

EXAMINING THE FEASIBILITY OF INDUSTRY 4.0 FOR THE REAL ESTATE SECTOR WITH A LENS OF VALUE AND JOB CREATION

*Nikolai SINIAK*⁵²,
*Sergey SHAVROV*⁵³,
*Ninoslav MARINA*⁵⁴,
*Karol KRAJCO*⁵⁵

Abstract: *A fourth industrial revolution Industry 4.0 is characterized by massive implementation of Cybernetics on the road to an end-to-end value chain with Industrial IoT and decentralized intelligence in manufacturing, in production, logistics and the industry, in service of human needs. Each individual branch of industry like real estate, health, transportation, trade, agriculture, and others have been targets of digital transformation. In the era of smart and digital development, companies are interested in solutions that allow their processes, machines, employees, and even the products and services themselves, to be integrated into a single integrated network for data collection, data analysis, the evaluation of company development, and performance improvement. Industry 4.0 did not pass and the real estate sector: land and individual real estate objects management, land administration, real estate market infrastructure, formed by banks, real estate, valuation, insurance organizations, and trustees. As digitalization disrupts society, concern is growing about how it is affecting issues such as jobs, education, value creation, management and security. This article discusses the major features of the four industrial revolutions, the opportunities and the challenges of the fourth industrial revolution through the prism of real estate industry.*

Keywords: *Internet of Things (IoT), Industry 4.0; business intelligence; Cyber Physical System; value chain; sustainable development; knowledge management; real estate.*

JEL Classification: *L16, O32*

1. INTRODUCTION

The concept of smart sustainable development and inclusive growth are rapidly gaining in importance and relevance as they are seen as vital contributors to addressing the pervasive and challenging social-economic issues of the 21st Century⁵⁶. A fully functioning smart territorial development is the most important factor to enhance the economy of countries in the European and other regions and promote long-term sustainable development and growth⁵⁷. Growth involves numerous aspects that should be based on knowledge and innovation (smart growth) and must include a complex of others aspects: promoting a more resource efficient, greener and more competitive economy (sustainable growth), fostering a high-employment

⁵² Asst. prof, PhD., University of Information Science and Technology "St. Paul the Apostle", Partizanska bb, Ohrid, 6000, R. Macedonia, e-mail: nikolai.siniak@uist.edu.mk

⁵³ Asst. prof, PhD., Belarussian State Technological University, 220006, Minsk, 13a, Sverdlova str, R. Belarus, e-mail: shavrov@ipps.by

⁵⁴ Prof., PhD., University of Information Science and Technology "St. Paul the Apostle", Partizanska bb, Ohrid, 6000, R. Macedonia, e-mail: contact@uist.edu.mk

⁵⁵ Asst. , Alexander Dubček University of Trenčín, Študentská 3, 911 51 Trenčín, Slovakia, e-mail: karol.krajco@tnuni.sk

⁵⁶ European Commission, 2010. Europe 2020: A strategy for smart, sustainable and inclusive growth. COM (2010) 2020 final [online]. [cit.2018-10-01]. Available at: <http://ec.europa.eu/budget/img/budget4results/SustainableDevelopmentInTheEU.pdf>.

⁵⁷ Territorial Agenda 2020 - Towards an Inclusive, Smart and Sustainable Europe of Diverse Regions [online]. [cit.2018-10-05]. Available at: http://www.nweurope.eu/media/1216/territorial_agenda_2020.pdf

economy delivering social and territorial cohesion (inclusive growth). Industry 4.0 has the potential to improve productivity and competitiveness, increase energy and resource efficiency and effectiveness and hence to protect the environment and provide opportunities for developed and developing countries to achieve economic growth and sustainable development in line with the 2030 Agenda for Sustainable Development. [58]. This also include new innovative approaches to development of the circular economy; the role of strategic partnerships; the role of agreed standards for the exchange of data and components in the digital ecosystem; data security and privacy issues; loss of jobs; and digital gaps. The physical components of production and service systems are being transformed by smart, digital networking into cyber-physical systems (CPS), allowing for the management of processes in real time across great distances and customized products and services [59]. Major challenges for businesses in the Industry 4.0 environment are mass customization, effective and efficient supply chain, getting timely information of customer needs and wants, smart work environment, and the right combination of products and services. Industry 4.0 requires better management of products, just in time production, and a more efficient time to market [60]. No doubt, these are very challenging and real issues for Industry 4.0, but most studies only discuss the technological aspects and focus on only manufacturing firms, but ignore the service sector. This study addresses these issues by considering the Industry 4.0 concept and its impact on the real estate sector. The concept of Industry 4.0 is very useful for the real estate sector, as personalized service, efficient supply and value chain, agility, smart work environment, use of big data for up to date information of customer preferences, highly customized services at lower cost, and digital enhancement can really affect the customer satisfaction, loyalty, and the perceived service quality.

