SKILLS AND CAPABILITIES IN THE KNOWLEDGE SOCIETY

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Abstract: *Information technology sets the directions and pace of social development. It creates new opportunities and challenges for individuals, groups, communities and whole societies. The paper discusses the nature of the knowledge society, its needs for successful growth, challenges and skills the worker should possess to prosper and contribute. It also presents different classifications of the sets of skills as well as proposes another one built up on neurodidactic concepts. Theoretical and practical solutions derived from neurodidactics and LMS tools are suggested as the effective methods and techniques for an educational process so fundamental for well-being of the knowledge society.*

Keywords: knowledge society, knowledge workers, skills, ICT technologies

INTRODUCTION

Information has always been important for humans, yet, it is IT systems for storage, transferring and processing that has increased its value. For the information society information was a main asset. The IT systems and information data determined the structure of employment, GNP and development (Sienkiewicz, 2002).

In the 1950s Fritz Machlup identified the sector of the US national economy, the knowledge industry, which accounted for nearly 29 percent of the US gross national product, and the proportion of the labour force employed in the knowledge economy raised from 11 to 32 percent between 1900 and 1959. The transformation to a knowledge economy started and continued throughout the rest of the century (Machlup, 1973).

Following Don Clark, data and information are about the past, are static. The next level of understanding is knowledge and as the timeline shows, it deals with the present. It is dynamic and built on experience through interaction. However, when we gain wisdom, we can deal with the future. (Clark, 2015). (Figure 1).

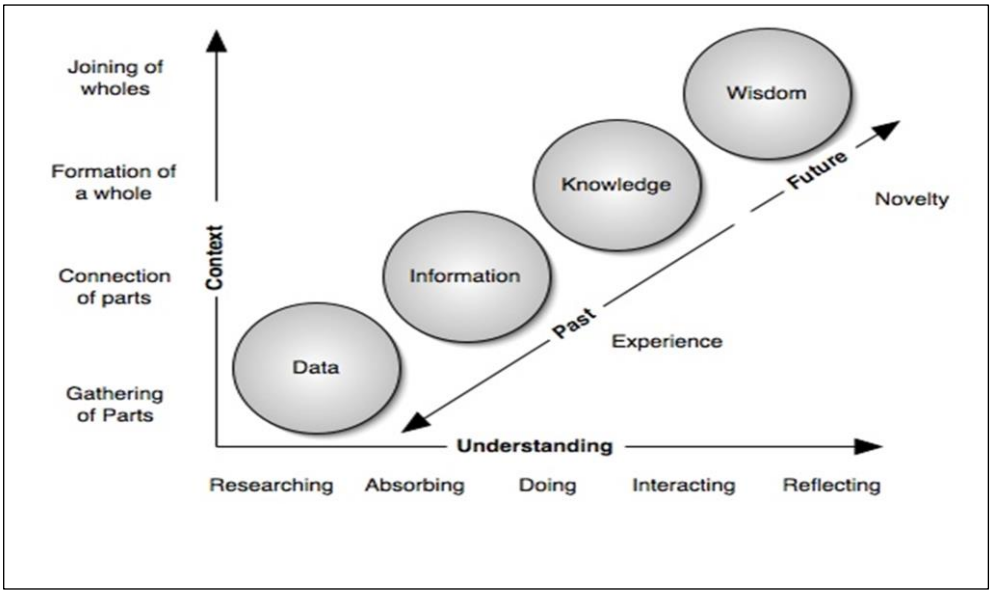

Figure 1. Understanding and performance
Source:
http://www.nwlink.com/~donclark/performance/understanding.html (30 June 2017)

1. NATURE OF THE KNOWLEDGE SOCIETY

Knowledge is about the present – present time, society, economy.

Reflecting upon selected definitions available listed in Table 1, the knowledge society may be understood as a natural successor of the previous phase, the "information society" (IS), which in turn followed the "industrial society" and consequences of technological advances fostering effective use of collective (explicit) knowledge through innovations leading to personal, national and global growth.

Table 1.

Selected definitions of the knowledge society

Definitions of the knowledge society
A new society formed as a result of the contemporary societal change pushed by technological innovation and institutional transformation, which is not only about technological innovations, but also about human beings, their personal growth and their individual creativity, experience and participation in the generation of knowledge. The primary role of cities in a knowledge society is to ensure that their knowledge sources are passed on and advanced by each generation (Yigitcanlar, 2015) (Knowledge-Based Urban Development)

A wider concept of information society; entails commitment of persons as knowers. (The Information and Communication Technology (ICT) Competence of the Young)

In an evolutionary view, it can be seen as the successor of a previous phase, the "information society" (IS), which in turn followed the "industrial society". IS was so called because of the huge flow of information that was triggered by the advent of computers, data processing systems and communications. In the knowledge society, knowledge, and not mere information, is the most valuable asset. It is what is in the head of people (tacit knowledge) and what can materialize tangibly in the physical world, as print, or human exchanges (explicit knowledge). It is what drives the economy in the new millennium. (Ambient Intelligence)

An association of people who have similar interests, be they social, economic, political, cultural and so on and by making effective use of their collective knowledge in their areas of interest thereby contributing to further knowledge that will lead to national progress and global development. (Computer Communication and ICT Attitude and Anxiety Among Higher Education Students)

Advanced societies reaching a stage of development predominantly based on production and utilization of knowledge. (Modelling Knowledge Society)

A society where main of the prosperity and well-being of its people came from the creation, sharing and use of knowledge. (Use of E-Collaboration Technologies Among Students of Management)

Knowledge Society is understood as the ability that people have in the face of information, to develop a reflective competence, relating its multiple aspects, according to a particular time and space, with the ability to establish connections with other knowledge and use it in their everyday lives (Pelizzari et al., 2002), (Information, Knowledge, and Learning Society)

Developed society based on the access to knowledge. (Strategic Crowdsourcing as an Emerging Form of Global Entrepreneurship)

Source: https://www.igi-global.com/dictionary/knowledge-society/16456 (29 June 2017)

This effective use of knowledge is just ability to establish connections with other knowledge. Thus, the knowledge society may be also perceived as the social network, i.e. "the interpersonal linkages created by the sharing of information in the interpersonal communication structure" (Rogers, 1986). Its nature is dynamic, non-hierarchical. The growth is triggered by more and more advanced technologies and communication tools.

Yet, the network is not only naturally growing but also scaling, responding when its size changes. The increasingly large and complex social systems, cities,

corporations and governments are continuously evolving and adapting like living systems (West, 2014).

