



SKILLS FOR DIGITAL LEADERSHIP - PREREQUISITE FOR DEVELOPING HIGH-TECH ECONOMY

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Abstract: *In the conditions of the already under way 4th industrial revolution in the field of management of business organizations there is a growing need for a new type of leaders with interdisciplinary knowledge, skills and competences that allow them to lead networking teams. Increasing digitalization in all economic sectors requires generation of new concepts of leadership in digital environment, as well as prioritization of new methods for creating the leaders of the future. This study investigates, analyses and synthesizes the skills for digital leadership needed for optimal management in the globalized, high-tech environment of network-based team collaboration.*

Keywords: *skills for digital leadership, optimal management, 4th industrial revolution, high technology economy*

JEL: M100

INTRODUCTION

The accelerating growth of digitalization in almost all sectors of socio-economic life in conditions of continuous globalization highlights the role of artificial intelligence in the development of the world economy over the next years. In parallel, the connection between the physical and the digital world generates new concepts, business models and economic and management tools in the economic terminology. In this respect, the concepts of “additive manufacturing”, the Internet of Things (IoT), sharing economy, circular economy, and blockchain are not only entering economic and management theory but are also effective business models and becoming integral part of the real global business practice.

In conditions of significant shift in the economic, social and technological environment, modern business organizations increasingly need new type of leadership able to thrive in digital environment and characterized by high-tech skills leading to optimal management and optimal team collaboration.

The CEO (Chief Executive Officer) of Ericsson BeLux, Digital Champion, Belgium, Saskia Van Uffelen (Uffelen, S., 2014) forecasts that in 2020 65% of the existing jobs will be very



different as a result of technological developments, and individuals should develop their skills and competences in order to remain competitive in the digital economy. According to Maria Laura Fornaci, Executive Director at Triple Helix Association, Italy, modern business organizations need new leaders with high-tech skills. This is confirmed by the European Commission's statement regarding the need for a greater number of IT professionals with competences to sustain innovation and competitiveness in the world market (E-skills for the 21st century: fostering competitiveness, growth and jobs, 2007). Additional calculations suggest that until 2025 each year the EU will need to develop around 50 000 professionals with leadership skills for high-tech environments, i.e. between 2018-2025 Europe will need a total of 400 000 such leaders. In a survey for the purposes of the current study amongst 35 Bulgarian business organizations, 75% of the respondents point to a significant shortage in their employees of leaders capable of operating in a digital environment, which impedes growth in their business units, and 51% think that the lack of digital leadership skills in human resources has a negative influence on the development options of business organizations.

The data confirms the defined need by the European Commission of a new type of leaders operating in a digital environment. This need results mainly from:

- ✓ **multidisciplinarity, which results from the combination of digital and main basic technologies;**
- ✓ **rapid development of innovations, robotics and sensory technologies;**
- ✓ **enhanced competition in the IT sector;**
- ✓ **unpredictable global market environment.**

The need for a new type of leadership is also confirmed in the McKinsey Global Survey in 2016, which shows the growing importance of automation and improvements in business processes, and thus of individuals' acquisition of new knowledge, skills and competences.

Consequently, it is timely to investigate and synthesize the main competences for digital leadership that can enable business organizations in the future to achieve optimal management and optimal team collaboration, which in turn are crucial for the development of high-tech global economy. Wide digitalization of the material world, as well as the transition from 'asset ownership' to 'access to assets' condition the transformation of the economic reality from 'economy of ownership' to 'sharing economy', and require from individuals new leadership skills and competences. The linear model for resource use based



on the principle of 'take – produce – throw away' needs to be effectively restructured into a new, modern model of circular economy, which creates serious challenges for the development of individuals' new leadership skills and competences. Linking the search for new type of leaders to the innovative nature of IT technologies, volume data of the Internet of Things and avant garde technologies, requires new leadership skills in the circular and sharing economy than those for the development of the economy of ownership.

This study investigates digital leadership as developed and applied in a digital environment and how it leads to optimal management and optimal team collaboration. In particular It is focused on the skills for digital leadership which, in the conditions of the 4th industrial revolution, are essential for the development of high-tech global macroeconomic system.

The objective of this study is to synthesize those high-tech leadership skills that are a prerequisite for the development of high-tech economy.the

Specific tasks of this paper:

- ✓ to investigate, analyse and synthesize definitions and concepts related to the researched area;
- ✓ to account for the influence of the 4th industrial revolution on the development of leadership in digital environments;
- ✓ to examine and analyse the relation 'skills for digital leadership – high-tech economic system'.

The limitations of the study are:

- ✓ the terms 'digital leadership' and 'leadership in digital environments' are considered equivalent and overlapping;
- ✓ studies are lacking on specific measurements of digital leadership;
- ✓ it is beyond the scope of this study to provide definitions of leadership styles applied in digital environments.

