



RIGA TECHNICAL UNIVERSITY  
57<sup>TH</sup> INTERNATIONAL SCIENTIFIC CONFERENCE

**“SCIENTIFIC CONFERENCE ON ECONOMICS  
AND ENTREPRENEURSHIP” (SCEE’2016)**

PROCEEDINGS

RIGA – 2016

# Innovation Vectors of Greening Economy in Third and Fourth Industrial Revolutions

Leonid Melnyk<sup>1</sup>, Iryna Dehtyarova<sup>2</sup>

<sup>1,2</sup> Sumy State University, Ukraine, melnyksumy@gmail.com, irina.dehtyarova@gmail.com

## Abstract

The abstract analyses providing elements for forming green economy as well as presents the role of the Third and Fourth Industrial Revolutions in this process. It reflects the socio-economic transformations targeted at the formation of decentralized renewable energy production. It also focuses on economic system transformation for sustainable development, which occur through dematerialization of energy and material usage and flows, greening the economy and as a result reduction of human footprint in conditions of Third and Fourth Industrial Revolutions.

*Keywords:* green economy, eco-efficiency, ecological footprint, third industrial revolution, fourth industrial revolution.

## Introduction

At large scale sustainable development (SD) includes the following three elements – each of which belongs to the class of open stationary systems: a man as a biological organism; ecosystem and biosphere in general; social-economic system. A principal goal of SD is applied at two levels: 1) necessary level, also known as subsistence level, which means physical survival of a biological human being; 2) sufficient level, which means spiritual development of a social human being. Both levels are extremely important.

## Methodology of Research

Social-economic system is the only element that can and must transform rapidly. It is necessary because of: satisfaction of social needs of a human being that change very quickly or in other words they progress; second, because of improvement of the social-economic system itself. Mainstream of an economic system transformation for SD is dematerialization of energy and material usage and flows. It might be called greening economy. Providing elements for forming green economy are: (1) sustainable style of life with the priority of information goods consumption; (2) diversification of green energy sources (solar, wind, geothermal, biogas, hydro); (3) deconcentration of energy sources (hundreds millions power units instead of hundreds ones) integrated in one EnerNet; (4) forming unified solidary economy on the European space.

Two approaches, conservative and that of positive changes constitute a methodological basis of a modern economic mechanism to achieve sustainable development. Conservative approach is based on the use of negative feedback mechanisms. With their help mankind resists any changes that can threaten ecosystem's sustainability. Positive changes approach is associated with incentives to stimulate changes on condition that they help reduce destructive pressure on the environment. Such approach is based on the use of positive feedback mechanisms.

## Findings/Results

To be sustainable organizations must embrace new objectives: optimize operations to minimize environmental impact and improve social outcomes in a manner that also maximizes performance. The key factors that relate economic transformation with sustainable development are innovations. Innovations create the prerequisites for the decrease in demand of a resource or for the substitution of one resource by another, which is more effective from an economic or from an ecological point of view. In this context, economy can increase along a number of pathways: 1). Increase in the efficiency of production or consumption without the substitution of key resources. 2). Substitution of less effective resources by more effective ones. 3). Less effective resources are substituted by more effective in social demand.

By green economy, we understand a phase transition to new energy; new communications; new settlements; new economic relations; a new lifestyle; new needs; and a new man. Green economy include sectors and types of activities, which help to reduce the load of production and consumption processes (goods and services) on the environment and the biological nature of man, as well as create conditions for personal difference human development.

The Third Industrial Revolution creates three crucial important things for greening economy and forming preconditions of the Fourth Industrial Revolution: cheap energy sources; digit as the mean of universal fixing and sending any forms of information; Internet as the mean of global communication; "cloud" phenomenon as the global memory system The Fourth Industrial Revolution ("Industry 4.0") introduces cyber physical systems in production processes. It is foreseen that cyber physical systems will be combined into a single network with the formation of special local "eco-systems" serving for maintenance of a certain house, company or city.