2. DIGITAL TECHNOLOGIES IN REAL ESTATE AND RELATED INDUSTRIES.

How exactly is the real estate landscape changing by innovative technologies? Here it is several examples bellow.

1. Inclusive spatial planning technologies. Companies in this vertical are focused on various aspects of urban, rural and community planning, including improving processes related to land release, planning approvals, protection and use of the environment, and the enhanced design of the urban environment. Examples Include: 1. Urban design software 2. Virtual reality and simulation technology 3. Mapping platforms 4. Satellite technology 5. Beacon technology. Specialized platforms, receiving the name of the PPGIS-public participation GIS/PPSS-The Public Participation support system, have provided a lot of new optimization features the best decision-making the use of certain areas with the assistance of volunteers on the principles of crowdsourcing and even crowdfunding [61].

⁵⁸ UNIDO, 2016. Industry 4.0. Opportunities and Challenges of the New Industrial Revolution for Developing Countries and Economies in Transition. Panel discussion online]. [cit.2018-10-01]. Available at: https://www.unido.org/sites/default/files/2017-01/Unido_industry-4_NEW_0.pdf

⁵⁹ Porter, M.E.; Heppelmann, J.E. How smart, connected products are transforming competition. *Harv. Bus. Rev.* 2016, 92, 18.

⁶⁰ Iansiti, M.; Lakhani, K.R. Digital ubiquity: How connections, sensors, and data are revolutionizing business (digest summary). *Harv. Bus. Rev.* 2014, 92, 91–99.

⁶¹ Maria Panagiotopoulou and Anastasia Stratigea. Spatial Data Management and Visualization Tools and Technologies for Enhancing Participatory e-Planning in Smart Cities / Smart Cities in the Mediterranean Coping with Sustainability Objectives in Small and Medium-sized Cities and Island Communities. Springer International Publishing AG 2017. P. 31-57.

Eric S. Belsky, Nicholas DuBroff, Daniel McCue, Christina Harris, Shelagh McCartney, and Jennifer Molinsky. Advancing Inclusive and Sustainable Urban Development: Correcting Planning Failures and Connecting Communities to Capital. Harvard College, 2013 [online]. [cit.2018-10-01]. Available at: http://www.jchs.harvard.edu/sites/default/files/jchs_isud_2013.pdf

2. Digital design & construction technologies. Construction technology has experienced rapid changes in recent years associated with the growing use of computers, software development, automation and offsite construction [62]. Companies in this category are focused on the tools and processes used for the design, development and construction of residential, commercial and industrial real estate projects [63]. Digital and innovative construction technologies in countries can be divided in several areas: Virtual reality and simulation technology, Enhanced architecture and design software, Project and cost management tools, Smart building platforms and artificial intelligence, Construction and workforce management solutions, Building material innovation, Material sourcing platforms, Beacon technology, Project finance and investment platforms. Examples include 1) Building Information Modelling (BIM), 2) Offsite construction, 3) New cutting-edge technologies (NCETs). 4) Indoor mapping, 5) different applications like 3D cadastre and GIS-applications.

3. Search, Sale & Acquisition technologies. Companies in this category are focused on the tools, processes and business models for searching, marketing and acquiring new and existing residential, commercial and industrial real estate. Examples Include: Buyer search and discovery tools including listing portals; Agent search tools including agent lead generation and management solutions; Virtual reality and simulation technology; Online brokerage, sales and auctions; Peer-to-peer brokerage; Inspection management software; Transaction management software; Broker back-office and infrastructure; CRM and lead management solutions; Property marketing and sales solutions, including social marketing and marketing automation; Acquisition finance and investment platforms, including crowdfunding, peer-to-peer lending and on-demand finance solutions, blockchain technologies.

“Blockchain offers an open source, universal protocol for property buying, conveyancing, recording, escrow, crowdfunding, and more. It can reduce costs, stamp out fraud, speed up transactions, increase financial privacy, internationalize markets, and make real estate a liquid asset.” – International Blockchain Real Estate Association (IBREA) [64]. They have already been used to resolve land disputes, reaching consensus without the involvement of any intermediary, implementing legal relations through the smart contracts. Real estate applications have still more in common with supply chain than digital currency, so we should begin to take notice of blockchain and its potential to transform the real estate industry.

