

University of Sopron
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**Sustainability in Digital Economic and Social
Environment**

Theses of doctoral (PhD) dissertation

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1. History of the Work, Goals set

The Thesis' aim is to analyze in detail the ever-stronger effects of digitalization – one of the newest additions to technological innovation at the early the 21st century – on economy and society, with an emphasis on how it affects sustainability. Besides being interested in the topic, the researcher's main reason for choosing this area was an interest to analyze the new directions of accelerated economic and social functions, as well as the adaptation to the changes in information technology from a scientific standpoint. The logical evaluation of sustainability indices and trends, and the interconnection and correlations of digitalization and economic and social sustainability efforts are at the center of the dissertation.

The aim of the researcher is to conduct a secondary type of reconnaissance research based on an ecological economical approach, followed by inductive logic. The author's intention is to review the literature on digital economy and society to date to determine the relevance of further in-depth studies covering subareas of the topic, and to draw conclusions from the currently available scientific information. Another goal is to facilitate the development of procedures that can be successfully applied to subsequent quantitative studies on the impact that OECD countries' digital transformation has on the different subareas of sustainability: Production, Trade and Consumption, Finance and Society.

Based on the mostly English language literature that the author had access to it was possible to conduct qualitative research on a trend-like basis, as the changes under review are still taking place in most OECD countries that are considered as sampling frames, but the related statistical series are expected to be available only in the coming years.

The aim of the research was to justify the following hypotheses:

Hypothesis I

The current scientifically accepted and applied economic and social sustainability indices are appropriate to indicate the changes in the different areas of digital transformation and their impact on the environment.

Hypothesis II

The increasing digitalization of the subsector of industrial production – with the introduction of new technologies, methodologies and theoretical concepts – facilitates and contributes to the more sustainable and efficient operation of its related subareas. This process reduces the amount of various economic and natural resources needed for production and thus reduces the environmental burden.

Hypothesis III

The increasing digitalization of the subareas of Commerce and Consumption – with the introduction of new technologies, methodologies and theoretical concepts –

facilitates and contributes to the more sustainable and efficient operation of related economic subareas. This process reduces the amount of various resources needed for production and thus reduces the environmental burden.

Hypothesis IV

The increasing digitalization of the financial system as an economic subarea, the introduction of new technologies, software-based applications, user opportunities and theoretical concepts will facilitate and contribute to the more sustainable and efficient operation of its related subareas. This process has a positive impact on the risks of the system and at the same time helps to eliminate the resulting pressure on economic growth, moreover it contributes to a more sustainable social functioning by widening access to and use of financial resources.

Hypothesis V

The ever-increasing digitalization of society, the transformation of the economy, the emergence of new technologies and the introduction of software-based applications and government innovations will facilitate and contribute to the more sustainable and efficient operation of its related subareas. This process reduces social differences, makes government operations more organized and cost-effective, and contributes to a higher level of social sustainability.

2. Content, Method and Justification of the Research

Before examining the hypotheses in the doctoral dissertation, the author reviews the literature, then summarizes the general tendencies in the subdivisions affected by the changes and their effects on the economic and social environment.

He briefly examines the impact of digitalization processes on indicators that form indices related to economic and social sustainability. Based on the literature it becomes clear that the sustainability effects of digital transformation have hardly been scientifically analyzed concerning the subareas affected by the process.

The author then presents and analyzes in detail the results of his own research, examining whether there are deeper correlations to be revealed between the results of digitalization of the selected subareas, and if long-term, trend-like conclusions can be drawn about the impacts on sustainability.

In the chapter containing the review of the literature, the researcher explores the theoretical background and the context of the topic primarily by organizing, processing and summarizing up-to-date international literature. In order to ensure better accessibility and processability of the topic of the dissertation, the author primarily uses the nominal measurement level variables of the social science research methodology in order to achieve relevant and comprehensive results.

In the selected topics the author intends to explore the correlations through cross-sectional examination, choosing the constant comparison method and second analysis, followed by inductive logic, all based on the currently available up-to-date literature, thus taking a scientific snapshot.

Due to the varied nature of the research area, the candidate opts for the use of ordinal measurement level variables when applying indicators of sustainability indices. For the qualitative organization and description of the research results his primary choice is the use internationally known and accepted indicators that make up complex sustainability indices (EIF, GS, UNEP SCP, DI, SSI). In the financial sphere the avoidability of structural risks identified and formulated by the Roman Club (Lietaer et al., 2015) are analyzed by means of qualitative analysis using nominal variables. Considering the availability and general reliability of the quantitative and qualitative information and statistics, the geographic scope and the sampling frame of the research are the most prominent OECD countries in the field of digitalization.

3. Results of the research

The results of the research show that based on the effects of digitalization on indicators in the subareas examined in the dissertation, the research hypotheses for improving sustainability were only partially justified by the revealed relationships.

Results Related to Hypothesis I

The assumption of the sustainability index hypothesis could not be verified by reviewing the related literature, as the popular and widely used sustainability indices in question most often use different indicators from each sustainability area (environmental, economic and social), which are sorted variously by index and weighted differently.

