DIGITALIZATION, SUSTAINABLE DEVELOPMENT, AND INDUSTRY 5.0

An Organizational Model for Twin Transitions

Edited by

BÜLENT AKKAYA • SIMONA ANDREEA APOSTU
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Digitalization, Sustainable Development, and Industry 5.0

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This book is dedicated to those who passed away in the earthquake that occurred in Turkey at 4:17 on February 6, 2023.

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Preface

Humanity is at a crossroads, bombarded by numerous economic, social, environmental, and technological challenges. International institutions, public authorities, private companies, investors, consumers, and other stakeholders are looking for solutions. Solutions are sought, objectives are established, measures are set up, action is taken, and the results are subsequently evaluated. The metamorphosis of the world economy is under the sign of digitization and a new energy transition process (from fossil fuels to renewable), humanity trying to promote a sustainable development that ensures the preservation of resources and the environment for the next generations. Public authorities create the legal and institutional framework; companies fuel the process of technological innovation but also to promote sustainable development in their activity. Social responsibility has become a key element of the business strategy, the concept being embraced by other categories of stakeholders such as portfolio investors and universities. All sectors of activity are in a complex process of restructuring, the actions of companies and stakeholders being reshaped by new technologies. In addition, the new normal is gaining ground after the pandemic generated by the Covid-19 crisis; Companies embracing a Society 5.0-based new normal model (a new function of the organization).

The books bring together 18 chapters that address from a managerial perspective the paradigm changes registered in different fields of activity as a result of the digital transition, the workforce being in a process of adapting to new technologies.

The digital transition is felt in all fields of activity, with remarkable results being recorded in health, the financial industry, or the energy sector. The reduction in population mobility during the Covid-19 pandemic has determined the promotion of telemedicine, which offers appropriate solutions for detecting certain diseases.

The need to promote the principles of sustainable development and energy transition has implications on business strategies, profit maximization no longer being the sole objective of companies. Nonfinancial performance is followed equally by companies and investors.

The book stands out for its complex character, analyzing the structural transformations recorded at the sector and company level as a result of the twin transition. In addition, the geographical dispersion of the authors and their expertise not only ensure the interdisciplinary approach to the twin transition phenomenon but also the presentation of specific situations for certain countries

and regions. In this way, the scientific approach is remarkable and ensures the reader the presentation of regional solutions that can be adapted to other regions.

We are convinced that this book will not only provide readers with relevant information about the twin transition process, solutions for certain challenges, but will also raise questions that can open the way to new research directions considering the astonishing speed with which new technologies enter the lives of citizens. Digitization and industry 5.0 do not only offer solutions that ensure the increase of productivity and results of companies but also challenges and risks are increasingly present in the VUCA world. Predictability is reconsidered in a world in deep change, where black swan events are more and more frequent.

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Chapter 1

Implementation of Key Enabling Technologies (KETs) in Nursing Care Processes in Viewpoint of Digital Transformation

Sema Üstgörül

Abstract

Key enabling technologies (KETs) are a set of six technological components that work together to address social challenges and build advanced for sustainable economies. Industry 5.0, the next industrial development, is designed to capitalize on specialists' unique creativity while also collaborating with powerful, intelligent, and precise technologies. Industry 5.0 outsourced repetitive and monotonous activities to robots/machines requiring employees to perform activities that involve critical thinking and are based on the 6R (Recognize, Reconsider, Realize, Reduce, Reuse, and Recycle), to improve production quality. With numerous supporting technical advancements, advanced and quick manufacturing concentrating on the interaction of machines and humans may be produced. Maintaining healthcare and nursing care, evaluating patients' health requirements using KETs, and giving care with manpower are all major advancements in Industry 5.0 today. Future studies may focus on providing healthcare using mainly technology and, therefore, no human workers. This chapter highlights healthcare advances in Industry 5.0, where KETs and people collaborate to create and innovate. In this framework, the purpose of this chapter is to present the deployment of KETs in the nursing patient care process.