4. Leasing & Management. Companies in this category are focused on the tools, processes and business models used for the leasing and management of residential, commercial or industrial real estate, from single properties through to solutions designed for complex property portfolios. Examples Include: E-Government, Auto consulting Technologies, List and search services, Peer-to-peer leasing, Inspection management software, Transaction management software, Internet of things, Beacon technology, Multi-layered Technologies for remote sensing of the Earth, Tenant screening technology, Lease and revenue management software, Digital mortgage Technologies, Smart building platforms and artificial intelligence, In-venue marketing technologies, Broker back-office and

⁶² Dr Mehran Eskandari Torbaghan, Carlo Luiu & Dr Michael Burrow. Applications of digital and innovative construction techniques in lower-income countries. UK Government’s Department for International Development (DFID) report, 2017 [online]. [cit.2018-10-01]. Available at: https://assets.publishing.service.gov.uk/media/5a7054beed915d265c511f6a/240_Construction_technologies_for_LICs.pdf

⁶³ Steven Maarbani. Real Estate Technology Threat or Opportunity? White Paper: The Future of RealTech. KPMG and Real Tech Ventures, May 2017. [online]. [cit.2018-10-01]. Available at: <https://assets.kpmg.com/content/dam/kpmg/au/pdf/2017/real-estate-technology-threat-or-opportunity.pdf>

Blockchain application in the real estate industry: Overview of projects that have been launched or are approaching deployment. iOlite platform. [online]. [cit.2018-10-01]. Available at: <https://iolite.io/static/pdf/iOlite-Whitepaper.pdf>

⁶⁴ M. Alshehri, S. Drew. Implementation of e-Government: Advantages and Challenges. [online]. [cit.2018-10-01]. Available at: <https://core.ac.uk/download/pdf/143886366.pdf>

infrastructure, CRM and lead management solutions, Property marketing and sales solutions including social marketing and marketing automation.

E-Government Technologies. These technologies have been currently considered as means of improving services and reducing costs of administrative procedures in construction, housing, registration real property rights fields, levels of organizational processes by streamlining and re-organizing operating procedures saving time and increasing the transparency, effectiveness and efficiency in the public sector [65]. They make an essential change in the whole society structure, values, culture and the ways of conducting business by utilizing the potential of ICT as a tool in the daily work. Advantages and benefits of e-government implementation are the same for both developed and developing countries [66]. E-government applications allow people, businesses, and government sectors to access to available government information 24 hours a day, 7 days a week, which improves the quality of these services.

Unlimited users auto consulting Technologies for execution of business processes on the real estate market. These transformation in-the-cloud technologies into mobile applications allow feel managers as a people without special education.

The Multi-layered Technologies for remote sensing of the Earth. They totally transformed "feedback" real property administration system, since in fact, continuously monitoring its State permit without physical surveys to detect compliance violations without physical examinations, to detect violations of compliance without leaving the area, reduce the risks of losses in emergency situations. These technologies lead to revolution in the area of cadastral engineering as well because they allow land plots surveying using SLAM methods [67].

The artificial intelligence technologies lead to an acceleration of State registration of real estate property from a dozen days for units of seconds; robots-registrars replace humans-registrars and use of expert systems and artificial intelligence, (in particular the application of neural networks) to real estate forecasting [68].

Digital mortgage Technologies. Includes the three primary value enablers — borrower collaboration, digital back office, and third-party collaboration. Fully interconnected, these enablers can position a lender to deliver an integrated mortgage solution across the product lifecycle that enhances customer experience, increases efficiencies and drives down costs in making decisions on mortgage lending, from several minutes to several hours [69].

Internet of things Technologies IoT. Things, chatting with each other, make a decision and replace facility managers [70]. For Facilities Management, IoT offers the possibility to understand in real-time what is happening throughout every aspect and component of a building and its operation, and can provide valuable contextualized data for analytics. The 'golden egg' for facilities management is the attainment of predictive instead of reactive

⁶⁵ V. Ndou, E-government for developing countries: opportunities and challenges. The Electronic Journal on Information Systems in Developing Countries vol. 18, no. 1, pp.1-24, 2004

⁶⁶ Nils Kok, Eija-Leena Koponen, And Carmen Adriana Martínez-Barbosa. Big Data in Real Estate? From Manual Appraisal to Automated Valuation. Special Real Estate Issue 2017 [online]. [cit.2018-10-01]. Available at: https://sustainable-finance.nl/upload/researches/Kok-et-al_Big-Data-in-Real-Estate.pdf

⁶⁷ E. Torres-Martinez, M. Schoeberl, and M. W. Kalb, "A Web of Sensors: enabling the Earth Science Vision," Proceedings of the International Geoscience and Remote Sensing Symposium, Toronto, Canada, June 2002.