The metabolic theory of ecology predicted that, from cells and whales to community structures, the pace of life gradually slows down with increasing size, and that this is accompanied by increasing economies of scale. Yet, as it comes to community structures, the cities – G. West's theoretical example – obey these if related to their infrastructure. But they invert them when it comes to social factors, where the network effect of having a lot of people in one place, plays its role: "The bigger you are, the more interactions take place, the more we talk, and the more we can create more wealth, new ideas, and so on." This holds true also globally. The one thing that stops growth - and the reason we wouldn't be better off living in one planet-wide city of 8bn people – is the limitation of natural resources. At this point G. West agrees with Thomas Malthus' theory of natural selection. The solution to this problem is technological innovation. However, as G. West puts it: "but the more energy hungry we get, the faster those innovations have to come to keep things moving. The only question that arises is, if as socio-economic beings we are able to stand the pace" (West, 2014).

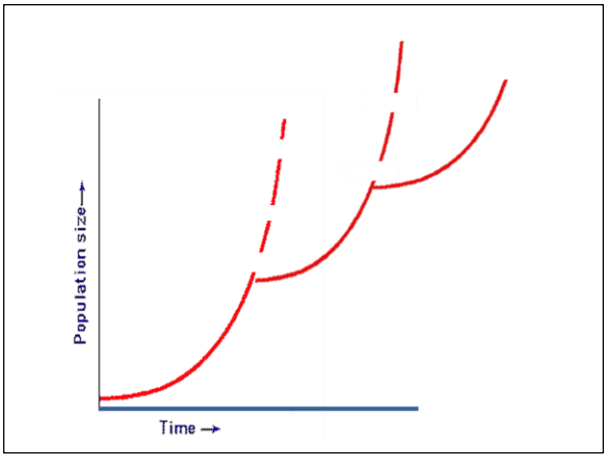

Figure 2. Unbounded growth requires accelerating cycles of innovations to avoid collapse

Source: *Elaborated on the work of G. West: The surprising math of cities and corporations https://www.youtube.com/watch?v=XyCY6mjWOPc (30 June 2017)*

Innovation is defined as creativity, novelty, the process of devising a new idea or thing, or improving an existing idea or thing (http://www.econlib.org/library/Enc/Innovation.html). Innovation seems to be not only the output of the effective use of knowledge but sine qua non for network structured society to sustain and avoid collapse.

The innovation, as Guy Kawasaki claims, needs to make meaning to the world, change it and make a technological breakthrough. It must be deep, with lots of

features and functionalities, intelligent, total and empowering to jump to the next curve of the exponential growth. (Kawasaki, 2014). Figure 2 demonstrates the curves of unbounded (exponential) growth by G. West.

The process by means of which innovation causes a free market economy to evolve; this jump to the next curve of exponential growth is, as Joseph Schumpeter named it, *creative destruction*. Creative destruction occurs when innovations make long-standing arrangements obsolete, freeing resources to be employed elsewhere, leading to greater economic efficiency (Joseph Schumpeter, http://www.econlib.org/library/enc/innovation.html, (2 July 2017)).

2. KNOWLEDGE SOCIETY SKILLS – VARIOUS APPROACHES

The condition of the society determines the condition of labour market by technology, automation and creativity.

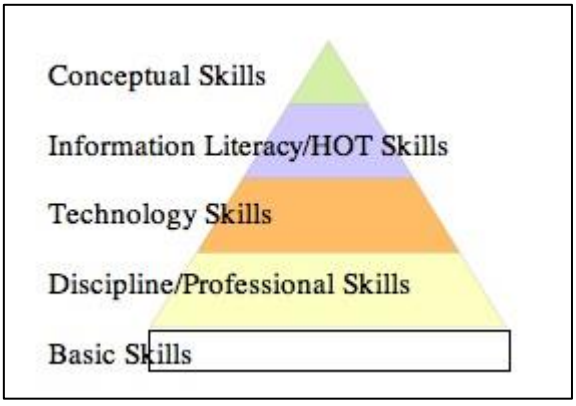

Figure 3. Johnson's Hierarchy of "Knowledge Worker Skills"
Source: Johnson D., (2005), Skills for the knowledge worker http://www.doug-johnson.com/dougwri/skills-for-the-knowledge-worker.html (3 July 2017)

The worker will need a particular set of skills and capabilities to adapt, survive, and what is more, contribute to the well-being of the community.

Skill should be understood as an ability and capacity acquired through deliberate, systematic and sustained effort to smoothly and adaptively carry out complex activities or job functions involving ideas (cognitive skills), things (technical skills) and/or people (interpersonal skills), (Business Dictionary, http://www.businessdictionary.com/definition/skill.html)

Capability – measure of the ability of an entity (department, organization, and person, system) to achieve its objectives, especially in relation to its overall

mission (Business Dictionary, http://www.businessdictionary.com/definition/skill.html).

Dough Johnson proposes, as he calls it, the Maslovian-type Hierarchy of Knowledge Worker Skills, skills that need be mastered prior to the acquisition and application of "higher order" skills. They are the following: Basic Skills, Discipline/Profession Specific Skills, Technology Skills, Information Problem-Solving/HOT Skills, and Conceptual Skills. Figure 3 (Johnson, 2005).

LEVEL ONE: The Basics Skills

reading for understanding, interpreting visual information, writing comprehensibly and, solving numeric problems

LEVEL TWO: Discipline/Profession Specific Skills

"cultural literacy" - a base of knowledge in history, social science, science, literature, and both physical and cultural geography followed by core skill sets and body of knowledge of science, law, education, architecture, medicine, computer science, engineering, accounting, and other professions

LEVEL THREE: Technology Skills

Technology skills are omnipresent and may be considered actually as "knowledge work," or even a new "basic skill."

LEVEL FOUR**:** Information Problem-Solving Skills and Higher Order Thinking Skills

Working with and developing technology require one of broader set of skills which is successful information problem-solving.

LEVEL FIVE: Conceptual skills

Johnson proposes in here Daniel Pink's (2005) idea of developing and using the right-brain abilities of high concept (seeing the larger picture, synthesizing information) and high touch (being empathetic, creating meaning).

Pat Sine (2008) draws up the whole spectrum of skills the extended professional of the 21st century should possess (Figure 4).

I CATEGORY:

- CORE SUBJECTS: English, reading or language arts, world languages, arts, mathematics, economics, science, geography, history, government and civics.
- 21ST CENTURY INTERDISCIPLINARY THEMES: global awareness, financial, economic, business & entrepreneurial literacy, civic literacy, health literacy.