Keywords: Key enabling technologies; nursing care; Industry 5.0; advanced technology; artificial intelligence; digital transformation

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1. Introduction

Covid-19 brought a series of novelties in many sectors, including health sector. Each of these sectors had to implement fast and smart solutions as a response to this crisis. Thus, it is of great importance to have continued investment in R&D, infrastructure, and human resources with regard to the health sector to foster sustained development (Akkaya & Üstgörül, 2020a; Frasholli & Hysa, 2015) and be prepared for such emergencies. In this regard, in order to create a comprehensive image of the literature regarding the opinion on health policy in Europe during crisis, the study of Vasilescu, Apostu, Militaru, and Hysa (2022) used bibliometric analysis for 1458 indexed in WoS and found that technology was one of the key clusters in association with "COVID," "Europe," "health," and "policy." Thus, innovation related to sustainable development has to foster (Alfaro, Yu, Rehman, Hysa, & Kabeya, 2019; Hysa, Kruja, Rehman, & Laurenti, 2020; Rehman, Hysa, & Mao, 2020; Üstgörül, 2022) in this sector as well.

Alike, sustainable manufacturing can be defined as "the creation of manufactured products which use processes that conserve energy and natural resources, minimize negative environmental impacts, are safe for employees, consumers, and communities economically sound" (Maqbool, Černe, & Bortoluzzi, 2019). Previously, the 3R (reduce, reuse, and recycle) approach was used to ensure the sustainability of sustainable production environmentally, socially, and economically (Apostu, Gigauri, Panait, & Martín-Cervantes, 2023; Panait & Raimi, 2021; Panait, Hysa, & Raimi, 2023). Later, the 6R (Recognize, Reconsider, Realize, Reduce, Reuse, and Recycle) approach was used to address sustainability in all its aspects (Shankar, Kannan, & Kumar, 2017). Now, it is stated that 7R (Redesign, Reduce, Reuse, Repair, Renew, Recover, and Recycle) is the key to living in a responsible society to ensure environmental and social sustainability (https://agrocorrn.com). These terms refer to ways that we can minimize the number of materials that we use, the amount of the Earth's resources that we use, the energy that we use, and the amount of waste which we produce in our everyday life (Nandy, Fortunato, & Martins, 2022). To achieve all of these, it is necessary to practice a responsible management, oriented to reality and in relation to the complexity and evolution of the environment (Akkaya & Üstgörül, 2020b; Popescu, Hysa, & Panait, 2022). In spite of all this, it is emphasized that the basis of the development of key enabling technologies (KETs) tools should be based on the 7R (https://agrocorrn.com).

European Commission defines KETs as technologies associated with rapid innovation cycles and high R&D (Research and Development) intensity (Dušková, 2021). KETs more often in combination with other generic technologies are the drivers of the development of digital goods. In the program of European Commission (2021–2027), the KETs are being micro/nano-electronics and photonics, advanced manufacturing, advanced materials, artificial intelligence (AI), life-science technologies, and security and connectivity (Ricciardiello, Leja, & Ollivier, 2021). The Architecture of Financial Networks and Models of Financial Instruments especially in accordance with the Just Transition Mechanism at the European Level (Manta et al., 2020) together with the current

challenges of AI will be redefined in a new era of technology, with direct implications in all fields of activity (Manta, Hysa, & Kruja, 2021), as literate provides that KETs in combination with other generic technologies are the drivers and innovation process of the development of digital goods for health sciences.

This chapter focuses attention on healthcare advances in Industry 5.0, where KETs and people collaborate to create and innovate. In this framework, the purpose of this chapter is to present the deployment of KETs in the nursing patient care process.

2. Key Enabling Technologies (KETs) and Its Components

(1) *Micro/nano-electronics* and photonics

Nanotechnology continues to evolve as a field and brings together a multidisciplinary group of researchers, including biologists, chemists, physicists, and engineers. Nano has numerous applications, including science, technology, manufacturing, and medicine (Tosello, 2022). They are part of the KETs. Today, electronic components are used in almost all devices and systems. KETs which can create new jobs to industrial competitiveness are the drivers of the development of digital goods (Graziano, Piccinini, Ardesi, & Siviero, 2021).

(2) Advanced manufacturing

The manufacturing industry is an important employment and prosperity sector, while research companies and institutes in Europe are key players in innovation and in research; for example, 28.5 million people employed in almost 2 million enterprises in Europe (Horobet, Vrinceanu, Popescu, & Belascu, 2021).

Advanced manufacturing produces complex products like airplanes and medical devices. During production, they use new knowledge and innovative and cutting-edge technologies such as AI, robotics, 3D printing, high-performance computing, and modeling. At the same time, they pay attention to reducing industrial pollution, avoiding any waste, and material consumption (Abdulhameed, Al-Ahmari, Ameen, & Mian, 2019).

