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IMPACT OF ICT ON QUALITY OF LIFE

Abstract: Information and communication Technologies (ICT) change human behavior in all aspects, starting from digital economy, health and education services, traveling, working life, personal and group communication, etc. On this way, ICT has impact on happiness and well-being on individual and macro level, sustainable development and mutual impact of all previous entities on quality of life.

In this paper, basic informations and models for digital society happiness, well-being, sustainable development, and quality of life have been presented. Based on this, models of impacts and certain results of investigation about impact of ICT on happiness are presented. At the end, gained conclusions, with the temporal meaning because there is not significant and reliable information for transition economies with different value systems, are presented.

Keywords: ICT, modeling, happiness, well-being, quality of life, sustainability

1. INTRODUCTION

A fast development and introduction of Infrastructural and Communication Technologies (ICT) changes our World in each domain and has impact on our quality of life. According a purpose of ICT a lot of activities supported by ITC becomes faster, higher, availability of data, easier, flexible and so on. On other side, ICT has possible negative effects regarding privacy, big data analysis, reliability and timeless of data and so on.

All of it as high and with development of ICT faster and stronger effects on quality of life (QoL). The question is what optimal solution of ICT from aspect of QoL may be. It is challenge for authors of the paper.

The goal of the research presented in the paper was to model impact of ICT on QoL and sustainable development. For this was necessary to analyze characteristics of digital society, from aspects of impact of ICT and it's possible well-being, social capital, and QoL. It is presented in chapter two of the paper. In the third chapter impact of ICT on well-being according to presented references and different models has been analyzed. In next chapter impact of ICT on QoL is analysed and presented the new model of QoL in function of ICT with introducing Quality of Working Life (QWL). In fourth chapter a part of results related to impact of ICT on sustainable

development has been presented, by using recommendations of World Economic Forum. On this way, that pillar related to Digital Agenda for Poland is smaller than in other countries in Europ, what implies that ICT is reservoir for improvement of QoL, well-being, sustainability and quality of working life.

2. CARRACTERISTICS OF DIGITAL SOCIETY

At the end of the twentieth century society has been under different pressures. One of its is deeper and higher involvement of ICT (Information and Communication Technologies) in all processes in society. On this way people recognized terms of Informations Age, Information Society, Digital Society, Digital Economy, e-Society and so on. If we wish to emphasize a broader aspect we express it through term digital societz or global willige.

Acrtual role of ICT is eliminating the barriers of time, space and distance through profiliation of high-speed communication networks among all entities in each society.

It is supported by globaliyation request and high annual growth of ICT performances. On this way ICT has impact on structre, authority, power, job content and personal issues.

In a huge reference in this area for purpose of the paper are interested works of [1-3],

investigated impacts of ICT on society in the new century and emphasized role of ICT on creating a new business models. An extension of problem of quality of life is Quality of Virtual Life (QoVL). It investigated Novak (2009) [4] with emphasize on virtual platforms and user

behaviors and motivation. He developed conceptual framework of QoVL in virtual world and its connection to QoL in real world.

According to (Turban *et al.*, 2005) [5] this impact of ICT is shown in Table 1.

Table 1. Impact of ICT

No.	Impact on:	Structure	Authority	Power	Job content
1	Flatter organizational structure	W	V	V	V
2	Change in blue-to-white-correr ratio staff	W	V	V	W
3	Growth in number of special unites	W	V	V	W
4	Centralization of authority	V	W	V	V
5	Changes in power and status	V	V	W	V
6	Changes in job content and skill performances	V	V	V	W

Legend: W – high impact, V – medium impact

In first case using ICT dominantly increases a span of control with reduction of total number of employees including staff and line managers. In second case increase number of white color staff including ICT specialist and other ICT related staff and decreases number of blue-color staff. In third case increases new special units as e-commerce centers, decision support centers, and so on. They are supported by or communicate directly to top managers. In fourth case ICT support authority on all levels. It influence on increasing power of each individuals and through high level of knowledge and skills on his/her status in organization or society as whole (fifth case). In sixth case ICT has impact on job content and skills performance. It is related to employe (or general people) satisfaction, compensation, status, productivity, quality of working life, motivation, and so on.

