m unobservable variables, called "common factors", in notation $F_1, F_2, \ldots, F_m$ (where $m \ll p$) and p specific, but unobservable factors, in notation $\varepsilon_1, \varepsilon_2, \ldots, \varepsilon_p$. Model in matrix notation is

$$X_{p\times 1} - \mu_{p\times 1} = B_{p\times m} F_{m\times 1} + \varepsilon_{p\times 1}$$

The elements of the matrix B *i.e.* βij are called factor loadings of *i-th* variable of *j-th* factor, and the matrix is called the factor loadings matrix. Before performing this multivariate method, it is necessary to examine whether the data are appropriate for factor analysis. This can be determined using the Kaiser-Meyer-Olkin (KMO) measurement of the adequacy of the sample (Kaiser, 1970). An alternative test is Bartlett's test of sphericity which checks whether the correlation matrix is an identity matrix in which case the factor model is inappropriate (Lattin et al., 2003). KMO indicator should have a value greater than 0.6 (Tabachnick & Fidell, 2013) and Bartlett's test of sphericity should be statistically significant ($p < 0.05$).

If the data are appropriate for factor analysis, the next step is to determine the number of common factors. The choice largely determines the quality of conclusions on the basis of the assessed model; therefore, it must be approached with great caution. If we choose very few factors, then the significant common factors will be excluded from the analysis, and in the opposite case (selection of too many factors) some of the specific factors will be mixed with the common factors. The best-known criterion for the selection of the number of factors is unit root criterion, based on which we keep as many factors in the model as there are common characteristic roots in correlation matrix sample which are higher than 1, so-called Kaiser's criterion (Kaiser & Dickman, 1959).

Once the number of extracted factors is selected, their interpretation and calculation of the factor scores follow. Factor scores are realized factor values for each observed unit. Direct calculating of the factor scores is possible only if the assessment of the factor models uses the method of principal components, which is the case in this paper.

Cronbach's Alpha is a coefficient of internal consistency. It is commonly used as an estimate of the reliability of psychometric tests on a sample of respondents. Cronbach's Alpha is widely used statistics in social sciences, business, medicine and others. The term *item* can denote a question, assessor, indicator - where the question is to what extent they "measure the same thing." Items which are commonly manipulated with are referred to as variables.

3 Results

In this paper, we have used the data compiled from 91 students of elementary school "Djura Jaksić" from Belgrade. The students did the professional interests test designed by the Association of Psychologists of Serbia. The test encompasses 120 questions that make bases for measurement of students' preferences by 10 different spheres of interest (administration, security, technical and craft work, culture, science, agriculture, nutrition and food, commerce, esthetic shaping, humanistic-healthcare work). For each 10 different spheres of interests, 12 questions are posed. The questions are periodically repeated, i.e. *administration* is covered by questions 1, 11, 21, 31, 41, 51, 61, 71, 81, 91, 101, and 111; *security* is tested by questions 2, 12, 22, 32, 42, 52, 62, 72, 82, 92, 102 and 112, and further on for each of the stated activities. List of all 120 questions is given in the appendix.

Based on the given data, we carried out an analysis of the main components and the factor analysis on each of the groups of questions that relate to individual activities. Due to the high similarity of the obtained results, we have presented and discussed only the results of the factor analysis. The aim was first to reduce the dimension of the problem, i.e. to form the factors within each activity. Then, within each factor, we selected only some of the questions in order to reduce the scope and duration of the professional orientation test. The aim was to reduce the number of questions from 120 to as small number as possible, at the same time retaining as much information as possible. Measures of adequacy and reliability of the data are given in Table 1.

Activity	**KMO measure**	**Importance**	**Cronbach's Alpha**
Administration	0.858	0.001**	0.907
Security	0.878	0.001**	0.909
Technical and craft work	0.869	0.001**	0.951
Culture	0.870	0.001**	0.881
Science	0.826	0.001**	0.877
Agriculture	0.766	0.001**	0.825
Nutrition and food	0.845	0.001**	0.902
Commerce	0.790	0.001**	0.813
Esthetic shaping	0.817	0.001**	0.841
Humanistic- healthcare work	0.784	0.001**	0.866

Table 1: Measures of adequacy and reliability of the data

** $p<0.01$

The results of this analysis show that the data are fully adequate and reliable. Kaiser-Meyer-Olkin measure confirmed the adequacy of the data while the Barthlet test of sphericity showed that in none of the studied groups of questions the answers i.e. data are not spherical. Cronbach's Alpha confirmed the consistency of data and thus their reliability.

Based on the analyzes, we selected the 30 most important questions out of the initial 120, which should provide the same information as the initial dataset. Questions are first divided by the initial activities, and then by the occupations. Instead of 10 activities we extracted 26 possible occupations. The results are given in Table 2.

Activity	**Occupation**	**Question**
Administration	Administrative jobs	Determining the rights of the unemployed
		Keeping the record of saving deposits at a bank
		Issuing certificates in the municipality
Security	Military	Training young soldiers to use weapons
	Border police	Preventing drug trafficking across the border
	Police	Regulating traffic on the city's intersections
Technical and craft work	Technical and craft jobs	Repairing and maintaining car engines
		Making special tools
		Adjusting the work of machinery and equipment
Culture	Journalism	Writing articles for newspapers and magazines
	Interests in acting and presenting	Directing educational TV series
	Organization and research	Surveying the ratings of educational programs
Science	Scientific research	Working to develop new alternative energy sources
	Pharmaceutical and medical research	Introducing new methods into the treatment of serious illnesses
	Technical research	Explore the properties of new materials in aircraft industry
Agriculture	Fruit growers	Spraying fruit with protective means
	Vegetable growers	Growing vegetables in greenhouses

	Crop farmers	Afforestation of bare land conifers
	Livestock farmers	Feeding animals in feedlots
Nutrition and food	Cookery	Preparing special meals in restaurants
	Confectionery	Baking and decorating cakes on order
Commerce	Procurement	Working as commercialist in a trading firm
	Entrepreneurship	Working at cash register
	Tourism	Working as a tourist guide
Esthetic shaping	Ornamentation	Designing floral arrangements for special occasions
	Design	Designing seasonal models of clothes
	Furniture	Restoring antique furniture
Humanistic-healthcare work	Care for the elderly	Nursing patients
	Spiritual values	Taking care of people's spiritual and religious needs
	Delinquency	Rehabilitating juvenile offenders

Table 2: Activities, occupations, and the most significant questions

4 Conclusion

The professional interests test proposed in this paper has an adequate and reliable factor structure, as evidenced by the measured indicators. The results obtained after conducting factor analysis are easy for interpretation. Instead of 10 activities of the original test of professional interests, we extracted 26 possible occupations. When it comes to objectivity, both tests are proven to be extremely objective. The validity of the tests is reflected in the explained part of variability, which is in both tests around 65%.

In the professional interests test, some occupations do not appear. There are many professions that do not appear in either of the two tests although they have become very popular over the last few years (system administrator, system engineer, web designer, programmer, analyst, project manager, PR manager, brand manager, portfolio manager etc.). Based on the above, we can assert that a large number of improvements can be introduced. To complement the tests with new occupations, it is necessary to formulate terms first, and then consult experts from these fields. Afterwards, it is necessary to define a set of questions for each of the proposed occupation, and then, using the methods of multivariate statistical analysis, try to reduce the dimension of the problem as much as possible.

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35th International Conference on Organizational Science Development
March 16th – 18th 2016, Portorož, Slovenia

How are ICT Professionals´ Wages Influenced by Economic Development in the Czech Republic?

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Abstract
The economies of European states have survived dramatic changes in the past fifteen years. The start of the present century and the millennium is represented by large economic boom, then in 2008 started the economic crisis and the consequences of which had not deeply hit the Czech economy until the year 2009, and ending period with small steps toward the current recovery. These economic trends are reflected also in ICT (Information and Communication Technology) sector. This article presents short overview of the development of number of ICT professionals in the Czech economy, further it presents progress in nominal and real (wages adjusted for inflation) wages for two main groups of ICT professionals – for ICT Specialists (ISCO 25) and ICT Technicians (ISCO 35) – definition of these groups is also the part of the article. This progress will be investigated and presented as well – at first in boom years (2000 - 2008) then in crisis years (2009-2011) and in recovery period (2012-2014) at the end of the article. Used data sources are mainly databases of the Czech Statistical Office and the Eurostat relevant databases as well. Methods used for investigation is data series analysis, regression functions in combination with least square method.

Keywords: economic cycle, ICT specialists, ICT technicians, wages in ICT

1 Introduction

Processes of political, economic and cultural integration of the Member States of the European Union are being appreciably supported by the implementation of information and communication technologies (ICT). These processes, envisioned as early as the 1960s, when Peter Drucker predicted in his book *The Age of Discontinuity* (Drucker, 1969) that "industrial-based economy will be superseded by a knowledge economy", currently permeate the entire society of the economically advanced world. At present, since the importance of ICT for the functioning of society is considerable, their overall impact on the economy and the social processes is momentous. Concepts of an information society as such are being further developed, for example, by Frank Webster (1994), who contemplates contemporary society from the perspective of five categories – technological, economic, professional, territorial, and

cultural. It is not very surprising that two dimensions are most accentuated in today's technically or even technocratically oriented society:

- technological (use of different information technologies, degree of use of the Internet, number of citizens using ICT in various everyday activities), and
- economic (more precisely, economic-cum-managerial – percentages of profit or GDP expended on investments in or expenditure on ICT, support for certain types of processes through ICT), for the general standard of the Czech economy.

The analysed areas sometimes include the professional sphere, where we deal with both an opportunity and a need to engage a person for a particular job with a certain sum of knowledge, and these considerations then lead to the educational system and required expertise for the performance of certain roles or jobs.

These skilled workers can be classified as ICT professionals. From the statistical point of view and from the perspective of the methodologies for classifications of professions this broad category is usually divided into two sub-categories, namely ICT Specialists and ICT Technicians. People working in the professions included in the category of ICT Specialists are the main force in the development of new applications (software and entire information systems), while workers in the categories of professions covered by the concept of ICT Technicians primarily provide support for the operation of information systems and communication and telecommunications systems.

The first feature of the advancement of an economy, but also its dependence on ICT, is the number of these specialists in the economy. The development of their number and their structure determines the development of information society in countries and regions (Doucek, 2009). As demonstrated by scientific studies, ICT penetration of the economy has resulted in growth of labour productivity and hence increased competitiveness of the economy in a global society (Dedrick, Gurbaxani and Kraemer, 2003, Yousefi, 2011, Rojko, Lesjak and Vehovar, 2011, Zelenyuk, 2014, Hančlova et al, 2015). The number of workers, however, must be accompanied by a corresponding structure and quality that is the required body of knowledge and skills (Doucek, Maryska, Novotny, 2015). The structure of workers in the labour market between the professions in turn affects the amount of wages offered to different professions (Marek, 2010, Bilkova, 2015).

2 Research Questions

The paper presents an analysis of the development of wages paid to ICT Professionals in the Czech Republic. This development is analysed by period and by category of ICT Professionals both in nominal wages and real wages adjusted for the effect of inflation. It aims is to show on the example of a small open economy of the Czech Republic how it follows the trends in the development of wages caused by the effects of the economic cycle – growth, crisis, and subsequent recovery of the economy.

3 Methodology and Data Collection

This part of the paper contains information about the origin of the processed data, as well as a classification of occupational groups of ICT Professionals, employing the CZ-ISCO methodology, and a description of the methods and analytical tools that we used for the processing of the results.

ICT Specialists and Technicians

Classification of occupations linked to the expertise required for following them has been developed in the Czech Republic over a relatively long period of about 50 years. In 2011 the Czech Republic switched to the CZ-ISCO methodology, which divides the ICT professions into the following two categories:

- Specialists in the area of information and communication technologies (CZ_ISCO 25), and
- Technicians in the area of information and communication technologies (CZ_ISCO 35).

3.1 Specialists in the Area of Information and Communication Technologies – ICT Specialists

Specialists in the area of information and communication technologies (CZ_ISCO 25) – these include professions which in economic practice conduct research, plan, design, write, test, provide advice, and improve ICT systems. These activities are performed in the hardware and software area. The professions are subdivided into the following subcategories:

- **Software and application developers** (CZ_ISCO 251) carry out research, plan, design, create, test, provide advice and improve information technology systems, such as hardware, software, and other applications to meet specific requirements. Occupations in this subcategory are divided into the following professions:
    - 2511 System analysts
    - 2512 Software developers
    - 2513 Web and multimedia developers
    - 2514 Application programmers
    - 2519 Software testing specialists and related professions

  Tasks performed usually include research on the use of information technology in the work of organisations with subsequent optimisation of corporate processes in order to achieve maximum effectiveness and efficiency in the deployment of ICT. Furthermore, research on theoretical aspects and operational methods for the use of computer systems in business practice. Another activity is designing of architecture and business plans for its implementation in specific organisations. In connection with previous activities, the additional responsibilities include the design, development, testing and maintenance of software for specific requirements and evaluating their performance.
- **Specialists in the area of databases and computer networks** (CZ_ISCO 252) design, develop, supervise and support the operation and optimal performance and security of information technology systems and infrastructure, including databases, hardware and software, computer networks and operating systems. Occupations in this subcategory are divided into the following professions:
    - 2521 Database designers and administrators
    - 2522 System administrators, computer network administrators
    - 2523 Computer network specialists (except administrators)
    - 2529 Data security specialists and related professions

  Tasks performed usually include design and development of data models, database architecture, data structures, dictionaries and naming conventions for information system projects. Furthermore, activities associated with the design, implementation and testing of database management systems. Design and development of policies to manage data and their safety and their documentation. As part of their duties they are involved in the design of business architecture and design of complex systems and their data models and diagrams in the development, configuration and integration of

computer systems. They participate in the maintenance and management of computer networks and related computing environments.

3.2 Technicians in the Area of Information and Communication Technologies – ICT Technicians

Technicians in the area of information and communication technologies (classification CZ–ISCO 35) provide support for the operations of computer and communications systems and computer networks. They also perform technical tasks related to telecommunications, broadcasting video, audio and other types of telecommunication signals on land, at sea or in the air. The professions are subdivided into the following subcategories:

- **Technicians in the area of information and communication technologies and related professions** (CZ_ISCO 351) provide support for routine operation of communication systems, computer systems and networks and provide technical assistance to users. Occupations in this subcategory are divided into the following professions:
    - 3511 Technicians operating information and communication technologies,
    - 3512 User-support technicians using information and communication technologies,
    - 3513 Computer network and system technicians,
    - 3514 Web administrators.

  Tasks performed usually include the operation and control of peripheral devices, including insertion of ICT materials in them and monitoring systems to detect faults and defects in their functioning. Their duties include the provision of service desk support as well as installation and repair of hardware, software or computer peripherals, supervision of the operation of systems and evaluation of their performance.
- Technicians in telecommunications and broadcasting (CZ_ISCO 351) control technical functioning of equipment for recording and editing images and sound and for transmitting radio and television broadcasts, video and audio, and other types of telecommunication signals on land, at sea and in the air, and they perform technical tasks related research in telecommunications engineering and design, manufacturing, assembly, construction, operation, maintenance and repair of telecommunications systems. Occupations in this subcategory are divided into the following professions:
    - 3521 Technicians in the area of broadcasting and audio-visual recordings,
    - 3522 Technicians in the area of telecommunications and radio communications.

  Tasks performed usually include control of equipment for audio recording, editing and mixing video and audio recordings. They are also responsible for inspection and maintenance of transmission and broadcast systems and satellite systems for radio and television programmes, radio communication systems, satellite services. Their activities also include provision of technical support related to research and development of telecommunications equipment and testing of prototypes, technical supervision of the manufacture, use, maintenance and repair of telecommunications systems.

3.3 Collection and Analysis of Data

The source data were supplied by the Czech Statistical Office (CZSO) for the evolution of the share of ICT Professionals in the Czech economy and determination of the annual inflation rate after deducting it from the nominal wages. In the research and analysis of the amounts of gross wages of ICT professionals in the Czech economy We employed the methodology for

classification of professions CZ ISCO, which is also administered by the Czech Statistical Office.

The main source of data for the purposes of this article was 'Labour Force Sample Survey', which is conducted every year by the firm Trexima for the Ministry of Labour and Social Affairs of the Czech Republic. The data consist of responses from approximately 1,900,000 economic operators active in the territory of the Czech Republic. Of these workers, approximately 19,000 were ICT Professionals. The trends were analysed for three periods: a period of economic boom in 2000 – 2008, a period of crisis 2009 – 2011, and a period of intended revitalisation of the economy in the years 2012 – 2014.

We processed the collected data using tools and statistical functions of MS Excel to analyse the time series. To approximate the evolution of the wages We used the linear regression method together with the method of least squares. The use of the linear regression method was based on an approximation of the linear function with the general formula 'y= ax+b', where constant 'a' represents the linear estimate line – the calculated development trend in the period under review. We performed all the regression analysis calculations with a 5% probability threshold. Annual Inflation rate in the Czech Republic is in following Table 1.

Variable %/Year	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**
Annual Inflation Rate	3.9	4.7	1.8	0.1	2.8	1.9	2.5	2.8	6.3	1.0	1.5	1.9	3.3	1.4	0.4

Table 1: Average Inflation Rate

4 Results

During the period under review the Czech Republic has gone a long way from centrally controlled economy, through transition economy to today's form of a relatively developed economy of a Member State of the European Union. These changes were manifested, inter alia, by the degree of its involvement in the computerisation of the European Union, not only with the spectrum of services offered and links to the central structures, but also the number of professionals working in ICT. Figure 1 shows the evolution of the number of ICT professionals and their share in the total number of all employees in the Czech Republic. The development of the structure of this sample is shown in following Fig 2.

4.1 Development of the Share of ICT Workers and their Structure

In 2013, the number of ICT Professionals equalled 148,000 active workers, including **13,300 women and 134,700 men**. They worked in practically all sectors of the economy, in particular in the ICT sector and in the financial and telecommunications sector. The current trend is a constant increase in their absolute numbers and also, their increasing share in the number of all employees in the Czech Republic. This trend typifies all advanced countries, but also countries transitioning from planned to market economy.

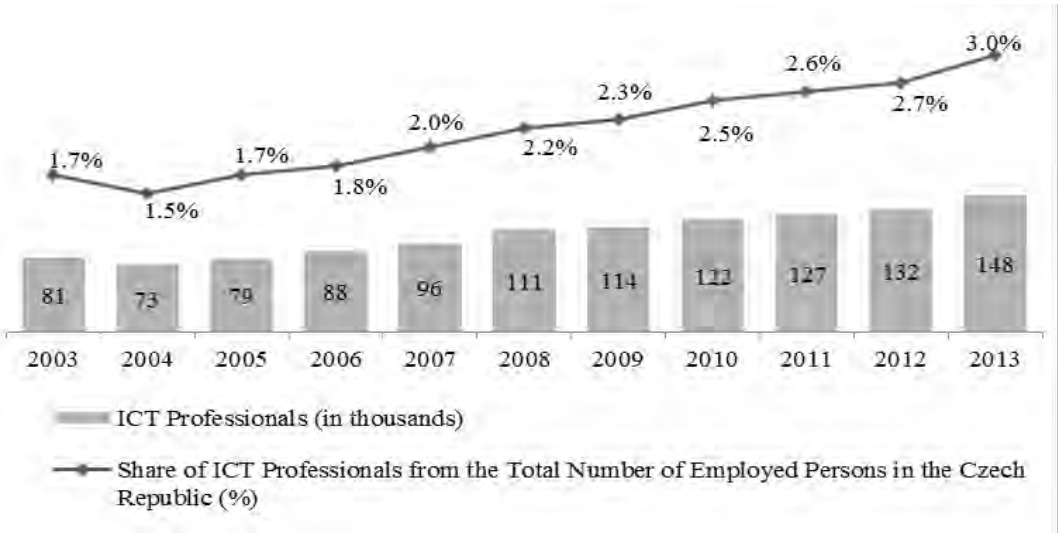

Figure 1: Ratio Between the Number of ICT Professionals and the Total Number of Workers in the Czech Republic (Source: CZSO, 2014)

4.2 Structure ICT Specialists, ICT Technicians

Another perspective for looking at ICT Professionals in the Czech economy is their structure, which is shown by gender and major occupational groups in following Figure 2.

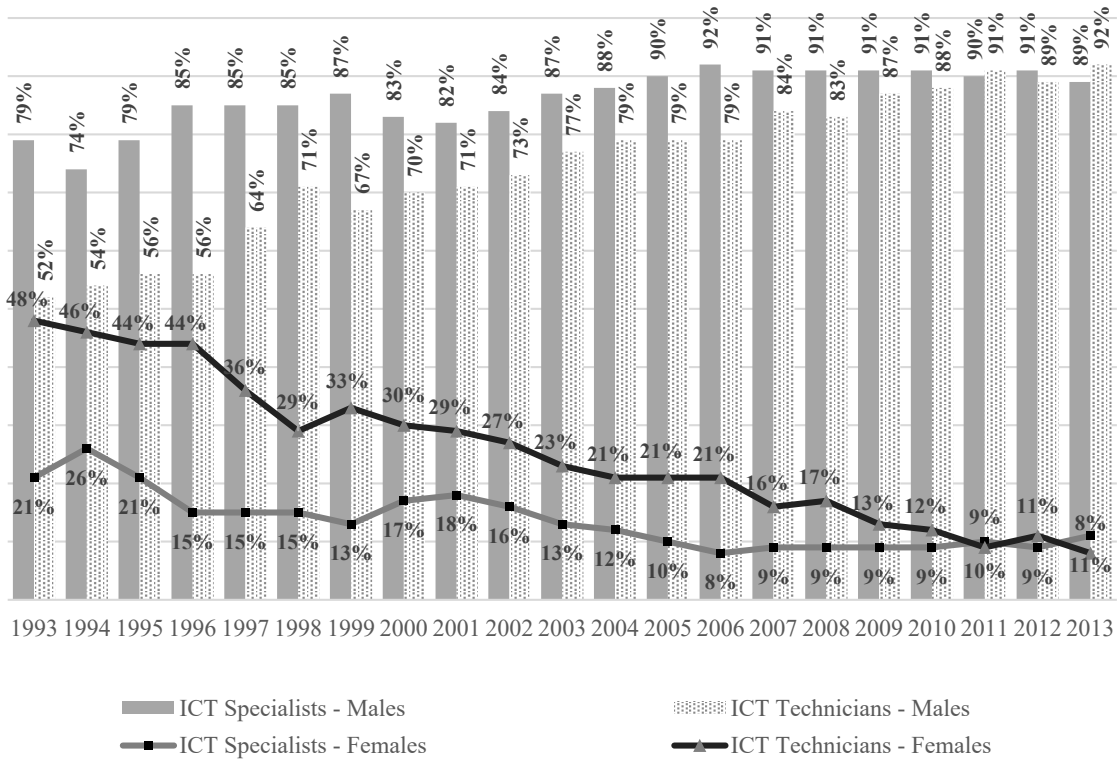

Figure 2: Share of ICT Professionals by Gender and Group of Profession

It shows males in ICT are becoming markedly dominant and it highlights the obvious decline in the number of women in both groups of professions. In recent years, the decline in the number of women has continued, particularly among ICT Technicians, which is understandable in view of the technical nature of the professions, while for ICT Specialists the decline has come to a halt and there has even been between 2012 and 2013 an annual increase of 2 percentage points.

The decline of women in the occupational group of ICT Specialists was probably caused by a combination of the following factors:

- uneven workload of teams doing project work; the workload is irregular for most employers, it is not adequately compensated financially and does not allow for regular care of the family,
- Women's wages are lower than those received by men employed in ICT professions; Here we analysed a comparison between women and men's wages in the Czech ICT fields and found that men's wages are about 20% higher than women's,
- Demands for permanent education in the sector (changing technology, work processes and methodologies); hence it is more difficult for women after maternal leave to return to the profession of 'ICT Specialist';

Yet, it has been proven by Oskrdal and Jelínková (2010) that female ICT specialists are important mainly in project management and in soft based activities in ICT oriented jobs.

4.3 Evolution of the economic cycle and evolution of nominal wages

The evolution of the wages presented in the following sections of the article is given in euros. This fact left its mark throughout the period under review as the Czech crown exchange rate was constant and therefore some excesses in respect of the euro against the Czech crown are reflected in the conclusions of the analysis.

Analysis of Nominal Wages

Evolution of nominal wages throughout the period under review (2000 - 2014) is shown in following Figure 3.

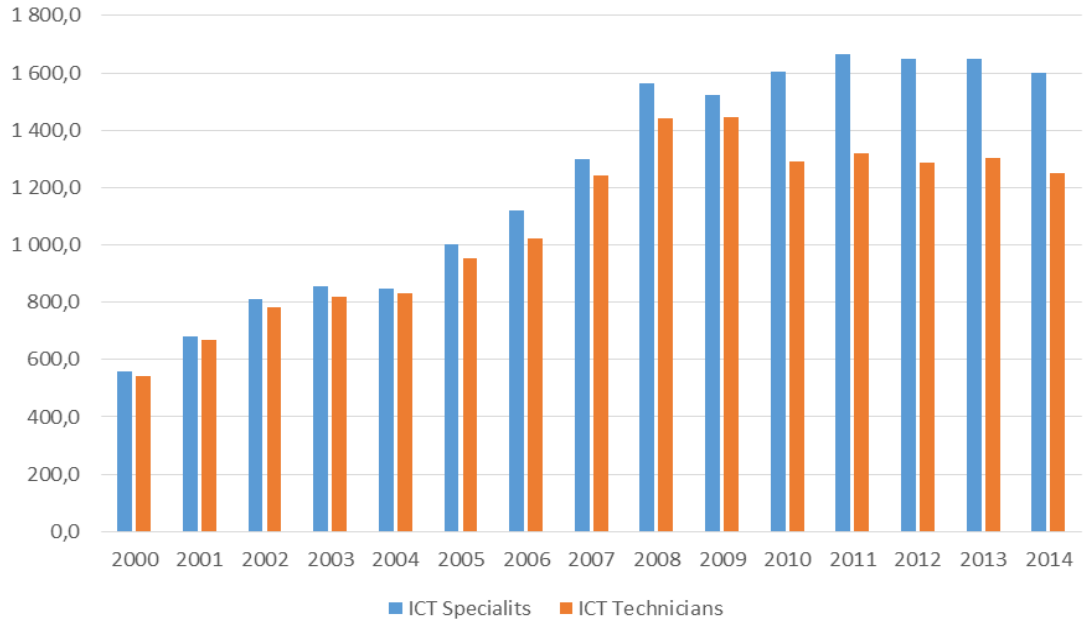

Figure 3: Evolution of Nominal Wages of ICT Professionals

Following Table 2 shows the results of the regression analysis which we applied to the three parts of the economic cycle as they appeared in the Czech economy.

Period/ Group of Jobs	ICT Specialists	ICT Technicians
Boom 2000-2008	$y = 110.56x + 417.98$ $R^2 = 0.9286$	$y = 99.097x + 427.03$ $R^2 = 0.93$
Crisis 2008 – 2011	$y = 38.462x + 1493.4$ $R^2 = 0.6887$	$y = -52.222x + 1506$ $R^2 = 0.694$
Recovery 2011- 2014	$y = -19.527x + 1689.5$ $R^2 = 0.7604$	$y = -19.521x + 1339.1$ $R^2 = 0.7061$
The Whole Period	$y = 86.743x + 534.76$ $R^2 = 0.916$	$y = 57.468x + 620.3$ $R^2 = 0.7613$

Table 2: Analysis of the evolution of nominal wages by period of economic cycle

The entire period under review was characterised by wages growth, where growth in wages was higher in the category of ICT Specialists than that of ICT Technicians. This difference is a factor of 1.5 for the entire period under review - the growth rate (the proportion between the first function derivatives) is for ICT Specialists 1.5 times higher than that of ICT Technicians. The situation is different in the boom period (2000-2008) when both occupational group exhibit relatively fast growth in wages. Both lines have practically same constant (the same default values) and the growth rate is only 1.115 in favour of ICT Specialists. Thus, the conclusion of the comparison of the first derivative of approximation functions indicates that the wages grew similarly for ICT Specialists and ICT Technicians. The rise in the wages is also marked by virtually permanent appreciation of the local currency against the euro, the annual average strengthening of the local currency was 4.65% per annum.

Period of Crisis (2008-2011) is marked by completely different trends in both groups of professions. While wages for ICT Specialists are still growing, among ICT Technicians they have a downward trend. Both approximate estimates are made with very similar reliability (0.6887 - 0.694 ICT Specialists and ICT Technicians). For ICT Technicians, this trend is caused by a deep wage decline in 2010, while ICT Specialists' wages fell slightly in 2009, and then continued to grow. This growth was three times slower than during the economic boom. Exchange rate fluctuations had minimal impact on the development of the nominal wages because average annual appreciation was measured at 0.58%.

Period of recovery (2011-2014) is characterised by decreases in the wages of ICT Specialists and ICT Technicians. The approximate directive line has practically the same decline slope (19.527 for ICT Specialists and 19.521 for ICT Technicians). Therefore, the wages declined equally in both categories. The decline is due to a significant degree to depreciation of the local currency by approximately 3.7% per annum. This is the largest decline measured in 2014, when the rate dropped by 5.7% on the previous year.

Analysis of Real Wages

Real wages differ from wages adjusted nominally for the impact of inflation. The statistically determined mean annual rate of inflation in the Czech Republic is shown in Table 1. Inclusion of inflation in the entire period under review is shown in Figure 4.

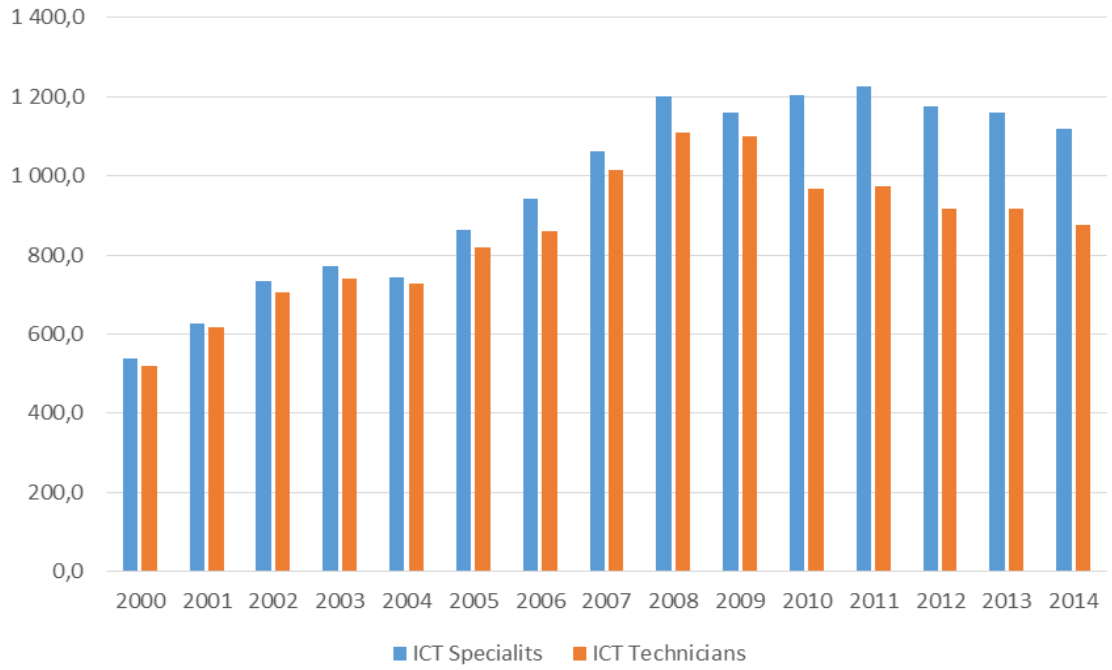

Figure 4: Evolution of Real Wages of ICT Professionals

This overall view represents the overall trend of sustained long-term growth in wages throughout the period under review (for ICT Specialists the reliability is 0.9437, for ICT Technicians it is 0.9423). However, this global view is deceptive, as shown by the partial analyses shown in Table 3.

Period/ Group of Jobs	***ICT Specialists***	***ICT Technicians***
Boom 2000-2008	y = 48.34x + 581.41 R^2 =0.8352	y = 27.862x + 634.62R^2 =0.5333
Crisis 2008 – 2011	y = 11.304x + 1169.7 R^2 =0.2946	y = -54.503x + 1174 R^2 =0.8139
Recovery 2011- 2014	y = -33.334x + 1253 R^2 =0.9648	y = -29.249x + 993.02 R^2 =0.896
The Whole Period	y = 74.484x + 458.48 R^2 =0.9437	y = 65.765x + 461.64 R^2 =0.9423

Table 3: Analysis of Evolution of Nominal Wages by Period of Economic Cycle:

For the period of **economic boom**, the difference in the coefficient between ICT Technicians and ICT Specialists increased to 1.13. Also, the reliability of the wage growth of ICT Technicians changed to 0.53, which is a significant decline compared to the inclusion of the adjustment for the effect of inflation. Thus, growth in wages are not so certain in the longer term.

For the period of **economic crisis**, it is essential that the decline in the wages of ICT Technicians has a reliability of 0.8139, while the growth of ICT Specialists is only with reliability of 0.2946. This significant decline in reliability is caused by a sharp decline in wages in 2010.

The **period of recovery** is typified by a decline in wages in both categories with reliability of 0.94 in virtually both categories. The effect of inflation was also reflected in the expansion of scissors in wages decline where for ICT Technicians the decline in wages is higher in comparison to the situation without taking into account the impact of inflation.

5 Conclusions

The overall conclusions are divided into categories by the economic cycle. For each period, the conclusions are as follows:

- The period of boom is characterised by the growth of wages in both categories of ICT Professionals. The reliability of the estimate is excluding the impact of inflation at around 0.92, which is very high. After taking inflation into account, the reliability of the estimate decreased development particularly in ICT Technicians no value to 0.53. Still, it can be stated that the period of boom feature highly wages growth in selected categories. In the period, the average annual inflation rate was 2.97%.
- In the period of crisis the trends in the behaviour of both groups diverge significantly. While wages of ICT Specialists show a moderate upward trend (reliability excluding inflation - 0.6889, but 0.2946 if the inflation rate is taken into account). The trend in the wages of ICT Technicians is downward – excluding inflation the reliability of the estimate is 0.694 and after taking into account inflation rate the reliability is even 0.8139. In the period, the average annual inflation rate was 2.67%
- The period of recovery is again identical as regards the development trend. For both categories it is declining. An estimate of the decline in wages excluding the inflation rate was carried out in both categories with reliability of 0.68 – 0.69. After taking into account inflation, the reliability of the estimate increased to 0.94 in both categories. In the period, the average annual inflation rate was 1.75%

In addition to the impact of the economic cycle, a significant impact of exchange rate fluctuations was manifested between the local currency and the euro. In the period of boom there was a strengthening of the local currency against the euro causing an increase in the wages. The period of crisis was characterised by oscillations of the exchange rate between the values of CZK 24 to CZK 26 per euro. During the period of recovery, a gradual weakening of the local currency to the level of 2007 deepened the characteristics of the trends identified in each period.

Acknowledgement

Paper was processed with contribution of long term institutional support of research activities by Faculty of Informatics and Statistics, University of Economics, Prague.