INVESTIGATION OF THE LINK BETWEEN HIGH-TECH ECONOMY AND OPTIMAL MANAGEMENT

The high-tech economy is based on the global industrial and technological process that started with the 4th industrial revolution and finds its roots in the development of science, digital technologies and innovations. The high-tech economic system is interlinked with



registered higher added value obtained with the production of certain goods, which in turn results from:

- ✓ the development of internet connectivity and interaction of cybernetic-physical systems without human involvement;
- ✓ processing and analysing of large data sets;
- ✓ decision-making by artificial intelligence;
- ✓ the introduction of robotics in the production processes;
- ✓ the use of digital clouds, digital modelization and simulation of production processes through virtual reality;
- ✓ intelligent automation;
- ✓ mass production of individualized products;
- ✓ development of new technologies;
- ✓ creation of new business models.

On the basis of the above, high-tech economy can be defined as the combination of interrelated digital technological decisions assisting the development of the automation, the integration and the exchange of data in real time in the production processes, delivering several times higher norm of added value compared to the traditional economic system. The added value of the high-tech economy derives from the possibilities of the cybernetic-physical systems to optimize production processes in the entire value chain by applying the principles of:

- ✓ resource effectiveness—minimizing expenses for the production of units;
- ✓ resource productiveness – maximizing production on the basis of available resources.

Typical of high-tech economy is rapid and large-scale development leading to a radical change of traditional business models and value chains. Key feature of the high-tech economic system is the striking development of technologies, innovations, robotics and artificial intelligence, giving rise to new forms of value creation and employment.

The main characteristics of the high-tech economy – monumental development, high level of digitalization, significant technological and innovation progress, high rate of added value, require the implementation of optimal management of economic processes. The optimization of the management process derives from the options for optimization of high-tech production processes ($L = \text{cost per item} \rightarrow \text{min}$; $L = \text{number of produced items of one}$



type → max). These criteria for optimization of high-tech economy are directly proportional to the need for:

- ✓ reducing the time for managerial decision-making;
- ✓ reducing the time for production;
- ✓ reducing the use of resources;
- ✓ reducing the use of energy;
- ✓ reducing the use of labour;
- ✓ increasing the volume of production.

On this basis it can be deduced that the optimal management of high-tech economy is linked to:

- ✓ the possibility for analysis and processing of big data and real-time decision-making using information and analytical systems with in-built artificial intelligence, which leads to a greater flexibility in process management, reduction in the time needed for managerial decisions, and as a result to reduction in the cost of the produced items;
- ✓ the possibility for dynamic organization of business processes in terms of quality, time, risk, durability, price, and environmental impact, which leads to reducing the cost of production of each item as a result of reduction in expenses for resources, energy, labour, and time needed for production;
- ✓ the possibility for maintaining a permanent balance between materials and logistics chains, which leads to reducing the costs of resources and production organization, in turn resulting in reduction of costs of the produced items;
- ✓ the possibility for fast design and organization of processes, change in production operations and compensation for losses in technology time, which leads to reduction of production time and thus of the costs of the produced items;
- ✓ the possibility for continuous optimization and adaptation of the production capacities with in-built artificial intelligence, leading to reduction of the expenses for resources, energy, polluting emissions, and thus of the costs of the production;
- ✓ the possibility for return on investment of individual and specific orders reflecting customer requirements in terms of design, configuration, order, planning, production, functioning, deadlines and changes in deadlines, which is linked to



increases of production of specific individual orders, thus leading to a greater competitiveness and market stability for the business organization.

The research conducted so far allows for defining optimal management as the systematic integration of economic, technical and organizational activities which aim to increasing the effectiveness of functioning of a given economic system with nontechnological methods that lead to rationalization of the management system. On this basis optimal management of the high-tech economy can be defined as a purposeful activity with the aim of getting the best result in certain conditions. The necessary steps for achieving optimal management are:

- ✓ choice and formulation of an objective;
- ✓ definition of limits – realistic possibilities for achieving the chosen objective;
- ✓ finding an appropriate means for reaching the goal within the identified limits (model);

The formulated objective (economic effect) in optimal management is linked to achieving the desired level of perfection of the economic system and is determined as a criterion for optimality (target function). The target function is a quantitative evaluation of the condition of the optimized object. The best value of the target function in the economic literature is called extremum or optimum.

The management as an object for optimization has several characteristics, depending on the aspect studied. They are function of its parameters and are allocated a defined in advance value according to the optimization targets and results, do not go higher than the defined in advance limit, and do not go beyond the limits of the defined interval for change. On this basis the limits for the implementation of optimal management can be mathematical formulae of object characteristics in the form of equations and inequalities. The respect of the requirements pre-defined in the limits guarantees the real existence of the management process, its proper functioning, and reaching the objectives defined in the optimization model.

The scope and reach of the ongoing technological transformation will trigger economic, social and cultural changes and dissonance on a scale difficult to predict. The emerging impact on the global economy entails both a difficult differentiation of one effect from another and the impact on all fundamental macro-variables - Gross Domestic Product, inflation, investment, consumption, employment, unemployment, trade balance. This



impact undoubtedly stems from the high level of technology and innovation of economic processes. The upcoming difficult macroeconomic projections impose optimal management of the high-tech economy by high-tech leaders to minimize the negative effects of subordinate technological specifics.