Impact of ICT on individuals could be:

- determination and other psychological Impacts,
- information anxiety,
- impact on health and safety (job stress, repetitive strain injuries).

If the role of ICT is seen in a broader sence, virtual communities' may be recognized. It is a groupu of people with same common interests who are interacting with one another.

On this way community is defined as feelings and affective bounds among members of a group that shares some common interests,

activity or space [6].

On the global level ICT urges people to reexamine their value systems, especially related to:

- security versus privacy,
- freedom of expression versus censorship, and
- intellectual property, piracy, and fair use.

In last case are developed Digital Rights Management (DRM) systems.

On the organization level are recognized managerial issues () of ICT:

- offshore outsourcing,
- managing and evaluating nonpresent workers,
- dealing with overloaded information,
- providing high quality information,
- displacmenet of employees with ICT,
- use of electronic surveillance,
- ethical issues and so on.

For a new role of ICT in digital society is necessary to develop and establishe local ICT iniciative in purpose to enhance social capital. According to Anderson *et al.* (2006) [7] in figure 1 conceptual model of community ICT impact on social capital and quality of life is presented. In this model start factor is:

- community ICT, defined as:
 - community network [8],
 - networked community [9],

- place based community network [6]
- community based ICT initiatives [10], or
- local net [11]

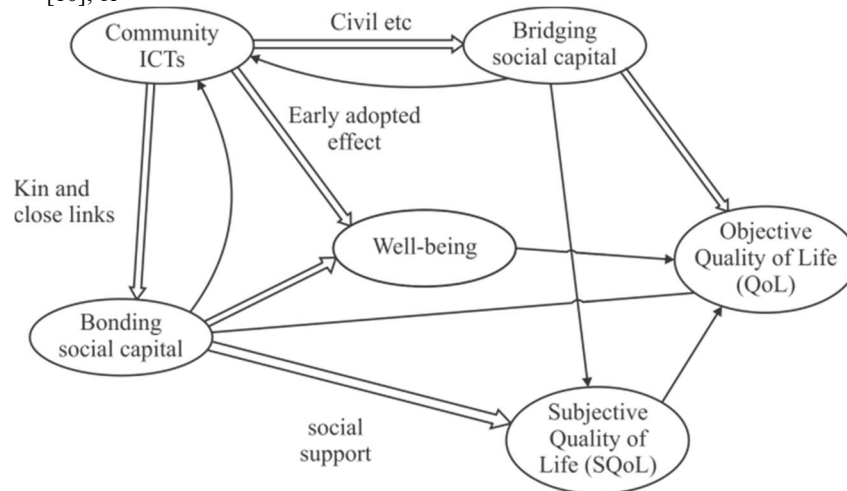


Figure 1. Conceptual model related to impact of ICT initiatives on social capital, happiness, and quality

For purpose of the paper in this base model is included well-being and added relations among them.

In next chapter more relations among factors in this model will be explained.

3. IMPACT OF ICT ON WELL-BEING

As other technologies ICT has positive and negative impact on people. Graham and Nikolava (2012) [12] tried to answer on question "Does access to information (and communication- added authors) make people happier". In this purpose they made research with two related objectives:

- understand the effects of worldwide increasing of communications capacity, speed and access to ICT on well-being, and
- contribute to understanding of the relationship among well-being factors and ICT.

They used Gallup World Poll (GWP) as source of data base from year 2005. Using scale with 10 points and using logits of them they formulated questions for three group of well-being dimensions:

- living experience,
- life satisfaction, and

- best possible life evaluations.
- The formal empirical model was:

$$Y_{itr} = \beta_1 \cdot landlive_{itr} + \beta_2 \cdot cellphone_{itr} + \beta_3 \cdot TV_{itr} + \beta_4 \cdot internet_{itr} + \gamma' \cdot X'_{itr} + \lambda' \cdot Z'_{itr} + \tau_t + \varepsilon_{itr}$$

where:

i – individual,

t – year,

r – region (country),

X' – a vector of observed individual – level variables such as gender, age, material status, and others,

Z' – a vector of person specific observed household – level variables as household location, and others,

γ' and λ' – coefficient vectors,

μ_r – controls for region (country),

τ_t – controls for time (year of survey), and

ε_{itr} – statistic error.