II CATEGORY:

- LIFE AND CAREER SKILLS: flexibility and adaptability, initiative and self-direction,
- SOCIAL & CROSS-CULTURAL SKILLS are: productivity and accountability, leadership and responsibility.

III CATEGORY:

- LEARNING AND INNOVATION SKILLS: creativity and innovation, critical thinking and problem solving, communication and collaboration.

IV CATEGORY:

- INFORMATION, MEDIA & TECHNOLOGY SKILLS: information literacy, media literacy, ICT literacy.

Figure 4. The 21st Century Skills

Source: *Pat Sine, from 20th Century Instruction to 21st Century Learning, Office of Information technology, University of Delaware, USA, 2008 https://www.slideshare.net/psine/from-20th-century-instruction-to-21st-century-learning-presentation?next_slideshow=2, (2 July 2017)*

Another skills classification presents the profile of the knowledge worker from the practical perspective and provides very detailed description of single skills. The skills fall into 7 groups. (Figure 5)

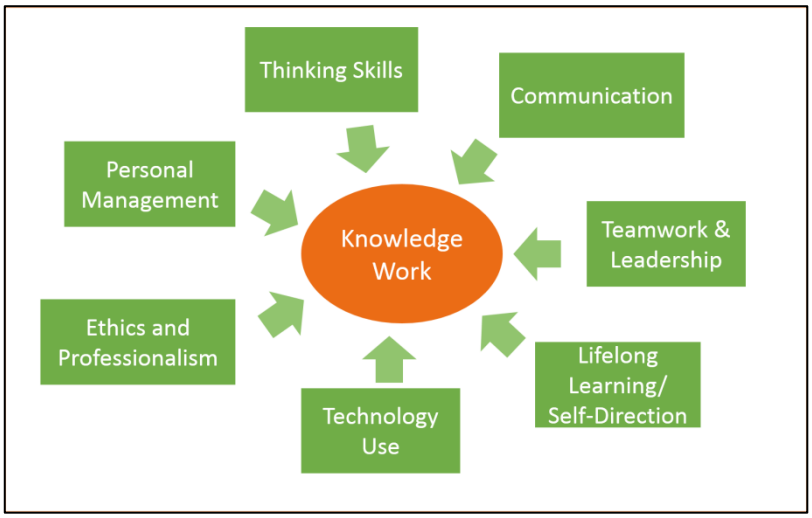

Figure 5. 7 Skills of Knowledge Work
Source: Gardner J., 2014, The 7 Skills of Knowledge Work http://joelleegardner.blogspot.com/2014/10/the-7-skills-of-knowledge-work.html (2 July 2017)

THINKING SKILLS - the ability to work with information effectively to solve problems, performs tasks, and design solutions. Thinking skills include:

- *critical thinking* - drawing appropriate conclusions based on data
- *systems thinking* - seeing the big picture, including how parts of a system affect and influence one another
- *analysis skills* - breaking down information and technologies into pieces to understand and categorize individual parts. Identifying the root cause of a problem.
- *problem solving* - identifying solutions to complex issues.
- *creativity* - using imagination to combine existing knowledge into new knowledge to fulfil a need.
- *design* - planning out the implementation of solutions to learning and performance problems.

COMMUNICATION - the ability to understand and share ideas effectively. This includes the following:

- Understand and interpret complex information from multiple sources through divers media.
- Communicate effectively and appropriately in a variety of formats, including visual, verbal, written, both face-to-face and in digital formats.

TEAMWORK AND LEADERSHIP - the ability to work with others to achieve a common goal. This includes the following:

- collaborating and working effectively with others to achieve goals.
- motivating others through appropriate strategies.
- working effectively with team and individual strengths to maximize the effectiveness of the whole.
- leading people to positive outcomes through persuasion, empathy, and effective management.

LIFELONG LEARNING AND SELF-DIRECTION -continual self-improvement through the constant knowledge acquisition, setting one's own direction in learning and growth. This includes the following:

- Development of general skills like those in this list.
- Development of field-specific skills.
- Gaining formal education, which to increase ability to sustain success in the knowledge society.

TECHNOLOGY USE – uses of technology to accomplish goals or tasks.

- Select the right tools and technologies for tasks and problem solving.
- Use tools and technologies to appropriately complete tasks and solve problems.
- Learn quickly how to use a new technology and be willing to adapt new technologies continuously.

ETHICS AND PROFESSIONALISM - is accountable for their own actions and work.

- Have good work habits and perform assigned work consistently.
- Interact with others in a professional manner.
- Work effectively and professionally with people of diverse backgrounds.

PERSONAL MANAGEMENT - manage habits to maintain health (physical, mental, emotional, and spiritual), which means maintaining balance in all areas of life (family, work, personal, community).

Gardner explains also how these skills should be actually utilized in the working environment to ensure further development for both workers and organizations (Table 2).

Table 2.

Organizations and Leaders in the Knowledge Society

Skills	Organizations and Leaders Should…
Thinking Skills	Share and give access to relevant, useful knowledge.
	Create systems and processes for knowledge sharing.
	Teach and communicate regularly with employees.
	Encourage and establish systems for knowledge sharing.
Communication	Continually communicate new knowledge to employees.
	Provide professional development opportunities to improve communication skills.
	Provide continuous opportunities to practice the skills of communication.
Teamwork and Leadership	Provide leadership and guidance in effective teamwork.
	Provide opportunities to practice leadership teamwork.
	Provide professional development opportunities to improve leadership and teamwork skills.
Lifelong Learning and Self-Direction	Provide many opportunities for learning and professional development.
	Provide career coaching and development opportunities.
	Provide access to relevant industry knowledge.
Technology Use	Utilize and demonstrate effective use of appropriate technologies.
	Provide professional development opportunities to improve employee technology capacities.
Ethics and Professionalism	Establish standards of ethical, professional behaviours through word and example.
	Hold employees accountable for their professionalism.
Personal Management	Provide opportunities for development of personal management skills.
	Provide a healthy working environment.

Source: Gardner J., 2014, The 7 Skills of Knowledge Work http://joelleegardner.blogspot.com/2014/10/the-7-skills-of-knowledge-work.html (2 July 2017)

McKinsey predicted the increasing demand for knowledge workers performing interactive jobs (McKinsey Global Institute report, *Digital America: A tale of the haves and have-mores*, 2016).