The high technology of an economic system is of a dual nature - it creates real prerequisites for deflationary processes, but also for stronger consumption sustainability, resulting in greater volume of consumption at lower prices. Optimal management of the high-tech macroeconomic system requires that predicted impacts on growth be addressed in the context of current economic trends and factors.

Productivity is one of the main indicators of high-tech economy, as well as a major factor for long-term growth and high living standards. Optimal management of a high-tech economy requires management of the functionality and quality of produced goods, their marketing strategy to offer highly competitive markets through digital platforms, and the strategy to reduce marginal costs. In fact, the transition from property and asset economy to sharing economy differentiates the integration of structural and systemic factors, which can create a real prerequisite for increasing economic growth and driving the principles of the circular economy even more intensively.

Optimal management is also needed in the labor market in conditions of high-tech economic development, as information-communication systems, robotics and artificial intelligence drastically change the nature of human labor and the need for it. However, it should not be overlooked that in a highly technologically advanced economy two effects on employment are possible:

- ✓ Effect of disappearance of certain occupations leading to unemployment - in it the subversive factors related to the technological development of the economy replace the human labor with capital;
- ✓ A capitalization effect conducive to the creation of new jobs, business organizations and industries - it is a consequence of the effect of eliminating specific professions and leads to increased demand for new goods, which creates conditions for revitalizing the labor market.

The technologically developed economy is subject to risks associated with the technological boom. At the same time, technology improves productivity and living standards, which in turn creates conditions for increased demand for goods and hence encourages job creation.



This peculiar contradiction of the high-tech economic system imposes its optimal management by prepared leaders of the future in order to prevent global crises and cataclysms resulting from inequality and poverty.

In the context of the Fourth Industrial Revolution, the optimization of the management process in the high-tech economy is essential due to the dynamics and the wide range of changes that have an economic, social and public aspect. Equally important is the development of leaders of a new type to manage both the highly technological and innovative economic environment and the human potential and capacity.

The shake up effect of the external to the economic subjects' environment, characterized by high technology, innovation, robotics, artificial intelligence, would have a strong undermining effect on any organization if the global macroeconomic system does not aim for optimal parameters of its governance process. On the other hand, the strong subversive influences of the high-tech economy lead to specific technological changes to the general public, and economic subjects can not remain isolated from these global processes that are conducive to a highly digitized and hyperlinked economic system. It is this that requires the optimal management of the high-tech macroeconomic system and the achievement of multidimensional model-based forecasting management.

SYNTHESIS AND DEFINITION OF THE FACTORS DRIVING THE HIGH-TECH ECONOMY

According to a study by the World Economic Forum in Davos in 2015, the factors that propel the Fourth Industrial Revolution can generally be divided into three main groups: Physical, Digital and Biological (Shwab, K. 2016). Among the factors driving industry 4.0 are also the sensory technologies, robotics, innovative manufacturing systems, logistics, information and communication technologies, cloud companies and large data sets (Wischmann, S., Wangler, L., Botthof, A. , 2015). The factors leading to the success of the new technological revolution can be summarized mainly in three: qualification, process speed, infrastructure (Beste, D., 2014). Other authors (Talin, B., 2018) assume that the factors determining the success of Industry 4.0 are five:

- ✓ Decentralization of decision-making from different physical and virtual systems;
- ✓ Large datasets allowing their rapid assessment in decision making;



- ✓ Interoperability, connecting in common communication machines, people, computers and sensors to exchange information and data among themselves;
- ✓ Technical support, in support of decision-making or in tasks that put at risk human life;
- ✓ Information transparency, assisted by data, sensors and virtual reality, allowing us to easily perceive our surrounding reality.

Factors influencing the development of high technology (Lefenda, J., Pöchhacker - Tröscher, G., Wagner, K., 2016) are:

- ✓ Integration of the physical and digital world in the context of the productive economy;
- ✓ The destructive potential of technologies;
- ✓ The evolution of the progressive digitization of production.

The exponential rate at which the Fourth Industrial Revolution is evolving leads to rapid upgrading of the achievements of the digital revolution, to the combination of many innovative and intelligent technologies, to new technological breakthroughs. This leads to both unprecedented changes in the paradigm in the economy, business and society, and a profound and long-term transformation of the whole economic model and the related tools. In this regard, the hi-tech economy of the future will be based essentially on two fundamental concepts that guarantee both its development and the conservation of resources for future new consumption. These concepts mark the transition from one type of economic system (asset-ownership economy) to another innovative type of economic relations (based on the relationship between the main contractors through technology platforms) and from one type of economic model (linear) to a qualitatively new (circular). The philosophy of these concepts generates the system of added value, largely characteristic of high-tech economic systems:

- ✓ Concept of sharing economy:
 - an economic system where people, assets and data are gathered in the virtual space, characterized by an entirely new way of consumption, resulting in a drastic reduction in transaction and friction costs based on lowering barriers to the production of material goods;
 - a result of the widespread penetration of the digital into the material sphere;



- an innovative economic model, a reflection of the transition from "ownership of assets" to "access to assets"
- ✓ concept of circular economy:
 - a circular model based on the "design - production / processing - distribution - use / sharing / loan / reuse / repair - waste collection - recycling" principle, effectively restructuring the linear resource consumption model based on the take - produce - throw away;
 - a new, modern model in which innovative value is created and shared on the basis of optimal interaction between materials, energy, labor and information (Temelkova, M., 2017);
 - a new business model ensuring sustainable development by preserving the planet's resources while maintaining economic and technological progress;
 - a system based on the concept of "sharing economy";
 - a strategy in which growth and prosperity do not have a negative impact on natural resources and do not lead to a decline in ecosystems.