The results of this study are divided in two parts:

- access to information technology and well-being,
- access to technology and financial services and well-being.

A basic finding related to the first part is that technology variables (cell phones, TV and internet) have a significant and positive

correlation with best possible life and also with smiling, while both stress and anger are negatively correlated with acces to ICT. There are variation accross regions, well-being dimensions and income levels.

In aggregate sense, ICT is positively assoiated with bouth aspects of well-being, higher and beyond the effects of other variables, such as income. Using Findex data in addition to GWP data, authors created marget data fill in purpose to assess a impact of ICT as means to use new technologies in financial services and their impact on well-being. This part od research is area of mobile banking.

Using this concept of ICT (Digital Economy) individuals can send and receive money [5,13] with less costs, time and engagement of other people. On this way ICT as mobile banking is associated with both higher levels of stress and anger. A financial transactions are now easier and more available and facilitating business transactions, but on the other hand they are making them a increasing part of every day life, which might be negative experience sense.

Those remarks are supported by other

researchers. So Choi & Hoon Yi (2009) [14] emphasize the effect of the Internet on Economic Growth. An economy of well-being [15] stated that high income improves evaluation of life but not emotional well-being. On other side, [16] analized intenet paradox and stated the question how much social technolgy reduces social involvement and psychological well-being. As extension of different previous researches [18] tried to project the economic impact of the Internet.

4. IMPACT OF ICT ON QUALITY OF LIFE

Quality of life as new paradigm has very complex structure and internal and external relations among other paradigms and factors. For purpose of the paper the figure 1 is made broader (figure 2) with intdocution of facots of external and internal environment. Also, well-being is devided into two parts: (1) subjective well-being (happiness), and (2) objective well being.

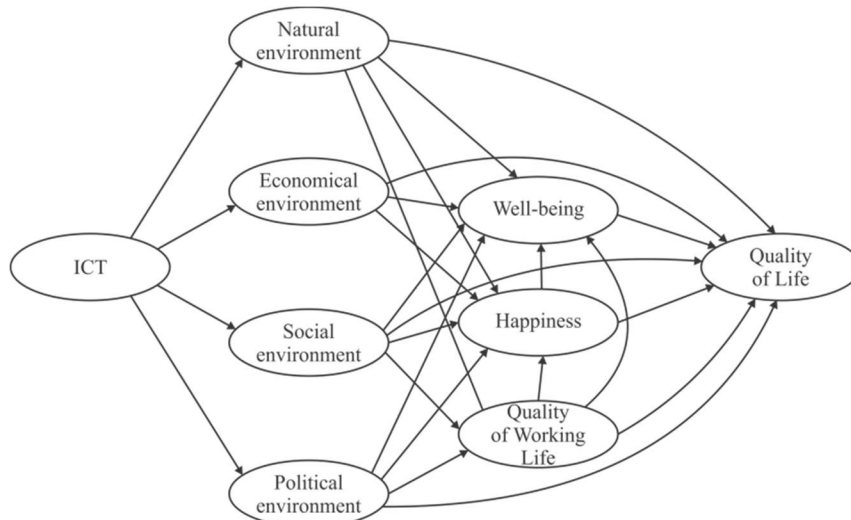


Figure 2. Extended model of ICT impact on quality of life

Accoridng to Pukeliene et al. (2011) [17] on Quality of Life (QoL) have impact factors of external environment and factors of internal environment, but Lindstorm and Ericson (1993) used more specific categories repreenting levels:

- global (macro environment, human rights, politics),
- external (work, standard of living, housing),
- interpersonal (family, close relationship, interpersonal relationship), and
- personal (physical, psychological, spiritual).

Those factors and other factors of QoL are related to ICT, through environment and other concepts as:

- well-being (WB),
- happiness (H), and

- quality of working life (QWL).
Impact of ICT on Well-being is presented in previous chapter.

Impact of ICT could be demonstrated according to [19] through flexible work practice (Table 1).