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35th International Conference on Organizational Science Development
March 16th – 18th 2016, Portorož, Slovenia

Using the "Big Data" and Real-Time Support Systems in the Municipal Management

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Abstract
Nowadays in most municipalities resources are limited, so that, public sector management looks for a proper management balance between people, statistics and investment. Different approaches and isolate events have been under development to support the implementation of smart urban technologies, e.g. data driven-decision tools. This article seeks to explore the real bases of a communicative/decision tool that let's cities management staff (Main system and subsystems managers levels) to accomplish two specific challenges: a) real time public procurement and b) real time performance monitoring. At the end, all these initiatives, applied in the cities, are looking for smart solutions transformation into modern municipalities and of course, in accordance with each city KPIs (Key Performance Indicators). In the case of smart cities, and in order to reinforce their transparency, open collection and processing of data, an equilibrium is required; economic, commercial, industrial, cultural, etc. Through out big data analytics are leading a process that let local government managers to track, in real time, key parametric and trend results of events occurring in the city, in order for them to act promptly and with the right/best decision. It is clear that these tools developments are quickly evolving and challenging the traditional technologies scenarios for the good of their citizens and urban systems.

Keywords: e-government, big data, real-time, analytics, metrics, local government

1 Introduction

Numerous municipalities can be counted as century-old, with old administrative structures, management methods obsolete, limited resources, budgetary constraints and with a remarkable functioning independence, which reinforces a lack of cooperation between their agencies and / or departments (subsystems) (United Nations Department of Economic and Social Affairs, 2012). While on the other hand, its citizens have little sense that they can play a role in the transformation of their cities, in general, it can be said as well that citizens, whose trust in government is at an all time low, are also becoming more and more versed in new technologies. This has been leaving both actors, public employees and citizens, in a cycle of inefficiency and frustration regarding the solution of problems generated in the inner functioning of the city (United Nations Department of Economic and Social Affairs, 2007).

Against this background, nothing encouraging, it is pertinent to rethink the model of governance or at least in a packaging of measures that permits the empowerment of their citizens and the public government employees, grouped into their different subsystems, that encourage their interaction and improves their efficiency. Taking note of this, several local governments had been implementing some tools in order to improve its internal function and the experience's interaction with their citizens via the so-called "the Electronic Government" (e-gov) (Jeong, 2007) and also "the Open Government" (Attard, 2015), allowing to do some public procedures such as license applications, municipal office and healthcare appointments, taxes related, public procurement information, audio/video presentations, etc. (Kaylor, 2001), this has been perhaps a mayor advancement, no only for to give more transparency and agility in the government's process, on the citizen's side, but to the government it self, even more as some process had been automatized, this has releasing pressure in the management of several municipal offices and to their agencies (gov-tech, 2005).

Now looking to advance forward the transformation process, local governments have slowly initiate a transformation into a data-driven governments (Niemeijer, 2002) through "Big Data Analytics" (Kitchin, 2014), this implies that cities are being instrumented with digital devices and infrastructure that produce "Big Data". This huge amounts of information stored in information technology systems that process transactions, mine that data across government agencies, and turn it into smart government, that one that can empower residents and municipal employees, foster constructive public engagement, and create local governments that are more transparent, responsive, accountable and cost-effective.

2 Big Data, Analytics and Metrics in the local government

Big Data

Cities hold and have access to a huge data sources and with diverse formats. How ever, they are not taking advantage of this, by converting it into knowledge and actionable intelligence that allow providing relevant information at operational levels, into various local government managers, in order to let them to take informed decisions, that at the end, will improve their responses and performances. Many local governments keep this information in separate systems, and also in isolated departments, which obstructs to have a global operational vision and so that difficult the actions coordination into its various agencies (Perez, 2015).

Figure 1: Components of City, Source: IBM, 2009

If a city does not have a unify view and with integrated events, real-time events or imminent crises cannot be processed and share information quickly, served more effectively and sustainable, and protected citizens or boost economic growth. Many times, it is discovered after an event that enough information was available to advance or even avoided incidents if proper bodies had had appropriate relevant information to coordinate actions; in the following table it is observed the Big Data main generators in the local governments.

Main Area	Big Data Unit Generator
Planning & Management	• Office of the Mayor • Administration & Finance • Advocacy & Strategic Investment • Public Property • Innovation & Technology
Human	• Personal & Labor Relations • Education • Economic Development • Human Services • Public Health • Housing & Neighborhood Development • Public Safety
Infrastructure	• Environmental & Energy Services • Streets, Transportation & Sanitation

Table 1: Big Data main generators. Source: Adopted by Authors

Another generators of Big Data are the citizens themselves, this data comes from everywhere: sensors that capture all kinds of data, posts or comments in social networks or blogs, photos or videos, commercial records transaction, GPS signal mobile phones or cars, etc. The large amount of data generated every day is also accompanied by a great complexity, that make management systems and traditional data processing can not provide the necessary service. The challenges associated with the management of Big Data include capturing, storing, searching, sharing, transferring, analyzing and visualizing them. Some estimates predict data growth up to 50 times

by 2020 (Gantz, 2012), a large amount of data is being generated and is keeping so fast that is flooding the society, and of course the cities. The Big Data It is becoming the next natural resource to exploit; and this represents both a challenge, but also an opportunity for the local governments.

Analytics
Analytics provide a way for organizations to draw on the great quantities of information in their control or available from other sources and to use the data to make better decisions and to create new products and services by means of use of information technology to harness statistics, algorithms, and other tools of mathematics to improve decision-making. In analytics, four discrete stages are identified: (1) collection; (2) integration and analysis; (3) decision-making, and (4) review and revision.

Metrics
As a result of analytics, metrics represent the values as a reflection of the analysis carried out in the data and can be represented in different types such as data lens pages, datasets, charts, maps, calendars, filtered views. As an example, in the following table are showed some propose metrics for local governments.

Main Area	Metric
Planning & Management	• City Budget performance • Mayors performance • Overall city performance
Human	• Call center performance • Satisfaction Survey • Emergency Medical Services response • Fire Department response • Library uses • Permits review
Infrastructure	• Graffiti control • Pothole • Trash recollection • Sidewalk • Street light • Sigh installation • Signal repair • Tree maintenance • Park maintenance

Table 2: Some propose Metrics for local governments. Source: Adopted by Authors

3 The Smart City

Smart City and Big Data
Knowing the importance of automating procedures and harnessing data analytics and in order to advance the city's innovation agenda, data has converted into a crucial part of a Smart City's strategy. In joint with appropriates tools that allow for more agile and sophisticated performance management, Smart Cities are now as interested in measuring outcomes as it is in monitoring activities. Cities must have to conform a data specialized task force group (IT versed) that leverages citywide data to better comprehend the metabolism of the city, searching for correlations

and emerging trends. As a result, this will produce high-level, predictive analytics that result in a more responsive and efficient allocation of city resources.

Key Parameter Indicators (KPIs)
Key Parameter Indicators define sets of values against which to measure. These raw sets of values, which are fed to systems in charge of summarizing the information, are called indicators. Into the Smart City concept these indicators can be visualized as metrics, so that in all the management levels a complete picture can be transmitted obtaining, a unify vision and control of what is going on hour to hour, day to day, etc., in the Table 3 can be observed the most common metrics applicable for Smart Cities.

Components	Features
Smart Mobility	Smart Parking, Fleet Management, Intelligent Transport System, Traffic Management, Community Biking, Electric Vehicles, Infrastructure Smart Taxi
Energy and Environment	Smart Building, Smart Grid And Smart Meters, Smart Urban Lighting, Waste Management, Watering Management, Noise Detection
City Economy	NFC Services, Digital Signage, E-Tourism, Connected Retailer
City Management	Smart City Dashboard, Smart City Operations Center, City Maintenance
Security and e-Health	Video Surveillance, Tele-Health and Tele-Care, Emergency Management

Table 3: Smart City Components, Source: Telefónica Company, 2013

In this way, citizens and non-profit organizations, enabling them to understand the development and progress related with their city, also city service providers, operation and maintenance organizations, can help them to fulfill the tasks of sharing information related to the use of all this processed data analytics in the city, and more over, enables real-time analysis of city life, new modes of urban governance, and provides the raw material for envisioning and enacting more efficient, sustainable, competitive, productive, open and transparent cities.

Citizen engagement
One important aspect, to take into consideration, to engage the citizens is referring to the necessity of using those technologies with the ability to access information in real time. By the other side, it is important to understand that citizens form an important role inside the Smart City concept. Now and as mentioned before, three simple tools are revolutionizing the delivery of city services. The phone, the camera and the GPS, now generally contained in the same device, are putting power into the hands of citizens. For example, free phone app that allows citizens to use their phone's built-in camera and GPS system to take a photo of urban damages such as potholes, graffiti and trash, and report them directly to the city managers; in Figure number 2 can be observed some actuators in the city.

Figure 2: Actuators in the city, source: http://quickhoney.com/

The number of these apps is increasing, as is the areas they cover, when combined with a city Twitter account, forms a similar two-way communication. These platforms alter not only how citizens interface with their government, but how government is structured to serve citizens. By the other side, cities are also turning to phone lines customer service systems to track the resolution of complaints, although this service is no cheap for the local governments are quite effective in order to put a human touch in the process. This kind of public services can be driven, by improving the collection and visualization of valuable customer data, provided by citizens which can be then used as guide for governments' rulemaking, problem solving and resource allocation.

According to several studies, the greatest public value and insights come when governments, through their open data and transparency initiatives, produce usable information that allows meaningful public participation in the delivery of public services. The proliferation of open data sets encourages private sector, nonprofit and interagency use of once locked information for the public good. It also prompts important discussions on data standardization and interoperability as well as around privacy concerns.

Real time control system

The structure of real-time control system tool is comprised of data collection, data storage, data process, and operation control. The details of communication and data exchange among these components vary depending on the design. Data storage is mostly facilitated by the database. Data process is designed to process raw data to generate information. In the final stage, operation control is a component wherein a decision is made to manage the metrics. Streamlining data collection though various sources, visualization tools and operation control with data processes are the keys for a successful real time control in the most demanding conditions. One time this is realized, a selection of available visual options help to understand the situation in a friendly a quickly way, as an example, in Figure number 3, can be observed a dashboard denominated as “City Score” in which shows some real time metrics, the red one values are bellow of the values set in their KPIs, and is developed by the city of Boston, and used by the management board.

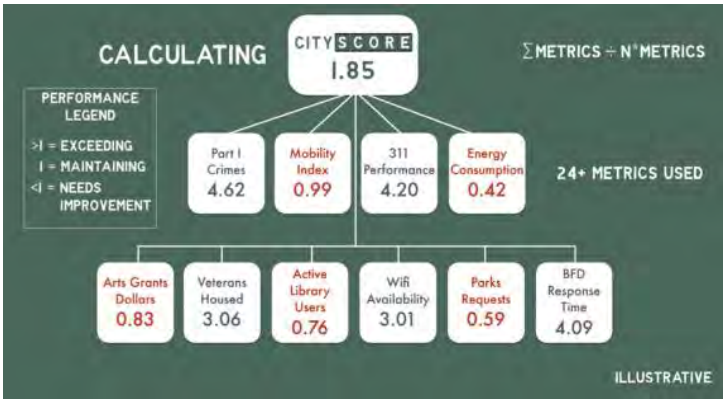

Figure 3: City Score dashboard – Boston's city, source: cityofboston.gov/open/

Now the dashboard concept is spreading through city departments to help managers monitor and track the performance of their agencies.

Implementing Real-time management tool
The missions of a real-time management tool are to give effective support and to grow up and impulse the analytics among the city. To carry out this kind of implementation is necessary to construct capacities and sustainable solutions, a credible analysis, analytics centralize in the user privacy and security.

The support expected in this kind of tools, to empower government operations, that maximizes the impact, among others, are to offer a data bridge between agencies (maximize interaction), risk analysis, preventing analytics (emergencies) and also important is the warranty of "open data" access. Regarding to open data access it is quite important to: 1) to put the data in the web with open license, 2) to put the data on the web as structured data, 3) to use open data formats and standards, 4) to use URIs to identified items, and 5) to link the data with the data from other people. To start a process of transformation towards the empowerment of system and subsystems managers a digital leader is required. This leader must have a clear technological strategy in combination with an organizational culture and focused in to drive the transformation.

4 Conclusions
Although technology is evolving constantly it is evident that in the local governments this evolution is happening at a slow rate. How ever it is clear that when these technologies are applied as an empowerment tool for the public sector employees and the citizens get involved in the process, the efficacy of these king of technologies are proven, through their efficiency and transparency.

Another important point is that in fact the local governments are realizing that their management tools need to evolve more quickly in order for them not to be behind by their own citizens, which are becoming more and more technological versed. Several cases can be found in different places around the world, but very few of them are driven a process that integrated all systems and subsystems, and even more, that integrated their Big Data in the process and in real time.

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35th International Conference on Organizational Science Development
March 16th – 18th 2016, Portorož, Slovenia

The Development of Counties (Regions) and Financial Exclusion: the Example of the Republic of Croatia

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Abstract
In this paper, on the grounds of a few indicators, it was attempted to create an composite indicator compound from some of economic development often used indicators, (GDP per capita, average unemployment rate of all work-capable population (15-64)) and the available indicators which could be used to "define" the financial literacy (the territorial outspread of business units per 1000 inhabitants and the territorial outspread of the bank's cash machine per 1000 inhabitants) for the period between 2010 and 2012 on a county level. Also, the results of the realized financial literacy can be an excellent indicator for the holders of the economic policy, as well as one of the more important indicators in creating the necessary strategies.
The aim of this paper is to depict the differences in the development of regions in the Republic of Croatia, wherein taking into consideration not only the most common economic indicators, but also the available financial indicators for the regional level of the Republic of Croatia. So, the indirect aim is to show the importance of financial involvement and financial literacy for the development of regions and to provide guidelines for ways of influencing the increase of financial involvement and financial literacy. The assumption of higher economic development implicates the existence of a lower level of financial exclusion.

Keywords: financial literacy, financial inclusion, economic development, regional differences

1 Introduction

Frequent changes of modern, thriving economies are usually manifested on the availability of financial services. Certain individuals or social groups have limited access to financial services and, in this case we are speaking of financial exclusion.

The term of financial exclusion can be defined in multiple ways. According to European Commission (2010:5) it is related to deficiency of access to basic banking services. Matić (2010:93; according to Tresaury, 2010) on the other hand, defines financial exclusion in the following way: "Financial exclusion can be defined as a gap between demand and supply of certain social groups on the offer of basic financial services given by the credit institutions."

Leko and Stojanović (2011) see financial exclusion as a result of willingness of profit-oriented banks to increase operational effectiveness and lower the costs. By doing so, certain non-profitable segments of the market are deliberately being neglected and therefore not taking advantage of banking services or using those services less than the average. Financial exclusion is usually connected to areas with high levels of poverty and socially endangered categories of population. Except for the given definitions, we could also include financial exclusion in the following (European Commission 2008:9): „*Financial exclusion refers to a process whereby people encounter difficulties accessing and/or using financial services and products in the mainstream market that are appropriate to their needs and enable them to lead a normal social life in the society in which they belong."*

Financial literacy and financial education in the Republic of Croatia belong to modern terms of official literature defined in the *National strategic framework of consumer's financial literacy from 2015 to 2020.* In the mentioned document terms are understood as *"...systematic and coordinated increase of knowledge and awareness of individual about available financial products and services, managing and planning of personal or family finances, about the importance of savings and numerous other financial terms."* It is stated that financial education becomes more and more important regarding all the complex financial products and services in a thriving and more dynamic financial market. According to OECD (2011:3) financial literacy is defined as: *„A combination of awareness, knowledge, skill, attitude and behavior necessary to make sound financial decisions and ultimately achieve individual financial wellbeing."* The World Bank (2011; according to PACFL, 2008) on the other hand defines it as: *„The ability to use knowledge and skills to manage financial resources effectively for a lifetime of financial well-being."*

Almost all definitions are basically directed towards using available financial services and knowledge in order to achieve financial welfare. It's also important to point out, in accordance to McGraw Hill Financial, that the financial literacy is a critical barrier to financial and economic participation. Because of a lack of knowledge about finances and financial products, many people – especially the poor and women – are not able to access banking and financial services, and are therefore kept out of financial markets. Atkinson and Messy (2012) also speak in favor of deficiency of financial knowledge amongst a sizeable proportion of the population of the countries used in their research, as well as of significant space for improvements in domain of financial behavior. Authors (2012:10) later claim that in most of the countries surveyed, women are less knowledgeable than their male counterparts. During his research, Cvrlje (2014) comes to very similar findings on the level of Republic of Croatia. Specifically, this research shows that females, people with lower or medium level of common education as well as some other groups are found least literate in the financial sense.
The aim of this paper is to present differences in development of regions in the Republic of Croatia, wherein except for the most commonly used economic indicators, some financial indicators are taken into consideration. Therefore, the indirect goal arising is to show the importance of financial inclusion and financial literacy in overall development of the regions, and to try and present a way to increase financial inclusion and financial literacy. The

assumption of lower economic development implicates the existence of higher level of financial exclusion so the purpose is to document specified relation in the Republic of Croatia. The assumption is that investing in financial knowledge is followed by higher level of growth and development. Reached level usually measures development in the certain period wherein documenting the monitoring of development level characterized by the accomplished height of economic development registered in the particular time point.

The paper is structured in five chapters. After the introductory part, second chapter presents basic definitions used in explanation of financial literacy. Third chapter is focused on research analysis by displaying methodological approach and presenting the research results. Fourth chapter includes conclusion remarks with potential recommendations and improvements.

2 Financial literacy and regional development: Term and importance

Vehovec, Rajh and Škerblin Kirbiš (2015) determine the achieved level of financial literacy in the Republic of Croatia, noting that some other indicators, like education, household income and employment status proved more important than regional affiliation. One of the research goals the authors are emphasizing is determining possible differences in financial literacy of citizens. The work of these authors is based on the idea of OECD's research about financial literacy, i.e. survey conducted by the OECD. The mentioned goal of the research will surely be of help in keeping track of existing differences of financial literacy according to chosen and available indicators from 2010 to 2012.

As financial literacy is multidimensional concept, this paper tries to determine one indicator i.e. composite indicator that will refer to achieved level of development in the specific Croatian county, on the basis of basic indicators of economic development (GDP per capita and average unemployment rate of all work-capable population (15-64)) and available indicators of financial literacy (territorial outspread of business units per 1000 inhabitants and territorial outspread of the bank's cash machine per 1000 inhabitants). As it is stated in the OECD's (2008:13) *Handbook on Constructing Composite Indicators: Methodology and User Guide*:*"The composite indicator should ideally measure multidimensional concepts which cannot be captured by a single indicator".* Limitation of the research in this paper is concerned with the lack of available data of financial indicators on the regional level. On the other side, economic chosen indicators in this paper are the one usually very often used as an indicator of achieved economic level (for example, GDP per capita and unemployment rate of all work-capable population). Usually unemployed people are more disenabled to participate in financial and education activities. Thus, unemployed persons are usually also more isolated from certain financial activities and therefore have less possibility to achieve high level of financial literacy. Speaking of financial indicators, in this paper were used financial indicators available on the Croatian county level. Besides this kind of research, questionnaire is another, more often used way of researching of the level of financial literacy.

Certain, already conducted researches by questionnaire speak in favor of extremely low level of financial literacy existence in the Republic of Croatia, i.e. research conducted by the Institute of Economics Zagreb (2015). The research carried out is based on OECD's questionnaire which includes elementary level of financial literacy and can be verified by three components, knowledge, attitudes and behavior. Common knowledge about financial literacy of Croatian citizens is satisfactory according to this research although somewhat lower level of knowledge is noticed in particular applicable knowledge, for example

calculation of the amount of corresponding interests. When observing from the gender point of view, male population proved to be somewhat financially more literate. Criteria of age implicates higher level of financial literacy in older and more educated citizens, while lower levels of financial literacy are more related to those with lower income and education.

Cvrlje (2014) claims that by the effects of financial literacy courses of citizens, improvement of financial well-fare of individuals and households can be reached, adding that almost 40 percent of population in the Republic of Croatia is either completely or to some extent illiterate. Except for that, improvement of overall economic and social conditions in the country is possible by effecting the decrease of poverty, indebtedness, financial exclusion and financial vulnerability of its citizens.

The importance of financial literacy is recognized on the national level, which is evident in the document "*The national strategic frame of financial literacy of consumers for the period from 2015 to 2020*" brought by the government of the Republic of Croatia. Active involvement of economic politics holders in the Republic of Croatia is also seen in conducting researches in the field of financial literacy "Measuring financial literacy" in accordance to methodology of Organization for economic cooperation and development (OECD), which is in process at the moment and which is adopted by conclusion of the Government of Croatia.

The results of composite index calculated on the county level of the Republic of Croatia for three years period, beginning with 2010, are presented below. In the beginning, used methodology is explained and then later, the results achieved with the research.

3 Research analysis

3.1 Methodology

Four relativized variables showing economic development and financial literacy, and creating so-called composite index (composite indicator) are used in the research. Based on the mentioned index it is possible to determine differences which occur between counties, as well as the changes that arise over time. When making the mentioned calculation the existence of certain deviations formed during specificity of collecting information or unavailability of higher number of data for the county level which ensures even higher objectivity of accomplished level of regional economic development and level of financial literacy.

Sources of information are the following: for the information on Gross domestic product per capita data of Bureau of statistics is used – GDP for Croatia, NKPJS – second level and counties for the period of 2000-2012. (ESA 2010), Announcement. Next available indicators: territorial outspread of bank's cash machines, territorial outspread of business units, registered unemployment rate and work-capable population of the county are first taken as separate data and then put in proportion to selected variables. Furthermore, information on territorial outspread of bank's cash machines and territorial outspread of business units are taken from the Bank Bulletin, wherein both data for the City of Zagreb and Zagrebačka County is shown cumulatively, i.e. information for the City of Zagreb and Zagrebačka County was not available separately.

Data for these two specified indicators is shown according to situation in December of observed years, i.e. December of 2010, 2011 and 2012. Data on registered unemployment rate are taken from the Croatian Employment Service and are referring to the average

unemployment rates for the specific years observed. In doing so, available databases on the official webpage of Croatian Employment Service were used, Statistics On-line. Bureau of Statistics, specifically Announcement, was used as a source for data on working contingent (15-64), e.g. announcement number 7.1.4 for the year of 2012. Overall number of residents in the county was obtained from the Bureau of Statistics, Announcement number 7.1.4, taking into consideration that assessments for 2010 were conducted on the basis of 2001 Census, while assessments for 2011 and 2012 were conducted on the basis of 2011 Census.

By using the mentioned sources of data the following relativized variables were obtained: territorial outspread of banks machines in relation to total population (observed on 1000 inhabitants), territorial outspread of business units in relation to total population (observed on 1000 inhabitants), average number of unemployed persons in the county in relation to total work-capable population (15-64), i.e. in relation to working contingent. By using these three relativized variables and already available relativized variable (GDP per capita), and according to available information for 2010, 2011 and 2012, composite indexes for all three specified years were made (Table 1). Therefore, it is possible to monitor changes in specific counties in regard to conditions recorded in 2010 and 2012.

3.2 Research results

To reflect the changes that have taken place by displaying the composite index in counties of the Republic of Croatia during 2010, 2011 and 2012, in extension is displayed table 1.

County	Composite index 2010	Composite index 2011	Composite index 2012
Zagrebačka County	1,2322	1,5914	1,6380
Krapinsko-zagorska County	-0,9046	-0,6992	-0,6206
Sisačko-moslavačka County	-0,2318	-0,0255	0,0874
Karlovačka County	-0,2048	-0,2130	-0,1690
Varaždinska County	-0,5263	-0,4639	-0,4479
Koprivničko-križevačka County	-0,3833	-0,3034	-0,2230
Bjelovarsko-bilogorska County	-0,2067	-0,1969	-0,1983
Primorsko-goranska County	0,2081	0,2999	0,3915
Ličko-senjska County	0,0495	-0,0537	-0,0490
Virovitičko-podravska County	-0,1112	-0,0425	0,0792
Požeško-slavonska County	-0,4405	-0,3214	-0,2446
Brodsko-posavska County	-0,4987	-0,3091	-0,2564
Zadarska County	-0,1004	-0,0597	-0,0215
Osječko-baranjska County	-0,0338	0,0777	0,1035
Šibensko-kninska County	-0,0020	0,0870	0,1825
Vukovarsko-srijemska County	-0,4628	-0,3149	-0,2207
Splitsko-dalmatinska County	-0,1153	0,0489	0,1581
Istarska County	0,2284	0,4875	0,4959
Dubrovačko-neretvanska County	0,3212	0,3311	0,3711
Međimurska County	-0,4603	-0,4440	-0,3164
City of Zagreb	0,7543	0,8296	0,8431

Table 1: Composite index in 2010 2011 and 2012 in county of Republic of Croatia
Source: author's work

Most of the counties have noticed positive movement of composite index if 2010 is taken as a starting year and 2012 as the final year. So, in observed period in Croatian counties there is a positive tendency in almost all counties by chosen variables that are included in the composite index. It is important to emphasize that data for the City of Zagreb and Zagrebačka County were not available separately and that is the reason Zagrebačka County has shown best results.

Highest composite index during 2010 has been recorded in Zagrebačka County (1,2322), followed by City of Zagreb (0,7543), while the lowest composite index has been recorded in Krapinsko-zagorska county (-0,9046). It is important to note that the highest achieved results in Zagrebačka County are probably a consequence of aggregated condition recorded in „Bilten o bankama“, in which data is not recorded individualy for Zagrebačka county but also includes City of Zagreb. Values mentioned include data on territorial outspread of business units and the territorial outspread of the bank's cash machines. Furthermore, when analyzing two variables mentioned aggregate state of territorial outspread of business units and the territorial outspread of the bank's cash machines has been taken into account in relation with real recorded individual data of county population, which surely also has an influence on high results of achieved composite index. For those two indicators data is shown in aggregate and all three years are taken into account when interpreting.

In addition, here is the composite index data for all three observed years according to height of composite index achieved (Table 2).

County	Composite index for 2010	County	Composite index for 2011	County	Composite Index for 2012
Zagrebačka	1,2322	Zagrebačka	1,5914	Zagrebačka	1,6380
Grad Zagreb	0,7543	Grad Zagreb	0,8296	Grad Zagreb	0,8431
Dubrovačko-neretvanska	0,3212	Istarska	0,4875	Istarska	0,4959
Istarska	0,2284	Dubrovačko-neretvanska	0,3311	Primorsko-goranska	0,3915
Primorsko-goranska	0,2081	Primorsko-goranska	0,2999	Dubrovačko-neretvanska	0,3711
Ličko-senjska	0,0495	Šibensko-kninska	0,0870	Šibensko-kninska	0,1825
Šibensko-kninska	-0,0020	Osječko-baranjska	0,0777	Splitsko-dalmatinska	0,1581
Osječko-baranjska	-0,0338	Splitsko-dalmatinska	0,0489	Osječko-baranjska	0,1035
Zadarska	-0,1004	Sisačko-moslavačka	-0,0255	Sisačko-moslavačka	0,0874
Virovitičko-podravska	-0,1112	Virovitičko-podravska	-0,0425	Virovitičko-podravska	0,0792
Splitsko-dalmatinska	-0,1153	Ličko-senjska	-0,0537	Zadarska	-0,0215
Karlovačka	-0,2048	Zadarska	-0,0597	Ličko-senjska	-0,0490
Bjelovarsko-bilogorska	-0,2067	Bjelovarsko-bilogorska	-0,1969	Karlovačka	-0,1690
Sisačko-moslavačka	-0,2318	Karlovačka	-0,2130	Bjelovarsko-bilogorska	-0,1983
Koprivničko-križevačka	-0,3833	Koprivničko-križevačka	-0,3034	Vukovarsko-srijemska	-0,2207
Požeško-slavonska	-0,4405	Brodsko-posavska	-0,3091	Koprivničko-križevačka	-0,2230
Međimurska	-0,4603	Vukovarsko-srijemska	-0,3149	Požeško-slavonska	-0,2446
Vukovarsko-srijemska	-0,4628	Požeško-slavonska	-0,3214	Brodsko-posavska	-0,2564
Brodsko-posavska	-0,4987	Međimurska	-0,4440	Međimurska	-0,3164
Varaždinska	-0,5263	Varaždinska	-0,4639	Varaždinska	-0,4479
Krapinsko-zagorska	-0,9046	Krapinsko-zagorska	-0,6992	Krapinsko-zagorska	-0,6206

Table 2: Rank of counties of Republic of Croatia according to achieved value of composite index in 2010, 2011 and 2012
Source: author's work

During 2011 highest composite index has been recorded in Zagrebačka County (1,5914), followed by City of Zagreb (0,8296), similar to the preceding year. Identical rank of highest achieved composite index remained also in the following year, 2012. The lowest achieved composite indexes were recorded during 2011 in Varaždin County (-0,4639) and in

Krapinsko-zagorska County (-0,6992), and the same counties were at the bottom of rank as well in 2012 with the following values of composite indexes: Varaždin County (-0,4479) and Krapinsko-zagorska County (-0,6206). The highest gap between Croatian counties was recorded during 2011 (2,2906), while in 2010 gap was a bit smaller (2,1368), and in 2012 it was slightly lower than in 2011 (2,2586). However, gap is actually in real something lesser than these evidented, because of such a high results marked for Zagrebačka county. Therefore, the need for careful interpretation is emphasized.

Except the fact that almost all counties recorded a positive trend of composite index changes, according to ranking with respect to the three selected years an increase of achieved composite index is also noted.

4 Conclusion: Recommendations and improvements

There are many ways to increase financial literacy. However, their organization and implementation is necessary and equally important on individual as well as on common levels. Also, policy makers of many countries have recognized the importance of financial literacy and have tried to implement it as a part of their future programs. As one of the "vulnerable" groups at the level of financial literacy are woman and senior citizens, it is necessary to establish specific programs which would ensure financial literacy of certain specified groups.

In addition, there are suggestions that could potentially increase the level of financial literacy:

- Starting the literacy programs focused on all groups affected by the financial illiteracy;
- Creation of educational programs tailored to all school grades starting with earliest school days in the form of programs in which the youngest participants in the school educational program will be able to find out about existing financial services and savings (for instance, visits to different financial institutions and clarification of the content they offer);
- The possibility to attend courses of financial literacy organized by the financial institutions;
- In counties that have extremely low rates of financial literacy should be established financial programs on personal levels, as well as for employees of businesses that could use improvements in their financial knowledge.

Financial services have changed significantly over time, in accordance with changes in the economy on a global level. As stated by certain authors, for instance Lusardi (2008), financial services have become more numerous and more complex and individuals are confronted with new and increasingly sophisticated financial products. Furthermore, the author emphasizes the increasing availability of credit and the possibility of borrowing and thus raises a legitimate question - are certain individuals financially literate enough to make such financial decisions?
Except by formal education programs, financial literacy is also ensured by other sorts of education as well as with experience. Therefore, the recommendation at the individual level is to try and follow the latest product information, fluctuations and credit conditions and about many other products that are offered by financial institutions and that are related to financial products.

Furthermore, financial literacy can be conditioned by socio-demographic characteristics of the environment which person is or grows up. Research which was conducted by Lusardi, Mitchell & Curto (2010) speaks in support of the influence mentioned above and emphasizes the connection between financial literacy and socio-demographic characteristics and family financial situation. Besides, Atkinson and Messy (2012) state that knowledge and behavior

are connected in each country, and the association is usually manifested in a way that people who have more knowledge are likely to exhibit positive financial behavior .
Level of the composite index values achieved at county level of the Republic of Croatia is mostly linked to higher values linked to counties which are the main „regional centres“. Also, in certain examples higher values are linked to counties in which tourism is the dominant economic activity.

It is interesting that there are no special changes in „usual“ rank of achieved height of composite indexes and that in all three years have noted almost an even distribution of county rank according to height of achieved composite index.

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35. mednarodna konferenca o razvoju organizacijskih znanosti
16.–18. marec 2016, Portorož, Slovenija

Sustainable Organization of Knowledge and Skills in the Work Environment: Empirical Evidence of the Slovenes Returning from Abroad

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Povzetek
Članek se osredotoča na identifikacijo ključnih izzivov, s katerimi se soočajo na osebnostnem in profesionalnem področju osebe slovenskega rodu ob povratku iz tujine v Slovenijo. Cilj članka je opredeliti ključna področja, ki so jim predstavljala težavo pri vstopu na trg dela v Sloveniji in prednosti, ki jih njihova integracija v slovensko delovno okolje prinaša za slovensko gospodarstvo. V članku so predstavljeni rezultati kvalitativnega raziskovalnega pristopa. Članek predstavlja možnosti za izdelavo priporočil za čim bolj učinkovito iskanje sinergij med povratniki in zaposlovalci v Sloveniji.

Ključne besede: trg dela, organizacijska kultura, povratne migracije, management sprememb

Abstract
This paper focuses the attention on the identification of the key challenges that people of Slovenian origin are faced with in the field of personal and professional life upon their return to Slovenia. The aim of the paper is to identify the key areas that represent the problem in entering the labor market in Slovenia and the advantages that their integration into the Slovene working environment brings to the Slovenian economy. The article presents the results of a qualitative research approach. The article opens possibilities for making recommendations for the most effective synergies between returnees and employers in Slovenia.

Keywords: labour market, organizational culture, remigration, change management

1 Introduction and theoretical background

Lukšič - Hacin (2010) established that migration studies are interdisciplinary and that there exists a trend towards making them an independent scientific subject. Broad migration policy stays in the jurisdiction of national politics and on the level of EU countries set the guidelines (Lukšič - Hacin, 2005). Cultural differences often serve as an argument for rejecting co-existence or mixing different ethnical groups or individuals (Kralj, 2008). Kralj (2008) found out that Slovene media and political representatives used discriminatory discursive practices in the period of the so called immigration crisis in 2000 to 2001, where the dominant thesis was one in which "slovenianhood" was threatened by the arrival of foreigners ("illegal" immigrants). Different kind of different happens when a Slovenian returns back from abroad. He or she is familiar with Slovene customs; however experiences gained abroad build one's identity and can cause adjustment challenges.

Our research aim is to research how Slovenes returning from abroad feel accepted at the working environment. Therefore, Slovenes returning from abroad are a unique group of individuals to be researched as migration studies usually research foreigners arriving to a new environment, whereas in the case of Slovenians returning from abroad, they have experienced foreign as well as Slovene environment. Specifics exist if they return after studying or working abroad.

Research questions of this paper cover both fields inside of the migration studies and also connect economical and sociological perspectives in its research aim by: (1) researching what happens after the arrival of people into a new environment (Lukšič - Hacin, 2010, p. 9); that is: what do Slovenes returning from abroad experience when they integrate into the Slovene working environment; and (2) researching why people decide to migrate and under what conditions (Lukšič - Hacin, 2010, p. 9), that is: why did people decide to return to Slovenia after years abroad and how they searched and got employment in the Slovene working environment.

Klinar (in Lukšič - Hacin, 2010, p. 10) defines factors of attraction: economic prosperity, raise of standard, higer income, professional promotion, appropriate employment and education. Main reason for moving is the misbalance between existing state and individual wish how it was supposed to be; the larger the misbalance, the higher the probability for migration (Klinar in Lukšič - Hacin, 2010, p. 11). Migration (Klinar in Lukšič - Hacin, 2010, p. 11) entails rational and emotional elements that need to be considered when researching migrations. Lukšič - Hacin (2002) identified three intensive waves of dealing with the returning of emigrants: at the end of the seventies, in the nineties, and at present. Lukšič - Hacin (2002) also states that conditions that define the migration circle of which part are also returned emigrants were not satisfied.

30.000 people moved to Argentina from Slovene ethnic environment after the second half of the 19th century (Žigon, 1999, p. 10) and there is a beyond standard preservation of ethnic identity of Slovene political emigration in Argentina (Žigon, 2001a). After the attainment of independence of Slovenia the "Slovene political emigration came into "contact" with the homeland as it was before "cut" (self-isolated) from the native country" before (Žigon, 2001b, p. 37). That is why an emphasis is given to answer research questions of the paper within the community of people returning from Argentina to Slovenia.