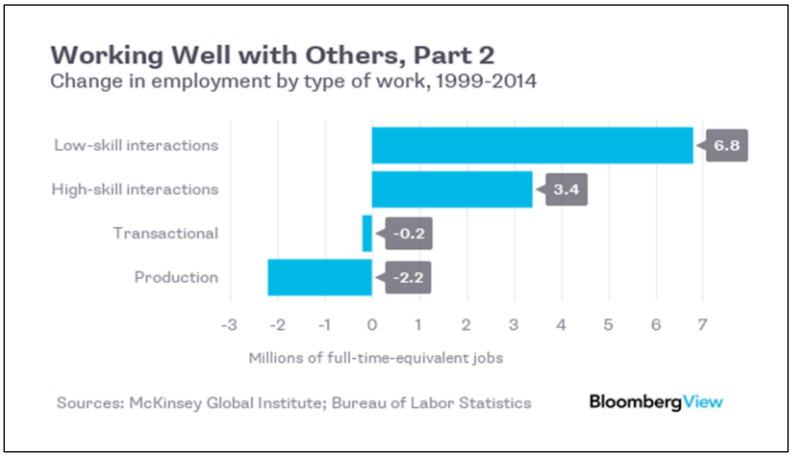

Figure 6. Change in employment by type of work 1999-2014
Source: McKinsey Global Institute; Bureau of Labour Statistics Report, 2016

The figures presented in Figure 3. demonstrate strong demand for high and low skill work: 6.8 and 3.4 m full-time positions respectively.

Production jobs are those that transform one resource into another, such as assembly work in the manufacturing sector. Transaction work is a routine, clerical task with clear rules to follow, for example the one performed by cashiers. Interaction work refers to occupations that involve customer engagement, team discussions, and creative thinking. These kinds of work comprise high-skill (such as doctors and scientists) and low-skill (such as retail salespersons and restaurant servers) (Fox, 2015).

The nature of work will change as processes are automated, yet it will not be clear cut division into automated and interactive occupations. Only a small percentage of occupations can be fully automated by adapting current technologies. Majority of occupations are made up of a set of activities with different potential for automation. For example, small shop owners will spend some time interacting with customers, serving them at the till, stocking shelves. They will need different skills for each of these activities to perform effectively and efficiently. (McKinsey, 2016)

Workers will need intrinsically human capabilities to perform activities which are complementary to those done by machines. Thus, policy makers, managers and future workers will need to focus more on identifying required skills and providing or taking proper education and training.

These intrinsically human skills are: logical thinking and problem solving, social and emotional capabilities, providing expertise, coaching and developing others, and creativity. (McKinsey Global Institute, *A future that works: Automation, employment, and productivity*, 2016)

2.1. A neurodidactic perspective on knowledge society skills

The concepts of knowledge society skills presented above include all possible skills a human can acquire and develop. They seem to be overlapping rather ran complementary. Yet, the way of their categorization puts more emphasis or importance on one or another set. Johnson's hierarchical arrangement stresses the order in which the skills should be mastered in the academic environment and as the last to develop, because most complex, are conceptual skills.

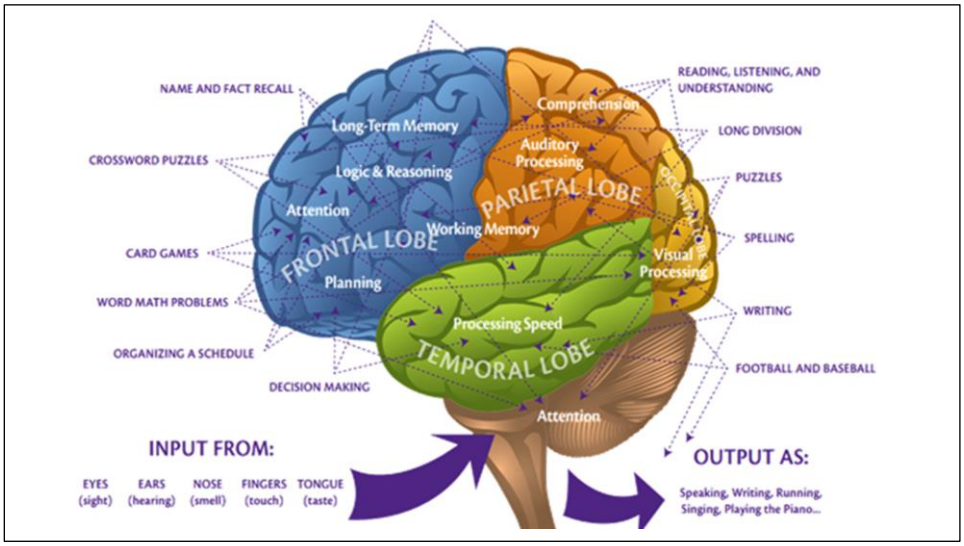

Figure 7. The parts of the human brain

Source: https://www.quora.com/Neuroscience-What-are-the-most-important-parts-of-the-human-brain

P. Sine distinguishes among others, 21st century interdisciplinary themes that include global awareness, civic literacy and health literacy.

Gardner focuses on business environment identifying personal management as the separate category of skills and arranges them in a circle together with other skills without attributing special importance to any category.

McKinsey emphasizes intrinsically human capabilities.

Referring to neurodidactics, we can further elaborate on knowledge society skills basing on the concept of the brain as a network.

The brain acts as a dense network of fibre pathways consisting of approximately 100 billion (10^{10}) neurons. The brain consists of three principal parts – stem,

cerebellum and cerebrum. The cerebrum is divided into specific areas: frontal lobe, occipital lobe, parietal lobe and temporal lobe which specialize in different functions - sight, hearing, speech, touch, short-term memory, long-term memory, language and reasoning abilities. And the cerebrum is where higher-ordered functions like memory and reasoning occur (cognitive skills) (Ford, 2011; Żylińska, 2013). The parts of the human brain and its functions are illustrated in Figure 7.

As defined by Pascale Michelon, cognitive abilities are brain-based skills we need to carry out any task from the simplest to the most complex. They have more to do with the mechanisms of how we learn, remember, problem-solve, and pay attention, rather than with any actual knowledge. For instance, answering the telephone involves perception (hearing the ring tone), decision taking (answering or not), motor skill (lifting the receiver), language skills (talking and understanding language), social skills (interpreting the tone of voice and interacting properly with another human being)

Another example shows that to carry out goal-directed movements, your motor cortex must first receive various kinds of information from the various lobes of the brain: information about the body's position in space, from the parietal lobe; about the goal to be attained and an appropriate strategy for attaining it, from the anterior portion of the frontal lobe; about memories of past strategies, from the temporal lobe. (http://thebrain.mcgill.ca/flash/d/d_06/d_06_cr/d_06_cr_mou/d_06_cr_mou.htm)

The analysis of brain functions and skills by P. Michelon is provided in Table 3. (P.Michelon, *What are Cognitive Abilities and Skills, and How to Boost Them?*; https://sharpbrains.com/blog/2006/12/18/what-are-cognitive-abilities/, accessed 18 December 2006).