⁶⁸ Peter Rossini. Using Expert Systems and Artificial Intelligence For Real Estate Forecasting. Sixth Annual Pacific-Rim Real Estate Society Conference proceeding, 2000 [online]. [cit.2018-10-01]. Available at: http://www.pres.net/Proceedings/..%5CPapers%5CRossini_Using_Expert_Systems_and_Artificial_Intelligence_for_RE_Forecasting.pdf

⁶⁹ Ashish Shreni, John Geertsema, Justin Wellen. The Path Ahead for Mortgage Digitization. Cognizant, 2018 [online]. [cit.2018-10-01]. Available at: <https://www.cognizant.com/whitepapers/the-path-ahead-for-mortgage-digitization-codex2480.pdf>

⁷⁰ IoT Technology Working Group. Internet of things for facilities management. Guidance notes for facility managers. British Institute of Facilities Management June 2018 [online]. [cit.2018-10-01]. Available at: <https://www.bifm.org.uk/bifm/filegrab/bifm-guidancenotes-internet-of-things-for-fm-final.pdf?type=documents&ref=6594>

maintenance to reduce downtime of assets and aid efficient labour management, amongst other benefits. This allows a facilities management professional to identify and make informed decisions on how to ensure their facilities are operated and maintained to optimal efficiency. Acting on the knowledge gathered and analysed through IoT can help encourage a reduction in operational and maintenance costs, lower energy use leading to lower greenhouse emissions, promote building user well-being and stimulate demand for further IoT technological advancements.

Across all of the categories above, Data & Analytics tools and Sustainability focused innovation are also having a significant impact. The following section expands upon both of these additional categories and lists examples of the technology solutions being developed in each category.

5. Data & Analytics. Companies in this category are focused on developing tools designed to identify, collate and analyse relevant data to enhance operational efficiency, inform decision making and improve the experience of participants across the residential, commercial and industrial real estate sectors. Examples Include: 1. Big data aggregation and management tools 2. Information crowd sourcing tools 3. Content, data and information portals 4. Tenant and visitor in-venue experience and engagement solutions 5. Tenant and visitor in-venue loyalty, transaction and value add solutions 6. Automatic valuation Technology.

Automatic valuation Technology of real estate uses Big data. These technologies have become gradually displace specialists- valuers [71].

6. Sustainability. Companies in this category are focused on developing tools and materials designed to: 1. Enhance building sustainability, 2. Enhance environmental sustainability, 3. Improve energy efficiency outcomes.

Industry 4.0 aims at digitalization all the value chain, beyond 2030 the world will evolve towards a complete digital ecosystem that encompasses the integration of research, production, services, marketing, and sales in a fully integrated digital system.

Mackinsey Global Institute (MGI) employed a simple model for assessing digitalization of USA industry based on 3 broad categories namely Digital assets (Computers, servers, networks and software), Digital usage (Usage in the form of transactions, customer and suppliers interactions together with internal processes using digitization) and Digital workers (The degree to which digital tools are put in the hands of employees to ramp up productivity) with 27 sub- indicators []. Digital usage and Digital workers were found to make the most crucial difference for increase of efficiency.

The most digitally advanced industry sectors were found to be in ICT, media, finance, and professional services—no surprises there, especially for the early-adopting technology sector, which more often than not acts as a digital pathfinder. Many industries are in the early stages of digitization with plenty of room for growth. The utilities sector and real estate were cited as a good example of an industry that could be at the forefront of future digital expansion.

Some sectors are highly digitized at one end of the scale (health care for example in diagnostics), but have a large workforce that uses only basic—or sometimes no—digital technology, ultimately slowing the overall pace of digital adoption.

Industries that are both local and labor-intensive (construction, leisure, hospitality) tend to have low digital usage, especially in their customer transactions.

Government, while having the greatest share of GDP and the highest share of employment, rated poorly across all three digitization categories. This should not come as a great surprise given the bureaucratic, regulated, and non-competitive environment in which our administrators all too often operate.

⁷¹ McKinsey Global Institute. Digital America: A Tale Of The Haves And Have-Mores. Executive Summary. December 2015. [online]. [cit.2018-10-01]. Available at: https://www.mckinsey.com/~media/McKinsey/Industries/High%20Tech/Our%20Insights/Digital%20America%20A%20tale%20of%20the%20haves%20and%20have%20mores/MGI%20Digital%20America_Executive%20Summary_December%202015.ashx

The real estate sector is the largest and most valuable asset class in the world, and it has managed to operate into the present day with relatively minimal innovation. As an asset class, direct real estate appeals to a broad range of investors and is seen as a relatively low-risk asset. As sector participants, such as developers, agents and financiers, continued to profitably provide real estate product to an eager market, many argued there had been very little reason to innovate ...until now.