The Third and Fourth Industrial Revolutions facilitate in achieving sustainable development. We can expect two key transformations in socio-economic activity. First, we can speak about: 1. Changes in consumption: transition from creation and production of separate products and services to the formation of systemic complexes for creating comfortable conditions for human biological needs, development of social needs and the realization of human creativity. 2. Changes in production: transition from "torn" production cycles to the formation of nature friendly labor, production and consumption organized according to closed cycles.

Based on the analysis of publications (Schwab K. , 2016) (Nazarov, 2016), the authors formulated the most important functions of cyber physical systems carried out without any human participation: information exchange (a kind of a "dialogue") in real time; control of external and internal parameters; self-activation and stop under certain information signals; self-tuning for optimal operating conditions; forecasted (anticipatory, preventive) systems self-service; interaction with produced goods (production systems case); adaptation to the new needs of consumers; definition of the needed equipment to produce the required products or meet new demands; self-learning of new work methods.

## Conclusions

Greening economy foresees forming the following sustainable sectors: power engineering (green energy sector); dwelling; infrastructure; settlements; construction; food production; transport; consumption. Sustainable economy is grounded on two key elements: renewable natural resources and constant reduction of energy, materials, water, and land input per unit of production

## References

- A.Haslinda, & A.Sarinah. (2009). A Review of Knowledge Management Models.
- A.Uriarte, F. (2008). *Introduction to knowledge management*. Jakarta: ASEAN Foundation.
- Aparicio, A., Vela, F., Sánchez, J., & Montes, J. (2012). *Analysis and application of gamification*. Elche, Alicante, Spain.
- Atkinson, R. (2015, August 10). How ICT can drive growth in emerging economies. Washington, US: ITIF.
- BIMCO. (2015). *Manpower Update 2010 - The Worldwide demand for and supply seafarers*.
- BiSMART, T. L. (2015). Tehnoloģiju toni Latvijā nosaka uzņēmuma vadītājs. *Kapitals. Biznesa Tehnologijas*.
- Bowers, L. (2011). Cloud Computing Efficiency. *Applied Clinical Trials*, 45-51.
- Deterding, S. (2012). Gamification: designing for motivation. *Interactions*, 14-17.
- Estonian President to Lead EU Cloud Computing*. (2012). Retrieved from ERR: <http://news.err.ee/v/politics/71d30c4d-6674-4bf4-9fc4-cb2610118577>
- EUROPE 2020: A strategy for smart, sustainable and inclusive growth. . (2010). Brussels: European Commission.
- European Commission. (2007). *An Integrated Maritime Policy for the European Union*. Brussels: European Commission.
- Focus Group. (2015, July - August). Riga, Latvia.
- Gartner. (2015). *Gartner Hype Cycle*. Retrieved may 8, 2015, from Gartner.com: <http://www.gartner.com/technology/research/methodologies/hype-cycle.jsp>
- Gekara, V. (2009). Understanding attrition in UK maritime education and training. *Globalisation, Societies and Education*, 7(2), 217-232.
- Getting Into The Cloud. (2014). *Accounting Today*, 31-38.
- Giannakouris K., S. M. (2014). *Cloud computing - statistics on the use by enterprises*. Retrieved from Eurostat: Giannakouris, K., & Smihily, M. (2014). Cloud computing - statistics on the use by enterprises. In Eurostat. Retrieved from: [http://ec.europa.eu/eurostat/statistics-explained/index.php/Cloud\\_computing\\_-\\_statistics\\_on\\_the\\_use\\_by\\_enterprises](http://ec.europa.eu/eurostat/statistics-explained/index.php/Cloud_computing_-_statistics_on_the_use_by_enterprises)
- Glen, D. (2008). What do we know about the labour market for seafarers? *Marine Policy*, 845-855.
- Harvard business school analytical review. (2013). *The impact of employee engagement on performance*. London: Harvard business review publisher.
- ICT sector statistics. (2013). Riga: Central Statistical Bureau of Latvia.