The study of the factors underlying the Fourth Industrial Revolution indicates that there is still no single opinion in the literature on the number, specificity and concrete effects of these factors. Moreover, the diversity of the research and the scientific investigations of various authors highlights a wide range of factors that need to be systematized. At the same time, this multi-dimensionality of the defined factors testifies to the extremely broad scope of the technological transformation of the global economic system. Some authors (Schwab, K., 2016) argue that much of the industry-driven 4.0 premise will change, and others are still not yet known. Due to the connectivity of the processes determined by the Fourth Industrial Revolution and the concrete practical manifestations of the hi-tech economy of the future, the prerequisites that are its basis are not sufficiently studied in theoretical literature. Summaries of the factors that are a prerequisite for building a high-tech economy are scarce in the scientific doctrine. This makes the task of the present study extremely complex and associated with numerous investigations of various theoretical and practical applications. Thus, based on the method of analysis and synthesis, the following global factors driving the high-tech economy can be defined by their basic characteristics:

- ✓ ecosystem "man - machine":



- hybrid type ecosystem created to perform certain tasks on certain conditions in which most frequently interact human factors and robotic systems based on artificial intelligence and sensor technologies;
- result of the automation of business processes and the use of collaboration tools and productivity in order to reduce communication latency;
- ✓ AI:
 - cyber-physical system having the ability to analyze the environment and take actions that increase the possibility of achieving certain goals;
 - robotic model, supporting the hypothesis that a fundamental human quality such as intelligence can be accurately described by an algorithm and simulated by a machine;
 - technology, based on sensors that use abstract symbols for trying to restore human thinking at hierarchically logical level or that mimic the human brain through neurons and neural networks organized in layers connected by simulated lines, these neural networks having the ability to build knowledge acquired by collecting experience and grow;
- ✓ Virtual reality:
 - branch of physical reality, representing interactive graphics in real time with three-dimensional models in combination with a display, that gives the user the ability to dip directly into a modeled world;
 - stereoscopic system, relying on computer simulations that use 3D graphics and devices;
 - illusion in synthetic environment pertaining to immersion in something that is interactive, multisensory, visually oriented towards three-dimensional computer-generated environment in combination with technologies needed to build this environment, whilst allowing to navigate and observe the world with three dimensions in real time;
- ✓ augmented reality:
 - system integrating elements of real and virtual world, representing an improved version of reality, in which given objects or environment is enriched with virtual images superimposed on the real, thereby improving the current perception of reality;



- new improved world located in the middle of a mixed spectrum - between real and virtual world using the existing natural environment around us, covering it with a layer of virtual information by which to our natural world are added graphics, sounds and feedback;
 - virtual information used as a tool that helps us in our daily activities;
 - ✓ 3D printing:
 - additive manufacturing, creating a real good, by digital printing of a material in an amorphous form layer by layer, based on the digitized 3D model, which easily allows customization of the printed product - i.e. there is an opportunity to meet specific customer requirements;
 - group of technologies allowing rapid prototyping and rapid manufacturing of goods;
 - ✓ 4D production:
 - process of creating a new generation of goods that have the ability to change over time and following changes in the environment;
 - technology, whereby a two-dimensional printed article may be transformed into three-dimensional, and a 3D shape can be transformed another, whereby different particles of the projected geometry have different material properties;
 - ✓ big data:
 - large and complex datasets that are difficult to process at analytical level, search, share, store, transfer, display, privacy with traditional applications;
 - concept characterized by three dimensions - volume growth, increase the speed of data exchange, a wide variety of information;
 - large data, the size of which exceeds the capabilities of typical database for storage, management and analysis of information (Manyika, J., Chui, M., Brown, B., Bughin, J., Dobbs, R., Roxburgh, C., Byers, A., 2011);
 - technologies allowing a large volume of diverse information that is updated frequently and is located in a variety of sources, the goal being to create new products and enhance the efficiency and competitiveness;
 - ✓ Internet of things:
 - system based on interrelated technologies and platforms through interconnection and interaction between products, services, places, buildings and people;
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- a network of physical devices, vehicles, buildings and other elements that have embedded electronics, software, sensors, mechanisms, and are connected to the Internet network, and all this allows these objects to collect and share data with each other;
- connection between the physical and digital world in which smart devices and technologies are interconnected and are managed from a distance on the basis of interaction with the global network.
- ✓ blockchain networks:
 - particular block chains that combine powerful cryptographic algorithms with systemic decentralized computing power, constituting means for the transfer of content (information);
 - a network of computers that together track, analyze and design the development of processes, that build the system architecture during their work through their ability to analyze the environment and take actions that increase the possibility of achieving certain goals;
 - technology based on the principles: mutuality, programmability, cryptographic protection and reliability;
 - knowledge with accurate recording of time and space, giving information about the values, assets, premises and hazards of the environment (internal and external);
 - technologically organized cyber opportunity to register, monitor and optimize assets and operations in fine details, to use effectively underused assets, to reduce costs in certain activities, processes and operations (transactional, frictional and limited), increase their competitiveness, to optimize time to perform an activity, a process, an operation, to increase the speed and scale the change for business and economics, to generate significant value, to apply collaborative innovation.