Thus, the structural and procedural changes resulting from the digital economic and social transformation may modify the partial results of the applied indicators and the final results of the indices, but in their present form they do not provide an appreciable indication of the effects caused by the digital transformation, and the measured changes do not provide complete, authentic feedback on actual processes in reality.

Results related to Hypothesis II

The assumption put forward in the Industrial Production Hypothesis can be justified by the analysis of related literature and the selected EIF, UNEP SCP and DS sustainability indicators of industrial production. Overall, the impact of digital economic transformation on indicators has been moderately positive. In addition to the moderate positive impact of Industry 4.0 – underperforming expectations – it can be emphasized that the wider application of Business Model innovation concepts and IoT structures could play a major role in achieving improved sustainability.

Included are the preliminary design of sustainable products and the digitized production process, with particular regard to meeting the expectations of the circular economy, and the

major reduction of waste generated during production that will significantly reduce the negative environmental impact.

Results related to Hypothesis III

The assumption made in the area of Trade / Consumption can only be poorly substantiated with the related literature analysis and the selected UNEP SCP and GCI sustainability indicators for consumption. The impact of digital economic transformation on indicators has also been poorly positive, and out of the three subareas only in two cases could I report on positive effects.

Regarding the thesis it can be emphasized that the achievement of the desired sustainability goal is particularly influenced by the accelerated spread of authorized consumers and e-commerce. On online markets small producers link themselves to end users. Excluding brokers and marketing tools can lead to a reduction in over-consumption and allow more durable products to be produced for individual needs in a much more environmentally friendly way, given that the population of OECD countries does not shift the structure of consumption towards luxury products.

The duality of this process can be seen in the moderately negative subresult of the Change in Consumer habits research subarea. However, concerning sustainability, the spread of a sustainable lifestyle model based on a positive approach and the rapid international advancement of the IoT concept of sustainable homes seems particularly encouraging.

Results related to Hypothesis IV

The hypothesis formulated in the Financial Hypothesis was only partially justified by the related literature analysis and the systemic risks concerning sustainability raised by the Roman Club. The efficiency gains can be clearly explained by the technological changes, but in four aspects of the five risk elements raised by the Roman Club, the links revealed by the literature remain close to the neutral category but in a positive state as far as sustainability goes. Based on these facts the researchers' assumption that the subareas have a positive impact on the system's risks and help eliminate the constant pressure on economic growth remains unjustified.

The assumed continuous economic pressure is not eliminated by the digitally transformed financial system, it only improves its speed and efficiency. Hopefully, in addition to the social regulatory functions of sustainability, the introduction of Block Chains that support sustainability on a higher level and the widespread dissemination of Community financial transactions will bear an evaluable positive result.

Results related to Hypothesis V

The hypothesis formulated in the Social Hypothesis was only partially verified in relation to the related literature and the selected SSI + HDI + DS indicators. Although the overall impact on sustainability has been moderately positive, it has yielded a result close to the threshold.

The impact of digitalization proved to be positive in 6 out of 8 subareas linked to social sustainability, and the rest, the Social Inequalities and Employment subareas had negative results.

Therefore, the balancing effect of the thesis on social differences has not been substantiated, but the government's cost-effective and more organized operating model seems to be being realized due to the positive effects of digitalization. Outside the government domain the positive impact of Digital Ecosystems is strongest, and their combined use could present an opportunity to reduce the impact of negative subareas and catch up to the sustainability benefits of the economy, and in the long run to achieve a higher level of sustainability.

3.1 New scientific results

As a result of the research carried out by the author, the following new and novel results surfaced:

- Summarizing the indicator systems used in the research, selecting and applying the indicators from the indices, exploring the literary background of the designated economic and social subareas, the way the results are presented, comparing the correlations and partial results can be considered a unique work and consequently a new scientific result.

- It is clear from the research results and from the literature that the industrial production and consumption in the digital economic environment can function successfully as a more closely connected model than before, creating digital ecosystems that primarily work as efficiency-enhancing closed-loop (circular) organizations that are trying to disconnect from the natural ecosystem.
- There is no specific need to change the current operating mechanisms in the financial field during the digital transformation; progressive technical developments in the field (Cryptocurrencies, Community financial transactions, Fintech applications) are connected to existing financial institutions and are to be centralized with the help of government assets, repressing Community financial transactions and leaving them with the risks of the existing system.
- For the examined subareas it has become clear that digital innovation will lead to a change in a number of elements in the given area in the near future, but there are no established research indicators and system of rules to quantify these impacts, allowing them to maintain their impact in an optimal framework for sustainability.
- It has been found that the opportunities arising due to the transformation and the emergence of a digital society are not exclusively positive, because the rapid transformation of the structure of employment, an increase in social

inequalities, and the attachment of the power elite to consolidated social and economic patterns hide new, unexplored social risks.

- Based on social impacts it has not yet been shown that the growing use of social media and the expansion of E-Government tools clearly contributes to the strengthening of democratic principles, as digital social governance processes can be directly influenced and controlled.