We need to learn and we do so, not single skills in a hierarchical order but practice and master rather a wide spectrum of different skills to perform even simple automated tasks working with robots in a factory or complex ones like elaborating on business strategy.

Bresslor and Menon's large brain network research (2010) also suggests that cognitive functioning is the result of interactions or communication between different brain systems distributed throughout the brain. When performing a particular task, just one isolated brain area is not working alone. Instead, different areas of the brain, often distant from each other within the geographic space of the brain, are communicating through a fast-paced synchronized set of brain signals (McGrew, 2011). The effectiveness of brain activity highly depends on the synchronization of signals flows (M. Żylińska, 2013). These signals run through paths creating "a large-scale functional network which is as a collection of interconnected brain areas that interact to perform functions" (Bresslor and Menon, 2010).

Table 3.

Cognitive abilities and brain functions

Cognitive Ability/ Brain Function	Skills involved
Perception	Recognition and interpretation of sensory stimuli (smell, touch, hearing, etc.)
Attention	Ability to sustain concentration on a particular object, action, or thought, and ability to manage competing demands in our environment.
Memory	Short-term/ working memory (limited storage), and Long-term memory (unlimited storage).
Motor skills	Ability to mobilize our muscles and bodies, and ability to manipulate objects.
Language	Skills allowing us to translate sounds into words and generate verbal output.
Visual and Spatial Processing	Ability to process incoming visual stimuli, to understand spatial relationship between objects, and to visualize images and scenarios.
Executive Functions	Abilities that enable **goal-oriented behaviour**, such as the ability to plan, and execute a goal. These include: **Flexibility:** the capacity for quickly switching to the appropriate mental mode. Theory of mind: insight into other people's inner world, their plans, their likes and dislikes. **Anticipation:** prediction based on pattern recognition. **Problem-solving**: defining the problem in the right way to then generate solutions and pick the right one. **Decision making:** the ability to make decisions based on problem-solving, on incomplete information and on emotions (ours and others'). **Working Memory:** the capacity to hold and manipulate information "on-line" in real time. **Emotional self-regulation**: the ability to identify and manage one's own emotions for good performance. **Sequencing**: the ability to break down complex actions into manageable units and prioritize them in the right order. **Inhibition:** the ability to withstand distraction, and internal urges.

Source: *elaborated on P. Michelon, What are Cognitive Abilities and Skills, and How to Boost Them?; https://sharpbrains.com/blog/2006/12/18/what-are-cognitive-abilities/, 18.12.2006.*

This way, Bresslor and Menon, (2010) distinguished three main networks that explain human behaviour.

1. The default mode (DMN) or default brain network is what a brain does when not engaged in specific tasks. It is a system for autobiographical, self-monitoring and social cognitive functions - processing, storing, and applying information about other people and social situations (social interactions).

It is also responsible for REST (rapid episodic spontaneous thinking) i.e., when not working on a specific task or, completing a task that is automatized (e.g., driving a car) the mind starts to wander and produce spontaneous thoughts (which can be both positive creative thinking and distracting thoughts).

The researchers at the University of California Irvine's Center for the Neurobiology of Learning and Memory (Ford, 2011) explained that automatization/ subconsciousness of task performance with the concept of learning and memorizing formation. Learning and memorizing are formed by the strengthening and weakening of connections among brain cells. In experiments with mice, they observed how the brain was learning a new task. It appeared that when two neurons frequently interact, they form a bond along which they transmit more easily and accurately. This helps to create more complete memories and easier recall.

They also support this concept with the example of the daily commute: *You don't really need to think consciously about how to get to work, because it is a trip you have taken so many times that the memory of how to navigate is ingrained. The neurons that control this memory have communicated so often, they have formed a tight bond* (D. J. Ford, 2011).

The neuronal paths created in the childhood are often used over the lifetime. This is how we gain the experience (Żylińska, 2013).

2. The salience network is a controller or network switcher. It monitors information from within (internal input) and from the external world, which is constantly bombarding us with information. The brain can process almost 100 megabytes of information per second into signals (Spitzer, 2007). This controller selects urgent, task relevant information, distributes it for processing in other areas of the brain.

The research at the University of Michigan's Biopsychology Program (Ford, 2011) also proves that the brain behaves selectively about how it processes experiences that enter through our five senses. The brain seems to be highly attentive to any novelty or unusual experience. It compares between the new information brought through the senses and existing information stored in the brain's long-term memory. When the brain finds a match, it eliminates the new memory as redundant.

When new information contradicts what's already stored in memory, the brain works to explain the discrepancy. If the new information is useful it becomes a permanent memory that can be retrieved later. While learning new information, we

estimate if it is useful and its source reliable. If they are not, we forget it or even reject it altogether, depending on the information we already possess.

3. The central-executive network (CEN) "is engaged in higher-order cognitive and attentional control", when engaged in working on a problem (McGrew, 2011) (Figure 8).

This can also be exemplified by D. J. Ford's experiment (2011). He contrasted our daily commute described above with the experience of driving to a completely new location. To make this trip, our brain works much harder for us to get directions, write them down or print them and then concentrate on road signs along the way. In this case, the neurons involved in navigating to this new destination have not communicated. They need to form new connections within the brain, which results in greater conscious effort and attention on our part.

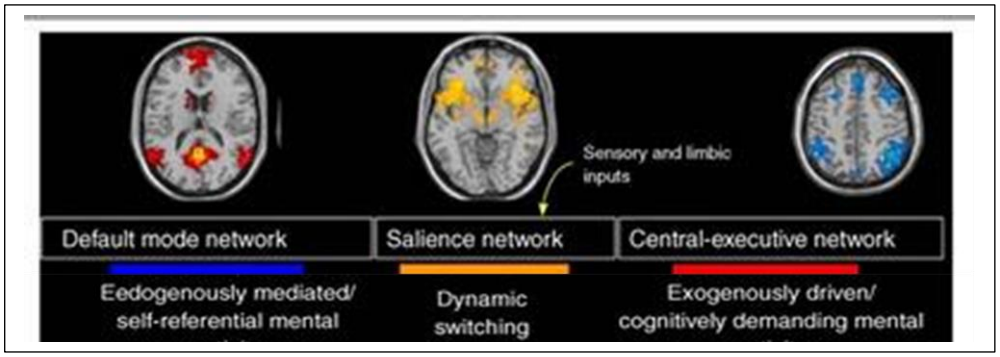

Figure 8. The large-scale functional networks
Source: *elaborated on McGrew K. (2011), The Brain as a Network: Focusing Your Network http://www.creativitypost.com/psychology/the_brain_as_a_network_focusing_your_network (4 July 2017)*

Following Bresslor and Menon's neuroscientific concept that cognition is the result of a number of large scale brain networks that require efficient brain rhythm or synchronization (McGrew, 2011) the system of skills of knowledge society may be perceived as a holistic and networked and build up around the large-scale function networks of the brain.