Toplak (2004) established that researchers of remigration, as well as Slovene political and public discourse, looked at different aspects of returning from abroad, however in most cases avoided problematizing life of individuals after their return to the country of origin. Toplak (2004) states that the first and only valid research of remigration of Slovenes was conducted in the second half of the seventies in the previous century. Remigration is connected with difficulties that an individual needs to overcome also with the support of remigration policy (Toplak, 2004). Žitnik (2006a) stresses that due to stereotypes and negative perceptions of Slovenes about immigrants there is a tendency to blend right into the dominant cultural patterns and hide one's uniqueness. In the case of Slovenes returning from abroad their personal identities (Milharčič – Hladnik, 2007) have been created through combining heterogeneous elements from different cultures and environments (Zubrzycki & Maffia, 2003).

2 Purpose and Methodological approach

Qualitative analysis (Bryman, 2004; Colville, Brown & Pye, 2011; Frankfort-Nachmias & Nachmias, 2008; Saunders, Lewis & Thornhill, 2009) of empirical data represents data gathered in the 2015 on the sample of people who answered the open ended questions. We introduce the results, gathered through survey (Čikić, 2002) where The Government Office for Slovenes Abroad, European parliament – Information office in Slovenia (Evropski parlament - Informacijska pisarna v Sloveniji), societies Rafaelova družba, and Slovenija in the world (Slovenija v svetu) helped in identifying key participants - Slovenes who returned from Argentina. Questionnaire was specifically focused on reaching Slovenes returning from Argentina.

Economic discipline traditionally approaches research questions: what explains the tendency to migrate and what are the effects of migrations through hypothesis that incorporation depends upon human capital of immigrants (Lukšič - Hacin, 2010, p. 22) which we expand by adding social capital (consideration of sociological perspective), because we consider the topic of reintegration to be interdisciplinary in its nature.

In order to understand remigration experiences combination of written sources and life stories (Mlekuž, 2006) experiences offers a wide insight into individual remigration experiences from different perspectives (Milharčič - Hladnik, 2005). This way, individuals are no longer considered as uniform group but instead as individuals who in different circumstances accept different personal decisions (Milharčič - Hladnik, 2005). Milharčič - Hladnik (2009) emphasizes the need to research specifics of women in (re)migration processes as their decisions are often connected to their family lives.

3 Results

Argentinian community of Slovenians is very strong in terms of perserving their ethnic identity from the Slovenian cultural point of view. However, these cultural patterns have remained quite rigid: »*These kids stumbel to kindergarten and school with hardly any Spanish word and almost know more about Slovenia than Argentina. And yet, they might acctually never have seen, felt or smelt this country, called Slovenia. They grew up in a culture that is not present around them – acctually it is nowhere to be found any more as it is composed of patterns which their parents brought with them and which stayed conserved for long decades*« (Žigon, 1998, p. 10)

Contact with Slovenia has strengthened after the independence of Slovenia and the wish to see, experience Slovenia rose among younger generations of Slovenians raised in Argentina: »*I love to go to Slovenia to personally see and experience the country about which I so far saw only photos, heard stories about life there or read about it. Yes, there – behind the sea is my second homeland, Slovenia*« (Sandra Jerončič in Žigon, 1998, p. 221).

Some Argentinian Slovenes, however, decided to return to Slovenia, permanently and in this paper the main experiential perception of their return to the labour market in Slovenia is presented. Argentinian Slovenes value the most in Slovene working environment the following chanracteristics: order, relaiability and knowing what to expect in the working environment.

Reasons for employment in Slovenia	**Adjustment and integration to the Slovene working enviornment**	**Value in the Slovene working environment:**
Because of crisis in Argentina in 2001. It repeats each decade. I did not want to experience such economic crises any more.	Process of adaption was very brief, because I came at a time when the company has the most work. Colleagues were all willing to help when I needed anything, so I felt accepted.	Accuracy, being on-time.
I've created a family	I work in education. I also worked in education in Argentina. I lacked some technical terminology and of course to adapt to different situations and habits.	Tidiness; relaxation
My live evolved like this.	I had luck. Before the end of my studies I sent request to the enterprise, where I am currently employed. They invited me for an interview and I passed it successfully. Now I have been working for four years. I had no problems adapting in cultural terms. Problems I had were probably unconnected with the fact that I am from Argentina, but more due to personal reasons.	In Slovenia, people still work quite hard. Diligence has not disappeared from the Slovenian character, even if Yugoslavian spirit did influence it. i perceive less laziness than in Argentina. In Slovenia formal processes are quite common and prevailing: order is important which is not the case in Argentina. I think German countries have even larger emphasis on formalities and processes.
When I moved to Slovenia I was still was still underage.	Somehow I always remain a stranger, thinking differently, otherwise perceiving others. For many people around me, it is often to different. Adaptation is still ongoing.	punctuality, seriousness
I am an entrepreneur, I was not looking for jobs.	Although I went on a couple of job interviews, I didn't get a job through ads, but through an acquaintance. At interviews people were astonished that I speak Slovenian. They were worried about because I am not educated in Slovenia, I do not know the laws, regulations, etc. I got my job through an acquaintance, who took me to his acquaintance. There they told me that they would like to see what I can do and told me to come the next day. They gave me a few things in the process to do and were satisfied with my work. During the integration my biggest help were great bosses that saw potential in me and also in others in the organization. They created a supportive and good working atmosphere.	hardwork; reliability
Because I wanted to stay a little more time here, and to better understand life in Slovenia.	Upon arrival I was underage.	Order; discipline
Because I am Slovenian, born in Argentina. I moved, when Slovenia gained independence.	The process was fast: my colleagues all excepted me positively; Adaptation has been long (in spite of knowledge of the Slovenian language, I needed some time to express exactly what I think, and I did not have the professional vocabulary). This was my first year. Today, after 12 years, it is still noticable that I am a foreigner.	stability
I didn't come to Slovenia due to job, but because of the desire to live in the land of my ancestors. Since I moved to Slovenia, I had to find a job in order to earn a living.	They accepted me quickly, only one conversation was needed. Adapting took a couple of weeks through conversation with colleagues, their advice, observations.	diligence, accuracy, responsibility
I have Slovenian roots	I wasn't looking for a job.	red, diligence, honesty (in some)
Due to the desire to return to the homeland of my ancestors and due to the current crime situation in Argentina.	I had no problems.	conscientiousness
I came to Slovenia for studying that is why employment in Slovenia at the end of the study was logical consequence. It was not my intention to return to Argentina.	They accepted me well, probably because I am a foreigner and because I did not criticize their way of employing (they accepted me, provided only as independent contractor for 8-hour working time). By no means they employ people full time as they directly tell that this is for them a large cost. I do not feel appreciated. During the integration it helped me the most help I had a student status and friendliness of the staff.	Well-organized work

Table 1: Transition from Argentinian to Slovene working environment

Our finding supportes the fact that (re)migration is composed of complex family decisions and is much more than just a consequence of socio-ecoomic and law circumstances (Milharčič – Hladnik, 2007). Returning to Slovenia upon starting a family was identified in young woman participant, stating that life style in Slovenia is more safe and did not want to move her whole family to Argentina. Key differences between Slovene and foreign work environment were identified in terms of: (1) collegial (Argentina) - formal relationship (Slovenia); (2) reliability (Slovenia) –unreability (Argentina); (3) creativity at work (Argentina) – sticking to boss's orders (Slovenia); and (4) easier cooperation (Argentina) – limited willingness to cooperate (Slovenia). The key differences are higlighted with proof quotes:

QUOTE 1: »*Argentinian employees are more resourceful, looking beyond, out of the box. they are therefore less reliable, they are more likely to cheat. Slovene (typical Slovene) keeps his word is reliable, sturdy in a good way*«.

QUOTE 2: »*I don't have a real experience of working in Argentina. Actually not such that would be comparable to what I'm doing now. In Argentina I mostly performed physical works as an apprentice at the time when I was going to high school. My first regular job was in Slovenia. However, I guess that relations are different. Argentines are more relaxed, Slovenes are more retained*«.

QUOTE 3: »*Slovenians are more reliable, stick to the given word. They are also more hypocritical and disput the truth. Argentines are more open, easier to cooperate with. But they are also increasingly unreliable*«.

QUOTE 4: »*Working with the Slovenes is more orderly. Relationship is limited to the working environment – as a co-worker. It is hard to establish a bond outside of the working setting with your co-workers. You mostly talk about work. Slovenes are very closed. You can not get close to them. Work with Argentinians is more relaxed. We also develop friendships. After office hours are a classic (coffee, drinks).«*

QUOTE 5: »*Slovenes are more reliable, but also more competitive*«.

QUOTE 6: »*Slovenes smoke a lot and loose a lot of time on on »smoking-breaks and coffees«. In Argentina, people don't even think about that during working hours. Slovenes stick to the schedule (arrival at work) and to the tasks that they have been ordered. Argentineans are not accurate, regarding arrival to work (strikes, long journeys to work, congestion) but they will remain after work in service, if needed - without protest. Slovenians are obedient and good. They carry out what they are ordered without any (direct) complaining. But usually they complain at home or with colleagues, secretly. Argentineans directly show and tell with strong temperament when they do not like something and give their opinion (which can be a good critic or a new idea)«.*

QUOTE 7: » *The average Slovene: reliable, seeks to adhere to the agreements, does not steal, is trustworthy. The average Argentinean: on the contrary*«.

QUOTE 8: »*Slovenians are more accurate, timely, responsible, and therefore perhaps a little more impatient. Argentines are more resourceful, especially when it seems that there is no*

solution. Argentines know how to be more collegial, and Slovenes, if they have become real friends«.

4 Discussion and conclusion

Chen, Dwyer and Firth (2014a; 2014b) analyze place memory and place expectation which include an individual's past experience and future expectation(s) of individual's attachment to a certain place. «*Attachment has been defined as an affectional bond or tie between an individual and an attachment figure, which is a basic human need for security*« (Bowlby in Chen, Dwyer and Firth, 2014b, p. 829). In the case of Argentinian Slovenes it was demonstrated that the returning generation to Slovenia »lives« Slovenia firstly through the memories of their grandparents and parents.

Argentinian Slovenes demonstrate a large place attachment to Slovenia, it is sometimes nostalgic for the past times, and how it was but also demonstrated in enormous love for the country and development of Slovenia. Chen, Dwyer and Firth (2014b, p. 829) state that »*memorable or life-changing events can also lead to an attachment to a place*« which is especially relevant for our discussion as Argentinian Slovenes have place memory – memories of interaction associated with a place (Chen, Dwyer, & Firth, 2014b, p. 829) strongly connected through relatives in Slovenia, ancestors' storytelling and own experiences during short time visits. »*Place expectation – individual's expectation of the future experiences perceived as likely to occur in a place*« (Chen, Dwyer, & Firth, 2014b, p. 829) are important dimension for the results' analysis as Argentinian Slovenes have often expectations of Slovenia that are very high, mixed with nostalgic stories of their ancestors, therefore when deciding to return to Slovenia this dimensions plays an important role for moving.

In terms of typology of the relationship to place (Chen, 2015) Argentinian Slovenes share narrative, dependent (on work), spiritual (storytelling from their ancestors), ideological relationship to place. In terms of place attachment as the degree of the bond (Chen, 2015) Argentinian Slovenes demonstrate place identity (ancestors' origin), place dependence (finding a way of better living), affective attachment (fondness of the place and history), social bonding (being Slovene is a value of higher order) and natural bonding (admiring natural beauty of the country). Finding a job is an important dimension in place expectation and Argentinian Slovenes are by gaining access to work place in Slovenia enabled to strenghthen the degree of place attachment to Slovenia.

Theoretical implications: We state the implicit employment theories of Slovenes living in Argentina upon returning to Slovenia. *Practical implications:* The study offers recommendations. We empower Slovenes living in Argentina with recent data about professional development in Slovenia by higlighting some of the examples to gain the benefit of their ideas and creativity and establish a learning community of stakeholders.

Methodological recommendation is in line with the research conducted by Čebulj Sajko (2001) where it was identified that autobiographies are essential source of personal interpretation of historical truth and vitaly connected with the identity of the storyteller. For future research we recommend a study conducted with in-depth interviews and gaining autobiographies of Slovenes who have returned back to Slovenia from different countries. Interesting research endavour would also be to investigate the involvement of Slovenes returning from abroad in Slovene cultural life (Žitnik, 2006b). Practical recommendation is in

line with research conducted by Lukšič - Hacin (2002) as our research also demonstrates the neccessity for active state policy that would encourage the returning (including the brain drain).

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ACKNOWLEDGEMENT

We would like to sincerely thank Mr Lenart Rihar (Rafaelova družba), Mr Klemen Žumer, MSc (European parliament – Information office in Slovenia), Mr Boštjan Kocmur (Slovenija v svetu) and Mr Zvone Žigon, PhD (The Government Office for Slovenes Abroad) for their support and help in reaching our survey participants. We also wish to thank to all the participants in our research endeavour for sharing their thoughts and experiences with us.

35th International Conference on Organizational Science Development
March 16th – 18th 2016, Portorož, Slovenia

Postgraduate Students' Attitudes about Sustainable Development Goals: a Case Study of Delphi Method

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Abstract
In the context of growing concern over the sustainability issues, the purpose of this paper is to shine light on the attitudes of postgraduate students about sustainable development, and its 17 urgent goals. The authors chose postgraduate students as an example of educated expert group in order to evaluate their levels of acquired knowledge at the Master studies and to point out the importance of the role of properly formally educated working citizens for the sustainable development of every country. In order to evaluate postgraduate students' attitudes we used the Delphi method. We suggested the usage of the Delphi method, having in mind that a lot of authors agree that this method has high applicability for sustainability foresight, as well having in mind the fact that it is one of the best-known qualitative methods of forecasting in the long run, especially when quantitative methods are not adequate, as it happened when debating on sustainable development, its goals and the possibilities of their achievement. The obtained results of our research have an important role in giving necessary feedback in the process of improving the curriculum of courses that are developed on a wide scale of scientific and practical knowledge of science about sustainable development.

Keywords: sustainable development, sustainable development goals, postgraduate students' attitudes, Delphi method

1 Introduction

Today, the Education for Sustainable Development represents a necessary education to shape a sustainable future. This means that the Education for Sustainable Development must include key sustainable development issues into the curriculum of the subject, with clear goals in order to motivate the student not only to learn, but to change their attitudes, behaviour and take actions for sustainable development (UNESCO, 2016).

In light of the above, the authors of the paper chose to do their research on how environmentally educated students value goals of a new sustainable development agenda.

For the panel group the authors chose postgraduate students enrolled at the Management of Environmental Protection course at the University of Ljubljana – Faculty of Administration, the Republic of Slovenia. For the purpose of this research the authors used the Delphi method for measuring students' attitudes about 17 sustainable development goals

2 Sustainable development and sustainable development goals

Sustainable development (SD) has been discussed extensively in the theoretical literature since the concept was adopted as an overarching goal of economic and social development by UN agencies, by the Agenda 21 nations, and by many local governments and private-sector actors (WCED, 1987). The literature includes many alternative theoretical and applied definitions of sustainable development. The theoretical work spans hundreds of studies that are based on economic theory, complex systems approaches, ecological science and other approaches that derive conditions for how development paths can meet SD criteria (IPCC, 2007).

Several definitions have been presented to describe the principle of sustainable development; the most frequently quoted being the one presented in the Brundtland Report (Brundtland, 1987). According to this report sustainable development is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". It contains within it two key concepts:

- the concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given; and
- the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.

More operational principles of sustainability were presented by the former Chief Economist for the World Bank, Herman E. Daly. These principles are known as Daly's rules and they define the condition of ecological sustainability:

- renewable resources such as fish, soil, and groundwater must be used no faster than the rate at which they regenerate;
- non-renewable resources such as minerals and fossil fuels must be used no faster than renewable substitutes for them can be put into place; and
- pollution and wastes must be emitted no faster than natural systems can absorb them, recycle them, or render them harmless (Smith, 2010).

The General Assembly of the United Nations adopted the new resolution on 25th September of 2015. This resolution is a new sustainable development agenda for the period of 2015-2030: Transforming our world: the 2030 Agenda for Sustainable Development: "The 17 Sustainable Development Goals and 169 targets which we are announcing today demonstrate the scale and ambition of this new universal Agenda. They seek to build on the Millennium Development Goals and complete what they did not achieve. They seek to realize the human rights of all and to achieve gender equality and the empowerment of all women and girls. They are integrated and indivisible and balance the three dimensions of sustainable development: the economic, social and environmental." (UN, 2015)

The 17 Sustainable development goals are (UN, 2015):

- Goal 1: End poverty in all its forms everywhere.
- Goal 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture.
- Goal 3: Ensure healthy lives and promote well-being for all at all ages.
- Goal 4: Ensure inclusive and quality education for all and promote lifelong learning.
- Goal 5: Achieve gender equality and empower all women and girls.
- Goal 6: Ensure access to water and sanitation for all.
- Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all.
- Goal 8: Promote inclusive and sustainable economic growth, employment and decent work for all.
- Goal 9: Build resilient infrastructure, promote sustainable industrialization and foster innovation.
- Goal 10: Reduce inequality within and among countries.
- Goal 11: Make cities inclusive, safe, resilient and sustainable.
- Goal 12: Ensure sustainable consumption and production patterns.
- Goal 13: Take urgent action to combat climate change and its impacts.
- Goal 14: Conserve and sustainably use the oceans, seas and marine resources.
- Goal 15: Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss.
- Goal 16: Promote just, peaceful and inclusive societies.
- Goal 17: Revitalize the global partnership for sustainable development.

3 Delphi method

Technology forecasting in developed countries is a process focused on recognizing critical generic technologies, and most likely it will exert great influence on economic, environmental, and social development in general. However, for underdeveloped and developing countries, the role of technology forecasting is of great importance for identifying technology niches – technology domains in which it is possible to accomplish a competitive position on the world market (Albright, 2002). Technology forecasting began to play an important role in companies' strategic planning, as well as in their race for comparative advantage. Technology forecasts use different methods among which is the Delphi method that presents one of the most widespread methods for intuitive forecasting.

Delphi method is the most commonly known forecasting method that is based on series of written questionnaires with feedback and re-voting (Popper, 2008). There are two participant roles: the design group (sometimes just one person) that makes the questionnaires and the consensus of the expert group, and the expert group – a panel that answers the questionnaires. The members of the panel do not meet face-to-face; they are characterized by three important conditions: anonymity, iteration with controlled feedback, and statistical response. This is not an opinion survey, but rather, a way of systematically finding out and summarizing expert judgment in successive rounds of the Delphi forecasts (Mullen, 2003).

Despite some limitations, it has been recommended that studies employing the Delphi should be continued in order to further refine the technique and to explore its application. The first idea for applying the Delphi method in forecasting events in education came from the article “The Delphi Technique: A Possible Tool for Predicting Future Events in Nursing Education”

by Bramwell L. and Hykawy E. in which the authors have presented the potential use of the Delphi method in this area (Bramwell & Hykawy, 1999). Despite the limitations they indicated, one suggestion supported by the panellist in the study was important, which is of special interest for the society in transition. They have suggested that the Delphi method seemed to have promising application as a tool for teaching people to think and discuss about the future in a more complex way than they ordinarily would.

The Delphi method is one of the best-known qualitative methods of forecasting in the long run, especially when quantitative methods are not adequate. It is applied for forecasting the probability and time of the emergence of future events. In order to give a prognosis, a group of experts identifies and defines the given event, the probability of its development and possible time of future event. Delphi method is also important because of the impartiality of participants bearing in mind that opinions and presumptions of forecasting experts are based on collecting data through polls, i.e. on filling out the questionnaires. Experts fill out questionnaires independently of each other, which gives this method the impartial character when it comes to judgment (Makridakis, Wheelwright, Hyndman & 1998).

The Delphi method is an attractive method for graduate students completing masters and PhD level research. It is a flexible research technique that has been successfully used in our paper to explain Postgraduate Students' Attitudes about Sustainable Development Goals. Delphi studies have been useful in educational settings in forming guidelines, standards, and in predicting trends (Skulmoski & Hartman, 2007). The Delphi method works especially well when the goal is to improve our understanding of problems, opportunities, solutions, or to develop forecasts.

Delphi studies have been useful in educational settings in forming guidelines, standards, and in predicting trends. The Delphi Technique will be useful for educators in developing curricula and learning experiences to prepare our students for future careers. Delphi studies are extremely useful for collecting data from students and alumni regarding the curriculum, and information science trends, and funding (Green, 2014).

4 Postgraduate students' attitudes about sustainable development goals – a case study

For our research we chose the students of the University of Ljubljana – Faculty of Administration, which have in the November of 2014/2015 school year attended the course Management of Environmental Protection, and which joined the research only when they have successfully finished the course.

At this course, a framework and a curriculum for good environmental higher education are developed on a wide scale of scientific and practical knowledge of environmental science and sustainable development as a good benchmark for the adequate improvement of students' knowledge at postgraduate level, as well as a promotion of higher order thinking skills in a cooperative context for learning and evaluation (Petrovic et al., 2014). Having this in mind, the curriculum of this subject accents the following topics: the resources of the Earth, particularly soil, water, minerals, etc., the implications of the resource distribution in determining the nature of societies and the rate and character of economic development, the role of science and technology in the development of societies and the impact of these technologies on environment, cooperative international and national efforts to find solutions

to common global issues, and to implement strategies for a more sustainable future, processes of planning, policy-making and action for sustainability by governments, businesses, non-governmental organizations and the public (NAAEE, 1996; Petrović, 2012; FOS, 2016).

4.1 Methodology

In this paper, we discussed the application of the Delphi method in evaluation of postgraduate students' attitudes about 17 sustainable development goals by using a five point scale (1 – *the most significant*, 2 – *very significant*, 3 – *significant*, 4 – *not so significant*, 5 – *the least significant/insignificant*).

We suggested the use of the Delphi method, having in mind that Bramwell and Hykawy (1999) have suggested that the Delphi method seemed to have promising application as a tool for teaching people to think and discuss about the future in a more complex way than they ordinarily would. It can be concluded that this method has high applicability for sustainability foresight, as well as it is one of the best-known qualitative methods of forecasting in the long run, especially when quantitative methods are not adequate, as it happened in this case.

4.2 Instruments

In order to evaluate the results of the questionnaire, we used statistical analysis for calculation of the arithmetic mean rating, variance and standard deviation:

- Calculation of the arithmetic mean rating (t_n) was made using the following equation :

$$t_n = \frac{1}{n}\sum_{i=1}^{k} f_i \cdot t_i \qquad (1)$$

where k is the number of different rating scores, f_i is a number of experts that evaluated observed item with rating score t_i, and n represents the total number of experts ($n = \sum_{i=1}^{k} f_i$).

- Calculation the variance and standard deviation were made using the following equations:

$$\sigma^2 \quad \frac{1}{n}\sum_{i=1}^{k} f_i t_i^{\,2} - t_n^{\,2} \qquad (2)$$

$$\sigma_n = \sqrt{\sigma_n^2} \qquad (3)$$

where σ_n^2 is variance and σ_n is standard deviation.

4.3 Results and discussion

After calculating the results of students from the first questionnaire, arithmetic mean and variance were calculated. Summarized results of the first questionnaire are given in Table 1. As a significant agreement in responses has been detected, the second round of questioning was not necessary.

No.	Sustainable development goals	Arithmetic mean (t_n)	Variance (σ^2_n)
1.	End poverty in all its forms everywhere	1.47	0.77
2.	End hunger, achieve food security and improved nutrition and promote sustainable agriculture	1.13	0.25
3.	Ensure healthy lives and promote well-being for all at all ages	1.6	0.91
4.	Ensure inclusive and quality education for all and promote lifelong learning	1.93	0.61
5.	Achieve gender equality and empower all women and girls	2.13	0.79
6.	Ensure access to water and sanitation for all	1.13	0.12
7.	Ensure access to affordable, reliable, sustainable and modern energy for all	1.67	0.48
8.	Promote inclusive and sustainable economic growth, employment and decent work for all	1.67	0.48
9.	Build resilient infrastructure, promote sustainable industrialization and foster innovation	2.33	0.90
10.	Reduce inequality within and among countries	2.20	0.96
11.	Make cities inclusive, safe, resilient and sustainable	2	0.67
12.	Ensure sustainable consumption and production patterns	2.27	0.58
13.	Take urgent action to combat climate change and its impacts	1.87	0.50
14.	Conserve and sustainably use the oceans, seas and marine resources	1.67	0.48
15.	Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss	1.73	0.60
16.	Promote just, peaceful and inclusive societies	2.13	0.53
17.	Revitalize the global partnership for sustainable development	2.27	0.58

Table 1: The results of the first questionnaire

Based on the responses gathered, we can conclude that, in the opinion of the respondents, the most important goals of sustainable development are to:

1. Ensure access to water and sanitation for all – with the arithmetic mean of 1.13, and variance of 0.12 which is more than a good mark and shows a fair compliance when it comes to the students' attitude.
2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture – with the arithmetic mean of 1.13, and variance of 0.25 which again shows the same complient attitudes as before.
3. The third place "share" the following goals - to ensure access to affordable, reliable, sustainable and modern energy for all and to promote inclusive and sustainable economic growth, employment and decent work for all and to conserve and sustainably use the oceans, seas and marine resources – with their arithmetic mean being 1.67, their variance 0.48, which are excelent marks and present a fair compliance between the students.

5 Conclusion

The key aim of the research presented in this paper has been to provide an idea of implementing the Delphi method in evaluating postgraduate students' attitudes about sustainable development goals, and proving that the Delphi method could be a good tool for the measurement of environmental education and the education for sustainable development achievements as well.

Gained results from our research pointed out that this kind of use of the Delphi method can provide good results having in mind that the results gathered, not only show a compliance in the students' responses, which speaks of the good background knowledge they gained during their studies at the course of Management of Environmental Protection, but also that the Delphi method can be used for further analysis of the reasons behind their assigning high marks to specific goals of sustainable development, which depicts the image of the students' attitudes towards these goals.

A more in depth analysis of these results demands a larger number of respondents, and not students from only one university, but instead conducting a broader and more detailed research, which should be a possible direction of future research, especially when having in mind that "a basic premise of education for sustainability is that just as there is a wholeness and interdependence to life in all its forms, so must there be a unity and wholeness to efforts to understand it and ensure its continuation" (UNESCO, 2012).

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35. mednarodna konferenca o razvoju organizacijskih znanosti
16.–18. marec 2016, Portorož, Slovenija

Management of Selected Local Public Utilities: a Review of Current Practices

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Abstract
Appropriate management of public utilities is becoming more and more important in terms of insufficient financial resources and at the same time the growing needs of the local population. Especially smaller municipalities are often faced with the problem that they are not large enough or do not have sufficient resources in order to effectively and efficiently perform their tasks. To minimize costs, municipalities manage the delivery of public utilities in different ways, including the outsourcing or privatization of utilities. Inter-municipal cooperation or joint delivery of public utilities is also becoming more and more topical. The purpose of this paper is to provide an overview of existing domestic and foreign practices in terms of the role of management in delivery of selected municipal utilities, for example in the field of water and waste management. The advantages and disadvantages of different forms of providing such public utilities will be shown through literature review, comparative analysis and critical review. In this way good practices could be found, which could be applied also in Slovenia, with an aim to improve the efficiency and effectiveness of selected local public utilities.

Keywords: management, local public utilities, water industry, cross-national comparison

1 Introduction

Municipalities are often confronted with the issue whether to provide public services and utilities on their own or to contract out their delivery. Their decision is based on the characteristics of the service, a set of external constraints and the production alternatives available (Roudriges et al., 2012, p. 618). The contracting out strategy became popular in the public sector in general because of the perception that public sector is less efficient than private sector. It is assumed that with exposing public sector activities to market mechanisms there can be benefits in terms of efficiency and effectiveness (Amagoh, 2009, p. 2). Better productive efficiency through private production can be achieved because the production costs tend to be lower in the private sector. But, private delivery choices involve transaction costs based on the need to mitigate agent opportunism in contractual agreements. At the end,

when total costs are considered, in-house options may even become more efficient options (Roudriges et al., 2012. p. 617).

Efficiency problems with services and utilities delivery are especially exposed in smaller municipalities, which often face the problem that they are not large enough or do not have sufficient resources in order to effectively and efficiently perform their tasks. In this context, amalgamation of municipalities serves as a possible solution, but this process is often not politically feasible. A possible pragmatic solution is inter-municipal cooperation in the performance of certain tasks. With such cooperation they achieve the necessary size and scope of activities, which enables more effective and rational performance of municipal functions (Pevcin & Petkovšek, 2015, p. 2).

2 Management of local public services and utilities

When making decision between different alternatives how to deliver public services and utilities, municipalities consider transaction costs as one of the most important element. Municipalities can choose between in-house production, outsourcing, privatization or inter-municipal cooperation. The most appropriate service delivery mechanism is the one that minimizes the transaction costs of service delivery. It is not enough just to compare the financial costs of the capital invested, personnel, and property costs to justify the chosen alternative mechanisms to deliver public services. Also the costs associated with negotiating, monitoring, and enforcing contracts with external vendors, as transaction costs, have to be taken into consideration. The level of transaction costs and the decision of externalizing the service depend on service complexity, asset specificity and the local political environment (Roudriges et al., 2012. p. 617).

Transaction costs result from bounded rationality and agent opportunism involved in contractual agreements. Bounded rationality is connected to the fact that imperfect contracts are due to the limited rationality of individuals. Such agreements then suffer from necessity of additional costs. The existence of opportunism on the other side is connected to benefits extension that can be carried out by using methods that are not entirely moral or even not legal. Protection against such practice brings additional costs (Jurčík, 2014, pp. 616-617). External delivery choices can therefore bring higher transaction costs and consequently higher total costs, even though it is believed that higher productive efficiency can be achieved through private production because production costs tend to be lower in the private sector (Roudriges et al., 2012. p. 617-618).

To make rational decisions about externalizing the service or utility, municipality has to have the ability to realize and quantify or estimate the size of transaction costs associated with the contract. When estimating the size of transaction costs it is important to take into consideration the costs of municipality and the costs of the private contractor. To achieve maximum effectiveness and efficiency in service delivery, the transaction costs of both sides involved have to be minimized (Jurčík, 2014, pp. 618).

As already noted above, transaction costs are an important element in deciding for service or utility delivery mechanism. Privatization of local services is more common in the provision of services, where transaction costs are not high. Municipalities usually decide for private provision of services or utilities due to higher transaction costs in the municipal in-house local production. In case of privatization the private contractor can optimize the extent of outsourced production by combining production for several municipalities at the same time.

The outsourcer is not limited to one municipality only, and in this way can spread fixed costs more efficiently (Pevcin & Petkovšek, 2015, p. 3).

Privatization of the delivery of local services and utilities is more efficient in bigger municipalities. In smaller municipalities it has proven not to be so efficient choice, because of smaller availability of private contractors which means fewer opportunities for privatization and bigger risk of failure to assure competition. Another reason are transaction costs which can not be reduced much due to the privatization, somethimes they can be even higher with privatization compared to municipal in-house service provision (White et al., 2014, p. 89-90).

Not just in case of smaller municipalities, in general privatization can bring certain disadvantages. One of the disadvatages is the fact that it is not possible to forsee all the events in the future. Particularly, it is possible to have assimetric information. Incompleteness of contracts can be mentioned in this context, meaning that private contractor can trigger the requirements to change the terms of contract, usually with justification of occurrence of external costs. The problem of asymmetric information and incomplete contracts leads to additional costs, and in order to mitigate those costs municipality has to monitor private providers and also renegotiate constantly (Pérard, 2009, p. 11).

Alternative to private provision of municipal services and utilities is inter-municipal cooperation and joint provision of services and utilities. Similar to private provision also inter-municipal cooperation can lower transaction costs and creates economies of scale, while simultaneously enables maintaining service delivery within the public sector. With joint provision of services and utilities municipalities can achieve common goals and solve similar problems and therefore create greater efficiency and effectiveness of provision of these services and utilities. Cooperation is best for services that are indirect if for which regional economies of scale are essential to ensure efficient delivery. And, especially in smaller municipalities, such cooperation provides an appropriate range of local services and utilities, because of the lack of appropriate resources. Inter-municipal cooperation is also seen as a way to create lasting savings, compared to privatization, but that also depends on the structure of local government and on the cost structure of each local service or utility (Bel & Warner, 2014, p. 8; Pevcin & Petkovšek, 2015, p. 4). However, inter-municipal cooperation can also suffer from of potential weaknesses. Among disadvantages we can find possible difficulties in reaching consensus in jointly run organization, regional issues, governance complexity, lack of transparency, accountability problems and policy making costs (Bel & Warner, 2014, p. 10-11).

Inter-municipal cooperation by itself, does not necessary brings efficiency gains. However, to manage the transaction costs of cooperation we need professional management. Policymakers should provide support for professional management and also study the potential economic benefits of cooperation, as well as weaknesses (Kettunen & Teles, 2015, p. 6).

3 Examples of current practices in managing water sector

Water and wastewater utilities are one of the most essential public services, playing a vital role in economic and social development. Governments are responsible for ensuring reliable universal access of services under accountable regulatory frameworks. Especially improved management is a prerequisite for increased efficiency in services delivery, better communication with customers and better self-promotion (Seppälä, 2015, p. 400). Using the

best available technologies and management systems in water provision and improving water allocation mechanisms may gain many benefits in productivity and efficiency (WWAP, 2015, p. 3).

Water utilities can be delivered in a public or private way. Private companies are usually considered as more efficient than public ones. Efficiency of the private ownership usually depends on the ownership, the competition and the regulation. Private ownership would be more efficient than the public one in a fully competitive market. However, usually water and wastewater utilities belong to less competitive markets (Pérard, 2009, p. 6). Also, the theory remains unclear about efficiency gains of private ownership and management of water infrastructure (Pérard, 2009, p. 7).

Municipalities will usually privatize water utilities if the private sector pays a higher concession fee than the present value of expected cash flows the public sector could get from running the activity, and if the private sector pays a concession fee equivalent to the present value of expected cash flows the public sector could get from running the activity, but by proposing a better services ratio than the public sector could offer (Pérard, 2009, p. 12). The following section shows a few examples, how countries are delivering water and wastewater utilities. The cases of Portugal, Germany, United Kingdom and Finland are presented. The selection of countries is based on the idea that several different examples and their experiences should be presented, in order to portray also existing variations in the management of particular local public utility, thus enabling the discussion on potential new modes of organization of the system in Slovenia. Besides, also regional and country size variations are taken into account in this sample, as experiences of both small and big countries, as well as Nordic, Southern, Anglo-Saxon and Central European perspectives are addressed. Finally, an important factor in selection is related to the availability of country-specific data and analysis.

3.1 Portugal

In Portugal the state retained ownership of the water sector. Despite that, the corporate concessionaires assumed control rights over businesses and enjoy a high degree of institutional and budgetary independence. Private management should enhance efficiency of the water sector, as it should be independent from political pressures. In contrast, when having public management, it is usually directly subjected to the political power. Portugal has decided for this process to meet European conditions for accession of European funds (Teles, 2015, p. 12).

In new corporate entities, multi-municipal management forms were introduced for bulk water supply and water waste management for various municipalities. Most of these bulk multi-municipal companies were integrated into holdings, becoming a 51% shareholder of capital for each company, together with municipalities that hold the minority 49% share. Private companies have therefore control of the whole water and waste water provision and in this case municipalities involved are voluntary deprived of control over the bulk water sector, which have handed it to the new multi-municipal corporate entities controlled by the central state through state-owned holding. In return municipalities are assured of needed investments and therefore do not need to incur debt and burden their budgets. On the other hand municipalities retained control over the retail water sector, to define and charge tariffs (Teles, 2015, p. 13).