Table 1. A role of ICT in flexible work form

Workin time	Work location
<ul style="list-style-type: none"> • extended accessibility of services, lengthening of working day • tuned management of task flow and quantitative manpower needs • just-in-time services 	<ul style="list-style-type: none"> • extension and diversification of distance working • remote organization and planning of project work and management by objectives • ubiquitous work
Work contracts	Subordination links
<ul style="list-style-type: none"> • using “just-in-case” management • modeling and planning of atypical work contact management • electronically monitoring performances conpled to performance related pay 	<ul style="list-style-type: none"> • support to subcontracting and externaliyation • coordination of remote independent subcontractors • increasing job detachment and third party supply in ICT industries and services

On this way ICT has impact on quality of working life (QWL) and Quality of Life (QoL).

A flexible working forms supported by ICT become base for concept of “social sustainable” flexibility. Some of the social relations has positive and some of them negative impact on heppiness (H) with two domains: (1) economic, and (2) relational. According to Rojas & Ibarra-Lopez (2014) [20] happiness is function of two goods consumptions: economic growth (E) and relational goods (R). Using Cobb-Douglas function they become relatin:

$$H = E^\alpha \cdot R^{1-\alpha}$$

If we suppose that persons have a limited endowment of time (T) which is distributed between two domains, i.e.:

$$T = T_Y + T_R$$

If we assumed that E=T_Y, and R=T_R than previous relation becomes:

$$H = (T - T_R)^\alpha \cdot T_R^{1-\alpha}$$

and T_R becomes the only control variable in equation.

If we introduce a production of relational goods, expressed by people who are willing to share a time with person, than relation becomes:

$$H = E^{\alpha/(n+1)} \cdot R^{(1-\alpha)/(n+1)} \text{ or } H = (1 - T_R)^{\alpha/(n+1)} \cdot (T_R)^{(1-\alpha)/(n+1)}$$

They distinguish two kind of persons:

- materialistic who work more and relate less, and
- human relating, who work less and relate more on scale (0-1) of materialistic values.

Castellaci (2013) [13] in description of

Norwegian Research Council “Samansver” programe pointed out the new approach to the effects of ICT on subjective well-being (happiness), which is in center. Around it are factors related to:

- personal carracteristics,
- working life,
- external environment, and
- private life.

In this model has been recognized relation to quality (consumption), quality of working life (quality and type of work, income, capabilities), quality of life (other carracteristics). In this model ICT is included in work package WP3: income-mediated effects and has to give answer on question “How is the rate of ICT adoption related to the happiness level of population”, or question in WP7: “How do ICT shape life satisfaction of citizens through changes in the environment”.

5. IMPACT OF ICT ON SUSTAINABLE DEVELOPMENT

In previous chapter analysed impact of ICT on well-being. In paradigm of Sustainable Development emphasize is on economic growth with protection of natural resources. Based on papers of [21- 24] he distinguished different dimensions: (1) ecological sustainability, (2) technological sustainability, (3) economic sustainability, (4) political sustainability, (5) cultural sustainability, (6) sustainability of other different areas as: science, art, education, ethics,

medicine, sports, and social relationship. In each of dimensions he recognized role of ICT with related opportunities and risks.

Jackson (2006) [25] analyzed relations among well-being, consumption growth and sustainability and stated a new paradigm: human well-being because there exists “well-being paradox”, i.e. on well-being money and financial situation is low ranked characteristic of

happiness and well being characteristic (Figure 3). The highest level has partner and family relationships (47%), place of live (8%), health (24%), and so on. Also, this paradox is demonstrated in analysis of Inglehart and Klingeman (2000).