Default skills → social interaction, creative thinking

Salience skills → selecting, analysing and organizing information

Central-executive skills → problem solving, critical thinking

All other skills are derivative or specific from of the main ones. The example classification is presented below. (Figure 9).

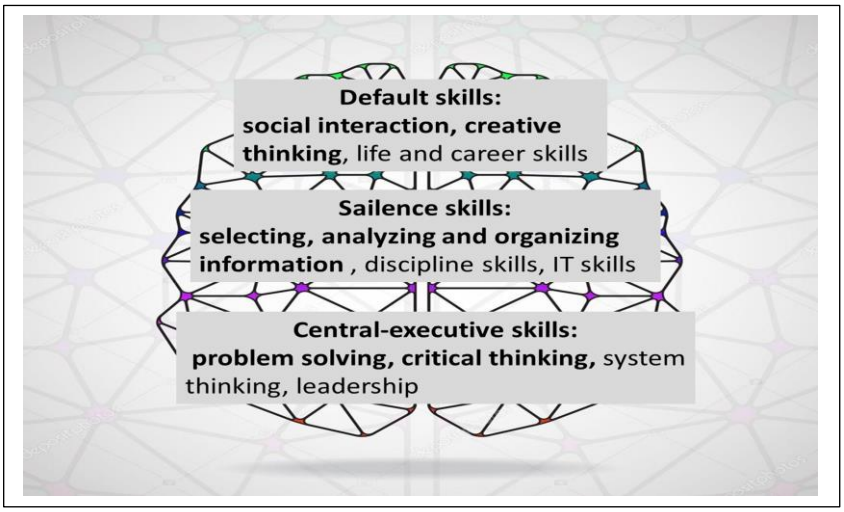

Figure 9. Knowledge Society Skills
Source*: Own Work*

In everyday life from the very beginning as a child and along the whole life we use and practice all skills of course at different level of complexity and responsibility. Although, it can be disputable weather the level of responsibility for a task performed perceived by a child and an adult is different.

Children acting *a mom and dad* role play use the following skills:

- default skills: social interaction, creative thinking: partnership, cooperation, creativity/imagination of various situations while involving their "children – dolls", earning a living,
- salience skills: comparing and selecting information for making right choices, telling the difference between good and bad information, acceptable or not for a child, a spouse
- central-executive skills: management (of family), strategic thinking, planning a day, the future, running (governing) a household, critical thinking: bringing up children, correcting their behaviour (quality of education)

Playing a strategic *war game*, usually boys, practice the following skills:

- default skills: social skills: partnership, cooperation with allies, creativity/imagination of possible dangerous situations
- salience skills: comparing and selecting right information for risk estimation, IT skills to use supportive applications (BPM applications)
- central-executive skills: command and control at the battlefield, strategic thinking, planning the operation,

There can be much more skills identified, I just limited the examples to the basic ones. These skills, although generally divided, are strictly interconnected. For example, cooperation or partnership, as social skills (default skills), are complementary to leadership skills which in this classification falls into central-executive skills category. Salience skills like collection and selection of information seem to be fundamental and supportive for other skills, e.g. the commander needs right information from the battlefield to draw a right strategy and right information about soldiers to communicate with them successfully. The quality and quantity of information we possess, determine our decisions and actions. At this point it seems appropriate to quote McGrew (2011): *This controlling network (salience functional network) must suppress either the default or executive networks depending on the task at hand. It must suppress one, and activate the other. Needless to say, this decision making and distribution of information must require exquisite and efficient neural timing as regulated by the brain clock(s*)

Analogy of the children plays can be easily identified in the adult life as a mature family members and managers we use and practice the same skills. Of course the children rather imitate the adults' behaviour and modify it with their own initiatives whereas adults have the opportunity to draw on experience in some situations.

For practicing and developing these skills in adulthood we employ role plays, games straight from the children world as a company training activities. Methods widely and successfully used are:

- Discussions: different roles give opportunity to develop different skills.

  The observers exchange thoughts, ask questions (select information, compare), cooperate in some sense

  The leader of the discussion explains differences, monitors exchanges of opinions

  Members of the cooperate and contributes to discussion by communicating their ideas, are open, tolerant and persuasive (social skills)

- Role plays: acting out specific role learns particular behaviours in different situations, find different options (critical thinking), selection, cooperation, communication of the problem and solving is based on the experience

- Simulations out or mimicking an actual or probable real life condition, or situation to find a cause of a past occurrence (such as an accident), or to forecast future effects (outcomes) of assumed circumstances or factors. A simulation may be performed through (1) solving a set of equations (a mathematical model), constructing a physical (scale) model, (3) staged rehearsal, (4) game (such as wargames), or a computer graphics model (such as an animated flowchart). Simulations are very useful tools that allow experimentation without exposure to risk.

(http://www.businessdictionary. com/definition/simulation.html, 15 August 2017)

- Case study - documented study of a specific real-life situation or imagined scenario. Students or trainees are required to analyse the prescribed cases and present their interpretations or solutions, supported by the line of reasoning employed and assumptions made (http://www.businessdictionary.com/definition/case-study.html, accessed 15 August 2017).

  The skills involved are collecting and selecting information, analytic and synthetic (critical) thinking, creative thinking, finding new solutions, decision making, communicating own ideas, justifying and reflecting. (Andrzejczyk, 2010)

While thinking about knowledge society skills it one should think not about single skill to be practiced but about capabilities (as McKinsey calls inherent human capabilities), since performing and completing a given task involves usually a few different skills. This performance is controlled by brain functions which are not exclusively located in specific brain areas acting independently (the right or left hemisphere).

3. AN EDUCATIONAL MODEL FOR THE KNOWLEDGE SOCIETY

Educational systems have not met labour market expectations. According to McKinsey survey of young people and employers in nine countries, 40 percent of employers point to lack of skills whereas 60 % - not adequate preparation for the world of work. There are gaps in technical skills such as STEM subject (science, technology, engineering and mathematics) degrees but also in soft skills such as communication, teamwork, and punctuality. (http://www.mckinsey.com/global-themes/employment-and-growth/technology-jobs-and-the-future-of-work, accessed May 2017).