In 2014 Portugal had 16 multi-municipal companies responsible for the bulk systems in water supply and 19 multi-municipal companies responsible for water waste. All these corporate entities are part of the state-owned holding. These corporate entities cover 71% of Portuguese population in water supply and 67% of population in waste water management. The rest of the population is covered by municipalities that refused the integration into the multi-municipal companies. The created water holding became the largest provider in the Portuguese water sector and it benefits from its corporate structure, financial sophistication and state backing (Teles, 2015, pp. 13-14).

Municipalities that retained corporate control have involved corporate concessionaires in municipal companies, where private capital holds only minority stakes. Such cooperation forms public-private partnerships between municipalities and private companies. There are 29 retail concessions out of three hundred and 80 managing entities and 2 bulk level private concessions at the municipal level out of 16 managing entities. They cover over 13% of the population in the retail sector, mostly located in densely populated areas (Teles, 2015, p. 15).

3.2 Germany

Municipal regulations and the water laws in Germany stipulate that drinking water supply is usually and wastewater disposal is always an obligation of the municipalities. There are different forms of organization of water supply and wastewater disposal implementation as municipalities' own responsibility, which are based on different constitutional provisions of the federal states. One form is ancillary municipal enterprise, where municipality operates within the framework of the general municipal administration. Another form is owner-operated municipal enterprise, where municipality operates as special asset with independent accounting. Further on, the form can be institution under public law, where public utility is economically and legally autonomous. Also autonomous company is possible, where private company cooperates with the municipality as shareholder. And operations management model / operator model / cooperation model / public-private partnership model, where plant operation is transferred to a private operator while the performance of public tasks and sovereign obligations rests with the municipality (Profile of the German Water Sector 2015, 2015, pp. 12, 18).

To make water supply and wastewater disposal more efficient municipalities can cooperate with each other, also in associations. Such cooperation usually takes place on a voluntary basis and can be implemented in the form of special-purpose associations as public corporations, institutions under public law, as joint enterprises of several municipalities, or water associations within the meaning of the federal law on water associations (Profile of the German Water Sector 2015, 2015, p. 18).

There are approximately 6,065 water supply enterprises and utilities in Germany in 2010, which are mainly small ancillary municipal utilities and owner-operated municipal utilities. In 2012 public sector companies accounted for 65% and the private sector companies amount to 35% of all providers. Private sector companies are mostly mixed public-private companies in the form of public limited companies or limited liability companies. In contrast, wastewater disposal is carried out by utilities under public law. The largest share is held by owner-operated municipal utilities as well as special-purpose and water associations (Profile of the German Water Sector 2015, 2015, pp. 31-32).

3.3 The United Kingdom

In the UK the regime of water company regionalization and private ownership has been in place since 1989. There are 26 private water companies providing drinking water in England. In each of Wales, Scotland, and Northern Ireland the services are provided by a single semi-governmental water company. In England, there are nine companies that also provide wastewater services. Several private suppliers regulated by the local authorities also operate across the UK. So, water services are privatized in England and the majority of systems are run by large, regional companies as a for-profit business, while in Wales, Scotland, and Northern Ireland water services are run as non-for-profit, semi-governmental water authorities (Speight, 2015, p. 302).

The UK private water systems were largely municipalized in the urban areas by 1900. Afterwards smaller systems merged and by the mid-1970s there were about 200 municipal water utilities. These municipal companies then merged by river basin area into 10 Regional Water Authorities. These authorities had jurisdiction over all aspects of water management and regulation as well as operation of water and wastewater services. Municipalities were represented on the governing boards of Authorities. In many cases municipalities still operate the systems under contract to the Authorities. The currently operating water companies in the UK, especially those providing both water and wastewater services, are large corporate entities with complex management structures (Speight, 2015, p. 304).

3.4 Finland

In Finland, water supply and wastewater services are managed at four levels: supra-municipal, city and community, small rural systems, and private on-site systems. Municipally run water distribution and sewerage networks were built only in population centers. In contrast, those living in rural areas had to come up with their own water supply and sewerage systems. This means that in rural areas there is a long tradition of private, consumer-owned and managed water systems that operate on a small scale on a non-profit basis. The involvement of the private sector in the production of water services takes place in two forms, either as competitive tendering, where the public sector is required to invite a compulsory tender usually from private enterprises for specific service production; or either as outsourcing, where the public sector contracts the private sector to produce specific services (Kurki, Katko & Pietilä, 2010, p. 816; Pietilä, Katko & Hukka, 2007, pp. 27-28).

Local governments play a very important role in service delivery. Traditionally municipalities are responsible for arranging the services, but they can be produced in different ways. Central government has started providing economic incentives to encourage municipal mergers. There have already been several periods of extensive municipal mergers, which affected the way water and wastewater services are managed. Water and sewage utilities have also promoted supra-municipal collaboration. Supra-municipal cooperation can be implemented as cooperation based on established joint organizations, which can take place under the framework of a company or a municipal regional authority, and as cooperation based on bilateral contracts. In Finland, inter-municipal contractual cooperation between water and wastewater utilities has been practiced for a very long time. The most common form of supra-municipal cooperation is bilateral contract. The number of bilateral contracts has tripled in the past three decades, from 89 in 1975 to 288 in 2006. The number of contracts is increasing especially in wastewater management (Kurki, Katko & Pietilä, 2010, pp. 816-817).

Wastewater treatment has become more centralized due to increased bilateral collaboration and construction of bigger wastewater treatment plants. The concentration process can take place either within a municipality or between municipalities, commonly based on bilateral contracts. Supra-municipal cooperation has been favored by the Finnish Government with aim to improve the efficiency of these systems and their operations. Collaboration in water and wastewater services also preceded cooperation in other services or municipal mergers (Kurki, Katko & Pietilä, 2010, pp. 821, 823).

3.5 Comparison between the selected countries

The selected countries (i.e., Portugal, Germany, the United Kingdom and Finland) have several similarities as well as differences regarding the management of water sector. These similarities and differences are shown in Table 1. Portugal, Germany and the UK manage their water sector on municipal level, so municipalities have the responsibility of ensuring the water supply and wastewater disposal. The exception is Finland, where water sector is managed at four levels: supra-municipal level, city and community, small rural systems, private on-site systems. The implementation of water supply and wastewater disposal is organized in different public, private or mixed forms.

	Portugal	**Germany**	**The UK**	**Finland**
Management of water sector	Municipal level	Municipal level	Municipal level	Supra-municipal level, city and community, small rural systems, private on-site systems
Forms of water utility organization	• Private multi-municipal companies as a part of a state-owned holding; holding is a 51% shareholder, municipalities 49% • Public-private partnership between municipalities and private companies	• Ancillary municipal enterprise • Owner-operated municipal enterprise • Institution under public law • Autonomous company • Public-private partnership • Special-purpose association	• In England – large, regional for-profit companies • In Wales, Scotland, Northern Ireland – semi-governmental not-for-profit water authorities	• Supra-municipal cooperation in a form of joint organizations (a company or a municipal regional authority) • Cooperation based on bilateral contracts • Competitive tendering • Outsourcing
Public/ private entities	• multi-municipal companies covered 71% of population in water	For water supply • 65% public sector companies – mainly small ancillary		• population centers – municipally run water utilities

	supply and 67% of population in waste water management • 13% of population is covered by public-private partnership	municipal enterprises and owner-operated municipal enterprises • 35% private sector companies – mostly mixed public-private companies For wastewater disposal • utilities under public law – owner-operated municipal enterprises and special-purpose or water associations		• rural areas – private, consumer-owned and managed water utilities
Inter-municipal cooperation, municipal mergers	No information in used literature	Cooperation between municipalities on voluntary basis – special-purpose associations (public corporations) and institutions under public law (joint enterprises of several municipalities)	Mergers of smaller municipal water utilities – regional water authorities	Municipal mergers and supra-municipal cooperation – joint organizations (a company or a municipal regional authority) and cooperation based on bilateral contracts

Table 1: Comparison between selected countries in the field of management of water sector

In Portugal most water utilities is managed through private multi-municipal companies as a part of a state-owned holding and a smaller part belongs to public-private partnerships between the municipalities and private companies. In Germany most water utilities are managed through different forms of public sector companies and only smaller share goes to the private sector. If we observe the UK context, England has large, regional for-profit companies managing water utilities, while in Wales, Scotland and Northern Ireland water utilities are managed by semi-governmental not-for-profit water authorities. In Finland water utilities are run by public sector in more populated areas, mostly in the form of joint

organizations in the range of supra-municipal cooperation or cooperation based on bilateral contracts; while in rural areas water utilities are run by private sector, in the forms of competitive tendering and outsourcing. In Germany and Finland we can therefore find inter-municipal cooperation in the field of water utilities, and in the UK there mergers of smaller water utilities took place. Municipal mergers are also promoted in Finland. Cooperation between the municipalities and mergers are done with an aim to improve efficiency of the water supply and wastewater management.

4 Conclusion

Municipalities have to decide whether to provide services and utilities on its own or to externalize their provision to the private contractor. Transaction costs are usually the dominating factor in making decision on the former. Privatization of local services is therefore usually more common in areas where transaction costs are not high. But, it can also happen that a private contractor reduces costs on the expense of service quality. Comparing privatization to inter-municipal cooperation, municipalities can join their capacities and resources and therefore achieve lower transaction costs. This is usually reflected in the desire to achieve common interests and goals of the participating municipalities, which has a positive effect on quality of services, greater efficiency and ability to meet the growing needs of the local population.

Specifically, water utilities can be provided publicly or privately. There is an assumption that private sector is more efficient as public sector, but we have to consider also ownership, competition of the market and regulation. As water sector belongs to a less competitive market, privatization can not necessary bring the highest efficiency gains. The comparison between selected countries in the area of water utilities shows that in general water utilities are managed at the municipal level. In Portugal and in the UK the water utilities are mostly run by private companies, while in Germany and in Finland public sector companies dominate. But also in Germany and Finland we find private forms of organizing and managing water utilities. In the case of Germany and Finland, the great propensity for inter-municipal cooperation exists, with an aim to improve efficiency of service delivery.

The lessons portrayed above can be found very useful also for Slovenia, where water industry is run mostly publicly, as according to IREET (2008) only 5% of water providers are concessionaires and the others are either publicly owned limited liability companies or municipal overhead plants. Moreover, the main assumption that emerged during the period was the paradigm that privatization of utilities is the best policy in order to increase efficiency, and consequently the legal provisions were not set up appropriately to generate sufficient amount of revenues to cover depreciation costs, a problem plaguing predominantly water industry companies (Rakar, 2012). Nonetheless, the evidence presented above indicates that several mixed models of managing water utilities exist in practice, putting alternative perspective on this topic.

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35th International Conference on Organizational Science Development
March 16th – 18th 2016, Portorož, Slovenia

Health Services Utilization in Older Europeans: an Empirical Study

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Abstract
Chronic diseases and associated co-morbidities are highly prevalent among elderly and are associated with an increase in health services utilization which in turn raises health care expenditures throughout industrialized societies. However, health care utilization in elderly is still inadequately understood, particularly regarding the differences among European jurisdictions. In our article, we use dataset of Wave 5 of SHARE survey to study the utilization of health care in older Europeans in 15 European countries. We investigate relationships between factors such as age, gender, income, education and health variables and the utilization of various types of health services. We apply regression modeling to study the determinants of health utilization (different socioeconomic and health variables) of older people. We show some significant differences between determinants of health utilization in terms of probability and frequency of usage. We also explore patterns between welfare regimes, taking Eastern European jurisdictions as a reference category. Finally, we show that provision of formal and/or informal homecare serves as a complement to utilization of health care services. Results of our article are important for the management of health care facilities in terms of health care usage by older people, and can be of value to health care providers and policy makers in the field.

Keywords: health utilization, older people, SHARE, determinants, health care expenditures, welfare regimes

JEL classification: I10, I12, I18, J14, C31

1 Introduction

Chronic diseases and associated co-morbidities are highly prevalent among elderly and are associated with an increase in health services utilization which in turn raises health care expenditures throughout industrialized societies. It has been widely recognized that health care service utilization among elderly depends on many factors. However, it is important to realize that older people in their consumption of health care services are not a homogeneous group as they may be particularly exposed to personal income and social inequalities. To better understand the factors that influence the use of health care resources among the elderly in 15 European countries, we use data from the fifth wave of European research on health, the process of aging and retirement in Europe, SHARE (Survey of Health, Ageing and Retirement in Europe)1. The data collected by the SHARE survey are particularly useful due to their multidisciplinary nature since they allow us to get a better insight into determinants of health services utilization of the older people which is – among others – important for future decisions in the field. Furthermore, we show that long-term care provision for older people acts as a complement to usage of institutional health care facilities which is important information for policy purposes, as the reforms of long-term and health care are under way in Slovenia and several other European countries.

2 Short literature review

In our study, we use Andersen's behavioral model of health service utilization (Andersen 1968; 1995; Andersen & Newman 1973) which is "a flexible framework that enables the study and selection of useful determinants of healthcare utilization" (Saeed, Oduro, Ebenezer & Zhao 2012). The model proposes that a sequence of factors influences the use of healthcare services. These determinants are categorized into three broad areas, namely predisposing factors (e.g. age, gender and educational level), enabling factors (e.g. income, settlement and availability of informal providers of long-term care) that influence ability of individuals to utilize services and need factors such a functional restriction and chronic disease that makes it essential to use health service (Willis et al. 2007).

The model we use is an Andersen's "initial" one, originating in the 1960's, not taking into account the possible recursive nature and reverse causality in the model (see Andersen 1995). Its structure is visualized in Figure 1. As stated by Andersen (ibid: 1-2): "the model suggests an explanatory process or causal ordering where the predisposing factors might be exogenous (especially the demographic and social structure), some enabling resources are necessary but not sufficient conditions for use, and some need must be defined for use to actually take place". We, therefore, do not establish an explicit causal structure in the sense of causal inference (see e.g. Pearl 2009; Morgan & Winship 2007) but test the interrelationships/correlations in the model.

1 This paper uses data from SHARE Wave 5 (DOI: 10.6103/SHARE.w5.100), see Börsch-Supan et al. (2013) for methodological details. The SHARE data collection has been primarily funded by the European Commission through FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARELIFE: CIT4-CT-2006-028812) and FP7 (SHARE-PREP: N°211909, SHARE-LEAP: N°227822, SHARE M4: N°261982). Additional funding from the German Ministry of Education and Research, the U.S. National Institute on Aging (U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04-064) and from various national funding sources is gratefully acknowledged (see www.share-project.org).

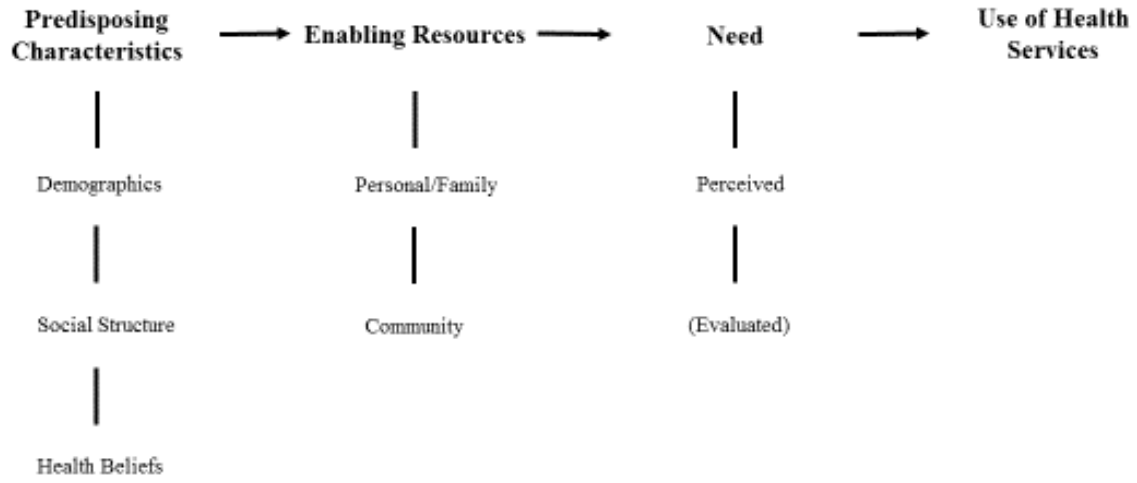

Figure 1: The structure of the Andersen's "initial" behavioral model. Based on: Andersen (1995).

In their seminal study, Santos-Eggimann et al. (2005) have corroborated the notion that high level of health care utilization is correlated with an old age, the exception being the oldest age group (85+), which has for most part a lower utilization than younger age groups. They have also indicated that "women reported significantly more medical consultations and more medications than men" (ibid.: 139) and that "there is a strong relationship between the level of education and several, but not all, indicators of health services utilization in Europe" (ibid. 2005: 139). Also, van Doorslaer, Koolman and Jones (2003), present new international comparative evidence on the factors driving inequalities in the use of general practitioner (GP) and specialist services in 12 EU member states. They find little or no evidence of income-related inequity in the probability of a GP visit in these countries. Conditional upon at least one visit, they even find evidence of a "pro-poor" distribution. By contrast, substantial "pro-rich" inequity emerges in virtually every country with respect to the probability of contacting a medical specialist. Despite their lower needs for such care, wealthier and higher educated individuals appear to be much more likely to see a specialist than those individuals who are less well-off.

In our study, we advance the methodology of Santos-Eggimann et al. (2005) by employing regression methods. Based on these methods, we are also able to make advancement in studying relationship between long-term care of elderly and health care utilization from an economical perspective, studying whether these two important variables complement or substitute each other.

3 Data and method

Bivariate and regression analyses are applied to cross-sectional database of Wave 5 of the Survey of Health, Ageing and Retirement in Europe (SHARE) (see Börsch-Supan 2015). We limit the respondents to only those aged 50 years or more (for more details, see Börsch-Supan et al. 2015; Malter & Börsch-Supan 2015; Börsch-Supan et al. 2013). Bivariate tests use t and F statistic to test the statistically significant difference between individual covariates, influencing health care utilization of the older people. The regression methods we use are Poisson for the dependent variables of count nature (nr. of medical visits, nr. of taken medications, nr. of hospitalizations) and probit for the dependent variable of binary nature

(probability of hospitalization). We test the models for goodness of fit (deviance and Pearson statistic for Poisson; Hosmer-Lemeshow test for probit) as well as classification and sensitivity (only for probit).

Dependent variable	Description
Nr. of medical visits	Number of visits to a medical doctor or qualified nurse about respondents health (excluding dentist visits and hospital stays, but including emergency room or outpatient clinic visits)
Nr. of taken medications	Number of taken medications as a sum of answers to the following question: »Do you currently take drugs at least once a week for problems mentioned2?«
Nr. of hospitalisations	Number of hospitalisations in a hospital overnight during the last twelve months
Probability of hospitalisation	Response to the following question: »During the last twelve months, have you been in a hospital overnight? Please consider stays in medical, surgical, psychiatric or in any other specialised wards.«

Table 1: Dependent variables used in the study

The variables used in the study are summarized in Tables 1 through 3: Table 1 delineates dependent variables and Table 2 independent variables, while Table 3 shows their descriptive statistics. As indicated in Table 3, the average number of medical visits, average number of taken medications, and average number of hospitalizations is 6.9, 1.79 and 1.78, respectively; the average number of years of education is 11.24. There are more females (55%) than males in the study group, more than two thirds live in the urban environment, and about one fifth is living alone in the household. About half of the study group has one or more chronic diseases, about a quarter has depression, and one sixth has severe limitations in their daily activities. The highest proportion of persons is coming from the continental welfare regime (44%) according to the Esping-Andersen classification, followed by the Eastern European (22%) and Mediterranean (17%) welfare regimes.

2 The drugs include the following: 1. Drugs for high blood cholesterol; 2. Drugs for high blood pressure; 3. Drugs for coronary or cerebrovascular diseases; 4. Drugs for other heart diseases; 6. Drugs for diabetes; 7. Drugs for joint pain or for joint inflammation; 8. Drugs for other pain (e.g. headache, back pain, etc.); 9. Drugs for sleep problems; 10. Drugs for anxiety or depression; 11. Drugs for osteoporosis; 13. Drugs for stomach burns; 14. Drugs for chronic bronchitis; 15. Drugs for suppressing inflammation (only glucocorticoids or steroids); 97. Other drugs, not yet mentioned

Independent variable	Description
Gender	Male or female
Age	Three groups – 50-64 years; 65-79 years; 80 and more years
EduYears	Years of education
Income	Total household income, classified into tertiles (low, middle, high) by individual country
Settlement	Living in an urban (encompassing: 1. A big city; 2. The suburbs or outskirts of a big city; 3. A large town; 4. A small town) or in a rural (A rural area or village) environment
LivingAlone	Binary variable, having the value of 1 if the respondent lives alone in a household and 0 otherwise
ChildDist	Binary variable, having the value of 1 if the respondent has a child living in the area of 25 km and 0 otherwise
Limited	Binary variable, having the value of 1 if the respondent is severely limited because of a health problem in activities people usually do and 0 otherwise
ChronDis	Binary variable, having the value of 1 if the respondent has 2 or more chronic diseases3; and 0 otherwise
Depression	Binary variable, having the value of 1 if the respondent has a score of 4 or more on the Euro-Depression scale and 0 otherwise
Welfare Regime	Individual countries grouped in the welfare regimes, following Esping-Andersen (1990) and related literature, as 1 – continental (Austria, Germany, Netherlands, France, Switzerland, Belgium, Luxembourg); 2 – social democratic (Sweden, Denmark); 3 – Mediterranean (Spain, Italy); 4 – eastern European (Czech Republic, Slovenia, Estonia); 5 – mixed (Israel)

Table 2: Independent variables used in the study

3 The chronic disease include the following: 1. A heart attack including myocardial infarction or coronary thrombosis or any other heart problem including congestive heart failure; 2. High blood pressure or hypertension; 3. High blood cholesterol; 4. A stroke or cerebral vascular disease; 5. Diabetes or high blood sugar; 6. Chronic lung disease such as chronic bronchitis or emphysema; 10. Cancer or malignant tumour, including leukaemia or lymphoma, but excluding minor skin cancers; 11. Stomach or duodenal ulcer, peptic ulcer; 12. Parkinson disease; 13. Cataracts; 14. Hip fracture; 15. Other fractures; 16. Alzheimer's disease, dementia, organic brain syndrome, senility or any other serious memory impairment; 18. Other affective or emotional disorders, including anxiety, nervous or psychiatric problems; 19. Rheumatoid Arthritis; 20. Osteoarthritis, or other rheumatism; 97. Other conditions, not yet mentioned

	Average	Median
Nr. of medical visits	6.90	4.00
Nr. of taken medications	1.79	1.00
Nr. of hospitalisations	1.78	0.00
EduYears	11.24	11.20

		Percent
Gender	Male	45%
	Female	55%
Age	50-64	46%
	65-79	42%
	80+	13%
Settlement	Rural	31%
	Urban	69%
LivingAlone	No	79%
	Yes	21%
ChildDist	No	25%
	Yes	75%
Limited	No	84%
	Yes	16%
ChronDis	No	52%
	Yes	48%
Depression	No	74%
	Yes	26%
Welfare Regime	SocialDem	13%
	Continent	44%
	Mediterr	17%
	Eastern	22%
	Mixed	4%

Table 3: Descriptive statistics of main variables used in the study

4 Results

Results of bivariate analysis are shown in Table 4. It is notable that female gender is significantly correlated with more medical visits and taken medications, but fewer hospitalizations. As expected, older people have significantly more medical visits, taken medications and hospitalizations. Higher level, i.e., more years of education are on the other hand significantly correlated with fewer medical visits, taken medications and hospitalizations as is the income.

More medications are taken – with high statistical significance – by those individuals who live in the urban area. Other strong statistical significances are observed for people living alone and having more medical visits and more hospitalizations and medications. All three health variables (limitations, chronic diseases, depression) are statistically significantly related to more medical visits and hospitalizations and a larger number of taken medications.

Comparison among various welfare regimes reveals that medical visits are the most frequent in mixed regime (Israel), followed by continental and Mediterranean regimes; Eastern European and socialdemocratic regimes have the fewest visits. For number of taken medications the ranking is as follows: mixed, Mediterranean, Eastern, continental, and socialdemocratic regime. Eastern European regime witnesses most hospitalizations, and is followed by the mixed, Mediterranean, and socialdemocratic regimes. For each of the three dependent variables, highly statistically significant differences among the welfare regimes are observed.

		Nr. of medical visits		**Nr. of taken medications**		**Nr. of hospitalisations**	
		Average	**t/F (Sign.)**	**Average**	**t/F (Sign.)**	**Average**	**t/F (Sign.)**
Gender	Male	6.5987	-7.7***	1.6832	-17***	1.9166	3.1***
	Female	7.2086		1.9086		1.6967	
Age	50-64	5.9877		1.3248		1.1706	
	65-79	7.4458	301***	2.0866	2791***	2.0447	192***
	80+	8.7554		2.6503		3.2449	
EduYears	below 12	7.4179	12.8***	2.0460	38.7***	2.1136	9.6***
	12+	6.4352		1.5508		1.4600	
Income	Low	7.9964		2.2501		2.3475	
	Middle	7.0292	106***	1.8385	639***	1.6514	50***
	High	6.0640		1.4536		1.2548	
Settlement	Rural	6.8870	-0.84	1.7437	-6.6***	1.8687	1.46*
	Urban	6.9584		1.8370		1.7615	
LivingAlone	No	6.6887	-11***			1.5863	-9.5***
	Yes	7.8493				2.5586	
ChildDist	No	6.9453	-1.51*			1.9154	1.30*
	Yes	7.0967				1.8025	
Limited	No	5.7450	-48***	1.5566	-76***	0.9863	-28***
	Yes	13.4203		3.1427		6.1050	
ChronDis	No	4.5028	-65***	0.8398	-180***	0.8830	-27***
	Yes	9.5665		2.8473		2.7751	
Depression	No	5.6684	-42***	1.4805	-69***	1.1288	-21***
	Yes	10.2178		2.6518		3.4004	
Welfare Regime	SocialDem	4.6072		1.5629		1.0200	
	Continent	7.6492	167***	1.7393	121***	2.0088	34.7***
	Mediterr	7.0196		1.9473		1.3680	
	Eastern	6.6339		1.9240		2.2045	
	Mixed	8.3433		2.1844		1.5453	

Table 4: Results of bivariate tests. The number of asterisks denote the level of significance (*** - 1%; ** - 5%; * - 10%). For abbreviations, see Tables 1 and 2.

Table 5 shows the results of initial regression models, including all covariates, except the long-term care variables. For the number of medical visits, gender has a positive, but weak influence (women tend to use medical visits more frequently than men). As for age, the 65-79 group has more frequent visiting than 50-64 group, while 80+ group uses medical visits less often as compared to 50-64 group, which is a phenomenon, already observed in Hren, Prevolnik Rupel and Srakar (2015a, 2015b). More educated tend to have more visits, but the relationship is much weaker than the one indicated in Table 4. When considering income, the highest tertile group tends to have significantly less visits, the relationship is strong in significance. Urban residents tend to have more visits which can be an indication of better access to health care in cities. Those living alone tend to have more visits, but the relationship is weak, while those having a child in the proximity of 25 km tend to have significantly more visits (having a child living close could be a reason for being able to visit a doctor more often with help of a child). As for the need (health) variables, the pattern is clear: the worse health, the more visits – all relationships are very strong, which hold for all dependent variables. As for the differences in welfare regimes, compared to Eastern European (reference category), social democratic countries tend to have less visits (which could be an indication of better health among older people in those countries in general, see e.g. Srakar 2015), while other three regimes tend to have more.

For the number of taken medications, gender has again a positive but strong influence, namely women tend to take much more medications than men. As for age, the 65-79 and 80+ groups have significantly more frequent taking of medications than the reference, 50-64 group. More educated tend to take fewer medications, as already observed for previous dependent variable and in Table 4. Groups with higher income clearly tend to take fewer medications. Urban residents tend to take more medications, which could again be a sign of better access to health care in cities in general. In the model we do not include the variables of living alone and child distance and we expect they do not have and logical interrelationship to the taking of medications. Again, the health variables have a strong relationship to the dependent variable: the worse health, the more medications. As compared to Eastern European (reference category), social democratic countries tend to have less taken medications, while other three regimes tend to have more, which is fully in line with the model for previous dependent variable.

As for probability of hospitalization, the gender has a *negative* and strong influence: women tend to have lower probability of hospitalization than men. 65-79 and 80+ age groups have higher probability of hospitalization than 50-64 group, which is fully in accordance with expectations and shows a slight difference between the probability and frequency of hospitalizations and frequency of visiting the doctor where an inverse U-shaped relationship has been observed as explained before. There is no influence of either education, income and/or settlement, while those living alone and/or having a child in proximity 25km tend to have a higher probability of hospitalization (for child distance, the relationship is weak in significance). Again, the relationship of health variables is positive and very strong. There is no relationship of socialdemocratic regime as compared to Eastern European (reference category), while continental countries tend to have higher and Mediterranean and mixed regime countries a lower probability of hospitalization.

Similar relationships can be observed for the number of hospitalizations: gender has a negative influence, namely women tend to have less hospitalizations than men. As for age, 65-79 and 80+ groups have more hospitalizations than 50-64 group. More educated and/or

richer people tend to have fewer hospitalizations, while there is no relationship of settlement. Those living alone and those having a child in proximity of 25 km tend to have more hospitalizations, while the relationships of health variables are again the same: the worse health, the more hospitalizations. As compared to Eastern European (reference category), continental countries tend to have more hospitalizations, while other three regimes tend to have less.

	Nr. of medical visits			Nr. of taken medications			Probab. of hospitalisation			Nr. of hospitalisations		
	Coef.	**z**	**P>z**	**Coef.**	**z**	**P>z**	**Coef.**	**z**	**P>z**	**Coef.**	**z**	**P>z**
Constant	1.1981	93.46	***	-0.2618	-12.31	0	-1.4687	-27.90	***	-0.3951	-15.20	***
Gender	0.0091	1.91	*	0.0458	5.36	0	-0.1066	-5.38	***	-0.2850	-29.93	***
Age65-79	0.0541	10.59	***	0.2100	22.29	0	0.0938	4.37	***	0.1705	15.91	***
Age80+	-0.0212	-2.93	***	0.2334	18.63	0	0.1439	4.76	***	0.2486	18.74	***
EduYears	0.0012	1.93	*	-0.0067	-5.74	0	-0.0035	-1.30		-0.0119	-9.10	***
IncomeMid	0.0064	1.11		-0.0284	-2.98	0	-0.0011	-0.04		-0.0481	-4.14	***
IncomeHigh	-0.0436	-6.83	***	-0.0917	-8.44	0	-0.0056	-0.21		-0.1585	-12.04	***
Settlement	0.0451	9.00	***	0.0265	2.94	0	-0.0106	-0.51		0.0086	0.87	
LivingAlone	0.0105	1.91	*				0.0571	2.48	**	0.1200	11.01	***
ChildDist	0.0287	5.58	***				0.0392	1.82	*	0.0404	3.95	***
Limited	0.5219	96.42	***	0.2856	28.99	0	0.5633	23.61	***	1.3205	131.36	***
ChronDis	0.5783	113.60	***	1.0199	102.91	0	0.3976	19.58	***	0.6882	60.90	***
Depression	0.2660	53.24	***	0.2328	26.05	0	0.2327	10.88	***	0.4799	48.57	***
Welfare Regime												
SocialDem	-0.1859	-20.66	***	-0.0602	-4.31	0	-0.0436	-1.28		-0.2836	-15.21	***
Continent	0.2529	42.04	***	0.0316	3.06	0	0.1434	5.78	***	0.2346	20.88	***
Mediterr	0.1868	24.07	***	0.0693	5.25	0	-0.1209	-3.59	***	-0.1830	-10.98	***
Mixed	0.2874	20.70	***	0.2080	8.88	0	-0.2172	-3.22	***	-0.3018	-9.17	***
Observations	28128			33604			28314			28299		
LR Chi2	46984.86	***		22611.85	***		2018.16	***		46703.78	***	
Log Likelihood	-142312			-50460			-11287			-110919		
Pseudo R2	0.1417			0.1830			0.0821			0.1739		

Table 5: Results of regression models (Poisson, probit). The number of asterisks denote the level of significance (*** - 1%; ** - 5%; * - 10%). For abbreviations, see Tables 1 and 2.

Perhaps the main interesting result is shown in Table 6, where we also include the long-term care provision variables. Informal care and formal care have a positive influence on all dependent variables: people receiving such care tend to have both a higher number of medical visits, number of taken medications, higher probability of hospitalization and higher number of hospitalizations. This shows the complementary relationship between long-term care and health care utilizations of the older people – long-term care serves as an addition (and not replacement) for formal hospital facilities. Although this relationship would need more econometric testing, as the variables of long-term care and hospital care are surely in an endogenous, reverse causal relationship and there are many possible confounders, this could be an important information for future measures in both areas, which are particularly adjourn and actual in Slovenia with reforms being under construction.

We can also see that for the control variables there are no notable changes in sign and significance of the coefficients.

	Nr. of medical visits			Nr. of taken medications			Probab. of hospitalisation			Nr. of hospitalisations		
	Coef.	z	P>z	Coef.	z	P>z	Coef.	z	P>z	Coef.	z	P>z
Constant	1.1830	91.95	***	-0.2640	-12.36	***	-1.4844	-27.89	***	-0.3832	-14.76	***
Gender	-0.0071	-1.49		0.0360	4.20	***	-0.1295	-6.48	***	-0.3432	-36.05	***
Age65-79	0.0380	7.41	***	0.2008	21.24	***	0.0736	3.40	***	0.0920	8.51	***
Age80+	-0.1109	-14.80	***	0.1886	14.52	***	0.0228	0.72		-0.0445	-3.24	***
EduYears	0.0007	1.08		-0.0068	-5.84	***	-0.0041	-1.51		-0.0130	-10.01	***
IncomeMid	0.0097	1.68	*	-0.0212	-2.22	**	0.0010	0.04		-0.0390	-3.35	***
IncomeHigh	-0.0437	-6.83	***	-0.0863	-7.94	***	-0.0076	-0.28		-0.1614	-12.22	***
Settlement	0.0492	9.81	***	0.0257	2.85	***	-0.0050	-0.24		0.0195	1.98	*
LivingAlone	-0.0196	-3.56	***				0.0129	0.55		0.0158	1.44	
ChildDist	0.0225	4.37	***				0.0366	1.69	*	0.0309	3.02	***
Limited	0.4344	76.86	***	0.2458	23.99	***	0.4546	18.31	***	1.0491	99.04	***
ChronDis	0.5533	108.11	***	1.0096	101.53	***	0.3672	17.91	***	0.6030	52.89	***
Depression	0.2348	46.67	***	0.2197	24.43	***	0.1961	9.06	***	0.3863	38.81	***
InfCare	0.2539	48.57	***	0.0860	9.05	***	0.2873	12.92	***	0.5634	55.48	***
FormCare	0.1716	25.68	***	0.1132	9.33	***	0.2975	10.07	***	0.6613	59.24	***
Welfare Regime												
SocialDem	-0.1897	-21.07	***	-0.0641	-4.58	***	-0.0526	-1.53		-0.3199	-17.13	***
Continent	0.2654	43.54	***	0.0270	2.57	**	0.1502	5.94	***	0.2162	18.96	***
Mediterr	0.2081	26.71	***	0.0738	5.58	***	-0.1015	-2.99	***	-0.1364	-8.15	***
Mixed	0.3094	22.24	***	0.2081	8.87	***	-0.2141	-3.13	***	-0.3132	-9.50	***
Observations	28128			33604			28314			28299		
LR Chi2	50533.82	***		22821.08	***		2341.40	***		55070.79	***	
Log Likelihood	-140538			-50356			-11126			-106735		
Pseudo R2	0.1524			0.1847			0.0952			0.2051		

Table 6: Results of regression models, including receiving of formal and/or informal care as predictor. The number of asterisks denote the level of significance (*** - 1%; ** - 5%; * - 10%). For abbreviations, see Tables 1 and 2.