As the allocation of venture capital funding by an increasing band of global investors is deployed to uncovering and developing the digital innovation of the future, traditional operators will come under increasing pressure to adapt or perish.

3. DIGITAL TRANSFORMATION AND WORKFORCE.

Companies in leading sectors have workforces that are 13 times more digitally engaged than the rest of the economy. In lagging sectors, the digital engagement of the workforce can be erratic; some organizations have made progress in certain areas but have not yet addressed foundational tasks their workers perform.

These and many other technologies of the “digital economy of the real estate sector” entail the reduction of traditional jobs, and therefore they often encounter resistance from citizens.

It seems to the authors that in this area, under the conditions of the fourth industrial revolution, there are certain prospects for solving this problem of job cuts. All of them are associated with the creation of new jobs, but with different approaches.

The first approach is connected with the training of specialists of a wide specialization (universalism). The practice of training universal specialists emerged: simultaneously in the field of management, and in the field of economics, and in the field of physics. Graduates work in the field of designing, planning and programming the development of territories, and in the field of environmental management. In addition, specialists with knowledge of geo-information and space technologies need health care, educational organizations, logistics, and travel companies.

Graduates work in the field of cartography, geoinformatics, telecommunications, economics, state and municipal management, geoecology, landscape design, tourism, and urban planning. The second approach is connected with the expansion of the field of activity of traditional specialties but on the basis of innovative technologies. For example, the roadmap for digitalization of real estate brokers (realtors) (gradually disappearing profession) of Belarus provides for expanding their activities in managing an unlimited number of real estate objects, condominiums using a single national interactive industrial Web platform integrated with the Internet of Things IoT. Another approach is related to the transition of real estate professionals to the IT sphere as business analysts, specialists in designing artificial intelligence systems with training, and developers of mass AVM models.

It is obvious that a wide profile of land management, real estate, becomes part of the process of education of land surveyors, real estate managers using an interdisciplinary, problem-oriented approach. This approach ensures the connection of academic programs with a wide range of functions and tasks in real estate with numerous modern challenges. Different disciplines should be taught on the principle of "learning-through-performance of work." The art of problem-solving should be taught through a project-oriented approach to education with an emphasis on the development of self-education skills "learning-learning". This approach even allows you to teach what is not yet but will appear in the future. Undoubtedly, the main challenge of the future is constant change. To cope with this constant change, the educational base must be more flexible.

CONCLUSION

Forget location. The new battle - ground in real estate, is technology, technology, technology.

Global technology entrepreneurs and investors have already begun turning their attention to reinventing the real estate sector, through business model innovation and product innovation. Going digital is an opportunity to reinvent core processes, create new business models, and put the customer at the center of everything. Companies are using digital tools to raise the bar in operational efficiency, customer engagement, innovation, and workforce productivity. Early examples, such as Airbnb, WeWork and Amazon demonstrate how digital disruptors can materially impact the markets in which they operate, leaving incumbents scrambling to catch up. Consumer expectations of real estate digitalization and their experience with the built environment have been elevated. As innovation in other industries continues to power ahead, consumer expectations will continue to put pressure on the real estate sector to innovate.

The volume and depth of innovation will increase, with more specialized technological solutions for nuanced real estate challenges as well as growing competition for more generalized solutions. Large real estate corporates – from agencies to developers, financiers to portfolio managers – will need to understand the latest in innovation and implement strategies to integrate those advancements into their projects and businesses in order to stay ahead of the pack. However, introducing a cost effective and impactful corporate innovation and venturing strategy into traditional real estate organisations comes with a number of material challenges.

Real estate sector specialists will begin to exit the major real estate corporates and consulting firms to build new businesses that focus on solving problems familiar to them in more agile, rewarding working environments. As dissatisfaction with the slow-moving titans increases, this exodus will begin to affect the ability of major corporates to attract and retain entrepreneurial talent at all levels.

The impact on the labor market is mixed with widespread dislocation of workers but a proliferation of digital tools that offer new ways of working, matching skills, and acquiring skills.

University graduates must have the skills to adapt to a rapidly changing labor market, they must have the skills to solve the still unknown problems of the future. The fact is that professional and technical skills can be acquired and updated at a later stage of their career, while theoretical problem- solving skills, self-development skills can be achieved only through the process of academic preparation at universities. To cope with this constant change, the educational base must be more flexible, universal and digital technologies oriented.