These factors have a driving effect on high-tech economy, but at the same time impose a need for a new generation of leaders holding high-tech knowledge, digital skills and competences that enable them to tackle global economic challenges, transforming the actual production in additive and linear traditional economy based on ownership of assets as well as in a circular economy based on the sharing of assets.



IMPORTANCE OF DIGITAL LEADERSHIP SKILLS FOR THE ECONOMY

The speed and dynamics with which technological changes occur in the global economy require more tangible synthesis of qualitatively new concepts of leadership in the digital environment. This is particularly relevant as high-tech economy needs individuals capable of generating new business models and tools with which they use and optimally manage the available opportunities and resources to create value based on new economic concepts. In fact, to date were considered key skills and competencies those associated with the introduction and use of digital technologies in the development of robotic cyber-physical systems and networks, as well as with generating software programs and products. Ignoring the entrepreneurship, management and leadership of a number of educational institutions, including in Bulgaria, has led to a lack of trained professionals, who in a digital market and smart specialization can lead to the creation of profitable high-tech economic system, job creation and social progress through new skills, knowledge, innovation, entrepreneurial spirit and economic thought. Indeed, the European Council has long pointed to the lack of 400 000 leaders by 2025 with not only digital, but also managerial and entrepreneurial skills. The conclusion is that there is a crisis in European economies with regard to finding professionals with interdisciplinary knowledge.

In Bulgaria the crisis is even more tangible because of the strict regulation in training and education at Bachelor and Master levels referring specialists to specific professional fields. This statutory restriction hinders the development of multidisciplinary and creation of hybrid specializations. Thus Bulgarian professionals are unprepared for the labor market, which requires and looks for individuals with knowledge and expertise in various fields of science and applied fields.

The need for professionals with skills in digital leadership emerges in all hierarchical levels of business organizations and the economy. The success of a business strategy and economic transformation depends on the key role not only of the strategic management but also middle management. Thus people with vision and potential for innovation, creative thinking and a strong ambition, with motivated behavior and knowing how to optimally manage not only physical but also human resources, are especially valuable in the development of high-tech economic system. A survey for the purposes of this study shows that 85% of 110 surveyed businesses in Bulgaria, Greece and Turkey do not have programs to develop skills for leadership in the digital environment for their employees.



The level of technological advancement of the economy of a country is a direct result of the strong technological advancement of the businesses operating in it. The degree of technological and innovative development of economic operators, however, is in direct relation with the knowledge, skills, abilities, competencies, preparedness, experience and potential of their managers at strategic and operational level. Therefore, to achieve a high level of technological advancement of an economic system it is essential to have those leadership skills that propel organizations to achieve optimum long-term success.

The multidisciplinary nature of spectacularly developing fields of micro and nanoelectronics, nanotechnology, biotechnology, photonics, robotics, smart materials and smart technologies, the intense competition for industrial goods and the hardly predictable market environment, require that labor resources have not only expertise in digital technologies, but and skills to work in a dynamic, difficult to predict environment, while motivating effective teams working from different geographical locations in a network. This trend, and existing educational models, create clear discrepancy and skills shortages of digital leadership.

If until recently we were saying that the world needed leaders who operate in a global market environment, today it can be argued very strongly that the emerging high tech global economic environment as a result of the Fourth industrial revolution leads to a need for leaders able to operate in a global digital environment. This leadership is a direct consequence of receding economic ownership of assets and the development of the economy of sharing, based on a giant digital platforms that are the result of increasingly strong:

- ✓ implementation of cloud technology, artificial intelligence and robotics;
- ✓ imposition of systems such as the Internet of Things, virtual and augmented reality;
- ✓ generating large datasets and different additive industries.

In the coming years, economic activity gradually but increasingly clearly will shift to cyberspace and thereby will enhance the growing shortage of individuals with the skills and potential of digital leadership.

In the eve of the fourth industrial revolution there has been a radical change in the paradigm of leadership, because leadership has increasingly lost its characteristic as a group process. In conditions of IT globalization, it becomes a process defining the mission, vision, values, goals and activities of the business organization which plays an essential role in the



functioning of the high-tech economy. The familiar to us traditional leadership takes place from inside outward, but today the conceptual doctrine of leadership is changing radically due to global challenges and increased competition. The new type of leadership is digital that evolves in the digital environment, does not require communication face to face and appears from the outside to the inside environment – i.e. SMART (Specific, Measurable, Agreed, Realistic, Time limited). It must withstand the shocks of new economic and social realities.