5 Discussion and conclusion

In the article we presented a statistical and econometric analysis of determinants of health care utilization in older Europeans, using SHARE dataset. Our main findings can be grouped as follows:

- Among the determinants, gender has a different effect for visiting doctors and taking medications vs. hospitalization. Women tend to have more visits to doctors and medications while men tend to be hospitalized more. This could be a consequence of women being more frail and prone to milder forms of health care while men using the health facilities mainly when their health situation is more severe.
- Age has an expected effect for most of the variables: older people tend to use health facilities more often, with an exception of visiting doctors where the oldest group tends to visit the doctors less frequently. Perhaps this could be explained by a survival effects – the ones who are the oldest had a largest probability of survival and are therefore more resist to at least the milder forms of health problems.
- Education and income have mainly expected effects: those with higher education and income tend to use health facilities less often.
- Those, living in urban areas tend to have more visits to doctors and taken medications, which could be a consequence of better access to healthcare as compared to rural areas.
- »Need«, i.e. health variables have an expected, positive effect to utilization of health care services: those in more need use health care facilities significantly more often.
- There are significant differences between welfare regimes: those in socialdemocratic countries tend to use health facilities less often (as compared to the reference, Eastern

European regime), which is probably a consequence of their better health in general4. Interestingly, those in continental regime tend to use facilities significantly more often (both the number of hospitalizations, number of taken medications as well as medical visits), compared to Eastern European regime, while Mediterranean and mixed regime tend to have more visits to doctors and taken medications, while having significantly less hospitalizations.

- Informal and formal long-term care contributes positively and significantly to the usage of health care facilities, which we interpreted as sign of complementarity between long-term care and health care utilization.

The main drawback to the study lies in an over-simplified causal structure of our models. For the future work, models of causal inference (instrumental variables, counterfactuals, etc.) should be used, taking into account several recursive, i.e. reverse-causal relationships in the model, as observed already by Andersen (1995). Furthermore, these techniques would allow us to estimate marginal effects of individual variables and by that the size of their effects on health care utilization. We, nevertheless, hope that the findings of our study will provide important information in both scientific sense as well as a foundation for the future policy measures in the field.

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35th International Conference on Organizational Science Development
March 16th – 18th 2016, Portorož, Slovenia

Culture as a Fourth Dimension of Sustainable Development – a Statistical Analysis and Indicators' Proposal

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Abstract
In recent years, many discussions have been led over the role of culture as a fourth dimension of sustainable development. Yet, most of the discussions have been developed on theoretical and descriptive level. In our article we use the dataset of Eurostat Sustainable Development Indicators which includes data on sustainable development indicators regarding 130 indicators for EU-28 countries in the period 1990-2014. On the basis of the dataset and recently published methodology of Srakar, Verbič and Čopič (2015), we construct an index of sustainable development, based on high-dimensionally adjusted (Metropolis-Hastings Robbins-Monro algorithm, correcting for the problems of small sample in the factor analysis results) factor analysis which allows us to include a full set of indicators into the statistically supported weighting scheme for the index calculation. We, next, include in the analysis the indicators for culture (following the preliminary selection of indicators, chosen by Srakar, Verbič and Čopič 2015), which allows us to explore the statistical consequences of including culture as a sustainable development dimension. We show that preliminary inclusion of cultural indicators has no influence in the construction of the index scheme, but has significant influence in the clustering of countries in the index. Finally, we discuss the research and political relevance of the article findings.

Keywords: sustainable development, culture, fourth dimension, statistics, composite indicators, multivariate analysis

JEL classification: Q01, Z11, Z18, C38, C4

1 Introduction

In past years, the debate on culture as a fourth dimension of sustainable development has come to the fore of development debates. There have been several notable efforts by UNESCO, the academia and other stakeholders. As stated by UNESCO: "Culture, in its manifold expressions ranging from cultural heritage to cultural and creative industries and cultural tourism, is both an enabler and a driver of the economic, social and environmental dimensions of sustainable development." (UNESCO, 2015) UNESCO also notes several key areas where culture can play a decisive role in the forthcoming international development agenda: poverty eradication, quality education, sustainable environmental management, sustainable cities and social cohesion and inclusion (ibid.). Yet, in our best knowledge so far there have been very few (if any) attempts to provide these efforts with a more solid statistical ground.

In our article, we will therefore study the consequences of including indicators to measure the cultural dimension of development, into the general framework of measuring/statistically following sustainable development in all its dimensions. To this end we will use a large cross-country (macro-data) database of Eurostat, available publicly. We will use methods from multivariate analysis to firstly construct an index of sustainable development, and, secondly, to observe the changes in the index when including also cultural indicators in the analysis. Although still in preliminary stages, the study will enable us to get first statistical insights into including culture as fourth dimension of sustainable development and to also propose a first, preliminary set of indicators to follow this topic in more rigor in future.

The article is structured in the following manner. Next section presents a short literature review. In the third section, we present the basic characteristics of the data and used methods. In the fourth section, we provide results of our analysis with discussion and conclude with the final section.

2 Short literature review

In recent years, many discussions have been led over the role of culture as a fourth dimension of sustainable development (e.g. Leach 1998; Langhelle, 1999; Nurse 2006; Seghezzo 2009; Axelsson et al. 2013; Birkeland 2015; Dessein et al. 2015). Sustainable development entered the debate on growth and development way back in the early 1970s. It is generally recognized that the concept of sustainable development was first proposed by the 1987 World Commission on Environment and Development. The potential conflict between economic and social development on one side and environmental development on the other was clearly recognized. The Brundtland Report contains the most widely recognized definition of sustainable development: "Sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (see e.g. Langhelle, 1999; Nurse, 2006).

For example, Leach (1998) argues that global environmentalism and its supportive science come to be seen as at least partly the product of particular, Western-dominated cultural traditions and relations of power. Langhelle argues that "at best, sustainable development would only widen the narrow concerns of mainstream economic and modernization theories that emphasize economic growth disregarding other concerns such as the relationship between ecology, inter- and intra-generational equity, and social justice" (Langhelle, 1999). As stated by Keith Nurse, "At one end of the sustainable development discourse, western science is viewed either as the cause or the solution to the problem. At the other end of the spectrum,

traditional or localized, particularly non-western, knowledge is either seen as “backward” and problematic or romanticized as “sacred wisdom” and therefore valued for its future value. So that when we speak of the promotion of cultural identities, cultural pluralism, cultural industries and geo-cultures as key elements of the fourth pillar of sustainable development, it refers to a need to redress the global imbalance in the cultural arena.” (Nurse, 2006: 14).

The literature in composite indicators formation is also growing. Let’s briefly mention just few influential studies. Brancato and Simeoni (2008) investigate the capacity of standard quality indicators to reflect quality components and overall quality, using structural equation models. Cecconi, Polidoro and Ricci (2004) detail a methodological approach to synthesizing basic indicators in order to compare territorial data collection quality, for the Italian consumer price survey. Munda and Nardo (2006) evaluate the consistency between the mathematical aggregation rule, used to construct composite indicators and the meaning of weights. Nardo, Saisana, Saltelli, Tarantola, Hoffman and Giovannini (2008) provide a handbook i.e. a guide on constructing and using composite indicators, with a focus on composite indicators which compare and rank countries’ performances. Polidoro, Ricci and Sgamba (2006) provide a novel methodology that expands on the methods detailed in Cecconi, Polidoro and Ricci (2004). Finally, the paper of Smith and Weir (2000) describes how to obtain some overall measure of quality by considering quality as a multivariate measure for any dataset, where each quality indicator represents one dimension of quality.

Despite several endeavors, particularly in cultural sector very few efforts have been devoted to statistically better ground the formation of the index. OECD’s Handbook on Constructing Composite Indicators recommends several steps in the construction of composite indicators (see Nardo et al., 2008) which we will mainly follow in the construction of our indexes. For clarity’s sake we recall them briefly. First, a theoretical framework should be developed to provide the basis for the selection and combination of single indicators into a meaningful composite indicator under a fitness-for-purpose principle. Second, indicators should be selected based on their analytical soundness, measurability, country coverage, relevance to the phenomenon being measured and relationship to each other. Third, consideration should be given to different approaches for imputing missing values. Fourth, an exploratory analysis should investigate the overall structure of the indicators, assess the suitability of the data set and explain the methodological choices, e.g. weighting, aggregation. Fifth, indicators should be normalized to render them comparable. Sixth, indicators should be aggregated and weighted according to the underlying theoretical framework. Seventh, analysis should be undertaken to assess the robustness of the composite indicator in terms of, e.g., the mechanism for including or excluding single indicators, the normalization scheme, imputation of missing data, the choice of weights and the aggregation method. Eighth, composite indicators should be transparent and fit to be decomposed into their underlying indicators or values. Ninth, attempts should be made to correlate the composite indicator with other published indicators, as well as to identify linkages through regressions. And, tenth, composite indicators can be visualized or presented in a number of different ways, which can influence their interpretation.

3 Data and method

Sustainable development policy aims to achieve a continuous improvement in citizens’ quality of life and wellbeing. This involves the pursuit of economic progress while safeguarding the natural environment and promoting social justice. The economic,

environmental and social dimensions are all part of the EU Sustainable Development Strategy adopted in 2001 and renewed in 2006. This strategy also includes an institutional and a global dimension, involving the adoption of good governance practices in the EU and the promotion of a global partnership for worldwide sustainable development. In view of these five dimensions, the strategy defines objectives and targets aimed at putting the EU on a path to sustainable development. Progress towards the strategy objectives is evaluated using a set of sustainable development indicators grouped into ten thematic areas. More than 100 indicators structured around the ten themes are represented.

The indicator framework covers ten thematic areas belonging to the economic, the social, the environmental, the global and the institutional dimensions:

- Socioeconomic development;
- Sustainable consumption and production;
- Social inclusion;
- Demographic changes;
- Public health;
- Climate change and energy;
- Sustainable transport;
- Natural resources;
- Global partnership;
- Good governance.

In our study we include 82 indicators (only for year 2005, as we have data for cultural indicators only for the years 2005 and 2009, and we decided to present the results for the year 2005, due to limited space we therefore omit the results and discussion for the year 2009) – we exclude other indicators due to missing data for more than 5 countries, for those that have data missing for 5 countries or less we implement a fully-conditional specification (FCS) method multiple imputation – see e.g. van Buuren et al. 2006).

Cultural heritage objects per mill capita
Arts tertiary students %
Employment in culture in total economy %
Value Added in Publishing Sector per 1000 capita
Value Added in Sound Recording Sector per 1000 capita
Expenditure for the consumption of culture per household
General government expenditure for culture per capita
Central government expenditure for culture per capita
Local government expenditure for culture per capita

Table 1: Included indicators on culture1

Our methodology consists of four main steps. Firstly, we impute the values for the missing data. We use multiple imputation, based on Fully Conditional Specification method (see e.g. van Buuren et al. 2006), which allows simultaneous imputation of different related variables with missing values. We use five different generated values for the estimation of imputation values.

1 General government expenditure includes, among others, both central and local government expenditure.

Secondly, we run factor analysis on our set of variables. We use transformation of each variable into its quartiles to standardise the variables and prevent the impact of different units of measurement. The factor analysis' results allow us to separate key decisive factors/dimensions and give them a stronger interpretation based on rotated (oblimin) factor loadings. A logical consideration is the high-dimensionality of the dataset, which includes approximately three times as many variables as there are units. Factor analysis commonly requires at least 10 times more *units* than variables (see e.g. Froman, 2001). This condition is not satisfied in our analysis, which is the reason to use high-dimensional corrections. We choose to use Metropolis-Hastings adjustment of the original Robbins-Monro (1951) algorithm, which is a root-finding algorithm for noise-corrupted regression functions (see Cai, 2010; Asparouhov & Muthén, 2012; Srakar, Verbič and Čopič, 2015).

Thirdly, we construct indices based on results from the factor analysis. The indices have been constructed by exploiting the nature of factors as standardised normal variables. We, therefore firstly transform the factors by adding 3 to each value (making them positive in approximately 99.86% cases), and then dividing their values by 6 (which is the range of the factor in 99.73% cases) and multiplying by 100 to get the conventional scales of the index values.

Finally, the resulting factors and indices allow us to perform a clustering analysis, using conventional hierarchical clustering with Wards linkage.

Such methodological construction allows us to study in slightly more detail the effects of inclusion of culture as an additional dimension in the sustainable development construct. The effects will be estimated in threefold sense: effects on the distribution of variables in the factor analysis; effects on the positions of countries in the dimensions of the sustainable development index; and the effects on the countries clustering.

4 Results

Below are shortly presented results of the factor analysis, using Metropolis-Hastings Robbins-Monro algorithm to correct for the high-dimensionality problems. Of the factors in the original ("basic") model - including only the 82 original indicators of sustainable development -, the first factor refers to general measures of economic development (GDP, households income, population change, etc.), the second and fifth refer to environmental issues, the third one to employment and education indicators, while the fourth one to the social dimension (poverty and other social indicators, including some additional indicators on employment). All factors are positively signed, meaning that the country that scores better on this indicator has a more positive condition on this indicator.

The factors in the basic model are:

1) Economic development,
2) Pollution and waste,
3) Employment and education,
4) Poverty and social conditions,
5) New technologies in energy use.

When we include also the 9 cultural indicators in the analysis, we observe no changes in the interpretation of the factors (we omit the full factor loadings' table due to limited space). The below representation shows which factors are best represented in the used cultural indicators. We can see that several of them cluster into economic development, particularly education in

culture, public (local) and private spending for culture and cultural industries. Interestingly, cultural heritage clusters into environmental dimension and can be found in both factors related to this dimension. As expected, employment in culture clusters into the third factor, while, interestingly, private consumption of culture and value added in sound recording sector (which is probably much more related to technological developments that the same measure for the publishing sector, which clusters into the social dimension).

The factors in the "culture-augmented" model are:

1) Economic development (including education in culture; private consumption for culture; cultural industries; local public financing of culture);
2) Pollution and waste (including cultural heritage);
3) Employment and education (including employment in culture; general public financing of culture);
4) Poverty and social conditions (including value added in publishing sector);
5) New technologies in energy use (including cultural heritage; private consumption for culture; value added in the sound recording sector).

Following the methodology, presented in previous section, we construct five indices on the basis of the calculated factors. Table 2 presents the results of the first three indices. There are no significant surprises here: as expected, the countries of Western Europe (in particular: Benelux countries, Scandinavian countries) score the best on economic development; large western countries (Germany, the UK, Italy, France and Spain) are best on main environmental indicators which could be a consequence of more wide reaching environmental campaigns and efforts in past years in those countries; while Scandinavian, Liberal and Baltic countries are best in the dimension of employment and education. The worse scoring countries in all the three dimensions are Eastern European countries, in particular the Baltic countries with regard to the first two indices/dimensions.

Economic development			**Pollution and waste**			**Employment and education**		
country	**index**	**rank**	**country**	**index**	**rank**	**country**	**index**	**rank**
Luxembourg	116.66	1	Germany	116.67	1	Denmark	116.61	1
Denmark	83.33	5.5	United Kingdom	116.55	2	Germany	83.33	3.5
Ireland	83.33	5.5	Italy	113.91	3	Ireland	83.33	3.5
Spain	83.33	5.5	France	113.50	4	Finland	83.33	3.5
Malta	83.33	5.5	Poland	83.73	5	Sweden	83.33	3.5
Netherlands	83.33	5.5	Spain	83.33	6	Austria	83.33	6
Austria	83.33	5.5	Netherlands	83.33	7	Netherlands	83.33	7
Sweden	83.33	5.5	Belgium	50.00	14	United Kingdom	83.33	8
United Kingdom	83.33	5.5	Bulgaria	50.00	14	Lithuania	82.87	9
Cyprus	83.33	10	Czech Republic	50.00	14	France	50.10	10
…			…			…		
Slovakia	16.67	22.5	Estonia	14.25	24	Bulgaria	16.67	25
Poland	16.27	25	Lithuania	-16.20	25	Malta	16.67	25
Lithuania	-16.20	26	Latvia	-16.67	26	Portugal	16.67	25
Romania	-16.67	27	Cyprus	-16.75	27	Romania	16.67	27
Latvia	-16.67	28	Malta	-17.39	28	Slovakia	-16.67	28

Table 2: Indexes and ranks, basic model, factors 1-3

As for the poverty and social conditions, again (with no surprise) Scandinavian and Benelux countries are the best scoring, including many countries from the Central Europe: Germany, Austria, Czech Republic, Slovenia and Slovakia. The worst scoring are again the Baltic and some Mediterranean countries. As for the usage of new technologies in energy use, the picture is more diverse, with Baltic countries, interestingly, scoring well, while some large Western countries such as the Netherlands and United Kingdom score very low.

Figure 1 shows the clustering of countries according to the combination of the five indices (and respective ranks). Four main groups of countries can be observed: firstly, the Western countries, including all Scandinavian countries, the Liberal countries, Benelux (apart from Belgium which is an outlier in many respects, which could at least partly be attributed to a larger share of missing/imputed values of several variables for this country) and some additional outliers, mainly the small countries such as Malta and Cyprus. Secondly, the Eastern European countries with the Baltic countries frequently in a separate cluster. Thirdly, the Mediterranean countries: Italy, Spain, Portugal and Greece, with France sometimes included. Finally, some clear outliers: Slovenia, Czech Republic and Belgium – the first two should be in the Eastern European cluster, but have significantly better social conditions (in Slovenia a low level of inequality has been clearly pointed out by previous studies, see e.g. Stanovnik and Verbič, 2014; Srakar and Verbič, 2015); while Belgium is apparently a special case as far as the Western European cluster is concerned.

Poverty and social conditions			**New technologies in energy use**		
country	**index**	**rank**	**country**	**index**	**rank**
Finland	116.67	1	Sweden	116.67	1
Netherlands	83.33	2	Latvia	116.67	2
Belgium	83.33	6	Austria	116.65	3
Czech Republic	83.33	6	Romania	83.33	4
Denmark	83.33	6	Spain	83.33	6
Germany	83.33	6	Portugal	83.33	6
Austria	83.33	6	Finland	83.33	6
Slovenia	83.33	6	Croatia	83.33	8
Sweden	83.33	6	Lithuania	83.33	9
Slovakia	83.32	10	Estonia	83.33	10
…			…		
Spain	16.67	25	Poland	49.99	24
Lithuania	16.67	25	Netherlands	41.48	25
Poland	16.67	25	United Kingdom	16.67	26
Portugal	16.67	25	Malta	16.67	27
Latvia	-16.66	28	Cyprus	-16.67	28

Table 3: Indices and ranks, basic model, factors 4-5

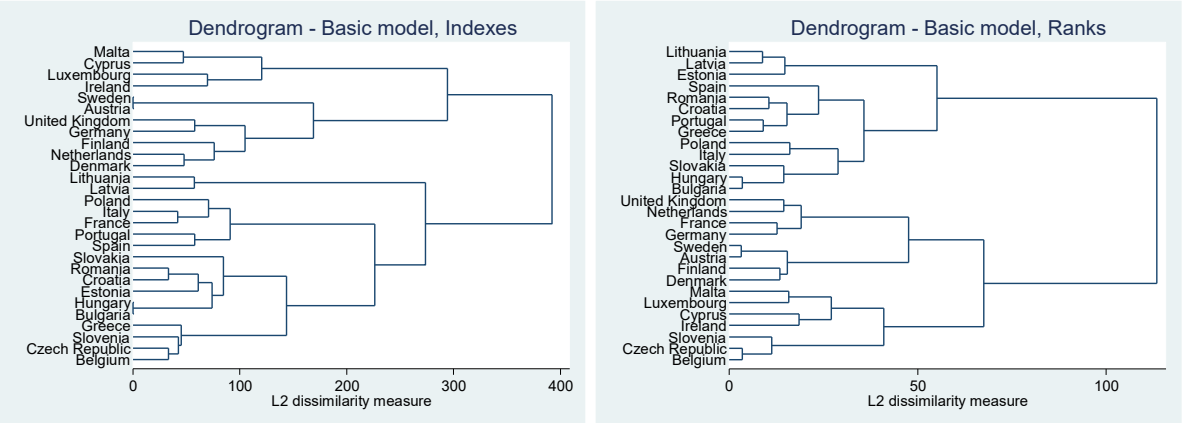

Figure 1: Results of clustering, basic models, indexes and ranks.

Let's now observe the changes of including the cultural indicators in the analysis (we will label this as "culture-augmented" model). As for the first three indices there are no significant changes. A slightly better position of France can be noted (France has a special care devoted to cultural issues on the national level which may explain the change) and an improved position of Estonia in the employment and education index (which can again be explained by

Estonia being a special case regarding culture, particularly the public financing of culture, see e.g. Srakar, Verbič and Čopič, 2015).

As for the indices in Table 5, no notable changes can be observed. Interestingly, Slovenia should be another special case regarding culture (again, see Srakar, Vebič and Čopič, 2015) but its position does not seem to improve significantly in most of the indices.

In Figure 2, the changes in the clustering are presented. Mainly, the same four groups of countries can be observed, although with France now slightly more clearly in the Western European cluster, and Estonia and Slovenia coming as clear outliers. Furthermore, Luxembourg, Ireland and Belgium are now more clear outliers, with all three noted as such already in the article of Srakar, Verbič and Čopič (2015), studying only cultural indicators for years 2005 and 2009. We can therefore conclude that although the changes when including cultural indicators are not significant, they show that the indicators slightly turned the relationships in favor of the countries being more prone to culture (e.g. France, Estonia, Slovenia, in some cases also Luxembourg with its specific place in the cultural index by the noted authors).

Economic development			**Pollution and waste**			**Employment and education**		
country	**index**	**rank**	**country**	**index**	**rank**	**country**	**index**	**rank**
Netherlands	150.00	1	United Kingdom	116.69	1	Netherlands	116.67	1
Luxembourg	116.67	2	France	92.88	2	Denmark	116.67	2
Belgium	83.33	7	Germany	83.79	3	Finland	84.96	3
Denmark	83.33	7	Italy	83.34	4	Sweden	83.33	4
Ireland	83.33	7	Spain	83.33	6	Estonia	83.33	6.5
Spain	83.33	7	Netherlands	83.33	6	Ireland	83.33	6.5
France	83.33	7	Poland	83.33	6	Austria	83.33	6.5
Malta	83.33	7	Belgium	50.00	14	United Kingdom	83.33	6.5
Austria	83.33	7	Bulgaria	50.00	14	Lithuania	72.24	9
Sweden	83.33	7	Czech Republic	50.00	14	Latvia	50.32	10
…			…			…		
Slovakia	16.67	21.5	Lithuania	16.67	23	Poland	16.67	23
Poland	-16.56	24	Luxembourg	16.67	23	Bulgaria	16.67	25
Lithuania	-16.66	25	Slovenia	16.67	23	Hungary	16.67	25
Latvia	-16.67	26.5	Cyprus	15.83	26	Slovakia	16.67	25
Romania	-16.67	26.5	Malta	-16.66	27	Italy	16.66	27

Table 4: Indexes and ranks, “culture-augmented” model, factors 1-3

Poverty and social conditions			**New technologies in energy use**		
country	**index**	**rank**	**country**	**index**	**rank**
Finland	83.34	1	Latvia	83.33	1
Czech Republic	83.33	5	Spain	83.33	3.5
Denmark	83.33	5	Austria	83.33	3.5
Germany	83.33	5	Romania	83.33	3.5
Netherlands	83.33	5	Sweden	83.33	3.5
Austria	83.33	5	Portugal	83.33	6
Slovenia	83.33	5	Finland	82.76	7
Sweden	83.33	5	Bulgaria	50.00	14
Belgium	50.00	14.5	Czech Republic	50.00	14
Bulgaria	50.00	14.5	Denmark	50.00	14
…			…		
Poland	16.67	23.5	Malta	44.01	23
Portugal	16.67	23.5	Ireland	16.76	24
Romania	16.67	23.5	Cyprus	16.67	26
Latvia	16.67	26	Netherlands	16.67	26
Lithuania	16.67	27	United Kingdom	16.67	26

Table 5: Indexes and ranks, “culture-augmented” model, factors 4-5

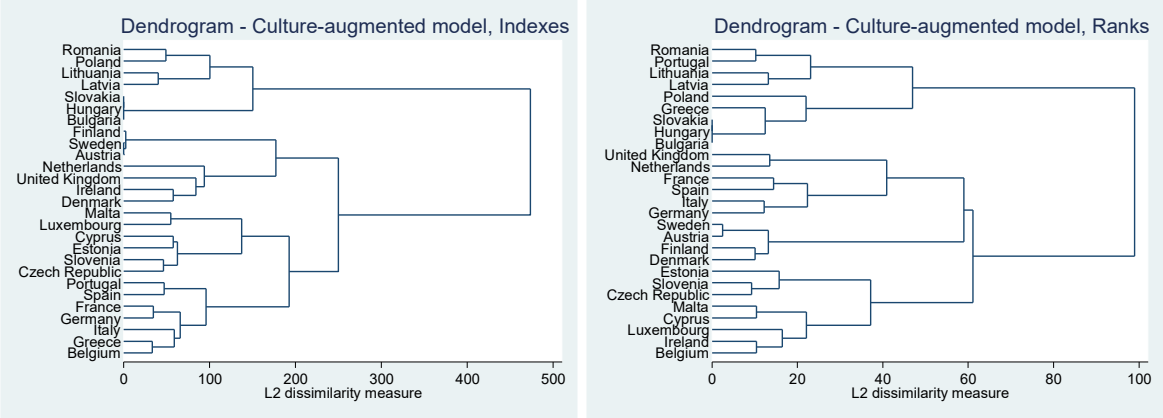

Figure 2: Results of clustering, "culture-augmented" models, indexes and ranks.

5 Discussion and conclusion

In the article we presented a preliminary statistical analysis of the consequences of including cultural indicators among the indicators of sustainable development commonly used. Our results pointed to three clear findings:

1) As for the dimensions of the construct of sustainable development, the inclusion of the cultural indicators brought no notable changes - all five dimensions stayed exactly the same. This finding could be corroborated, on the other hand, by the low number of indicators of culture and perhaps a more thorough analysis (also for the year 2009) which will be performed in the follow-up work of this study/ to provide a different and more comprehensive perspective.
2) As for the content of the dimensions, the cultural indicators clustered sensibly, with a particularly interesting observation (in accordance with some observations from theory) that cultural heritage clustered into the environmental factors.
3) As for the positions of individual countries in the indices and clusters, although the changes are not significant, they clearly favor the countries more prone to culture, such as France, Slovenia and Estonia. Some clear outliers from the commonly used classification of Esping-Andersen (1990) can be noted nevertheless (e.g. Belgium, Luxembourg, Malta, and Cyprus).

The present analysis opens a lot of issues, previously not addressed nor studied. Firstly, what should be the choice of cultural indicators of culture to include in the measurement of the construct of sustainable development? Secondly, is the inclusion of culture as a fourth dimension of this construct on sound terms and does it really bring new challenges that would change/improve/complement the existing construct? Finally, is there a possibility to upgrade the statistical analysis of this article and, perhaps, validate it also in an econometrical, regression framework? In any case, our conclusion is not unsympathetic to the inclusion of culture as fourth dimension of sustainable development: we provided some preliminary statistically founded arguments that validate its usage and we hope that further research in the lines of this article will be able to (finally) provide more empirical insights on the research topic and methodology.

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Appendix

Crude rate of population change	Gross nutrient balance on agricultural land	Components of domestic material consumption
Employment rate of older workers	Real adjusted gross disposable income of households per capita	Domestic material consumption by material - 1 000 t
Total fertility rate	Nominal unit labour cost - 3 years % change	Electricity consumption by households
Crude rate of net migration plus adjustment	Young people neither in employment nor in education and training (15-24 years) - % of the total population in the same age group	Final energy consumption by sector
Duration of working life	Greenhouse gas emissions	Number of persons in households
Old-age-dependency ratio	Primary energy consumption	Final consumption expenditure of households, by consumption purpose
Real GDP per capita, growth rate and totals	Greenhouse gas emissions by sector (source: EEA)	Healthy life years and life expectancy at birth, by sex
Net national income	Greenhouse gas emissions intensity of energy consumption	Death rate due to chronic diseases
Total employment rate	Energy dependence	Proportion of population living in households considering that they suffer from noise
Employment rate by educational attainment level	Gross inland energy consumption by fuel type	People at risk of poverty or social exclusion
EU Imports from developing countries by income group	Electricity generated from renewable sources	Relative median at-risk-of-poverty gap
EU Imports from developing countries by group of products	Share of renewable energy in fuel consumption of transport	Inequality of income distribution
EU imports from least-developed countries by group of products	Combined heat and power generation	Severely materially deprived people
CO2 emissions per inhabitant in the EU and in developing countries	Implicit tax rate on energy	People at risk of poverty after social transfers
Municipal waste generation and treatment, by type of treatment method	Aggregate replacement ratio	People living in households with very low work intensity
Emissions of sulphur oxides (SOx) by source sector	General government gross debt	In work at-risk-of-poverty rate
Emissions of nitrogen oxides (NOx) by source sector	Investment by institutional sectors	Long-term unemployment rate, by sex
Emissions of non-methane volatile organic compounds (NMVOC) by source sector	Household saving rate	Gender pay gap in unadjusted form
Emissions of ammonia (NH3), by source sector	Labour productivity per hour worked (ESA95)	At-risk-of-poverty-rate, by highest level of education attained
Early leavers from education and training	Total R&D expenditure	Low reading literacy performance of pupils
At most lower secondary educational attainment by age	Turnover from innovation	Energy consumption of transport relative to GDP
Lifelong learning	Energy intensity of the economy	Modal split of passenger transport
Tertiary educational attainment by sex, age group 30-34	Shares of environmental and labour taxes in total tax revenues from taxes and social contributions	Modal split of freight transport
Public expenditure on education	Level of citizens' confidence in EU institutions	Volume of freight transport relative to GDP
Volume of passenger transport relative to GDP	Official development assistance as share of gross national income	Energy consumption of transport, by mode
Emissions of nitrogen oxides (NOx) from transport	Official Development Assistance per capita in donor and recipient countries	HICP - annual average indices for transport prices
Share of renewable energy in gross final energy consumption	Resource productivity	Greenhouse gas emissions from transport
		Emissions of particulate matter from transport

Table 6: Included indicators of sustainable development

35. mednarodna konferenca o razvoju organizacijskih znanosti
16.–18. marec 2016, Portorož, Slovenija

Stochastic Search Optimization in Strict Hierarchical Manpower System Modelled by System Dynamics

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Abstract
In this paper, the System Dynamics model of a strict hierarchical manpower system is used to simulate the human resources dynamics. Such systems can be found in, for example, the military, police, medical care, and elsewhere. The optimization approach of the restructuring process in such a system is considered. The novel algorithm, based on the stochastic search principles, combined with genetic algorithms, is tested with random scenario generation.

Keywords: stochastic search optimization, manpower, human resources, system dynamics, simulation

1 Introduction

Human resources management is one of the critical activities in any larger organization and has been intensively studied (Škraba et al., 2011; Škraba et al., 2015a, 2015b, 2015c) from the quantitative point of view. Recent approaches in this area consider Enterprise Resource Planning (Babaei et al., 2015), in which special attention is given to the balanced organizational structure, which is one of the main factors for organizational reengineering success. The human resources management problem has been tackled, for example, by the

application of the Description Logic with the Resource Assignment Language (Cabanillas et al., 2015). It has been emphasized that the human resources flows should be taken into consideration in order to provide proper control. With regards to operational research, the workforce scheduling problem has been addressed with mixed integer programming (Lin et al., 2015), which takes into account employee's preferences and the equality of scheduling in order to achieve an optimal balance among employee's satisfaction, customer service levels, and labor costs. Another promising approach is the application of the methodology of Stochastic Processes (Gupta et al., 2014; Majd et al., 2015), providing the optimal time of promotion in an organization. In our previous research, the problem of human resources planning was addressed with the application of system dynamics modelling, numerical optimization and finite automata (Škraba et al., 2011). The recent expansion of the research has been performed in the area of biologically inspired optimization algorithms for the optimization of the human resources restructuring problem (Škraba et al., 2015a, 2015b, 2015c).

Given the organizational structure described in Škraba et al. (2011), our task is to restructure the human resources from initial states in particular ranks to new states in the shortest possible time, providing a proper management strategy that would not allow for oscillations in recruitment, transitions or wastage. If one considered only the criterion of the least time, the solution would be oscillatory, which would not be desirable.

2 Methodology

The strict hierarchical model of human resources considers the transitions only by one rank at a time, where transitions are cascaded over the exponential delay chain. The system was modeled as the exponential delay chain; details are given in Škraba et al. (2011). Optimization was performed by the stochastic search algorithm, whose pseudo-code for finding transition is provided in our recent work (Škraba et al., 2016). Although we have observed that the transition coefficients in the restructuring strategy have peaks, they cannot be considered to be oscillations. Moreover, oscillations in the transition and fluctuation coefficients do not always result in non-monotonic transition values. In order to test the stochastic search algorithm, the test scenario was generated using a random procedure; the desired and initial values were generated in such a manner that each next rank had lower values. More precisely, we used the following equation:

$$X\_value_i = \left(200 + Random(0, 300)\right) * \left(0.7^i\right),$$

where i=1…NumberOfRanks. The values of the boundary conditions were generated in the following ranges: for lower boundaries [0.04, 0.06], and for upper boundaries [LB+0.15, LB+0.35], where LB is the corresponding lower boundary. The actual values used in the next scenario are presented in Tables 1 and 2.

Rank	$r_{\min}$	$r_{\max}$	$f_{\min}$	$f_{\max}$
Rank 1	0.0406	0.321	0.0575	0.390
Rank 2	0.0568	0.378	0.0535	0.295
Rank 3	0.0573	0.348	0.0562	0.329
Rank 4	0.0569	0.268	0.0449	0.195
Rank 5	0.0488	0.226	0.0569	0.237
Rank 6	0.0425	0.370	0.0473	0.348
Rank 7	0.0413	0.210	0.0551	0.233
Rank 8	0.0514	0.320	0.0498	0.293

Table 1: Minimal and maximal transition coefficients

In Table 2, the initial and the goal positions are shown for the eight ranks. Some of the numbers should be increased while others decreased.

Rank	*Initial*	*Desired*
Rank 1	202	215
Rank 2	144	229
Rank 3	111	79
Rank 4	107	55
Rank 5	76	63
Rank 6	31	24
Rank 7	30	20
Rank 8	17	21

Table 2. Initial and desired values for all ranks

The next scenario was generated by a random algorithm for 20 ranks. We changed the parameters of the generation algorithm, so that the number of people at each rank was calculated as:

$$X\_value_i = \left(300 + Random(0, 400)\right) * \left(0.87^i\right),$$

where i=1…NumberOfRanks. The values of the boundary conditions were generated in the following ranges: for lower boundaries [0.02, 0.04], and for upper boundaries [LB+0.15, LB+0.35], where LB is the corresponding lower boundary. In Table 3, the initial and the goal positions are shown.