- IKT nozares eksperti: Latvijas prezidentūra ES jāizmanto, lai izceltu nozares panākumus. (2014, June 17). Riga, Latvia: focus.lv.
- IMO. (2015, 02 15). *Vision, Principles and Goals*. Retrieved from <http://www.imo.org: http://www.imo.org/OurWork/HumanElement/VisionPrinciplesGoals/Pages/Default.aspx>
- Information and Communication Technology Industry in Latvia. (2013). Riga, Latvia: LIAA.
- Informatīvais ziņojums par darba trīgus vidēja un ilgtermiņa prognozēm. (2014). Riga, Latvia: Ministry of Economics.
- KPMG. (2014). *Cloud Survey Report*. Retrieved from KPMG: <http://www.kpmg.com/US/en/about/alliances/Documents/2014-kpmg-cloud-survey-report.pdf>
- Kubick, W. R. (2011). Are We Ready to Fly into the Cloud? *Applied Clinical Trials*, 28-30.
- Law, D. (2013). Will The Cloud Rain On My Parade? Clarifying Terms And Privacy Concerns. . *Claims*, 20-25.
- McLaughlin, H. (2015). Seafarers in the spotlight. *Maritime Policy & Management*, 42(2), 92-95.
- Measuring the Information Society Report. (2014). Geneva, Switzerland: International Telecommunication Union.
- Miller B., A. R. (2014). *Raising European Productivity Growth through ICT*. Retrieved from <http://www2.itif.org/2014-raising-eu-productivity-growth-ict.pdf>
- Nazarov, K. (2016, December 27). *The fourth industrial revolution : the Internet of Things , circular economy and blokcheyn (In Russian)*. Retrieved from FURFUR: <http://www.furfur.me/furfur/changes/changes/216447-4-aya-promyshlennaya-revoljutsiya>
- Nonaka, I., & Takeuchi, H. (1995). *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*. New York: Oxford University Press.
- O. Shenkar, Y. L. (2015). *International Business* 3rd edition. New York, US: Routledge.
- Robson, K., Plangger, K., Kietzmann, J., McCarthy, I., & Pitt, L. (2015). *Is it al a game? Understanding the principles of gamification*. Elsevier.
- Rowell-Jones, A. G. (2011). *Executive Summary: Optimizing IT Assets: Is Cloud Computing the Answer?* Retrieved from Gartner: <https://www.gartner.com/doc/1570215?ref=SiteSearch&stkw=cloud%20computing&fml=search&srcId=1-3478922254#a168627>
- Schwab, K. (2015). *The Global Competitiveness Report 2015-2016*. World Economic Forum.
- Schwab, K. (2016). *The Fourth Industrial Revolution: what it means, how to respond*. Retrieved from World Economic Forum: <https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/>
- Seaborn, K., & Fels, D. (2015). Gamification in theory and action: A survey. *International Journal of Human-Computer Studies*, Vol. 74, P. 14-31.
- Skolu un studiju TOPs. (2014). [www.prakse.lv](http://www.prakse.lv).
- Sommer, T. S. (2013). Implementing Cloud Computing in Small and Mid-Market Life-Sciences: A Mixed-Method Study. . *Journal Of International Technology & Information Management*, 55-76.
- The Global Information Technology Report 2013. (2013). Geneva: World Economic Forum and INSEAD.
- Unit, E. I. (2010). *Digital Economy Ranking*. Retrieved from [http://graphics.eiu.com/upload/EIU\\_Digital\\_economy\\_rankings\\_2010\\_FINAL\\_WEB.pdf](http://graphics.eiu.com/upload/EIU_Digital_economy_rankings_2010_FINAL_WEB.pdf)
- Waals, F. A. (2002). Forecast Model and Benchmarking of the Supply and Demand of Maritime Officers. *International Association of Maritime Economists Annual Conference*. Panama: Panama City.
- Zabalza, J. R.-B. (2012). *Benefits Related to Cloud Computing in the SMEs*. Retrieved from [http://www.adingor.es/congresos/web/uploads/cio/cio2012/EN\\_09\\_Information\\_Systems\\_and\\_ICT/637-644.pdf](http://www.adingor.es/congresos/web/uploads/cio/cio2012/EN_09_Information_Systems_and_ICT/637-644.pdf)

### Acknowledgment

This material is prepared in the framework of the Lithuania – Ukraine research cooperation project “Forming institutional and economic bases of sustainable development and green economy on regional level” (2016 – 2017).