Leadership in the digital environment requires combining the model of competence of the leader with the systems of the organization to plan, organize and control activities and management of business processes. It is based not only on effective organization, but also to the security of fundamental factors that condition the meeting of expectations and needs of customers, employees, investors, partners and the society, and thus realizing the power of added utility. On this basis, in high-tech economy, effective leadership in the digital environment is the result of:

- ✓ team perfection (optimal in terms of cost, productivity and quality of work processes);
- ✓ attitudes of subjects with which the leader partners (satisfaction, commitment to the strategic goals of the organization, to company culture, etc.).

Effective team collaboration is an essential prerequisite for achieving optimal management in business organizations. In a high-tech economy, the ability to manage optimally team interaction is fundamental to the range of skills required of the digital leader. In this sense, the definition of team collaboration in digital environment is essential not only for the development of science, but the exact fleshing skills for digital leadership. In this sense, of content with the skills of digital leadership. In this sense, defining team interactions in a digital environment is of utmost importance not only for the development of science but also for the accurate fleshing out of *the* vision of digital skills leadership.

Team interaction is defined as the relationship between the main factors that affect group work, including the organizational context, the borders and the development of the team (Gladstein, DL, 1984). At the same time it represents the relation between the structure of the working team and implementation (Campion, MA, Medsker, GI, Higgs, AC, 1993), playing the role of entrance to the organizational system, where there is a reciprocal relationship



between the performance criteria of the team process and performance criteria defined at the entrance of the very organizational system (Cohen, SG, 1994).

Those definitions of team interaction serve as a foundation for defining it in a digital environment. In this paper they warrant that team interaction in a digital environment is a process:

- ✓ involving interpersonal communication and coordination, implemented in the digital environment
- ✓ affecting directly or indirectly the performance and efficiency of the organizational business system;
- ✓ creating a link between the performance indicators of the team and the organization on the one hand, and the satisfaction indicators of the members of the digital team on the other.
- ✓ Team interaction is determined cumulatively by the factors external to the team environment and the internal processes in it and, through the created team product, establishes the *brand* and maintains *the reputation* of the business organization in its macro environment. The team processes are factors that directly affect both team and organizational excellence, as well as the added value in terms of the organization's brand image in a market niche, segment or region.

Achieving effective team interaction in a digital environment is a skill for digital leadership whose expression is strongly dependent on the structure of the workflow, the interdependence between tasks, objectives, feedback, motivation, characteristics of the team, the strategic and operational context and process.

Efficiency criteria defining the effectiveness of team interaction in the external organizational environment should be productivity, teamwork satisfaction, the assessment of consumers who use groupware products, services, information or managerial solutions. Thus the viability of the team is determined in the long run.

The importance of the economy of skills for digital human resources leadership has emerged as a key priority given that overcoming subversive technology trends is only possible if economic processes are managed by leaders trained to work in a digital environment. Thus inequality and poverty, which would have appeared as a consequence of the technology boom, would be overcome using a set of measures balancing technological, social and moral-ethical aspect of the intensive development of technology and innovation.



SYNTHESIS OF DIGITAL SKILLS FOR LEADERSHIP NEEDED FOR PROFESSIONALS IN A DIGITAL ENVIRONMENT

The exponential growth rate at which the Fourth industrial revolution develops leads to rapid building on the achievements of the digital revolution, to combining of many innovative and intelligent technologies, to new technological breakthroughs, covering areas such as artificial intelligence, robotics, the Internet of Things, autonomous vehicles without a driver, 3D and 4D manufacturing, nanotechnology, biotechnology, photonics, materials science, energy storage, quantum computation. This leads to unprecedented changes in the paradigm in economics, business and society as well as a profound and long-term transformation of the whole conceptual doctrine of leadership and its provisioning tools. Against the backdrop of this radical change, leaders of the future operating in a digital environment should possess skills that enable long-term development of a high-tech economy. These skills should include both complex interdisciplinary competences such as teamwork, communication, planning, forecasting, project management, network and platform architectures, cryptic thinking, programming, robotics and others, and competence to understand and communicate with multiple cyber-physical systems in different platforms, environments and networks.

According to the needs of fast-growing small and medium-sized enterprises, leaders of the future need skills in three areas (www.skills-lead.eu):

- ✓ strategic leadership;
- ✓ business entrepreneurship;
- ✓ digital technologies.

These three areas form the leadership in the digital environment and enable business organizations to develop as high-tech economic entities optimally benefiting from the opportunities provided by digital technologies.

A high-tech economy requires the building of leaders, capable of operating in a digital environment.