Rank	*Initial*	*Desired*	Rank	*Initial*	*Desired*
1	353	517	11	109	142
2	510	326	12	105	100
3	352	302	13	114	97
4	241	349	14	96	76
5	221	231	15	52	51
6	227	297	16	56	65
7	222	180	17	47	53
8	151	173	18	56	33
9	135	114	19	48	43
10	125	151	20	31	31

Table 3. Initial and desired values for 20 ranks

The presented scenarios enable us to test the developed algorithm, which is an important methodological aspect. This would enable us to develop a robust algorithm that could provide accurate results for all given constraints.

A genetic algorithm was used to determine the starting values for the transition coefficients, as well as the recruitment level. These values significantly influence the efficiency of the whole stochastic search. The fitness value was calculated as the minimal number of steps required to achieve the goal over 100 runs of the algorithm, plus the penalty value depending on the oscillations magnitude. The genetic algorithm and the penalty calculation for the strategy are the same as used in our previous work (Škraba et al., 2015a).

3 Results

For the randomly generated scenario, the following results were achieved. The recruitment level change is shown in Figure 1. For this case, the algorithm requires eight steps to achieve the goal.

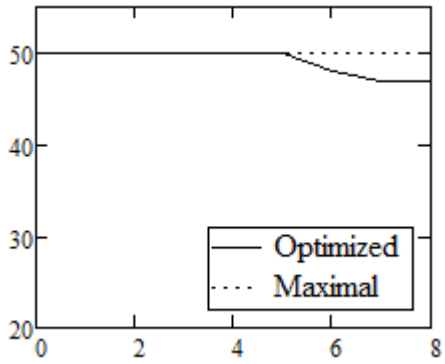

Figure 1. Recruitment level, first scenario

The recruitment level gradually decreases from the maximal level at the first steps, because the first and the second rank have fewer people that needed. In Figures 2 and 3, the change of the number of people at each rank is shown. At time step 0, the initial values are shown. For most ranks whose values are close to the desired, the algorithm is capable of achieving the goal in one to three steps. Sometimes it may difficult to keep the system in equilibrium when adjusting the other ranks because of the boundaries. This results in situations when the current value is higher or lower than the desired value, such as for ranks 3 and 5. Regardless, the algorithm is capable of rebalancing the system and finding the solution.

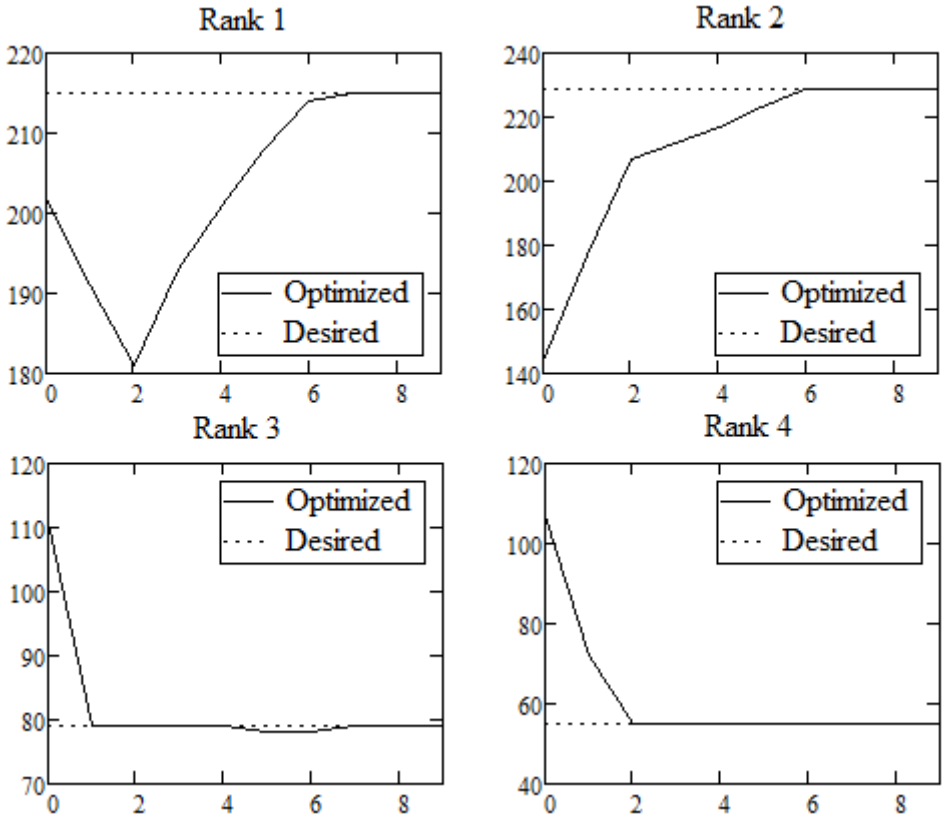

Figure 2. Ranks 1-4, fourth scenario

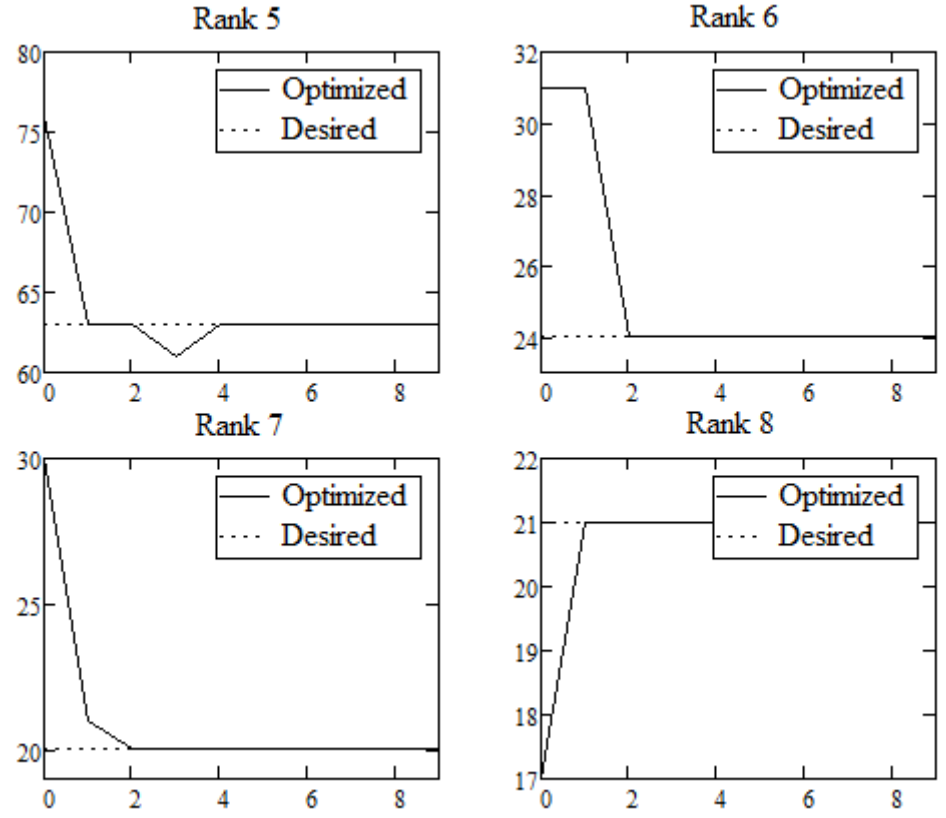

Figure 3. Ranks 5-8, first scenario

Figure 4 shows the transition and fluctuation coefficients achieved by the algorithm.

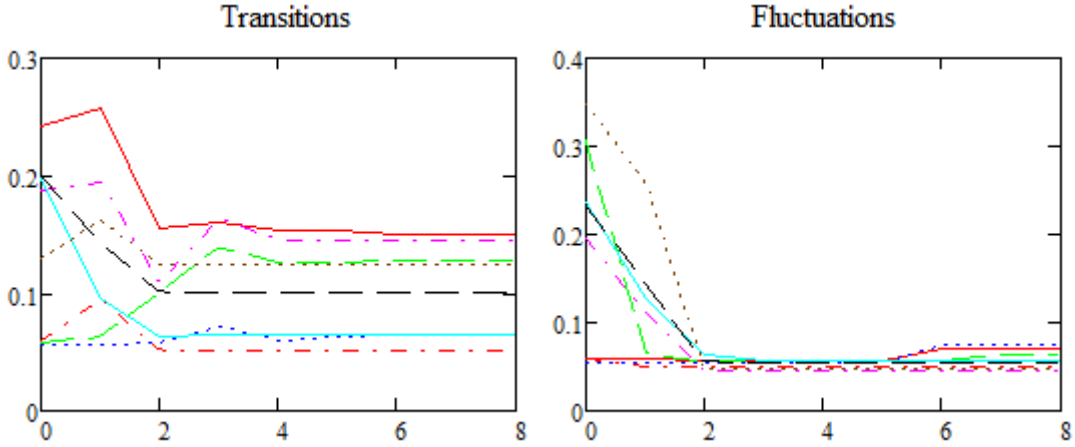

Figure 4. Transition and fluctuation coefficients, first scenario

The last step shows that the transition and fluctuation values are stable, as is the number of men at each rank. In Figure 5, the values of transitions and fluctuations are presented.

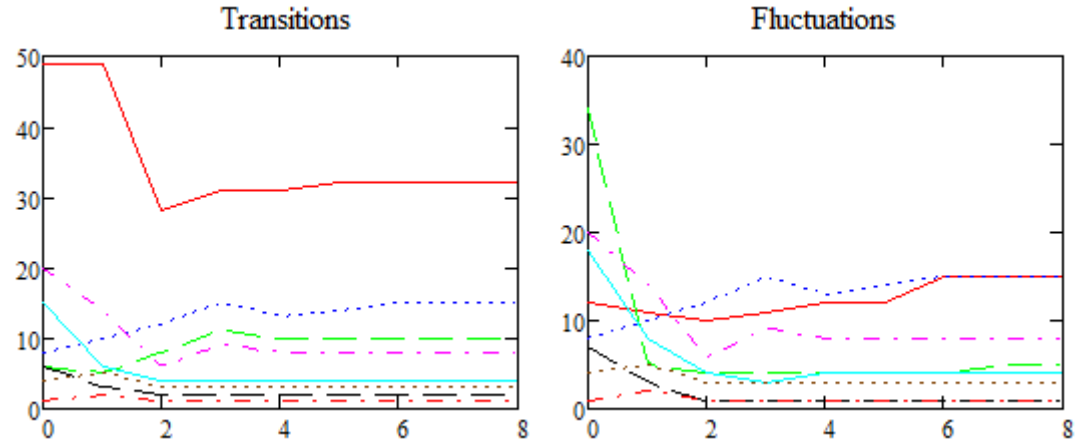

Figure 5. Transition and fluctuation values, first scenario

Here we may observe several small oscillations in the transition values. However, these oscillations are quite small and decrease with the number of steps, stabilizing the system. For the second randomly generated scenario, the following results were achieved. The recruitment level change is shown in Figure 6. For this case, the algorithm requires 24 steps to achieve the goal. The maximum recruitment level was set to 125.

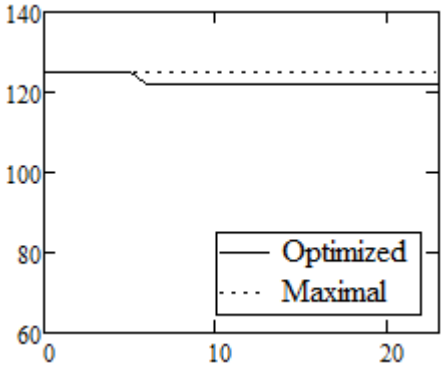

Figure 6. Recruitment level, second scenario

The change of the number of people at each rank is shown in Figure 7.

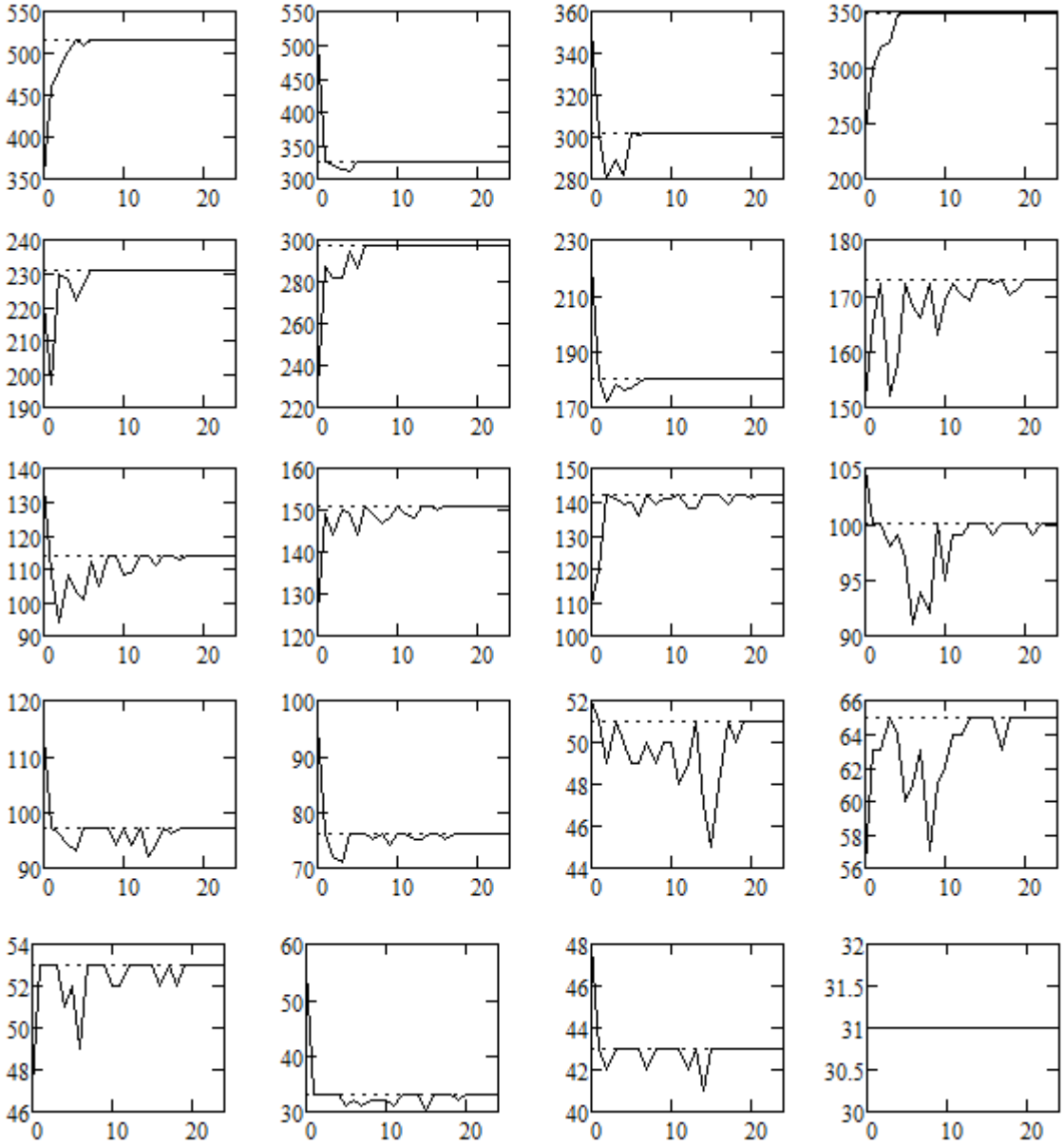

Figure 7. Ranks 1-20, second scenario

Figure 8 shows the transition and fluctuation coefficients achieved by the algorithm.

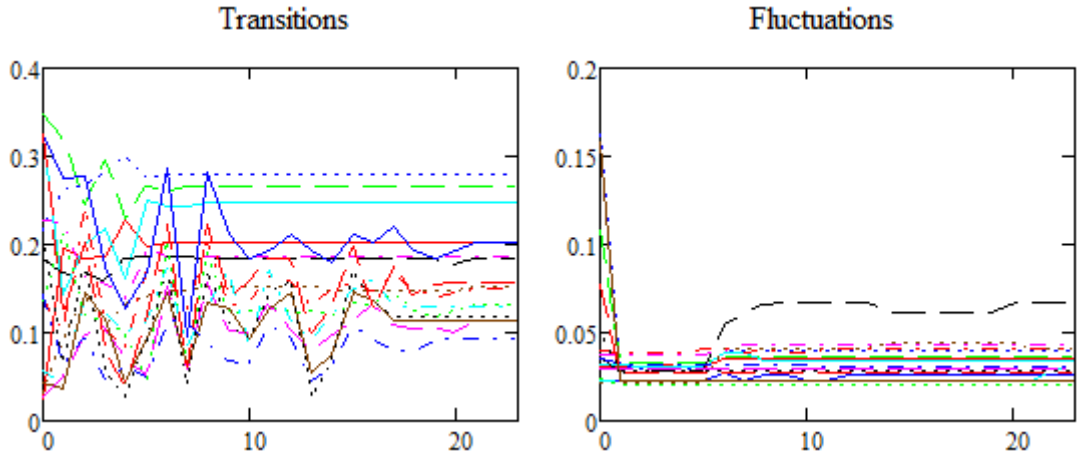

Figure 8. Transition and fluctuation coefficients, second scenario

The last step shows that the transition and fluctuation values are stable, as is the number of men at each rank. In Figure 9, the values of transitions and fluctuations are presented.

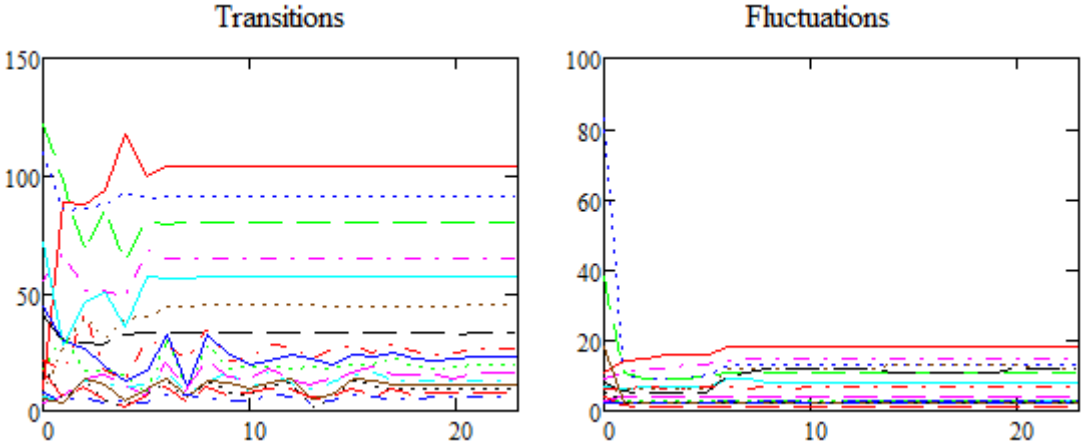

Figure 9. Transition and fluctuation values, second scenario

Here we may observe several heavy oscillations for transition coefficients for higher ranks, although these oscillations are smaller for transition and fluctuation values. It is noteworthy that lower ranks are easier to stabilize, and they have fewer oscillations. Higher ranks are dependent on all the previous ones; therefore, they are harder to stabilize.

4 Discussion

The simulation model of the strict hierarchical model was successfully applied to the problem of human resources restructuring, which is a challenging one, due to its dynamical character. Several time steps for all the parameters in the model as well as the states should be considered. Furthermore, the parameter boundaries are changing in time. This makes the problem challenging and unsuitable for the solution with the analytical methods. The stochastic search optimization method algorithm has been successfully developed and applied to the given task. In order to achieve the desired states without the oscillations in the obtained strategy, one should improve the multi-criteria weight function, which would determine the importance of the oscillations in the criteria function. The deviation from the desired state and the possible oscillations in the obtained strategies, i.e. promotions, wastage, and recruitment, should be considered here. By running several randomly generated experiments on the developed human resources model, we have confirmed that the algorithm is well designed for

the given task providing proper solutions for the decision makers at the organizational restructuring of human resources.

Acknowledgment

This research was supported by the Ministry of Higher Education, Science and Technology of the Republic of Slovenia, (Contract No.: BI-RU/14-15-047, Contract No. P5-0018) and Russian Federation Presidential Scholarship No. 16-in-689.

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35th International Conference on Organizational Science Development
March 16th – 18th 2016, Portorož, Slovenia

Segmenting Terms of Trade; the Case of Croatia

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Abstract
Favourable terms of trade developments present opportunities for countries to enhance economy-wide productivity growth, facilitate efficient resource allocation, reduce inflationary pressures and improve capability for serving debts. In that manner small, open, indebted and import dependent economy such as Croatia is much exposed to varying types of shocks, terms of trade being among variables to consider due to their feasibly wider cyclical and short-run instabilities. The aim of this paper is to consider different aspects of terms of trade changes within business cycle framework by segregating them into two variables (barter terms of trade, income terms of trade) and three parts (aggregate, goods, services) and relating them to output movements in Croatia. By using HP filter for extracting cyclical movements from selected variables and analyzing disproportion in its lags/leads, this paper gives a reflection on the dynamics of terms of trade and its (in)significant effect on the Croatian growth perspective. Results suggest general improvement in terms of trade as well as positive correlation with leading characteristics to output changes.

Keywords: terms of trade, output developments, business cycle, HP-filter, cross-correlations, Croatia

1 Introduction

Most of the economists would agree that the field of international economics is roughly categorized as concerned with either the real side or the financial side of international issues. As the real side is mainly focused on the sources of comparative/competitive advantages and the terms of trade developments, financial side analyzes how exchange rate disproportions evolve as macroeconomic shocks that affect all participants in international trade. How well can a country balance its international trade engagement over international price changes

This work has been fully supported by the Croatian Science Foundation under the project number 9481 Modelling Economic Growth - Advanced Sequencing and Forecasting Algorithm. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of Croatian Science Foundation.

and/or applied exchange rate regime is of great importance, especially during unstable economic periods. Therefore, the point of understanding the international financial position and trade establishment is closely related to the comprehension of the terms of trade. The perspective or better to say determination of the terms of trade has been considered as one of the most important technical problems in the pure theory of international trade (Peon, 2004) for its importance relies on the fact that terms of trade are integral part of the mechanism determining the global income distribution among the countries engaged in international trade. Both, theoretically and empirically, terms of trade are relevant explanatory factor of the movements in many other macroeconomic variables. Movements in terms of trade affect changes in output and investment perspective and benefits a nation captures from trade, it influences both savings and consumption uncertainty trough its volatility, it operates as a channel for technological spill-over and shocks, participate in exchange rate alignments and current account developments, and etc. While positive movements in terms of trade could increase domestic purchasing power and real income, significant terms of trade shocks can lead to macroeconomic instability. Given the fact that the terms of trade play a key role in determining the gains from trade and in that manner the welfare and growth, it is also very important to recognize and understand what its fundamental determinants are.

Ditto, favourable terms of trade developments present opportunities for countries to enhance economy-wide productivity growth, facilitate efficient resource allocation, reduce inflationary pressures and improve capability for serving debts. Essentially, terms of trade movements may have an effect on economic growth through a long-run trend in the terms of trade and/or through levels of short-run fluctuation around the trend. Small, open, indebted and import dependent economy such as Croatia is much exposed to varying types of shocks, terms of trade being certainly among variables to consider due to their feasibly wider cyclical and short-run instabilities. Hence, its cyclical property could help in identifying Croatian growth perspectives and/or turning points in economic trend. The aim of this paper is to consider different aspects of terms of trade changes within business cycle framework by segregating them into two variables (barter terms of trade, income terms of trade) and three parts (aggregate, goods, services) and relating them to output movements in Croatia. We use non-export gross domestic product instead export-inclusive gross domestic product to isolate the influence of exports on output from that incorporated in the growth-accounting relationship. By using HP filter for extracting cyclical movements from selected variables and analyzing disproportion in its lags/leads, this paper gives a reflection on the dynamics of terms of trade and its (in)significant effect on the Croatian growth perspective. Results suggest general improvement in terms of trade as well as positive correlation with leading characteristics to output changes. Section 2 surveys theoretical and empirical literature. Section 3 gives a full perspective to the analytical part by describing used methodology and data, whereas Section 4 evaluates the results. Section 5 provides some concluding remarks.

2 Theoretical background and short review of the literature

The terms of trade variable can be defined in many ways, but the most used concept is the one that defines terms of trade as the ratio of the price of a country's exports to the price of its imports in the broader meaning i.e. the number of units of the exportable good that a country needs to give up per unit of an imported good, so that the definition that includes goods is known as net barter terms of trade. Besides net barter terms of trade, prominent literature recognize also gross barter terms of trade, income terms of trade and single or double factorial terms of trade. Whereas, income terms of trade is the ratio of the value of exports to the price

of imports, single (double) factorial terms of trade present net barter terms of trade adjusted for the changes in the productivity of exports (productivity of both imports and exports). What is important to realize is that income terms of trade as well as both single and double factorial terms of trade could rise even when net barter terms of trade declines (Peon, 2004) if the quantities of export grow at the larger scale or the productivity of domestic factors included in imports or exports improves. The gross barter terms of trade, single and double factorial are theoretically superior to the net barter terms of trade, yet they are relatively difficult to calculate so generally two concepts, namely net barter terms of trade and income terms of trade are applied in empirical studies (Fatima, 2010).

Changes in terms of trade represent changes in relative prices, so they do not directly affect standard measure of a real output, although they are likely to have substantial indirect effect, especially if we consider income terms of trade as the impact variable. Much of the contemporary literature analyzes the relationship between terms of trade and economic growth based on cross-country evidence. Most of them suggest that the improvement in terms of trade will lead to an increase in investment and consequently to economic growth (for example: Mendoza, 1997; Bleaney and Greenaway, 2001; Blattman et al., 2007; Eicher et al., 2008; see Škare et al., 2012)[2]. An increase in export prices relative to import prices allows a larger volume of import to be purchased with a given volume of export. The implied increase in the real purchasing power of domestic production is seen as a transfer of income from the rest of the world and can have substantial effect on consumption, savings, investment and growth. Terms of trade can also be seen as a rate of return on investment and therefore a secular (i.e. a long-term tendency or a trend) improvement in terms of trade can lead to an increase in investment and hence economic growth (Borkin, 2006). The higher the terms of trade the more benefits a country captures from trade. With any given pattern of real output and expenditure, a rise/improvement in the terms of trade will however, have a direct effect on the trade balance and on the current account positions. For example, if there are no changes in quantities imported or exported, higher export price will generate an increase in nominal export earnings and thus an equivalent shift in the trade balance.

Few interesting macroeconomic relationships elevated as the result of the studies on terms of trade. The debate of whether or not there has been a secular decline in terms of trade of developing countries has been alive since the contributions of Prebisch (1950) and Singer (1950) who argued that specialization in primary commodities, combined with a relatively slow rate of technical progress in the primary sector and a negative trend in the commodity terms of trade in fact caused developing economies to lag behind the industrialized world. Their work is today recognized as famous *Singer – Prebisch hypothesis*, however recently it found no empirical ground whatsoever (Škare et al., 2012). In the same year, again in two different papers (Harberger, 1950; Laursen and Metzler, 1950), we may find interesting debates on how can a decrease in current income arise from an adverse terms of trade shock that would lower both private savings and current account balance what in the end became known as the *Harberger – Laursen – Metzler effect*. Their works are primarily based on the observations of the impact of terms of trade shocks on the economy. It should be noted that the concept of terms of trade is different from the concept of real exchange rate which could be understand as the price variable that brings about equilibrium in the balance of payments (Peon, 2004). There is an uncertain affiliation in *terms of trade – exchange rate nexus*. Terms of trade have shown to be (theoretically and empirically) important explanatory variable of

[2] On the other hand there is a strong negative effect of terms of trade volatility on economic growth (Mendoza, 1997; Blattman et al., 2007, etc.).

the movements in exchange rate since an increase in relative terms of trade is expected to lead to the appreciation of the real exchange rate. Inverse, exchange rate variability can have, altogether a strong effect on the terms of trade, especially if we observe income terms of trade. A large depreciation in the value of the exchange rate would lead to a fall in export prices, subsequently rising the cost of import what worsens the terms of trade index. What effects will that have on the balance of payment depends on the change of the volume of export. On contrary, a lower exchange rate could restore competitiveness (Fatima, 2010). The nature and the intensity of terms of trade effect on one economy directly depend on the exchange rate, for its stability or variability determines net gains of international trade. Whether depreciation actually helps in improving trade deficits remain a key question that has drawn much scholarly attention. This relation is concentrated around the *J-curve phenomenon* and *Marshall-Lerner condition*, and recently a new concept based on asymmetric cross-correlations between terms of trade (exchange rate) and trade balance suggestively named the *S-curve* (Tomić, 2016). Another interesting international issue is the *nexus debt – terms of trade*. The pressure to service debt in its impact on terms of trade can produce two vicious circles. One lies in the interaction of debt and terms of trade, whereat following Keynes's view, the debt-service pressure leads to deterioration of terms of trade. The second vicious circle relates to import compression because of debt pressure. All mentioned is in line with the Fisher's paradox: 'the more you pay the more you owe!' (Tomić, 2012).

Considering such (possible) relevance for macroeconomic structure of one country, we can say that there is a lack of serious as well as consistent studies on the importance of terms of trade in Croatia. Interesting papers on this topic are mainly dealing with terms of trade trend and volatility dynamics within distinct growth perspectives and real exchange rate developments. Belullo and Broz (2009) tried to determine which fundaments are important in explaining the behaviour of the exchange rate in Croatia by employing behavioural equilibrium exchange rate approach. Using Johansen's methodology, authors found that all selected variables adjust to long-run equilibrium in less than one quarter, except terms of trade! This means that terms of trade are in fact weakly exogenous i.e. enter the long-run relation, but do not adjust to it within the short-run. Tomić (2012) found positive (negative) impact of terms of trade (terms of trade volatility) on economic growth in Croatia (2000-2010) by using Prais-Winsten regression which was accompanied by unrestricted stationary VAR. Škare et al. (2012) modelled augmented production function for Croatia (1997-2010) with the usage of cointegration equations and parsimonious error correction models, and confirmed the expectations of a positive relationship between income terms of trade changes and GDP *per capita* on one hand, and of a negative association between the volatility in income terms of trade and GDP *per capita* on the other. Kovačević and Tomić (2012) confirmed above mentioned results by including the indirect effect of the openness of the economy in terms of trade (volatility) – growth nexus. Tomić (2014) affirmed the importance of income terms of trade in creating export opportunities for Croatia (2000-2013) by developing augmented production function which utilized the effects of both volume and price change. Tomić (2016) found evidence of nonlinearity in the income terms of trade variable for Croatia (2000-2014) and identified two distinct levels in the data using Markov switching approach with time-varying transition probabilities. Most of these papers, in one way or another, look for particular behaviour of terms of trade within distinct development periods in Croatia suggesting that we have empirical motivation for examining different aspects of the movements in segregated variables representing terms of trade.

3 Methodology and data

In order to evaluate cyclical characteristics of the terms of trade, methodologically we followed the works of Stock and Watson (1998), Agresti and Mojon (2001), and Napoletano, Roventini and Sapio (2005). Though their work was based on Baxter-King filter, we used Hodrick-Prescott (HP) filter that has come to be recognised as standard method for removing long-run movements from the time series in the business cycle literature.

The problem of the optimal method to decompose a data series into two components (long term trend and stationary cycle) is still much debated. In the context of business cycle analysis, this problem is much more important if the entire analysis that follows is based on the results of such filtering method. Taking into consideration fairly large literature that is criticizing HP filter, Ravn and Uhlig (2002) emphasised that this filtering method withstood the test of time and the intensity of discussion and criticism remarkably well, so it appear it will most likely remain the popular method for detrending in theoretically oriented researches for a long time to come. The popularity of the HP filter in detrending time series certainly arises from the fact that it is easy to estimate and to comprehend. Hodrick and Prescott's (1997) analysis was based on the assumption that time series are consisted of cyclical and growth components, so if growth accounting can provide estimates of growth components with errors that are small relative to the cyclical component, computing the cyclical component is just a matter of calculating the difference between the observed value and the growth component. It resulted in creation of the filter that became the most popular method for removing long-run movements from the time series within the business cycle analyses. The HP filter focuses at removing a smooth trend τ_t from some given data y_t by solving next equation:

$$\min_t \sum_{t=1} ((y_t - \tau_t)^2 + \lambda((\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1}))^2) \quad (1)$$

so the residual $y_t - \tau_t$ is then commonly referred to as the business cycle component. This is actually a linear filter that requires previous specification of a parameter known as lambda (λ). Giving the form of the observation (annually, quarterly or monthly) this parameter tunes the smoothness of the trend i.e. penalizes the acceleration in the trend component relative to the cycle component. Many point that the parameter λ does not have an intuitive interpretation for the user and that its choice is consider the main weakness of the HP filter. Non-the-less, HP filter has been applied in a number of relevant studies; Blackburn and Ravn (1992), De Arcangelis and Di Giorgio (1999), Benazić and Tomić (2014), etc.

According to Stock and Watson (1998) and Napoletano, Roventini and Sapio (2005), co-movements between variables are revealed through the cross-correlation of the cyclical component of each series with the cyclical component of real gross domestic product as a benchmark variable, which is thought to represent the business cycle. This is the correlation between x_t and y_{t+k}, where x_t is the filtered series and y_{t+k} is the k-quarter lead of the filtered real gross domestic product. A large positive correlation at $k = 0$ (i.e. around lag zero) indicates pro-cyclical behaviour of the series; a large negative correlation at $k = 0$ indicates counter-cyclical behaviour; and no correlation indicates acyclical behaviour of the series. A maximum correlation at, for example, $k = -1$ indicates that the cyclical component of the variable tends to lag the aggregate business cycle by one quarter. In other words, if the absolute maximum (or minimum) is achieved at some real gross domestic product lead, then the variable is denoted as *leading*, whereas it is called *lagging* in the opposite case. Finally,

coincident variables are those displaying the bulk of their cross-correlation with real gross domestic product at lag zero[3]. Furthermore, we calculated standard deviations and autocorrelations to clarify doubts that could rise within explanations of the results.

To conclude, in order to analyze behaviour/movements between the variables we calculated standard deviations (relative values), cross-correlation (to estimate the degree to which two series are correlated) and autocorrelation (for finding repeating patterns) coefficients, hence introduced time lags/leads to evaluate time analogy between them[4].

Quarterly data for the terms of trade variables and national output were collected from the Croatian Bureau of Statistics for the period 2000:Q1 – 2014:Q4. Data were seasonally adjusted using the Census X12 seasonal adjustment procedure and then transformed to their logarithmic form. In order to extract the business cycle component that presents the stationary cycle of the variable we used smoothing parameter λ of 1,600 which is the standard value for quarterly frequencies. To test the integration properties we analyzed graphical displays of the variables and applied three unit root tests; Augmented Dickey Fuller test, Phillips-Perron test and Kwiatkowski-Phillips-Schmidt-Shin test. Generally, graphs and tests confirmed the absence of unit root in the observed variables which is important property of detrended variables (results available upon request).