(3) Advanced materials

Advanced materials and material innovations are an essential element used in all manufacturing industries and organizations (Borowski, 2021). In Industry 5.0, the rational design of advanced materials with new technology and their integration into structures and systems is needed (Çeviker & Akkaya, 2021; Maddikunta et al., 2022). At the same time, technological advances are closely related to the progress of the material used in production. Advanced materials are used for societal needs such as energy technology, health technology, (micro)electronics industry, production, and construction technologies in general (Salvarli &

Salvarli, 2020). Approaches in advanced materials should have four directions. They should be materials with novel or improved properties, integration into structures and systems, natural (eco-design and bio-inspiration), and smart structures allowing for self-sensing and self-healing (Lim et al., 2020).

(4) Artificial intelligence (AI)

Considering global competitiveness, organizations needs to accelerate the pace of adoption of digital technologies. One of the most important of these is AI technology.

AI applications are currently being implemented across a range of industries such as healthcare, automotive, financial services, energy, media, and the tech sector (Shahzad, Asl, Panait, Sarker, & Apostu, 2023; Uunona & Goosen, 2023).

At the same time, it is important to use AI tools in order to generate a control of processes from different industries which requires permanent monitoring of complex operations and immediate reaction in the case of imminent danger (Popescu, Avram, & Mocanu, 2020).

(5) Life-science Technologies

Science and interdisciplinary cooperation and collective intelligence are of great importance for scalable and sustainable advancing technology and AI refers to technologies that are able to perform tasks that would require intelligence (Apell & Eriksson, 2023). The development in AI, which produces content that is indistinguishable from human creations, is described as a big step forward. It is stated that 46% of the jobs that will be affected by AI are administrative, 44% are legal, 6% are construction, and 4% are in the maintenance and repair sector (Prentice, Dominique Lopes, & Wang, 2020).

AI is a strategic imperative for any business looking to achieve greater efficiency, new revenue opportunities, and higher levels of customer loyalty (Bulearcă & Popescu, 2020; Wang, Li, Lu, & Cheng, 2022). With AI, organizations can process more transactions in less time, create personalized and engaging customer experiences, and generate higher profits (Biswas, Carson, Chung, Singh, & Thomas, 2020). However, AI is still a new and complex technology. Getting the most out of this requires expertise in building and managing AI solutions at scale (Helo & Hao, 2022).

(6) Security and connectivity

When providing cutting-edge services, it is important that advanced technology is security and connectivity (Krishnamoorthy, Dua, & Gupta, 2023). For example, the Internet of Everything (IoE), which is being used in education and industry today and produce huge data, connects people and devices, has to provide security. Advanced technology seeks to enable 6G, which is expected to provide AI-powered services. Thanks to 6G, it is expected to allow applications with ultrareliable, fast, and

uninterrupted wireless connection in service areas such as health and industry (Mishra & Tyagi, 2022). The direct tools of AI will also impact strategic areas, as it can also be identified within the current paradigm of the EU energy system and its impact on the sustainability of member states' economies until 2050 (Zhao, Manta, Militaru, & Folcut, 2022). But all these current challenges generated by AI must be carefully evaluated and monitored in terms of impact, so that economies are more resilient both now and in the future, and AI applications have positive effects on the financing and resilience of the European economy (Manta, Panait, Hysa, Rusu, & Cojocaru, 2022) and the global economy as a whole.

3. Why Should the Health Organizations Support KETs in the Nursing Care Process?

KETs form the basis of automotive and industrial robotic technology that supports improving people's health. Radiotherapy, tomography, and robotic surgery, which are examples of technology used in the field of health, have been in our lives for many years. However, scientists have discovered certain nanostructures that have practical uses today or in the near future. These structures include quantum dots (qdots), spherical fullerenes (buckyballs), carbon nanotubes, and cylindrical fullerenes known as nanowires (Mishra & Militky, 2018). For example, they believe qdots will have future applications in diagnostic tests, including the location of cancer cells (Zhao et al., 2018). Bucky balls can be manipulated to have anti-inflammatory properties to stop allergic reactions (Soltani, Guo, Bianco, & Ménard-Moyon, 2020); nanoparticles can also reduce bleeding and accelerate clotting (Nguyen, Iqbal, Block, & Mousa, 2022).