Digital leadership skills require the development of certain knowledge and competences in professionals. They form the competences of a leader in strategic leadership, entrepreneurship and digital technology manifested in a digital environment. The research, analysis and synthesis of the answers of 330 respondents participating in a survey

conducted in 110 Bulgarian, Greek and Turkish business organizations in the period January 2018 - July 2018, as well as the review of numerous theoretical studies and practical-applied projects (Bräutigam, P., Klindt, T., 2015), (Davies, A., Fidler, D., Gorbis, M., 2011), (Bakalov, N., 2017) allows the creation of a model of skills for digital leadership (Figure 1), reflecting the causes and links between them for building of the new type of leadership - the digital one.

The main reasons for building skills for digital leadership in professionals are the factors driving the high-tech economy. Investigating their relationships and interactions allows for a precise definition of the knowledge and competences that should build *digital leadership skills*.

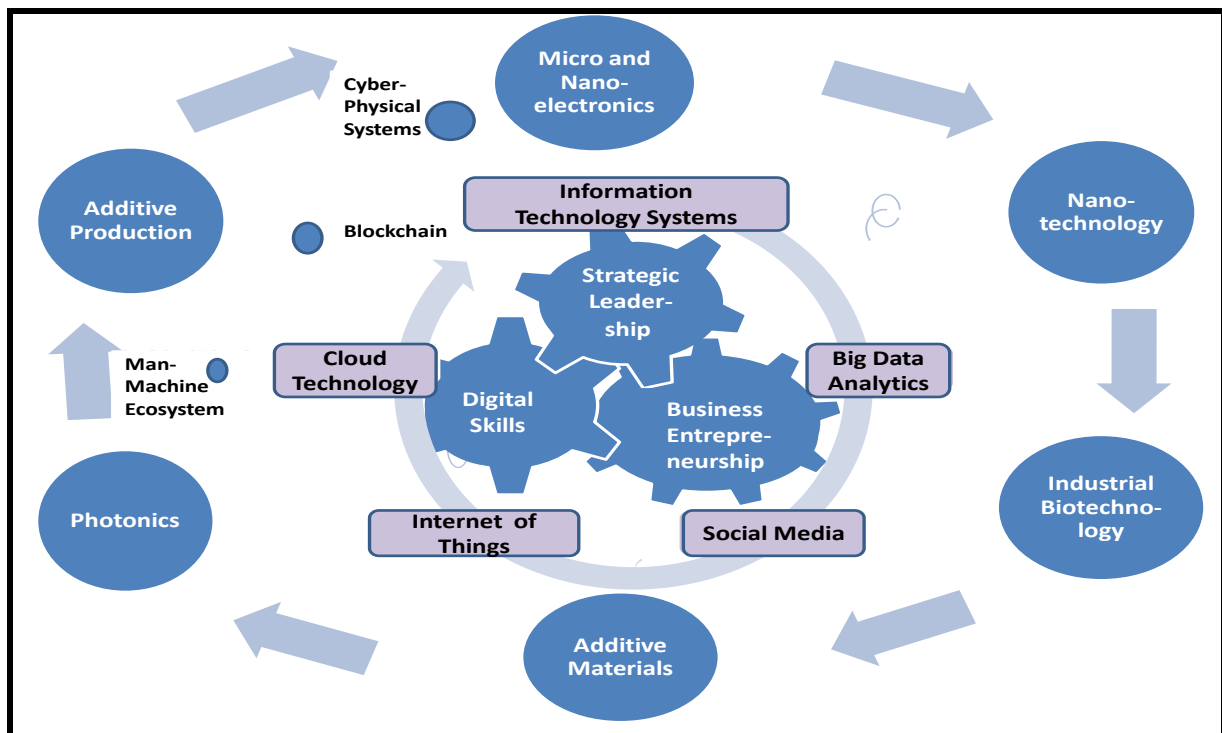


Figure 1. Model of skills for digital leadership (author's work)

The foundation of digital leadership is the systemic interrelationship and interdependence of the three functional areas - strategic leadership, business entrepreneurship and digital technology. The relational dependence between these three spheres should exist in unity and lead to a synergetic behavior of the leader operating in a digital environment. At the same time, each of the three functional areas is replete with certain basic knowledge and skills that determine the scale and capacity of the digital leadership. Strategic Leadership Thinking aims at managing interdisciplinary, increasingly international teams, and focuses



on direct impact and influence on employees, customers, suppliers, investors, shareholders, society. It is directly dependent on the availability of knowledge in the field of:

- ✓ management;
- ✓ controlling;
- ✓ finance;
- ✓ marketing;
- ✓ logistics;
- ✓ organizational structure;
- ✓ communication.

At the same time, strategic leadership is a consequence of the ability for:

- ✓ collecting information;
- ✓ analyzing information;
- ✓ planning;
- ✓ forecasting;
- ✓ generating strategic alternatives;
- ✓ searching for and finding optimal solutions
- ✓ creativity;
- ✓ verbal and nonverbal communication;
- ✓ managing teams;
- ✓ motivation of human resources;
- ✓ control.

Strategic leadership as a functional area that determines the effectiveness of the digital leader should also be based on clearly defined cultural, moral and ethical values and models.