Having in mind the characteristics of the Croatian economy we introduced two distinct features. First, in order to evaluate different aspects of terms of trade changes within business cycle framework we segregated them into two variables (barter terms of trade, income terms of trade) and three parts (aggregate, goods, services) which led us to six selective variables presenting the terms of trade. Instead of focusing just on barter terms of trade we also used income terms of trade measure for Škare et al. (2012) and Tomić (2014) found that this variable is more relevant in macroeconomic modelling. Therefore, our analysis follows the variables income terms of trade (based on national accounts data on nominal and real exports and imports in HRK) which is calculated by multiplying the basic or in narrow manner net barter terms of trade measure (ratio of export deflator to import deflator) with the volume of exports. Higher (lower) ratio implies improvement (deterioration) in terms of trade. Thus, we recognize **TOT** – terms of trade in general, **TOTg** – terms of trade for goods, **TOTs** – terms of trade for services, **ITOT** – income terms of trade in general, **ITOTg** – income terms of trade for goods and **ITOTs** – income terms of trade for services. Second, since export is a part of output *via* the national accounting identity, a positive and significant relationship between the export and output is almost inevitable, even if there are no productivity effects. This is even more so true if we observe income terms of trade which include the volume of export. To remedy this problem, we separated the impact of export on output by considering real output net of export i.e. non-export real gross domestic product which is obtained as real output minus export or $N_t=Y_t - X_t$ (for example see Dreger and Herzer, 2013; Tomić, 2014). Within cyclical framework this variable was specified as **NGDPr** – real gross domestic product net of export. Next section is concentrated on the results of the analysis.

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[3] The concept of lags/leads is usually used to describe phase relations between the variables in time domain. Specifically it is a notion of a lag in time domain as a 'pure delay' in relationship.

[4] In order to understand the presented tables it is first necessary to understand correlation as a measure of the linear relationship between two variables, the cross-correlation function (*Table 1*) as just the correlation of one time series versus lag/led version of the other i.e. real output, and the auto-correlation (*Table 2*) as the cross-correlation of a function and itself. Thus these tables display the time structure and the strength of the linear relationship, both internally (autocorrelation) and from one to another (cross-correlation).

4 Dynamics in terms of trade vs. real output relationship

First, we will evaluate basic properties of terms of trade dynamics by analyzing (graphical) relation between its derived variables and real output. Next, *Table 1* presents extracted cyclical components of segregated terms of trade variables, whereat we simply completed cross-correlations with lags/leads between the **NGDPr** and selected variables, plus we introduced standard deviation measure. In addition to current correlation coefficients (*t-0*), lag/lead analysis was also introduced in order to determine if some variables lag, lead or coincide with fluctuations in **NGDPr**. *Table 2* displays autocorrelations (ACF), i.e. they are basis for the persistence analysis.

Graphical displays of all variables confirmed that we are indeed dealing with variables that are in some way related to the movements in real output in Croatia (see *Appendix*). Though we cannot visually reveal any co-movements between main terms of trade variables (**TOT** and **ITOT**) and **NGDPr**, when introducing other derived variables we have noticed resembling cyclical movements of **TOTg**, **TOTs**, **ITOTg** and **ITOTs** and the movements in **NGDPr**, meaning we are detecting positive linkage in their behaviour. Visual perception of co-movements between the variables is just a first step. In order to comprehend true statistical bond we will turn to the results from the cross-correlations functions in *Table 1*.

Variables	St. dev. in (%)	t-4	t-3	t-2	t-1	t-0	t+1	t+2	t+3	t+4
TOT	0.92	+ 0.0297	- 0.0416	+ 0.0774	+ 0.0788	- 0.1423	- 0.1859	**+ 0.2331**	- 0.0480	- 0.1711
TOTg	2.10	+ 0.0176	+ 0.2052	**+ 0.3179**	+ 0.1809	+ 0.1394	- 0.1063	**+ 0.2699**	+ 0.0053	- 0.3360
TOTs	1.75	- 0.1791	- 0.0074	- 0.1327	- 0.0773	- 0.1328	- 0.0660	+ 0.1580	- 0.0816	+ 0.0892
ITOT	4.13	**+ 0.3152**	**+ 0.2174**	**+ 0.2847**	+ 0.0762	**- 0.3171**	+ 0.0496	+ 0.0954	- 0.1577	- 0.1173
ITOTg	6.80	**+ 0.2925**	+ 0.0938	+ 0.1964	+ 0.0896	**- 0.3210**	- 0.1285	- 0.0505	**- 0.2393**	- 0.1960
ITOTs	4.49	**+ 0.2519**	**+ 0.2525**	**+ 0.2679**	+ 0.0878	- 0.0937	**+ 0.2846**	**+ 0.2396**	+ 0.0396	- 0.0775

Table 1: Cross-correlation to NGDPr with lags and leads up to 4 periods
**bold number denotes 1%, 5% or 10% significance levels respectively*
Source: Authors' calculation.

First column in the aforementioned table presents standard deviations of the variables. If we take standard deviations as a measure of volatility we can notice that all variables presenting standard terms of trade ratio are less volatile in comparison to the **NGDPr** (st.dev. is 2.84%), while income terms of trade ratios are being highly volatile. This means that changes that are occurring in the economy are manifesting more in the volatility of exports, hence in the income terms of trade volatility. It also means that income terms of trade variable/s could be more important factor in explaining the changes within the Croatian economy, compared to more statistic standard terms of trade ratios that are being relatively stable through time, therefore in more exogenous position. If we observe cross-correlation coefficients we can notice relatively weak (but statistically significant) relationship between the terms of trade variables and real output, **TOTs** being only variable that has shown extremely weak and statistically insignificant correlations. **TOT** and **TOTg** are shown to be pro-cyclical and leading variables, together with **ITOTs** which revealed persistent pro-cyclical tendencies with statistically significant cross-correlation coefficients both in leading and lagging patterns. Variables **ITOT** and **ITOTg** also revealed pro-cyclical characteristics however with lagging indices. If we get back to graphical displays we can perceive leading tendencies of these variables in the period before the crisis, than lagging behaviour over a period of crisis, and

then again leading pattern in the crisis aftermaths. With these conclusions we have be very careful and suspicious because crisis years in the end of observation period tend to drive the results. Explanation can be probably found in the fact that if **TOT** and **TOTg** are pro-cyclical and leading variables, it means that due to a lagging effect on the volume of exports, **ITOT** and therefore **ITOTg** especially, could sometimes display lagging behaviour. Interestingly, all three variables that present income terms of trade measure are showing negative (counter-cyclical) current correlation coefficients (relatively high and statistically significant for **ITOT** and **ITOTg**) which may indicate that changes in these variables could be representing some kind of turning points in the behavoiour of the **NGDPr**, and national output in that manner.

Variables	t+1	t+2	t+3	t+4
NGDPr	0.1992	0.0137	0.1606	0.1182
TOT	0.2094	-0.1953	0.0959	**0.2135**
TOTg	0.1595	0.0597	0.1541	-0.0075
TOTs	-0.0028	0.0372	-0.0811	0.0389
ITOT	**0.5044**	**0.2149**	0.2009	-0.0288
ITOTg	**0.4337**	**0.2263**	0.1219	-0.0286
ITOTs	**0.3904**	**0.2224**	0.1218	0.1173

Table 2. Autocorrelations (ACF) – (persistence analysis)
**bold number denotes 1%, 5% or 10% significance levels respectively*
Source: Authors' calculation.

Finally, we have observed the persistence of the variables (*Table 2*). Persistence indicates the length in which one variable stays within a phase of a business cycle. Both **NGDPr** and standard terms of trade ratios are showing no persistence during a business cycle, which is strange especially for terms of trade measures since they revealed relatively stable behaviour during the observed period. On the other hand, lacking the persistence over a business cycle for the variable **NGDPr** (which eliminated exports in its equation) suggests very important function of exports in the creation of national output, not just through its price change but also due to utilization of exports volume (similarly to Tomić, 2014). All other three variables, namely **ITOT**, **ITOTg** and **ITOTs** are persistent in a phase of a cycle for at least two periods, suggesting that variables fluctuate persistently and stabilize within specific economic periods.

Another interesting fact about income terms of trade dynamic elevated when we compared it to national output dynamics. Namely, when we observed **NGDPr** and income terms of trade growth rates for all three variables we have noticed pictorial similarities in their movements (similarly to Tomić, 2016 who relates it to the change in a regime). Graphical displays of the variables reveal that larger income term of trade (**ITOT**, **ITOTg** and **ITOTs**) improvements (deteriorations) precede **NGDPr** increase (declines). All the peaks/trough in output (for example in 2008:Q2 and 2010:Q1) have been followed by strong movements in income terms of trade. Strong build-up by income terms of trade since 2013 certainly had some positive effect on the annulling of negative output growth rates. This issue can be interesting for Croatian macroeconomic policy makers since yet again terms of trade are shown to be an important factor in explaining output developments and as this analysis suggests might also be used as a motivator for studying economic activity turning points in Croatia based on (income) terms of trade changes. This hypothesis needs further verification, however it suggests next line of research inquiry.

5 Conclusion

Terms of trade are important variable since they are directly related to exports and exports are related to growth and welfare as well as questions like convergence versus divergence. Namely, terms of trade trend and its volatility can have a critical impact on economic growth, particularly during the process of global integration when export/import prices and volumes converge/diverge worldwide, inducing strong changes in terms of trade and growth perspective of one country. The discussions on terms of trade has been mostly limited to a consideration of the relative prices of a country's export compared to its imports of commodities and manufactured goods (sometimes) ignoring the fact that Marshall-Lerner condition and income and/or demand elasticity also play important role in describing its final effect on trade balance and economic growth. In addition, some countries may have favourable terms of trade developments if they have a higher share of services in their export structure. Therefore, by segregating terms of trade variable by two distinct features (basic vs. income terms of trade and general vs. goods vs. services terms of trade) we derived six ratios representing movements in key terms of trade elements and confronted them to real output developments in Croatia. Since we evaluated this relationship within business cycle framework we were able to make some reasoning regarding the role of terms of trade in explaining cyclical movements of the Croatian economy.

Results suggest general improvement in all six terms of trade variables during the observed period as well as pro-cyclical pattern with leading characteristics to real output changes. Moreover, we found that all three variables representing segregated income terms of trade ratios reveal stronger persistence during a business cycle compared to basic terms of trade measure and a positive cross-correlation bond to real output with relatively disproportional effects in its lags and leads. Following some catching deductions in the explanation of the relationship between terms of trade and real output (i.e. changes in growth rates and cyclical components) we came to conclusion that terms of trade variables, especially the ones representing income terms of trade dynamics could be used in detecting/identifying changes and/or turning points within Croatian growth perspective. Very puzzling hypothesis, yet interesting for further research aspirations.

For example, with other types of research (causality between terms of trade and relevant macroeconomic variables, correlations between other trade variables, exchange rate dynamics - Marshall-Lerner conditions - J-curve and S-curve patterns, terms of trade fluctuations-shocks - volatility and its causal relation to trade balance or output, analyses on disaggregated level (by commodities), effects of productivity changes with embodiment of technical progress on terms of trade developments and etc.), revealing a possible cyclical nexus between national output and terms of trade (through the nonlinearity discussions on regime switching, structural breaks, nonlinear cointegration, spectral analysis and etc.) could be of great help in resolving some short and long-run economic policy goals in Croatia.

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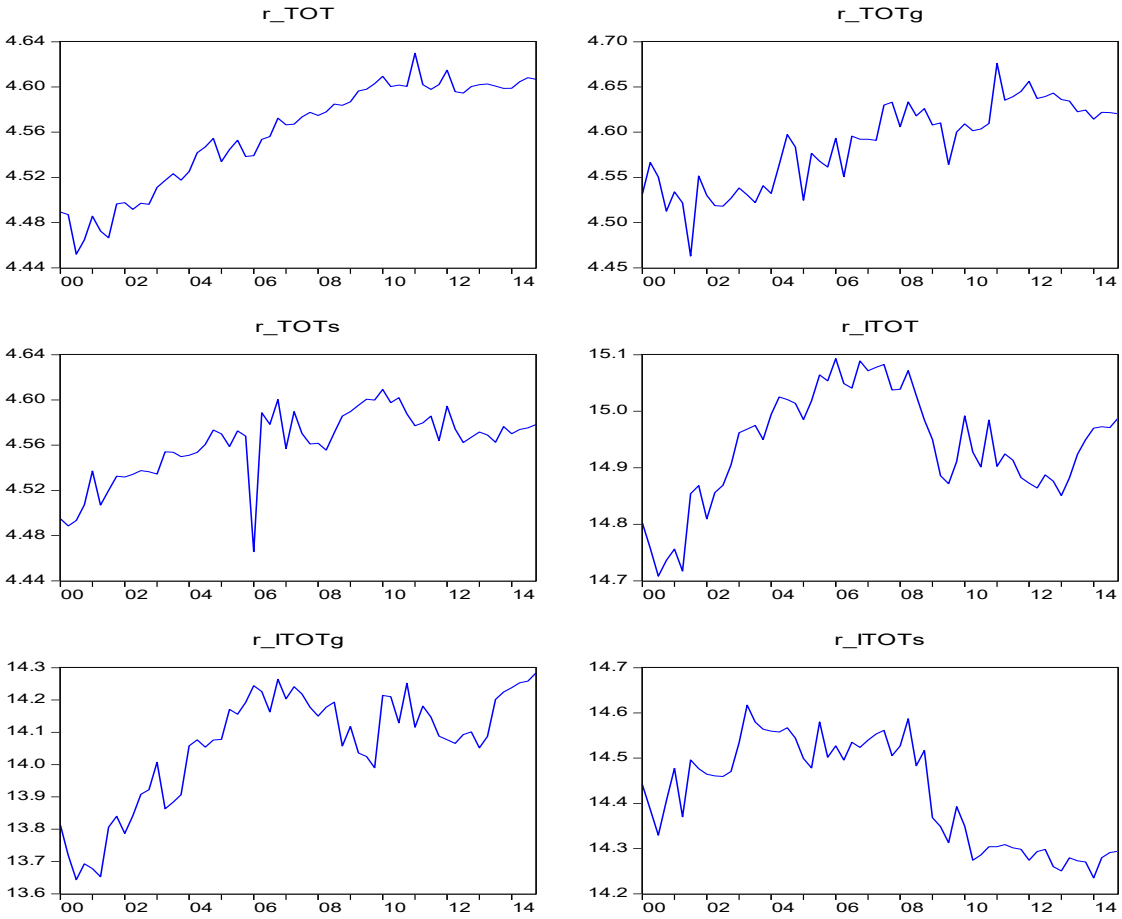
Appendix



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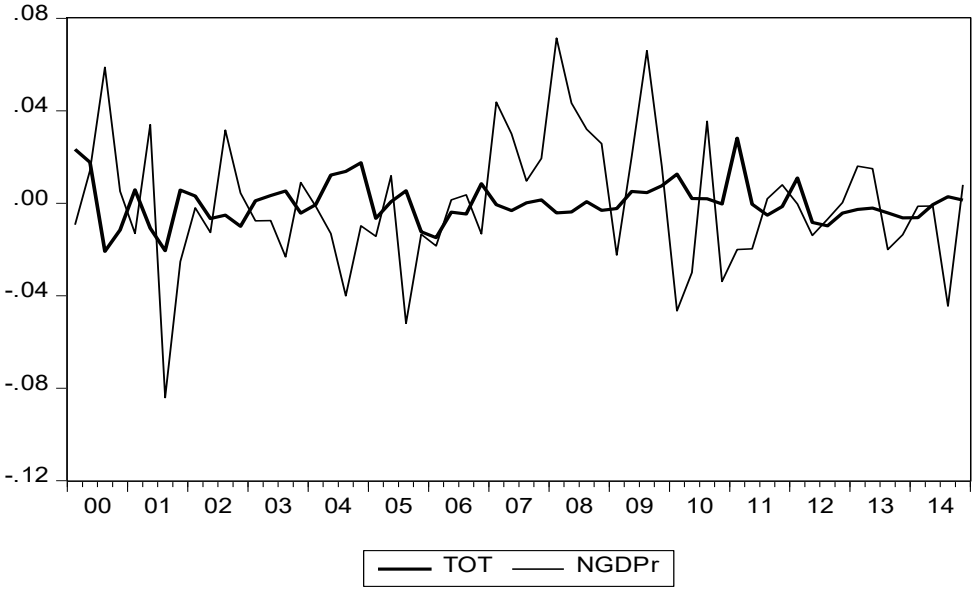

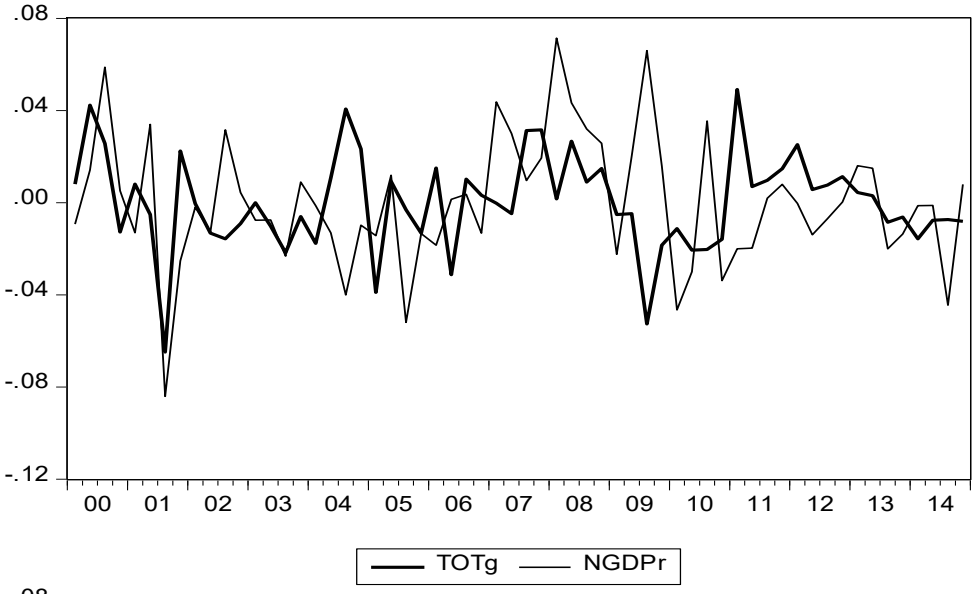
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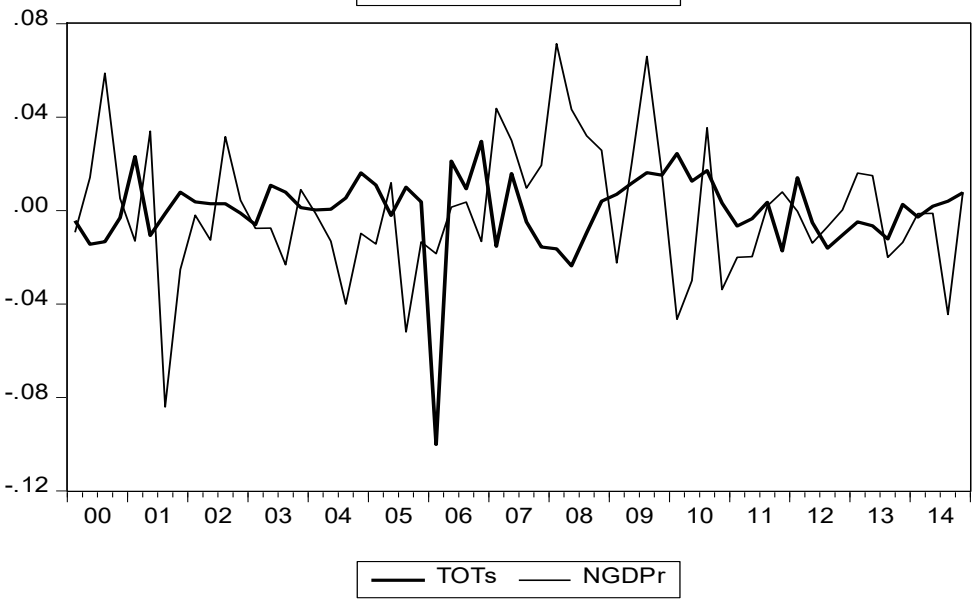
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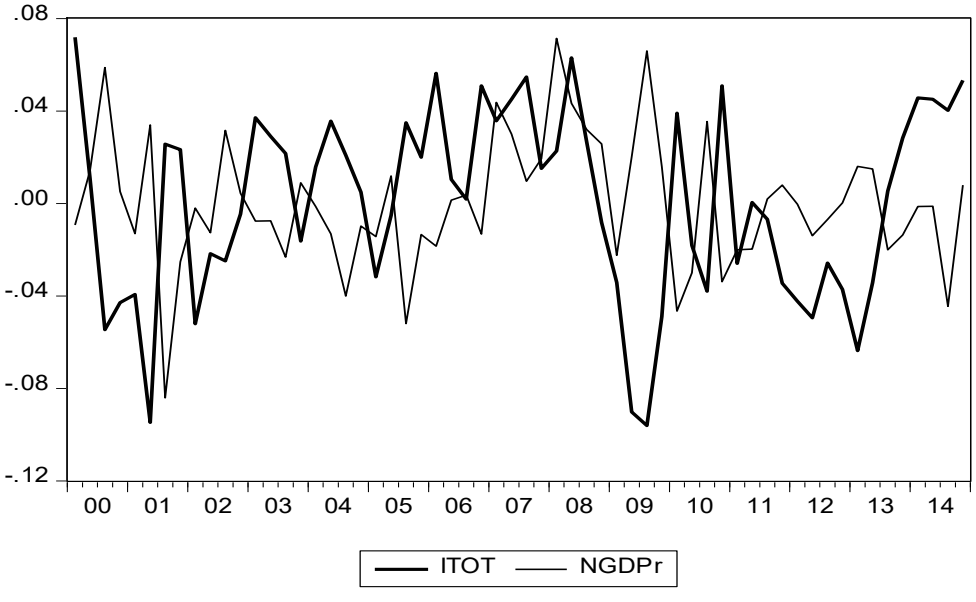
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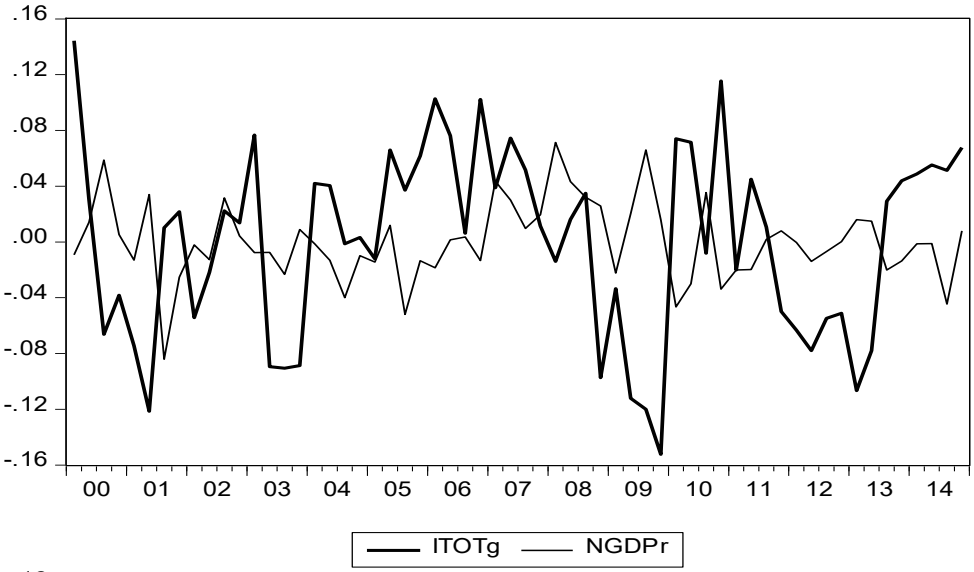

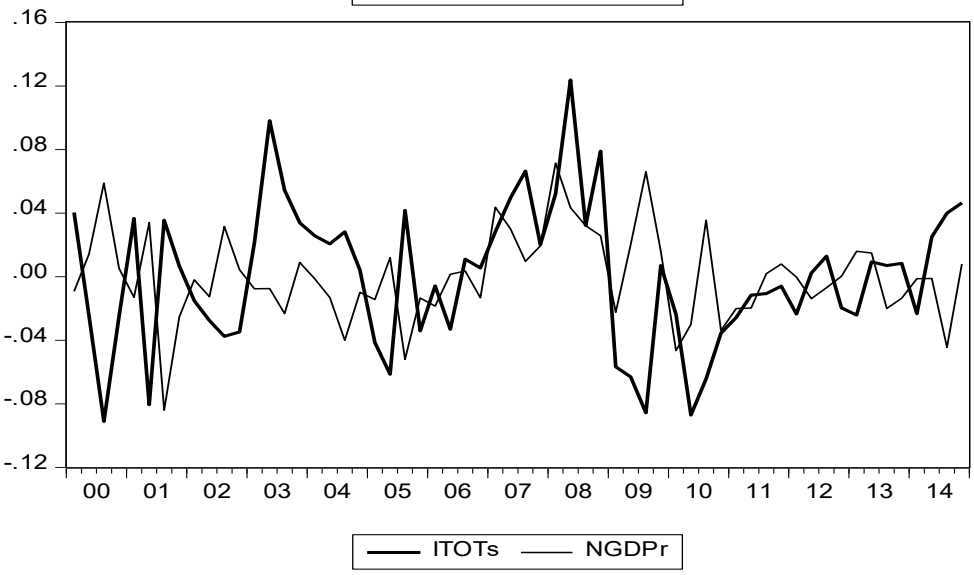

*** cyclical co-movements between NGDPr and terms of trade variables*

35th International Conference on Organizational Science Development
March 16th – 18th 2016, Portorož, Slovenia

User Adoption Analysis of the E-Government Services in the Republic of Macedonia with Technology Acceptance Model (TAM)

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Abstract
Higher utilization of e-Government services has multiple impact on wellbeing of citizens and businesses. The aim of the research is to identify factors that influence the level of adoption of e-Government services in the Republic of Macedonia. Using Technology Acceptance Model several constructs are defined (perceived ease of use, perceived usefulness, perceived trust, user's satisfaction, social influence, facilitating conditions and demographic factors) that can influence user adoption of e-Government services. TAM is useful in analysis of e-Government adoption because it can be extended by applying domain-specific constructs. Relationships between constructs proved to be significant after analysis of the survey results. Adoption of electronic public services is influenced by the level of trust the users have in conducting transactions with the government. User satisfaction is influenced strongly by the usability and usefulness of the electronic public services that has direct impact of the adoption of e-Government services. Determining the significance of the factors can help policy makers to react in specific directions in order to improve utilization of e-Government in the country.

Keywords: e-government, electronic public services, e-government adoption, technology acceptance model, republic of Macedonia

1 Introduction

E-Government is term that is differently defined by the authors that have research focus in this area. International organizations propose definitions starting from different viewpoints and stressing certain aspects and ideas about what is e-Government. E-Government can be defined as widespread use of information and communication technologies (ICTs) in public administration. E-Government is the term that reflects the use of information and communication technologies (ICTs) in public administration to change structures and

processes of government organisations (Löfstedt, 2005). In fact, e-Government is radical process of reformation of the public administration. Digitalization in the context of public administration is known under the term e-Government and it emerged in the late 1990s, but the history of computing in government can be traced back to the beginnings of computer history. For example, Fountain's definition: "… a government that is organized increasingly in terms of virtual agencies, cross agency and public–private networks whose structure and capacity depends on the internet and web" (Fountain calls this phenomenon "Digital Government" or "Virtual State") is still applicable (Fountain, 2001). E-Government defines an area, the public sector, as well as the institutions, people, and processes which operate within this area and e-Government can be defined as special case of ICT-enabled business process change (Scholl, 2003). More radically, e-Government can be seen as an ultimate innovation because it redefines and improves transaction processing via an IT platform (Estevez, Joseph, 2008).

At the offset of the first wave of e-Government, there are similarities in the definitions mentioning three goals: more efficient government, better services to citizens, and improved democratic processes (Grönlund, 2002). Nowadays, technological standards such as openness, usability, customization and transparency for public portals and interoperability between systems in agencies on different levels are a must for the implementation of e- Government projects and are reflected in the definitions. Obviously, it is not only about services or technology; it is about reinventing the way in which governments interact with citizens, governmental agencies, businesses, employees, and other stakeholders (Löfstedt, 2005). The most important goal of e-Government is the delivery of faster and cheaper public services to citizens, business partners, employees, other agencies, and government agencies (Layne, Lee, 2001). E-Government is about change and on the last instance e-Government becomes government. One of the reasons why e-government is being adopted, is to strengthen transparency and accountability and to change the passive role that citizens as 'customers/clients' had (Dimitriu, 2008). The common idea in these definitions is that e-Government involves the automation or computerization of existing paper-based procedures, new styles of management, new ways of debating and deciding strategies, new ways of listening to citizens and communities, and new ways of organizing and delivering public services and information.

E-Services (electronic public services- EPS) have to be designed and implemented to meet the complex and evolving service needs of citizens and other clients (businesses). Latest research is focused on providing for more efficient and user focused methods for delivering e-Services. Thus, user awareness of these services, their willingness to use them, and ease of use all are important factors for the further development of e-Government (CEC, 2003). Success in delivering electronic services depends upon the capability and self-confidence of citizens in performing electronic transactions, as well as their trust and confidence in the protection of their personal data within an open and accountable government. The research goal of this paper is to examine the influence of different factors on adoption of electronic public services in the Republic of Macedonia.

2 Literature Review – Selected Theories of Adoption of Technologies

Theories of adoption of new technologies are in fact explanations of the factors influencing the decision making over adoption and usage of new technologies and therefore they are relevant to analyse the adoption of electronic public services. In the literature of innovative technology adoption there are many approaches that are elaborated and several are widely used by the researchers. Philosophy of Technology as a concept can contribute to the area of e-Government adoption on a very abstract level (Surry, Farquhar, 1997). Davis's technology acceptance model (TAM) is one of the most influential approaches to explain and predict user acceptance of information systems (Davis, 1989). TAM model is based on the Theory of Reasoned Action (TRA) and to some point on the Theory of Planned Behavior as an extension of the TRA proposed by Ajzen (Fishbein, Ajzen, 1980). According to the TRA behavioral intention that leads to actual behavior is determined by belief or information about the likelihood that particular behavior will lead to certain aspired outcome.

The behavior is influenced by the (i) personal attitude towards the behavior and (ii) the subjective norm towards the behavior. In the TBC another factor is included as variable that is affecting both behavioral intention and behavior - perceived behavioral control. Namely, the more resources and opportunities individuals think they possess, the greater should be their perceived behavioral control over the behavior. Perceived behavioral control is included as variable that has direct effect on behavior and indirect on behavior through intention by motivational implications for behavioral intention (Madden et all, 1992). The Technology Acceptance Model (TAM) is widely used for explaining the acceptance of information technologies. Four of the most important concepts that have been constantly used in the TAM literature are perceived ease of use, perceived usefulness, behavioural intention and actual usage behaviour. The perceived usefulness of a technology increases with perceived ease of use. The more ease of use a user thinks a new technology is, the stronger his or her intention to use the technology; furthermore, the stronger the usage intention, the greater the actual usage behaviour. TAM model is more specialized model than TRA and TBC because it focuses on acceptance of information technologies in organizations and by persons. TAM model is not a general model; and it is designed to be applied only to computer usage behavior (Davis, 1989). Therefore, the application of TAM model is appropriate for research purposes while studying acceptance of electronic public services.

Unified Theory of Acceptance and Use of Technology (UTAUT) is formulated in order to incorporate different approaches (or theories) and to construct unified theory (Venaktesh et all, 2003). In order to leverage the full potential of ICT, the technology has to be used in practice, in everyday operations. The role of this model is to fully understand the usage as dependent variable. UTAUT is appropriate model especially in organizations that are in the process of introducing new IT and their employees are attending training of some sort, investigating both mandatory and voluntary use. Under the UTAUT seven variables are perceived as significant for behavioral intention (performance expectancy, effort expectancy, social influence, gender, age, experience, voluntariness of use) and one variable that is directly influencing the use behavior - facilitating conditions. As the authors of UTAUT mentioned, the methodology is primarily focused to investigate the acceptance in organizational context. The extension of UTAUT is UTAUT2 (Venaktesh, Tong, Xu, 2012). In UTAUT2 the theory is tested from consumer viewpoint, focused on consumer technologies. Three new constructs are presented such as hedonic motivation, costs (price value), and the most interesting one, habit. Hedonic motivation is defined as the fun or

pleasure derived from using a technology, and it has been shown to play an important role in determining technology acceptance and use. The cost and pricing structure have a significant impact on consumers' technology use because consumers usually bear the monetary cost (whereas employees do not) and price value is consumers' cognitive trade-off between the perceived benefits of the applications and the monetary cost for using them. Habit is a perceptual construct that reflects the results of prior experiences. Gender, age, and experience have a joint impact on the link between facilitating conditions and intention. From the aspect of e-Government use, definitely UTAUT2 can be applied as there are elements of hedonism, value and habit. As pretext, the previously mentioned theories can serve to explore the adoption of electronic public services.

3 E-Government in the Republic of Macedonia

The Government of the Republic of Macedonia has been making significant attempts to develop a proper framework for implementation of e-public services and the development of e-Government. During the past decade important steps were made in setting and developing of the national e-Government infrastructure.

The beginnings of the implementation and development of the e-Government concept and creation of e-Government applications in the Republic of Macedonia was guided mainly by the legislation, strategies, directives and recommendations imposed by the European Union. These laws, which came in force in the Treaty of Lisbon, besides for all governments of the Member states, also include the countries which are accessing the European Union. In this sense, Republic of Macedonia guided by its aspiration to become EU member state, starting from 2001 paves the way of modern e-society with the first formal document on a national level i.e. the initiative "e-Macedonia for all" by the President of the Republic of Macedonia. In 2002, the Parliament adopted the e-Declaration by which the institutional base was formed for further development of the information society. The institutional framework was set by the creation of the Commission for information technology, later developed into Ministry of Information society and today Ministry of information society and administration. In 2005, a National strategy for development of the information society and action plan was created and E-Government was defined among the seven pillars in this strategy.

The first National Strategy for e-Government was set for the period of 2010-2012. It incorporates the vision, goals and potential benefits associated with e-Government. Following the EU guidelines, it identifies the main stakeholders, the priorities and the measures needed to accelerate e-Government development. This strategic document views e-Government as having a much more important role than just supporting the operation of the public administration. The e-Government is recognized as a major factor for achieving sustainable development for the Republic of Macedonia and its society as a whole. The current e-Government strategy of the Republic of Macedonia is based upon a set of projects, initiatives and e-service development which are stated in the relevant documents such as the National strategy for e-content development 2010-2015, the Public administration reform strategy 2010-2015 and the National strategy for e-inclusion 2011-2014. (MIOA, 2015)

As a result of the government's efforts to create a more efficient and transparent administration by presenting to the public all available services for both citizens and business entities the national e-Government portal "uslugi.gov.mk" as the single point of access to information and services of the government was developed. The portal is based on a system with a scalable architecture that allows expanding the capacity when needed. In the next

stages of development, the portal will upgrade to allow full two-way communication between citizens and government. The preparation, processing and publication of the portal's content is entirely decentralised and distributed throughout all government institutions. (MIOA, 2015).

Regarding the 20 basic public services (12 for citizens and 8 for businesses) identified by the European Commission and Member States, in the eEurope initiative of 2000, to measure the take-up by businesses and citizens of electronically-available public services, currently in the Republic of Macedonia among the most developed portals providing e-public services in the G2B segment are the e-public procurement (eProcurement system - EPPS), e-customs (the Single Window for Export/Import licenses and tariff quotas system - EXIM), corporate tax and VAT (the eTax service) and from March 2014, registration of a new company (the system for e-registration). The most developed e-public service in the G2C segment is application for building permit i.e. the national electronic system for issuing building permits. Income taxes (declaration, notification of assessment), student grants, enrolment in higher education/university are also available online. The citizenship registers are fully digital, but not available online and not available for interoperability mainly due to technical reasons. The main problem is the availability of digital signature i.e. people do not have digital signature, very few organizations are offering them, they are expensive and the Government is not intensively promoting them. The e-public services in the G2C segment are less developed in comparison with the G2B ones.