Since the nature of the knowledge society, its labour market needs, the knowledge worker profile, and educational inadequacies have been identified, naturally the question how to satisfy these needs arises.

To provide successful education it is necessary to define the profile of the learner first and then apply the right methods and techniques to reach desired goals.

The learner of the knowledge society is born from 1996 to the present.

At the Center for Generational Kinetics, the researchers call them the generation after Millennials "Gen Z or iGen." and define them as cloud natives rather than digital natives.

Gen Z feel more digitally free, they use more peer-to-peer social media and messaging apps, such as Snapchat, Vine and Instagram. They may even have anonymous accounts to share their experiences without fear of online reputation repercussions. The recent study showed that nearly 25% of 13- to 17-year-olds left Facebook, as being for "older generation". This shows that apps that are more instantaneous, use less personal information and are more visually appealing to users are gaining popularity.

This could have profound implications for everything from their relationships and how they learn to virtual reality training and problem-solving.

Their world is "iEverything." As a result, they tend to live most of their lives from interacting with friends and family to making major purchases—online and via their smartphones.

They live using new communication technology on a daily basis, which changes their lifestyle, habits including learning habits and working environment (http://genhq.com/generations-gen-y-millennials-research/).

They have changed as learners and so should the teaching methods to be effective.

3.1. Neurodidactic foundations

Neurodidactics seems to offer theoretical base as well as practical solutions. It encourages the management and process of learning, in a stress-free, reliable, social learning context. (Anastasia, 2016)

Learning is not simply memorizing knowledge to be tested and graded, but communication and an enhancement of performance. The process of learning is affected by the emotional state of the learner, motivation and the memory functions.

The brain is a "social organ", constantly seeking for cooperation, relationships that carry it forward, a friendly and relaxed state that inspires trust, and not fear of failure or faults, since trust enhances creativity. These characteristics make learning attractive and enhance personal willingness towards it. Rewarding and fun in team work, are more important than performance.

This is why we refer to the brain's neuron plasticity and mirror neurons, reflecting our relationships with our surroundings. When for instance we watch another individual perform a task, we also perform it intuitively. They allow us to communicate and find a mutual, social agreement and form the neuron-biological foundation for learning according to one model (Anastasia, 2016).

In neurodidactics, motivation is the student's curiosity for learning. Learning in the form of a game, causes improved perceptive abilities and experimentation with social roles. A child learns not passively, via ready knowledge, but by actively investigating the unknown. The room becomes a field of experimentation and innovation.

Information to which we pay attention and which we process, reaches the long-term memory. Transfer of information from the short-term to the long-term memory, is not a passive process. Information we learn, is abundant of associations to already stored sections in our memory. The storage process is the formation of associations between learning impulses and the long-term memory contents. For instance, the organization of a complex material makes its storage simpler. Grouping vocabulary using certain criteria with regard to its content or phonetics can also help. There are similar options for the recalling process, reducing its demands and using external impulses-guidelines, which may be verbal or visual.

3.2. 3.0 learning and the extended 70:20:10 framework

The integrated, interactive environment is a key element of 3.0 learning model, based on the concept of emergent learning," which means that we create new knowledge continuously as we interact with a number of people and resources." (Taylor, 2011) In emergent learning the learners organize and determine both the process and to some extent the learning destinations, both of which are unpredictable." (Williams, et al. 2011).

Figure 10 shows how the 3.0 learning model interaction pattern differs from previous models 1.0 and 2.0.

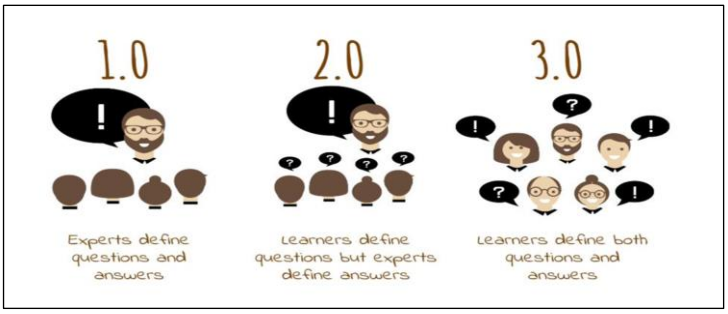

Figure 10. Learning types

Source: Pimentel, M., Learning 3.0 – Re-learning to Learn using the Learning Canvas, (2016) https://elabor8.com.au/learning-3-0-re-learning-to-learn-using-the-learning-canvas/ (2 July 2017)

Aberdeen Group did more research on 3.0 learning and extended the 70:20:10 framework. The traditional 70:20:10 model divides sources of learning into 3 categories: 70% - experienced based, 20% - coaching, developing through others, 10% - formal learning. The researchers broke down social category into 2 different compounds: referential and relational. Referential refers to the prior conception of learning from others. Relational takes place in a social context, through participation in activities (on or off – line), collaboration, is relationship-based (Figure 11). However, these elements should not be thought of as a separate one. Actually they are interdependent and their proportions are defined by the environment the learning happens.

3.0 learning encourages integration of formal and social learning through social learning management systems (LMS). It stresses value of user-created video content, social learning via online social networking, blogs, and wikis.

The modalities of 3.0 learning model include gamification, micro-learning, simulation/role play.

Gamification applies game mechanism to non-game context to teach new or enhance present behaviours.

Micro-learning makes learning tolerable as it delivers short but targeted content to the learner to elaborate on within 4 minutes.

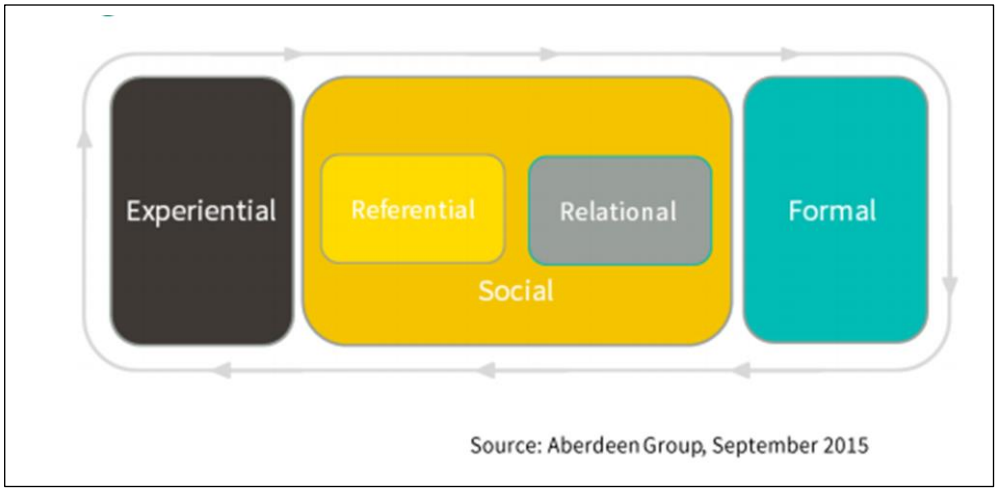

Figure 11. The new 70:20:10 framework

Source: Aberdeen Group, 2015, The New 70:20:10 - The Changing Face of Learning, www.aberdeengroup.com

Simulation/role-playing develops decision making and strategic planning skills and collaboration through creating the risk-free environment where the student deals with workplace like or life like situation.