Business entrepreneurship is aimed at generating innovative operational and manufacturing business models through which a higher added value is realized. As a functional area of digital leadership, "business entrepreneurship" integrates knowledge about:

- ✓ market and its principles;
- ✓ marketing strategies;
- ✓ business analyses;
- ✓ innovation;



- ✓ investment.

The competences that accompany the "entrepreneurial spirit" are related to:

- ✓ building and maintaining customer relationships;
- ✓ realization of sales;
- ✓ establishing partnerships;
- ✓ project management;
- ✓ process optimization;
- ✓ analyzing the environment, processes and operations;
- ✓ financial management;
- ✓ implementation of flexible methodology.

The "digital" functional area is associated with a vision of synergic, cutting-edge, high-tech results achieved on the basis of innovation, and scientific development. This requires knowledge in the field of:

- ✓ large datasets and tools for analyzing them
- ✓ information technology tools;
- ✓ complex business systems;
- ✓ cyber-physical systems;
- ✓ artificial Intelligence;
- ✓ information technology architectures;
- ✓ platform architectures;
- ✓ Internet of Things;
- ✓ Cloud technologies.

The skills characterizing the competence of a leader working in a digital environment, in the functional area "digital technologies" requires abilities for:

- ✓ analysis of large data sets;
- ✓ work in a blockchain network
- ✓ virtualization;
- ✓ creation and development of mobile applications;
- ✓ creation and development of web pages;
- ✓ creation and development of IT architectures and platforms;
- ✓ ensuring cybersecurity;



- ✓ work with social media.

Based on a survey conducted in 110 business organizations from Bulgaria, Greece and Turkey, a group of skills for digital leadership can be synthesized. They are a prerequisite for sustainable management and conduct of the leaders of the future. Generally speaking, these skills for leadership in a digital environment are the foundation on which the leadership potential of professionals in the high-tech economic system develops:

- ✓ an ability to work with digital technologies - the basis of high-tech economy are information and communication technologies, digital tools, programs, platforms, cyber-physical systems and this requires good knowledge and manipulation;
- ✓ an ability to communicate effectively - the relationship between different hierarchical levels and human resources, as well as the optimal management of the business organization, requires maintaining communication processes that ensure the achievement of organizational goals;
- ✓ an ability to build knowledge and competence throughout life - the new economic and social realities entail continuous updating and upgrading of knowledge and competences in a multidisciplinary perspective.
- ✓ an ability to analyze dynamic processes - the intensity with which the external and internal organizational environment develops requires monitoring of a number of factors that determine them in order to highlight trends in their development;
- ✓ an ability to apply a sustainable and non-traditional flexibility and adaptability-- the pace of change requires not only fast analysis but also a timely response to changes in the environment in order to transform the emerging or already occurring economic, social, socio-cultural and other changes in competitive advantage.
- ✓ an ability to implement innovative and creative solutions, methods, technologies, instruments at moderate risk - the high-tech economy requires high-tech business units in which innovation-aware and open to innovation entities should work, capable of taking a measured and balanced risk;
- ✓ an ability for optimal management of team interaction - the development of a high-tech economy requires organizing and maintaining an effective process between people located at different spatial points but working in a network to find resources



and information, manage and transfer interdependent activities to achieve an immediate result.

A summary of synthesized skills for digital leadership leads to defining the essence of the term "digital leader" - namely a person operating in a digital environment, possessing unique and distinctive abilities, skills and competencies, enabling them on the basis of their knowledge in the field of digital technologies to transform the specialized knowledge, to bring together the scarce organizational production, financial, tangible and intangible resources, and generate an effective and competitive strategy and team interaction, leading to higher added value for organizations and their employees, partners, society and the entire economic system.

The essential advantages of digital leadership skills should be sought in achieving optimal management that, according to research and analysis, is associated with cumulative fulfillment of three targeted functions:

- ✓ minimizing the cost of producing one unit of good
- ✓ maximizing productivity;
- ✓ efficiency of team interaction.

CONCLUSION

Nowadays skills for digital leadership are an important prerequisite for achieving high technology in the economy, because technological development in the future will increasingly be based on the development of the knowledge of leaders in the field of digital technology. Research shows that at least in the next five years, the focus will be primarily on the skills of a digital leader for analyzing large data sets, aligning business aspects with IT trends, handling digital products, systems and networks. Combining these capabilities with the requirements of the entrepreneurial concept leads to building a new type of a leader who monitors the development of the digital environment and the digital sector and skilfully generates innovations. Thus, the leader needs to have commercial, investment and financial skills, project management skills, skills for market penetration, skills for undertaking effective marketing moves and countermoves.

Skills for digital leadership led to the construction of:

- ✓ effective business organization representing a network-based organizational structure;



- ✓ high-tech economy based on knowledge, scientific achievements and development.

The leader in a digital environment should be established as an interdisciplinary hybrid, in charge of multistage international teams and implementing effective digital and information technology strategies and effective leadership skills should be a prerequisite for:

- ✓ acceleration of economic growth;
- ✓ increasing the innovativeness of the economy;
- ✓ increasing the competitiveness of the economic system;
- ✓ increasing the financial and trade turnover;
- ✓ optimizing global production processes.

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