Today, the Republic of Macedonia is ranked 96th out of 193 countries by its e-Government Development Index (EGDI), and it is accompanied by countries from South America, Africa and Eastern Europe. EGDI (ranked 0-1) has dropped in the Republic of Macedonia from 0,5587 in 2012 down to 0,4720 in 2014. In terms of the development of E-Government and e-Government index among the countries in the region, the Republic of Macedonia is ranked ahead Bosnia and Herzegovina, while Albania, Bulgaria, Croatia, Greece, Montenegro, Serbia and Slovenia are ranked higher (UN E-Government Survey, 2014). The EGDI is comprised by three components: Online Service Component, Telecommunication Infrastructure Component and Human Capital Component. These scores for the Republic of Macedonia are 0,2441; 0,4521 and 0,7198 respectively (UN E-Government Survey, 2014). The lowest index is the Index of Online Services – IOS (0,2441). This means that the Republic of Macedonia must focus its effort on online services. Therefore it can be concluded that this segment i.e. online services inevitably requires an improvement and further development, especially in the G2C segment.

In the last decade the Republic of Macedonia has made a great progress in the development and the implementation of e-Government. The development of the e-Government is one of the strategic priorities and an additional effort for further improvement in the functionality and sophistication of the e-Government services is expected. The goal of our research, to investigate the factors affecting the e-Government adoption i.e. the usage of e-public services in the Republic of Macedonia can help in our strategic commitment.

4 Methodology and results

As mentioned previously, the main aim of the research is to investigate the factors that influence electronic public services usage (adoption) in the Republic of Macedonia. Having in mind the variety of types and different levels of sophistication of the EPS, this proved to be very complicated task. Official statistics is not measuring the level of usage of electronic

public services. The success and acceptance of e-Government initiatives are dependent on citizens' willingness to adopt and utilise these services. According to the data more than one third of EU citizens (38%) refuse or choose not to go online to use public services (Tinholt et all, 2014). According to the data of the State Statistical Office, in the first quarter of 2015, 70% of the households had access to the Internet at home (of which 99% broadband). In the same period, 69,2% of the total population aged 15-74 used a computer, while 70,4% used the Internet. Internet was most used by pupils and students, i.e. 95% and 71,2% of the Internet users used a mobile phone or a smart phone for accessing the Internet away from home or work. (State Statistical Office, Information Society, News Release 8.1.15.31) The purpose of usage of EPS is presented in Table 1.

Purpose and type of usage	**% of the internet users in the last 12 months**
Have used Internet for interaction with public authorities	31,3
Obtaining information from public authorities' websites	26,3
Downloading official forms from public authorities' websites	13,4
Sending filled in forms to public authorities' websites, electronically	11,2

Table 1: Using the Internet for interacting with public authorities in the last 12 months
Source: Adapted from State Statistical Office, Information Society, News Release 8.1.15.31

In 2011 the State Statistical Office conducted a research to analyse the usage of information and communication technologies in the public sector. In the Table 2, relevant findings from that research are presented.

Available items on the websites	**In %**
Availability for downloading and printing forms	71.8
Receiving/sending filled in forms	32,1
Personalized content for regular visitors, clients	29,5
Online ordering or reservation	5,1
Online payment	2,6
Advertisement of open job positions or online job application	25,6
Sending filled in forms	68,7
Treat administrative procedures completely electronically	31,3
Online notification for public procurement and tender specifications	83,1

Table 2: Purpose of the Internet usage in the public sector, 2011
Source: Adapted from State Statistical Office Information Society, News Release 8.1.11.31

From our own research (Trenevska Blagoeva, 2015) the maturity level measured by the Business Process Interoperability Methodology is the highest in public procurement and taxes.

EPS as a category is very diverse and variable and consists of set of public services that is not constant; actually the number of services is growing and the scope as well. The types and characteristics of users are also very variable. Those two facts, growing number of EPS and their variability of sophistication and the variability of users make the research design complicated and this research can be regarded as the initial pilot in order to get some insights.

We decided to use TAM modified because this methodology is widely used to analyse citizens and businesses acceptance of EPS. On the other hand, UTAUT is used to analyse technology acceptance in organizations. Therefore, TAM is used because the main advantage of this model is that it can be modified to best suit the purpose of the research and it can be extended by using specific constructs when used with new technologies.

The first construct is *perceived ease of use*. In order to get the insights for this construct we defined 5 statements (EPS usage is simple; Web site navigation of the EPS is simple; Assistance via the web site is available if needed; Accessibility for users with special needs; Learning to use EPS is fast and simple). The second construct is *perceived usefulness* with five statements to measure it (EPS offer relevant information; Information are updated; EPS usage improves my performance; EPS usage can bring me savings of time and money; Via EPS it is possible to communicate with the authorized public servant). *Perceived trust* is measured by four questions (EPS are reliable; Privacy is well protected while using EPS; Transactions are secure; Negative consequences are possible if using EPS). The next construct is *user satisfaction*. User satisfaction is measured in our questionnaire by four statements (Satisfaction of the content of the EPS; Satisfaction of the interface of the EPS; Satisfaction of the speed of receiving EPS; Satisfaction of the security while using EPS). The previously mentioned four constructs are influencing the intention and adoption of EPS. *Adoption* is measured by three statements (I have positive attitude towards using EPS; I plan to use EPS; I use EPS frequently).

In this occasion we would like to point out that for the purpose of this research, although demographic factors are considered important external factors influencing technology adoption i.e. e-Government adoption in similar studies (Colesca and Dobrica, 2008; Suki and Ramayah, 2010) we concluded that for our country those factors are not very significant. According to data collected by our survey (supported by the official data from the State Statistical Office of the Republic of Macedonia), demographic factors like age, gender, education, are not determinates of the adoption or the intent to use EPS. Based on the discussion above, the proposed research model is presented in Figure 1 and the following research hypotheses are set.

H1: Perceived ease of use of an EPS will positively influence perceived usefulness of EPS.
H2: High perceived trust will lead to increased perceived usefulness of EPS.
H3: Perceived ease of use while using an e-public service has a positive effect on user satisfaction.
H4: Perceived usefulness of EPS has a positive effect on user satisfaction.
H5: High perceived trust on an e-public service will lead to increased e-Government adoption.
H6: User's satisfaction has a positive effect on the adoption of EPS.

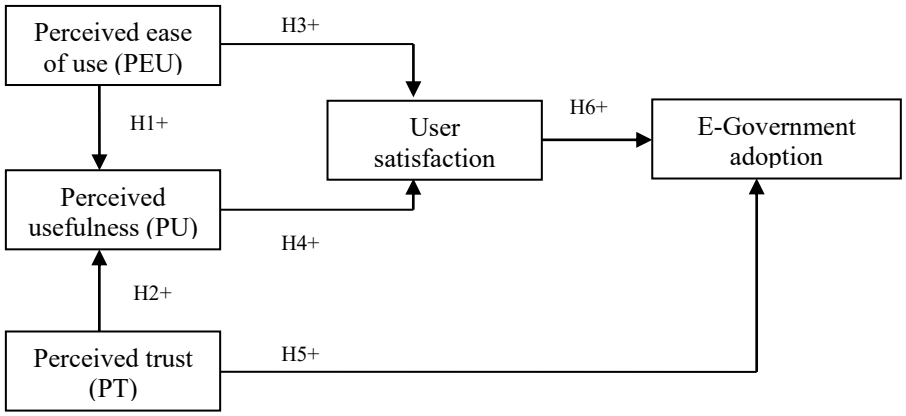

Figure 1: The research model (TAM based)

For the purposes of this research i.e. to analyse the factors that influence electronic public services usage (adoption) in the Republic of Macedonia, a survey was performed based on the previously prepared questionnaire. Regarding the structure of the questionnaire, it consists of six parts. The questions in the first part (A) refer to the demographic characteristics of the sample. All other parts (from B to F) comprise questions regarding the factors that are our research model; for which we assume influence the e-government adoption. A five point Likert scale was used. The research was conducted during the period from October to December 2015. The total number of received answers was 122, but after the filtering of the data, 10 questionnaires were excluded from further analysis due to the missing data (more than 10%), low standard deviation in answers, more than one answer in the fields where three possible options were offered (in the first part of the questionnaire) etc. (Hair, 2010). The total number of questionnaires valid for further analysis is 112. In the Table 3 the demographic characteristics of the sample are presented.

Demographic characteristic	**Item**	**Frequency**	**Percentage**
Gender	Male	50	44,6
	Female	62	55,4
Age	18-29	76	67,9
	30-65	36	32,1
Education	High school	50	44,6
	Bachelor	50	44,6
	Master/PhD	12	10,7
Internet usage	Every day	99	88,4
	Several times per week	10	8,9
	Several times per month	3	2,7
Type of internet connection	From home (PC)	43	38,4
	From work (PC)	14	12,5
	Mobile phone	55	49,1
Citizenship	Skopje (capital)	60	53,6
	Other	52	46,4

Table 3: Demographic profile of respondents

Before testing the hypothesis set based on the proposed research model, we performed a validity and reliability analysis. Cronbach's alpha as a measure of internal consistency, for the data set of the research is 0,84 after excluding the demographic factors and some statements. Those results are considered to be a good measure of scale reliability. Cronbach's alpha was calculated for the constructs explained previously. Since Cronbach's alpha values for some of the constructs (Perceived trust and e-Government adoption) were below the satisfactory level, some of the items in these constructs were deleted in order to improve the sample consistency. From the construct PT we deleted the forth item (Negative consequences are possible if using EPS) and from the EGOVA construct, the third item (i.e. I use EPS frequently), was deleted. After that, the final measures of internal consistency are satisfactory and are presented in the Table 4 below.

Construct (Number of items)	Cronbach's alpha
PEU (5)	0,70
PU (5)	0,67
PT (3)	0,68
US (4)	0,72
EGOVA (2)	0,76

Table 4: Cronbach's alpha for the constructs

Although Cronbach's alpha values for the two constructs PU and PT are below generally accepted level 0,70 (0,67 and 0,68 respectively) we decided to take them into consideration for further analysis since in the literature (Chakrapani, 2004) those values are also considered as satisfactory. A correlation analysis was performed based on each of the constructs defined in the research model. The results of the correlation analysis are given in the Table 5 below.

Constructs	PEU	PU	PT	US	EGOVA
PEU	1				
PU	0,47	1			
PT	0,28	0,32	1		
US	0,49	0,44	0,45	1	
EGOVA	0,24	0,34	0,29	0,22	1

Table 5: Correlation of constructs

As it can be seen from the matrix, there is a significant relationship between the e-Government adoption (EGOVA) and the rest of the constructs, although the relationship varies in strength from one construct to the next. In the Table 6, we summarize the findings regarding the research hypotheses.

Hypotheses	Variable	β	Significance
H1	PEU - PU	0,47	0,000
H2	PT - PU	0,30	0,001
H3	PEU - US	0,52	0,000
H4	PU - US	0,48	0,000
H5	PT - EGOVA	0,25	0,004
H6	US - EGOVA	0,20	0,019

Table 6: Hypothesis results

All the hypotheses are supported on the level of significance of 0,05 and 0,01 (except the H6). We can conclude that perceived usefulness is strongly influenced by ease of use and trust, and is influencing user satisfaction. Namely, user satisfaction is determined by usefulness and ease of use. User satisfaction and perceived trust are influencing the adoption of EPS with significant but not very strong relationship. User satisfaction is an attitudinal construct and we think that it should be included in technology adoption models. E-Government being application of ICT and new way of doing Government is an example of new technology acceptance. It is important to underline the significant relationship between adoption of EPS and perceived trust, because it is pointing out that users of EPS can be attracted by improving their trust while dealing electronically with the Government. Confidentiality, security and trust are important for the users and are guidelines for policy makers, analysts and developers.

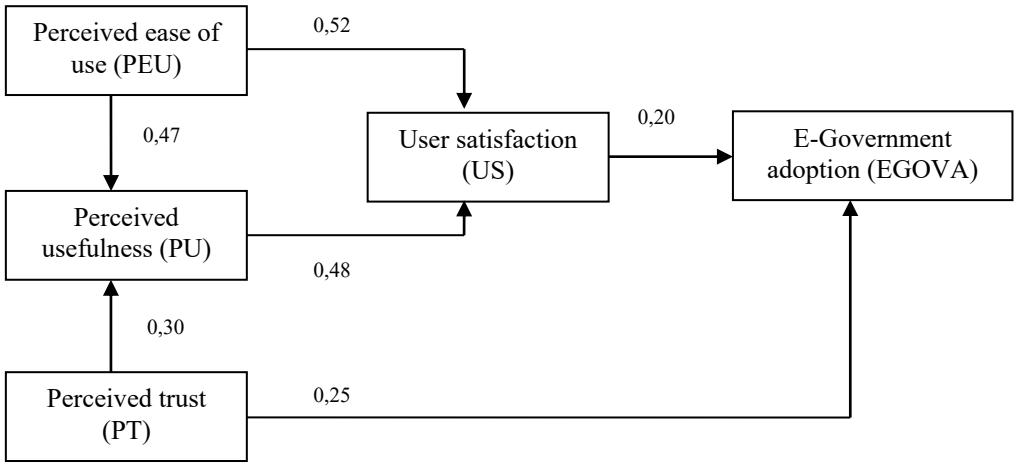

Figure 2: Results of the tested model (and hypotheses)

5 Conclusion

The aim of the research is to provide insights in factors that facilitate the usage of electronic public services in the Republic of Macedonia. The results proved that well established TAM can be implemented in the case of the Republic of Macedonia.

This research is important from the viewpoint of proving the possibility to use TAM model as technology acceptance model for e-Government adoption. In order to include demographic factors in the model the sample should be very well chosen and structured. Also, for further analysis we think that the distinction between citizens as users and businesses as users should be made and analyzed. However, the typical demographic characteristics such as gender, education level, and even age probably are not significant in our case. Internet usage is also not differentiator in e-Government adoption in the country. Further research should be focused on business user and demographic characteristics of organizations as well as on channels of access and delivery of services. Furthermore, local government and user centricity can be included in research.

The goal of the research can be elaborated as an indicative study to analyze and predict users' requirements and help design better solutions. User satisfaction, trust, ease of use and usefulness are significant factors for e-Government adoption as general predictors, but their scope and variants should be improved by further examination.

This research represents the first study in this field in the country, hence it could be used as a guideline for policy makers when improving current or implementing new EPS. The follow-up of this research should include more variables and more structured and bigger sample. The process of e-Government adoption is constantly changing and the research of this important topic should follow the development of new relation of the government with its constituents.

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35th International Conference on Organizational Science Development
March 16th – 18th 2016, Portorož, Slovenia

Sustainable Organizations through Dynamic Capabilities – Comparing Conceptions

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Abstract
The paper describes different conceptions of dynamic capabilities and their practical application to implement corporate sustainability. Dynamic capabilities are seen as a possibility to adapt to rapid changing environments and to implement sustainable innovation. While extant literature with theoretical contributions on dynamic capabilities has been published, there is still a discussion on how to operate them. The paper reviews seminal contributions on dynamic capabilities in the field of strategic management and literature on corporate sustainability. It summarizes the main conceptions and discusses the implementation of corporate sustainability applying the dynamic capability perspective.

Keywords: dynamic capability, corporate sustainability

1 Introduction

Dynamic capabilities are a fashionable topic in strategic management. Since it has been acknowledged that capabilities are relevant for the sustainable competitive advantage, organizational capabilities are seen as valuable and attractive. However, long-term success requires the continuous adaption to the changing environment and therefore appropriate modification and development of capabilities, too. The existing capabilities would otherwise no longer be sufficient to respond to new requirements. In addition, capabilities have the risk of rigidity (Schreyögg & Kliesch-Eberl, 2007). Different conceptions have been developed to describe the requirements to achieve long-term competitive advantage, especially for firms operating in environments of rapid technological change. However, despite 20 years of theoretical development, there is still no consensus on the definition of dynamic capabilities and especially on the operationalization (Noori et al., 2012, p. 3).

The aim of the present paper is to describe the development of the dynamical capability debate based on a review of five seminal publications in the field of strategic management. Additionally, it builds on two studies which use the dynamic capability view to practically implement corporate sustainability. It applies the lens of Schreyögg & Eberl (2015) to describe the different approaches to realize dynamic capabilities.

Section 2 explains the origins of dynamic capabilities and the different approaches to realize them. Section 3 illustrates the challenges firms face when implementing corporate

sustainability and how dynamic capabilities help to realize sustainable innovation. Finally, section 4 gives a short discussion on the different conceptions of dynamic capabilities.

2 Conceptions of Dynamic Capabilities

2.1 Origins of dynamic capabilities

With the recognition of the resource-based view organizational capabilities moved into the centre of attention, too. Organizational capabilities are reliable action patterns, provide "best practices" for handling routine situations and focus on the combination of resources. While organizational capabilities allow for replication of successful patterns, they also have an inherent tendency to inertia. Path dependence, structural inertia and commitment are the three main reasons why capabilities become rigid and hinder adaption to a changing environment (Schreyögg & Kliesch-Eberl, 2007, p. 914-916).

Since the 1990s, scholars increasingly started to consider fast changing business environments and discussed the importance to continuously renew resources over time. The resource-based view does not sufficiently explain how successful firms are able to respond and to coordinate competences under such conditions. Teece, Pisano, & Shuen (1997) extended the resource-based view to dynamic markets. Since then dynamical capabilities became a popular concept in strategic management as a key to competitive advantage. Several assumptions are related such as the evolutionary economics addressing the role of organizational routines, the Schumpeterian approach on creative destruction and innovation, considerations on behavioural aspects of firms or the core-competence perspective. All contributions see the firm as bundle of path-dependent resources which need to be reconfigured in order to achieve sustainable competitive advantage (Ambrosini & Bowman, 2009, p. 31).

2.2 Introducing dynamic capabilities in strategic management

In their seminal paper Teece, Pisano & Shuen (1997) refer to empirical evidence that competitive advantage of firms operating in environments of rapid technological change is accomplished through responsiveness and innovation. They established the concept of dynamic capabilities to explain long-term competitive advantage. "*Dynamic*" refers to the changing business environment, "*capabilities*" emphasizes the strategic role of "*adapting, integrating, and re-configuring internal and external organizational skills, resources, and functional competences*" (Teece et al., 1997, p. 515). The competitive advantage of a firm lies within its managerial and organizational processes, shaped by its asset position and the paths available to it. Organizational processes have the role of coordination and integration (e.g. external activities and technologies), learning (e.g. identification of new product opportunities) and reconfiguration and transformation (e.g. surveillance of markets and technologies; willingness to adopt best practice). (Teece et al., 1997)

This *integrated dynamization approach* attempts to modify organizational capabilities by integrating mechanisms which allow to address rapidly changing environments (Schreyögg & Eberl, 2015, p. 159).

2.3 Dynamic resource configuration

Eisenhardt & Martin (2000) explicitly address the critique that the concept of dynamic capabilities is vague, non-operational or tautological. According to them dynamic capabilities consist of specific strategic and organizational processes that create value for firms within

dynamic markets. They integrate different research areas thus allowing access to a large body of empirical work. Dynamic capabilities are seen as "best practices" of identifiable and well-known processes: Product development or strategic decision making are capabilities that *integrate resources* by combining expertise. Capabilities like knowledge transfer or forms of collaboration *reconfigure resources*. Alliance and acquisition routines or knowledge creation are examples of capabilities which *gain and release resources*. (Eisenhardt & Martin, 2000, p. 1107-1108)

High velocity markets are characterized by unpredictable changes, blurred market boundaries, and unclear business models. In the that case temporary competitive advantage comes from valuable dynamic capabilities which alter the resource base with unpredictable results. Their evolution is shaped by learning mechanisms such as practice, codification of gained experience, trial-and-error-learning, proper pacing of experience and market dynamism. (Eisenhardt & Martin, 2000)

This concept of dynamic capabilities is according to Schreyögg & Eberl (2015, p. 164) a *radical dynamization approach*.

2.4 Linking learning mechanisms

Zollo & Winter (2002) relate the dynamic capability debate to organizational learning. Like other authors they see dynamic capabilities as routinized activities to develop and modify operating routines. However, in existing definitions they miss the information where the dynamic capabilities come from. In addition, they loosen the linkage to the rapidly changing environment as firms also adapt operating routines in less dynamic environments.

The authors argue that mechanisms of organizational learning can either directly shape operating routines or they can lead to dynamic capabilities, which then lead to the evolution of operating routines. That way, learning mechanisms can be seen as second order dynamic capabilities. Routines for *experience accumulation* represent the pattern or behaviour, how an organization has learned to respond to internal or external stimuli. In rapidly changing environments dynamic capabilities have to be developed through learning and even the (higher-order) learning mechanisms will have to be updated, too. Second, collective learning requires *knowledge articulation* based on individual's explicit expression of opinions and beliefs, constructive confrontations and discussions. In the context of the adoption of routines this mechanism helps to improve understanding of the new or changing action-performance links. Finally, explicit *knowledge codification* (e.g. in manuals, spreadsheets, decision support systems) uncovers the linkages between action and performance outcomes (e.g. by performing post-mortem audits) and provides guidelines for the execution of future tasks. Explicit codification leads to a higher degree of understanding of what makes a certain process succeed or fail and therefore an important element in capability building. Learning investment is especially high in the case of knowledge codification. Organizations have to consider whether learning mechanisms are worth the efforts of time, resources or opportunity costs. The evolution of knowledge as a cycle of *variation* (scanning, recombination) – *selection* (evaluation) – *replication* (knowledge transfer) – retention (enactment) is related to the concept of exploration and exploitation. (Zollo & Winter, 2002, p. 340-343)

Schreyögg & Eberl (2015, p. 174) denote the approach by Zollo & Winter as *meta-competences in form innovation routines*. These higher order routines should analyse the changes in the environment and then modify the lower-order operative routines.

2.5 Competitive advantage in regimes of rapid technological change

Teece (2007) stresses the relevance of dynamic capabilities for multinational enterprises in fast-moving business environments. Instead of optimizing against constraints and capturing scale economies, firms will have to develop new opportunities, transfer technology, develop new business models and actively shape the market place.

Sustainable advantage requires difficult-to-replicate dynamic capabilities. They are aggregated of (1) *sensing and shaping opportunities and threats*, (2) *seizing opportunities* and (3) *enhancing and reconfiguring* assets. *Sensing opportunities and threats* means that firms need analytical systems and capabilities to continuously run search activities in order to explore technologies, to understand customer needs and to know changes in the environment. To create opportunities one needs access to information and actively use it to shape competition. This requires appropriate skills of individuals and organizational processes which ensure the activities. (Teece, 2007, p. 1322-1326)

Seizing opportunities means to address new products and services and to make strategic decisions about the firm's resource position. It requires organizational innovation to be able to establish appropriate decision rules, to recognize path dependencies and to decide on investments around new technologies with uncertain outcomes. The microfoundations of the seizing capability include selecting product architectures and business models, selecting the enterprise boundaries, managing complements and platforms to use economy of scale effects or shape interdependences and developing decision making processes. (Teece, 2007, p. 1326-1334)

The capability of *managing threats and reconfiguration* aims to continuously realign assets. While routines ensure continuity under stable conditions, enterprises face path-dependency or other forms of resistance (e.g. anti-cannibalization bias, cognitive limitations) when the environment changes. Leadership skills are required to enable change and renewal. The microfoundations are decentralization and near decomposability (open innovation, autonomy to organizational units), managing co-specialization (to achieve strategic fit and value enhancing effects), knowledge management and corporate governance (e.g. to achieve incentive alignment). (Teece, 2007, p. 1334-1340)

Operational capabilities help to sustain technical fitness (how well a capability per-forms the function) and to make competitive returns on the short term. Dynamic capabilities on the other hand sustain evolutionary fitness (how well the capability enables a firm to make a living) and build long-term value. They help to proactively shape competition and markets Teece, 2007, p. 1321).

It requires the ability to sense opportunities and address them in the sense of entrepreneurial management to achieve long-term competitive advantage in the current business environment (Teece, 2007, p. 1332). This approach explicitly describes dynamic capabilities as a meta competence and stresses the *entrepreneurial orientation* (Schreyögg & Eberl, 2015, p. 184).

2.6 Competence-monitoring

While dynamic capabilities are supposed to have the potential to overcome rigidities, Schreyögg and Kliesch-Eberl (2007) question whether capabilities can be conceived as being in flux at all. They come to the conclusion that (1) capabilities cannot be fully flexible (as

they refer to a patterned and replicable activity), (2) capabilities stick to their underlying logic and dynamization therefore requires "frame-braking changes" and that (3) innovation routines also restrict the scope of change to the logic of familiar programs. It is necessary to separate the dimensions of stability and dynamic as it is not possibly to have the positive side of capabilities without their negative characteristics in one conception.

They therefore suggest a dual process model with two separate strategic functions. One process practices organizational capabilities and exploits them. Capability monitoring as the second process continuously observes the organization's capabilities, evaluates their suitability in changing environment and identifies change requirements. The organization then has to choose between adequate reactions. As it is a structural risk to apply traditional patterns to new tasks, the monitoring function can be seen as risk compensation. This suggested reflecting observation of observation on the operational level comes close to the concept or double-loop learning. The authors are aware that monitoring is also affected by different individual and organizational biases, which have to be addressed by appropriate organizational measures. (Schreyögg & Kliesch-Eberl, 2007, p. 925-930)

3 Dynamic capabilities for corporate sustainability

Having summarized the main conceptions of dynamic capabilities, this section describes the idea of corporate sustainability to simultaneously aim for economic, ecological and social goals and the challenges organizations face. Two current studies (Castiaux, 2012; Wu et al., 2013) are reviewed which explicate dynamic capabilities by applying them to realize corporate sustainability strategies are described.

3.1 Corporate sustainability strategies

Sustainable development aims to secure an equitable world based on the three pillars of economic growth, environmental protection and social equality. On the micro-level, corporate sustainability defines sustainability within an organization and applies the economic, the ecological and the social pillar to firms (Baumgartner & Ebner, 2010, p. 77). In order to address the different issues of sustainability, firms have to incorporate sustainability within their strategies, whereby varying degrees of intensity exist. Kauffeld et al. (2009, p. 6-8) define 3 different levels how firms can address ecological issues: The minimal and least-evolved level (*responsible green*) implements measurement and reporting and aims for legal compliance. The second level (*efficient green*) pursues initiatives which reduce costs by improving efficiency and reducing waste and energy consumption. Finally, in the most advanced level (*differentiated green*) ecological goals become an inherent part of the corporate strategy and help to develop new business opportunities.

While the previous approach addressed ecological issues only, Baumgartner and Ebner (2009) discuss similar, but more detailed and holistic sustainability strategies. According to them, the least-evolved level (*introverted strategy)* also aims for risk mitigation and for conforming legal and external requirements. Second, companies can focus on the external communication of their sustainability activities (*extroverted strategy*). At a more advanced state, companies also would try to positively influence the conditions for corporate sustainability. The third strategy (*conservative strategy*) focuses on cost-reduction by improved processes with eco-efficiency and cleaner production. The highest developed approach (*visionary strategy*) addresses sustainability issues to achieve a competitive advantage by developing new products and markets.

3.2 Challenges for implementing corporate sustainability

When firms try to implement corporate sustainability, firms face several challenges. Economic results and efficiency is no longer the only rationality. Considering environmental costs and costs for resources as well as social and environmental issues extents the scope and the perspective of the corporation. Sustainable efforts are not always consistent with economic interests and have to be long-term oriented. The challenges become more complex, interdependent and ambiguous (Müller-Christ, 2010, p. 103). In addition, firms do not directly generate revenues when pursuing social or environmental goals (Wu et al., 2013 p. 257).

Considering the triple bottom line requires to apply a systems view. Organizations have to address different interests and stakeholders. Indirect stakeholders like non-governmental organizations and civil groups have to be considered, too. Their interests are difficult to sense and easily overlooked (Wu et al, 2013. p. 257). It is not sufficient just to address the business ecosystem, corporate sustainability has to address a global and natural ecosystem (Borland et al., 2014, p. 11).

When implementing corporate sustainability, the dynamics behind are complex (Castiaux, 2012, p. 127). However, organizations tend to prefer reliable and already efficient operations and they will try to avoid disturbances (Wu et al., 2013, p. 262). They face different forms of rigidities like dominant logic or limitations of the current business model. Factors such as technical interrelatedness, cognitive frames, irreversibility of investments or economy of scale effects can finally lead to innovation lock-ins (Spiegel & Marxt, 2015, p. 270).

3.3 Dynamic capabilities for corporate sustainability

Firms have to develop new organizational capabilities in order to overcome different rigidities, develop new perspectives and monitor the different requirements and changes in a wider eco-system. To be able to integrate various stakeholders, to manage complex requirements and to consider the triple bottom line, existing competences and resource will have to be modified. Dynamic capabilities are seen as a possibility to adapt to a dynamic environment. They could also be helpful to consider not only changing requirements in terms markets and technologies (Teece, 2007), but also in terms of ecological and social requirements. If firms have to change strategies, operations and structures they require dynamic capabilities to modify their functional capabilities (Wu et al., 2013, p. 257).

Castiaux (2012) analysed examples of ecological innovations from the IT industry. The application of dynamic capabilities is linked to the intensity of the green strategy as described before. Each level has different requirements on the capabilities of the organization. Just applying minimal standards in order to meet legal requirements (*responsible green*) presents the lowest requirements on dynamic capabilities to alter the resource base. However, such firms risk to be substituted by newcomers who better able to develop innovative solutions to meet the environmental expectations. On the next level (*efficient green*) firms have an internal strategic focus on environmental issues in terms of efficiency (e.g. cost or waste reduction). To realize process innovation is in order to achieve efficiency requires a higher level of dynamic capability in order to renew the resource base. When firms integrate green strategy into the core strategy in order to create new business opportunities (*differentiated green*), they have to consider eco-innovation within the entire product life cycle. This requires radical new perspectives and a high level of dynamic capabilities. (Castiaux, 2012, p. 130-131)

The higher the level of sustainability, the more existing resources and capabilities have to be questioned and reconfigured. While – in terms of the three types of dynamic capabilities as suggested by Teece (2007) – sensing capabilities are involved for the first two stages, all three types (sensing, seizing and transforming) are required for the differentiated green strategy. (Castiaux, 2012, p. 134-137)

While dynamic capabilities are usually seen as possibility to achieve sustaining competitive economic advantage, Wu et al. (2013, p. 258) see a possibility to apply them to corporate sustainability: They define dynamic capabilities for corporate sustainability as "*the firms' ability to address the rapidly evolving sustainability expectations of stakeholders by purposefully modifying functional capabilities for the simultaneous pursuit of economic, environmental and social competence.*" They analysed corporate CSR reports of leading companies in the UK to identify best practices and developed a conceptual framework showing which dynamic capabilities help to develop corporate sustainability. Referring to Teece (2007), dynamic capabilities for corporate sustainability are organizational capabilities which enable a firm to sense emerging sustainability needs, to seize new sustainable development opportunities and to reconfigure existing capabilities for corporate sustainability. The monitoring capability is seen as an information processing mechanism to exchange new sustainable development insights with all direct and indirect stakeholders. The seizing capability consists of clearly defined sustainability strategy and extensive boundary spanning knowledge sharing. To reconfigure unsustainable business functions, finally, firms needs elements like risk analysis methods, environmental management systems, collaboration with partners and training activities to support organizational process reconfiguration. (Wu et al., 2013, p. 260-265).

4 Discussion

Since the publication of the seminal paper by Teece et al. (1997) extant literature has been published on the topic of dynamic capabilities. Most of the initial publications are conceptual papers which discuss different approaches in order adapt organizational capabilities to the changing environment and to overcome rigidities. However, while dynamic capabilities gain much attention in the field of strategic management the theoretical conceptions are still difficult to grasp.

Eisenhardt & Martin (2000) combine the dynamic capability discussion with specific routines of research areas outside the resource-based view. Their examples (new product development, strategic decision making, alliances and acquisitions) are rather generic and it remains unclear what these dynamic capabilities would look like in terms of the radical dynamization approach for high-velocity markets. Zollo & Winter (2002) suggest developing innovation routines as meta-competences. The idea of dynamic capabilities as a meta-competence is comprehensible in terms that a firm be-comes adaptable to environmental changes. The approach is very similar to the general attempt to improve innovative capability of a firm.

The concept by Teece (2007) is more comprehensible, also due to the fact that for each of the three dimensions (sensing, seizing, transforming) the contributing micro-foundations are described in detail. The entrepreneurial approach seems to be a plausible way to address persistence in organizations and to adapt to a changing environment. The approach justifies the implementation of certain elements within the enterprise which foster the entrepreneurial orientation.

The introduction of a monitoring process (Schreyögg & Kliesch-Eberl, 2007) introduces reflection capability to the organization and thereby helps to understand the necessary adaptions. This approach is related to organizational learning and institutionalizes the monitoring process. But couldn't the concept according to which the monitoring takes place and according to which necessary adaptions are detected be also subject to inertia? In addition, the monitoring process could be seen as costly to the organization.

Apart from these theoretical conceptions, research is still unclear how firms should operate dynamic capabilities and so far it is not possible to develop appropriate guidelines for executives (Ambrosini & Bowmann, 2009, p. 45). The implementation of corporate sustainability is a complex issue which involves numerous challenges such as a wider eco-system, the consideration of all stakeholders, changing perspectives, long-term thinking or new business models. The context is therefore suitable to illustrate the application of dynamic capabilities in order to modify operational capabilities and to reconfigure resources. Two studies (Castiaux, 2012; Wu et al., 2013) have been used to show how dynamic capabilities are involved in the implementation of a corporate sustainability strategy.

Both authors apply the *sensing-seizing-reconfiguration* conception defined by Teece (2007), which can be seen as a meta competence with an entrepreneurial orientation. The degree of the intensity of the sustainable strategy determines the type of the dynamic capability. For lower levels of sustainability, which mainly address external stakeholders, only the monitoring capability is required in order to identify relevant changes and emerging sustainability requirements. A more ambitious strategy would also require the seizing and, finally, reconfiguration capability, which also allows for internal organizational reconfigurations (Wu et al., 2013, p. 265).

The illustrated examples are plausible in terms of how forms can operate dynamic capabilities when implementing corporate sustainability. They apply the entrepreneurial orientation to adapt to changing requirements and to implement visionary and innovative strategies. However, they do not address the initial intention of dynamic capabilities and the capability paradox described by Schreyögg & Kliesch-Eberl (2007, p. 916-919): Dynamic capabilities are supposed to overcome the inherent tendency of inertia which is caused by path dependency and lock-in, structural inertia and commitment. The entrepreneurial orientation as a meta-competence considers several processes to identify changes but does not address rigidities which could occur when establishing new competences (Schreyögg & Eberl, 2015, p. 187). For example, the monitoring capability to scan emerging sustainability requirements is seen as a dynamic capability, but could itself be subject to inertia. This initial issue of the dynamic capability debate is not addressed and remains unsolved.

Management science has developed a variety of different solutions to address the changing environment. How do the conception of dynamic capabilities and the idea to adapt to changing environment fit to different existing conceptions on renewal, flexibility, innovation, etc.? As Teece (2007, p. 1337) states: "*In many ways, much of the traditional literature on organizational adaptation and 'fit' (e.g., Miles and Snow, 1994) is consistent with dynamic capabilities.*" In that sense it is probably the merit of the dynamic capability debate to amplify the integration of different research streams (operational topics like new product development as well as topics like organizational learning, innovation, entrepreneurship) to the field of strategic management. The discussion on dynamic capabilities not only combines different work on the idea of competences (organizational routines, architectural knowledge and

competence, core capabilities, rigidities) but also innovation, entrepreneurship, learning theory, and even various other field of operational management which – as best practices – can be seen as implementation of dynamic capabilities. This makes the field flourishing since the 1990s.

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