The research results of this thesis can contribute to the correct interpretation of the practical process of digital transformation, to the more precise regulation of critical and key areas, to the higher-level validation of sustainability aspects in the economic and social decision-making in the subareas. They may draw the attention of the institutions concerned to the risks inherent in the inequalities of digitalization.

4. Conclusions and Recommendations

In the case of the indicators appearing in the dissertation, we can observe that digitalization highly supports sustainability, thus raising the need to develop new guiding research frameworks and parameters for solving global natural and social problems. The essence of the changes that increase efficiency and speed lies in the significant reduction of the role of human workforce and in extending the full functionality of the digital control + regulatory systems. The

process itself leads to a significant reduction in environmental load. The global expansion of the constant growth pressure of the financial area through digitalization could block the feasibility of UN SDGs. In terms of sustainability, the financial area seems to be the least stable. The acceleration of the economy, the reduction of resources and costs will characterize the early stages of the spread of digital technologies. The resulting profits are therefore basically one-off, and later on resources of similar size will no longer be available for extraction from the more efficient systems.

- In his dissertation the author proposes the transformation or extension of the indicators of existing sustainability indices, possibly the development of a new sustainability index.
- Using DLT technology can create a new look for urban communities, and through digital developments that serve environmental sustainability a city can become a self-sustaining, independent part of society.
- The lack of indicators of population growth and the impact of agricultural production from sustainability indices may undermine the hopes of digital transformation.
- The author suggests conducting a Text Mining analysis on the relationship between sustainability and digitalization to complement or directly pursue the results of this research using digital tools.

The author's publications related to the topic of the dissertation

- A klímaváltozás hatásainak megítélése eltérő gazdasági nézőpontokból In: Kulcsár László, Resperger Richárd (edit.) Európa: Gazdaság és Kultúra = Europe: Economy and Culture: International Scientific Conference; Sopron, 2016. november 10. Tanulmánykötet. 1070 p.
- Újszerű, kreatív stratégiák a vezetéselméletben In: Kulcsár László, Resperger Richárd (edit.) Európa: Gazdaság és Kultúra = Europe: Economy and Culture: International Scientific Conference; Sopron, 2016. november 10. Tanulmánykötet. 1070 p.
- A klímaváltozás és a fenntarthatóság kapcsolatai In: Kulcsár László, Resperger Richárd (szerk.) Geopolitikai stratégiák Közép-Európában = Geopolitical Strategy in Central Europe: International Scientific Conference; Sopron, 2017. november 09. Tanulmánykötet. 1059 p.
- Újszerű, kreatív stratégiák az üzleti menedzsmentben. Acta Carolus Robertus : Károly Róbert Főiskola Gazdaság- És Társadalomtudományi Kar Tudományos Közleményei 7(1):(13) pp. 203-220. (2017)
- A klímaváltozás, a világgazdaság és a klímapolitika kölcsönhatásai [The Climate Change, the World Economy and Climate Policy Interactions] Gazdaság és Társadalom 2016: (4) pp. 40-61. (2016)

- Interactions between Climate Change, World Economics, and Climate Policy. *Acta Regionalia et Environmentalica* 14:(1) pp. 15-23. (2017)
- Gary Hamel: What matters now - Mi a lényeges most: Hogyan győzhetünk a könyörtelen változás, kegyetlen vetélkedés és megállíthatatlan innováció világában – Recenzió és Cikk (Gazdaság & Társadalom, Sopron 2017. Lected)
- A fenntarthatósági Indexek értékelése és Használhatósági problémái In: Resperger Richárd (edit.) Demográfiai változások, változó gazdasági kihívások International Scientific Conference; Sopron, 2018. november 8. – Tanulmánykötet. / Publications. Sopron, Magyarország : Soproni Egyetem Kiadó (2018), 692 p. ISBN: 9789633343135 pp. 207-218.
- Digitális innováció a gazdaságban és a társadalomban In: Kőszegi Irén Rita (edit.) III. Conference on Economy and Management Sciences: Versenyképesség és innováció. Kecskemét, Hungary: Neumann János Egyetem (2019) , 1175 p. ISBN: 9786155817199 pp.662-667.

Conference Presentations

- A klímaváltozás hatásainak megítélése eltérő gazdasági nézőpontokból (*International Scientific Conference – Joint Event of the Hungarian Science Festival – Univerity of Sopron; Sopron, November 2016.*)
- Újszerű, kreatív stratégiák a vezetélméletben (*International Scientific Conference – Joint Event of the Hungarian Science Festival – Univerity of Sopron; Sopron, November 2016.*)
- A Klímaváltozás és a Fenntarthatóság kapcsolatai (*International Scientific Conference – Joint Event of the Hungarian Science Festival – Univerity of Sopron; Sopron, November 2017.*)
- A fenntarthatósági indexek értékelése és használhatósági problémái (*International Scientific Conference – Joint Event of the Hungarian Science Festival – Univerity of Sopron; Sopron, November 2018.*)
- Digitális innováció a gazdaságban és a társadalomban (*III. Conference of Economy and Management Sciences; Kecskemet; September 2018.*)