3.3. Technologically integrated learning environment

Neurodidactics emphasizes the importance of the environment for learning process. For iGen this learning environment should be technologically integrated to optimize and maximize social interactions if it is to feel natural.

Technology integration means using technology to support new models of learning, including opportunities for students to collaborate and construct knowledge (Protheroe, 2005).

The social learning platforms can organize learning environment in a way that students can create and share the content. They support learner to progress, give

opportunities to practice rich conversations and reflect on their achievements. The platforms can also serve as the repositories for that knowledge.

Learning through many and varied methods including just-on-time, social and informal learning provides student with the diverse spectrum of learning experience and create learning opportunities and content which is accessible, targeted and continuous.

Docebo Company developed the four stage model of technology-enhanced 70:20:10 learning, which is to learn, coach and share the knowledge.

Here's an example of instructions for activities to perform at a given stage:

1. RECORD & UPLOAD

- capture a video (for example, recording a new procedure) by using mobile recording devices such as smartphones, wearable devices

- upload that video to a "Knowledge Hub" using mobile or desktop devices.

2. DISTRIBUTE

- categorize and tag the content (the video) to share it within the organization through the appropriate channels, e.g.: a Knowledge Library, Learning Object within a course, CMS etc.

3. PEER REVIEW VALIDATION

- peers validate the uploaded video through a peer review process, which ensures that the content is trustworthy and valuable, for example, for employees required to perform similar tasks.

- edit, curate (with notes or tooltips) and made available for publishing in a Knowledge Library.

4. SOCIAL & COACHING

- peers may engage the 'experts' (SMEs, or subject matter experts) and ask questions about the content,

- or, they can also be coached on the topic to improve their understanding and ability to perform.

Integration is defined not by the amount or type of technology used, but by how and why it is used.

Research institutions recommend tools for technology integration assessment. One of them is Levels of Technology Assessment (LoTi). LoTi instrument measures eight specific stages of technology implementation: Awareness, Exploration, Infusion, Mechanical Integration, Routine Integration, Expansion, and Refinement. The idea behind the LoTi framework is that teachers will progress from low levels of technology integration, which are teacher-centred, to higher levels of use, which are learner centred (Summaka, et al., 2010) (Figure 12).

While building a successful learning strategy no matter if for one class or a long course and implementing any ICT tools, the basic thing is to understand the end user/ student. Different learners respond differently to digital learning, they demonstrate different learning styles and preferences. Learning materials should also be designed for specific media and adapted to organizational competencies.

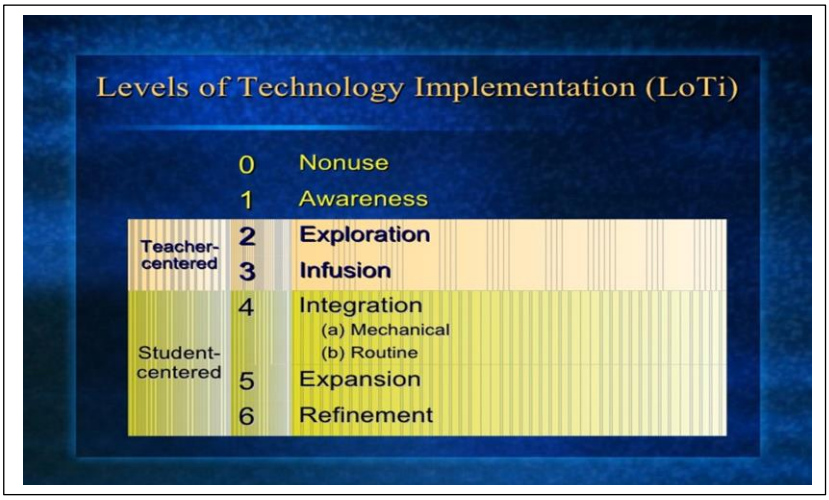

Figure 12 . Levels of Technology Implementation (LoTi)
Source: Sine P., 2008, From 20th Century Instruction to 21st Century Learning, Office of Information technology, University of Delaware, USA;https://www.slideshare.net/psine/from-20th-century-instruction-to-21st-century-learning-presentation?next_slideshow=2, (2 July 2017)

CONCLUSION

Development of new technology creates new social, technological, demographic and environmental trends are dramatically changing the structure and functioning of the society to create knowledge society. This society is defined by the effective use of knowledge, which means ability to establish connection with knowledge through the network of integral communicative structures. The social network is growing in an unbounded (exponential) manner, which lead to collapse. This collapse may be avoided by innovations that help to jump to the next curve.

Thus, the society needs a particular set of skills (capabilities) both to function in automated environment and create innovations. These are called intrinsically human (cognitive) skills, and can be classified from different perspectives, academic or business one. The research in neuroscience and neurodidactics led to new concepts about functioning of the human brain. We need to learn and we do so, not single skills in a hierarchical order but practice and master rather a wide spectrum of different skills to perform even simple automated tasks working with

robots in factory or complex ones like elaborating on business strategy. This performance is controlled by brain functions which are not exclusively located in specific brain areas acting independently (the right or left hemisphere). The research based concepts of the holistic, synchronized and network structured functioning of the brain gave foundations for the author' attempt to suggest another perspective and classify (build up) the sets of skills by the Bresslor and Menon's large-scale function networks of the brain: default, salience and central-executive.

Neuroscience provides also theoretical and practical base for the educational model putting emphasis on integrated and interactive, relaxed leaning environment for iGen. 3.0 learning and the new 70:20:10 framework encourage integration of formal and social learning through LMS and ICT tools. This technological integration should be defined by how and why it is used, and how student centred it is. This can be measured with specially designed tools like LoTi measurement tool.

Mastering the defined skills in a well-organized learning environment should ensure that the knowledge society will move successfully to another stage of development – wisdom stage.

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