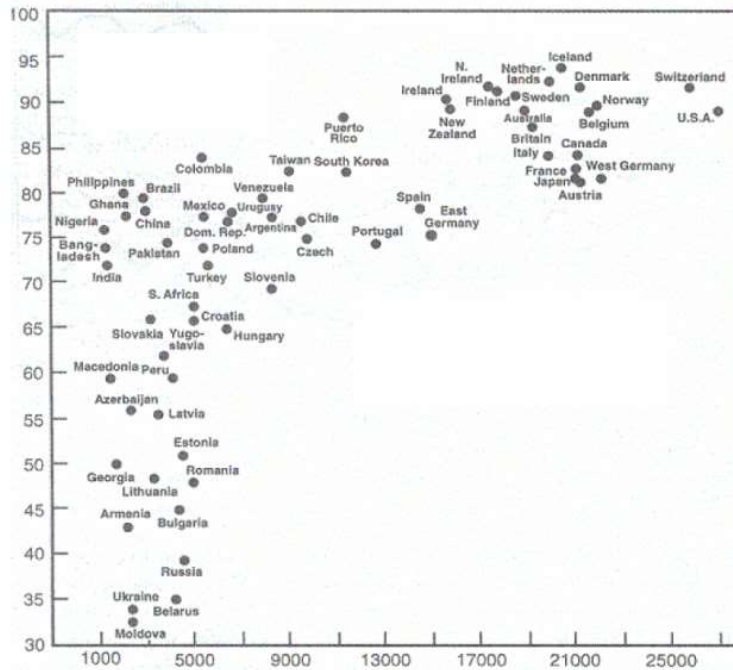


Figure 3. Subjective wellbeing and per capita income

In the Europe 2020 strategy there are the three axes of the strategy:

- smart growth: developing and economy based on knowledge,
- sustainable growth with promotion of a more resource – efficient, greener and more competitive economy with decoupling economic growth and territorial cohesion,
- inclusive growth with fostering a high – employment economy delivering social and territorial cohesion.

For it the strategy identifies seven flagships initiatives. One of them is Digital Agenda for Europe, with acceleration of roll-out of high-speed internet and reading the benefits of a digital single market for households and firms. It is the second pillar of sustainable competitiveness. In this pillar, which has 14% of

total competitiveness, there are:

1. ICT readiness (33%) with:
 - government strategy for ICT,
 - mobile phone subscriptions,
 - international internet bandwidth per internet user,
 - fixed broad-band internet subscriptions,
 - mobile broad-band subscriptions, and
 - laws related to ICT.
2. ICT usage (3%) with:
 - Government Online Service Index,
 - Internet users,
 - ICT use for business-to-business transactions, and,
3. ICT impact (33%) with:
 - ICT and access to basic services,

- ICT and business model creatins,
- E – partitipation index, and
- Patent Cooperation Treaty (PCT) patent applications.

In report of World Economic Forum (2014) Poland has smaller Europe 2020 index with score 4.0 in 2014 edition and had rank of 22 for total 28 ranked EU countries. For pillar: Digital Agenda Poland was ranked better (rank 19) with ICT readiness score of this pillar of 4.7, ICT usage 4.6 (rank 24) and ICT impact of 27 (rank 26). In this report the best ranked country was Finland with total score 6.1 on the scale 1-7.

In this report there are no information about Serbian competitiveness rank. But, based on previous investigation (World Economic Forum, 2014) we can conclude that Serbia could be ranked more below 28 positions.

6. CONCLUSION

In XXI century there is a permetation of different paradigmas. In the paper are analyzed impact of ICT (digital society) on well-being, quality of life, sustainable development including competitiveness. The results of investigation are twofolds: (1) a review a previous investigations related to these topics and (2) generating a basic model of ICT impact on well-being, quality of life and sustainable development. The first partial results pointed out that ICT has positive and also negative effects on some carracteristics, but in total this effects is positive. The question is which amount and structure of ICT we can radically and efficiently improve the quality of life and sustainability. For answering on this question and resolving this problem is necessary to made a lot of sub-model using combinations of button-up and top-down approach to resolve this problem for different problem situation.

REFERENCES:

- [1] Amichai-Hamburger, Y. (2009). *Technology and psychological well-being*. Cambridge, UK: Cambridge University Press.
- [2] Willmott, M. & Nelson, W. (2005). *Complicated lives*. Chichester, West Sussex, England: John Wiley & Sons.
- [3] Lee, K.R. (2009). *Impacts of Information Technology on Society in the New Century*, Retrieved from: <http://www.zurich.ibm.com/pdf/Konsbruck.pdf> Accessed 2009/08/ 08.
- [4] Novak, T. (2009). Quality of Virtual Life. In D. Mick, S. Pettigrew, C. Pechmann & J. Ozanne, *Transformative consumer research for personal and collective well being: Reviews and Frontiers* (1-40). Riverside, California: University of California.
- [5] Turban, E., McLean, E., & Wetherbe, J. (2005). *Information technology for management*. New York: Wiley.
- [6] Blanchard, A. & Markus, M. (2004). The experienced "sense" of a virtual community. *SIGMIS Database*, 35(1), 64. <http://dx.doi.org/10.1145/968464.968470>
- [7] Anderson, B., Dries, J., Gaved, M., Heres, J., Mooy, R., Stoneman, P., & Thomas, F. (2006). *SOCQUIT Project: D11: Detailed Results of Modelling and Analysis SOCQUIT Project Deliverable (Final Results of Modelling and Analysis)*.
- [8] Horrigan, J. (2001). *Online communities: networks that nurture long distance relationships and local ties*. Washington, D.C.: Pew Internet & American Life Projec.
- [9] Day, P. (2001). *The networked community: policies for a participative information society*. Brighton: University of Brighton.
- [10] Liff, S. (2004). Competing Models of Community Networks: Significance of different approaches to place based web sites for community participation and engagement. In *Building & Bridging Community Networks: Knowledge, Innovation & Diversity through Communication*, Brighton, East Sussex, England: Centre of Communication and Information Technology.
- [11] Schuler, D. (1996). *New community networks*. Reading, Mass.: Addison-Wesley Pub. Co.
- [12] Graham, C. (2005). Insights on Development from the Economics of Happiness. *The World Bank Research Observer*, 20(2), 201-231. <http://dx.doi.org/10.1093/wbro/lki010>
- [13] Castellacci, F. (2013). *Innovation and happiness: The missing link*. NUPI workshop, Thornbjornrud.

- [14] Choi, C. & Hoon Yi, M. (2009). The effect of the Internet on economic growth: Evidence from cross-country panel data. *Economics Letters*, 105(1), 39-41. <http://dx.doi.org/10.1016/j.econlet.2009.03.028>
- [15] Kahneman, D. & Deaton, A. (2010). High income improves evaluation of life but not emotional well-being. *Proceedings Of The National Academy Of Sciences*, 107(38), 16489-16493. <http://dx.doi.org/10.1073/pnas.1011492107>
- [16] Kraut, R., Patterson, M., Lundmark, V., Kiesler, S., Mukophadhyay, T., & Scherlis, W. (1998). Internet paradox: A social technology that reduces social involvement and psychological well-being? *American Psychologist*, 53(9), 1017-1031. <http://dx.doi.org/10.1037/0003-066x.53.9.1017>
- [17] Pukeliene, V. & Starkauskiene, V. (2011). Quality of Life: Factors determining its measurement complexity. *Inzinerine Ekonomika - Engineering Economics*, 22(2), 147-156.
- [18] Litan, R. & Rivlin, A. (2001). Projecting the Economic Impact of the Internet. *American Economic Review*, 91(2), 313-317. <http://dx.doi.org/10.1257/aer.91.2.313>
- [19] Valenduc, G., & Vendramin, P. (2001). *ICT, flexible working and quality of life. European Conference, Unity and Diversity*, Workshop 3: Social and Cultural Changes: The Impact on Well-being Bruges.
- [20] Rojas, M. & Ibarra-López, I. (2014). Happiness and Human Relations: The Role of Materialistic Values. An ABM Illustration. *IJIMAI*, 2(5), 23. <http://dx.doi.org/10.9781/ijimai.2014.253>
- [21] Alakeson, V., Aldrich, T., Goodman, J., & Jorgensen, B. (2003). *Making the net work. Sustainable development in a digital society*. Teddington. Forum for the Future.
- [22] Coyle, D. (1997). *The weightless world. Strategies for managing the digital economy*. London: Capstone.
- [23] Dalal, B., & Bass, S. (2002). *Sustainable development strategies*. A resource book. London/Sterling, VA: Earthscan Publications Ltd.
- [24] Mansell, R., & Wehn, U. (1998). *Knowledge societies. Information technology for sustainable development*. Oxford: Oxford University Press.
- [25] Jackson, T. (2006). *Beyond the "Wellbeing Paradox": wellbeing, consumption growth and sustainability*. Centar for environmental strategy, University of Surrey.