Besides imaging and diagnostic tools, nanotechnologies are also being explored for drug delivery systems, therapeutic applications, antimicrobial options, and advances in cell repair and regeneration. Researchers are currently developing ways to use nanoparticles to deliver drugs directly to specific cells. This is particularly promising for the treatment of cancer cells. Targeted drug therapies increase efficacy and reduce potential side effects by delivering the drug directly to the affected cells. Antimicrobial bandages are currently commercially available, but there are many other possible uses. Creams can be used to attack infections and treat wounds; burn dressing treated with antimicrobial nanocapsules can prevent and treat infections (Khan et al., 2023).

In the future, nanorobots could be coded to repair damaged cells, similar to the body's innate way of healing. Applications of nanotechnology in medicine have the potential to increase lifespan, diagnose and treat diseases more effectively, and provide treatments that closely mimic the body's natural health processes (Aghebati-Maleki et al., 2020).

The KETs can help human beings and robotics to work better together in Industry 5.0. KETs can be called robotics and human-machine interface. For example, smart watches, smart wearable devices, and smart sensors can be used to monitor the patient's healthcare data. Data can be recorded. Afterward, there is a need to evaluate the records of health professionals (doctor/nurse/midwife).

These devices can alert the health person to treat the patient. Through robots, health professional can take help from the robots that can communicate with each other (Mehdiabadi et al., 2022).

It is very important to keep data systematically in health services (Popescu, EL-Chaarani, EL-Abiad, & Gigauri, 2022). This requires a lot of working people and time for the job. Clustering and archiving of big data can be done easily with AI. There is no need to assign personnel and there is no loss of time (Wang et al., 2022).

Another point where AI is used in healthcare is postsurgical care. It states that in research, AI is helpful in predicting the death rate of patients after heart surgery. Depending on the patient's postoperative condition, the need to be hospitalized in the intensive care unit provides information about the need for the nurse to monitor the patient more closely (Chang Junior et al., 2020).

New technology can be used not only in times of illness but also for healthy aging. Elderly individuals can have a healthy age if they are encouraged to actively participate in society with robot-assisted approaches professionally and/or socially. However, the use of augmented reality tools in the interventions, therapies directed by sensors and actuators, and the use of micromechanical surgical devices and catheters will shorten the hospital stay (Nilsson, Andersson, Magnusson, & Hanson, 2021).

Iddagoda (2021) points out that on the path to organizational success, mistakes are unavoidable, and the leader has a crucial role to play in turning the mistake into a success-producing lesson. Health professionals are needed to use the core technologies of Industry 5.0, such as collaborative robots, digital twins (DT), edge computing (EC), IoE, blockchain, and future 6G systems, in a secure and confidential way. Thanks to KETs; nurses can provide care faster with less workload while processing nursing care. This means meeting the needs of many patients in a short time. It has an important contribution both for the health sector and for the general health status and economy of the country (Maddikunta et al., 2022).

4. Conclusion

The health sector is the institutions where human service is most intense. Many multidisciplinary teams work together for the care, diagnosis, and treatment of sick individuals. Health institutions are the only institutions that serve people 24/7 without production. Undoubtedly, the best savior in these institutions, where both time and workforce are needed, is to benefit from the newly advanced technologies, which have been described by the European Commission as a "fusion of digital and KETs." In this context, KETs help healthcare professionals monitor their practices and provide quality treatment to their patients. Innovative technology is needed to support the circular economy, strengthen chip circularity, and reduce environmental costs. These technologies should also be designed based on the 6R or 7R (Redesign, Reduce, Reuse, Repair, Renew, Recover, and Recycle) approach to ensure good use of resources and sustainability.

Recently, the usage areas of AI have been frequently mentioned in researches. When the use case is evaluated, the rate of digitalization and adoption of AI is low in the health sector compared to other fields. It should not be forgotten that the health sector is one of the largest service sectors and new technology should be adapted by the health sector in order to reduce the workload and reduce the cost of health expenditures.

In addition, it can be said that the use of KETs in applied sciences such as medicine, nursing, midwifery, and paramedic is very important in the education sector in terms of simulation. New technologies should be integrated into education in the field of health and the dynamic nature of the health industry should be also reflected in its processes and activities.

As a result, there is a need for research on the use of KETs to examine how enabling technologies are now used to manage information in the health sector and also to examine the advantages of projects involving digital solutions.

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