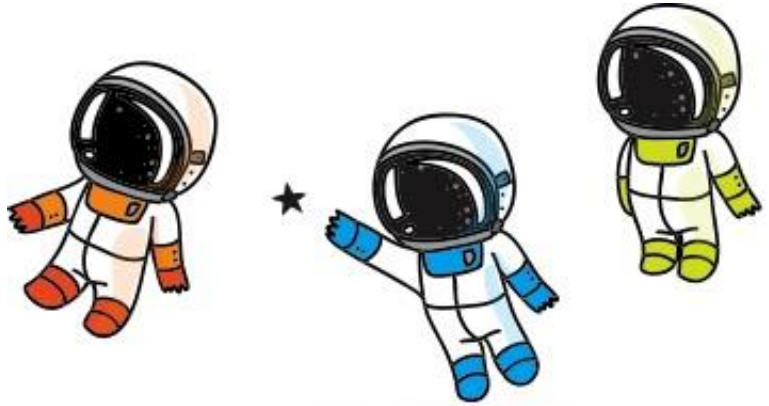

GUIDE TO THE FUTURE JOBS

OPPORTUNITIES ON THE LABOR MARKET IN TOMORROW'S WORLD –2nd edition

September 2019

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President of INACO think tank – The Initiative for Competitiveness

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NOTES ON THE 2ND EDITION

In an ever-changing world, only change itself remains a certainty, and because the rate at which it occurs is increasing, learning can no longer be linear. For this reason, answering the key questions – "What will the jobs of the future be? What jobs are emerging, transforming, or even disappearing altogether in a world of exponential change? What competencies and skills will employers seek above all? How can we acquire them through exponential learning?" – becomes increasingly difficult as well.

The community of professionals in INACO, The Initiative for Competitiveness think tank, found an easy, accessible answer to these questions in the first edition of the Guide to the Future Jobs, published in 2018. Stimulated by positive feedback from students and parents, in 2019, we created Romania's first three digital educational labs – Smart Lab 4.0 –, pilot projects of the exponential learning school developed by INACO. Those labs are at the Titu Maiorescu Secondary School, the Alexandru Ioan Cuza Theoretical High School of Bucharest, and Smart Lab 4.0 Măgurele in Ilfov County.

The exponential development of humanity is now driving us to come back with a second edition of the Guide, with a new, improved, and updated visual tour of the future, based on the latest findings on the economy of the future. Here, you will find what the labor market and what jobs themselves will most likely evolve into, in addition to several other recent practical examples. The novelty of this edition lies in its correlation of personal profiles with the jobs of the future, particularly the foregrounding of vocational education and the results of a recent INACO survey among high school students concerning their career expectations.

The fourth industrial revolution, also known as Industrial Revolution 4.0 or the Digital Revolution, introduces new job opportunities. Until 2028, this revolution will continue to bring major innovations by means of artificial intelligence, robotics,

NOTES ON THE 2ND EDITION

3D printing, biotechnology, augmented and virtual reality, or autonomous transportation. Its consequences are reflected rapidly in the way we work and live, both being characterized by digitalization, dematerialization, demonetization, and democratization – tendencies which underpin the current disruptive leaps of humanity.

The Guide to the Jobs of the Future is a Romanian project addressed to learners, teachers, and parents alike. Its second edition, of 2019, was developed with the support of the District 3 City Hall on the basis of the non-reimbursable loan agreement no. 611507 of 8.30.2019, "*Consiliere vocațională cu privire la meseriile viitorului, învățământul profesional și dual pentru elevii claselor a VII-a și a VIII-a din școlile generale ale sectorului 3*" ("Vocational counselling on the jobs of the future, apprenticeship, and dual vocational training for 7th and 8th grade pupils in District 3 primary & middle schools"). We would like to thank our co-authors, Alexandru Mironov, Alexandra Cernian, Marin Iachimov, Anca Tamaș, and Ioana Enache, as well as all our members and collaborators who contributed to the enrichment of our project. We learned a lot from Varujan Pambuccian, Răzvan Bologa and Bogdan Dumitrescu, from the technologically-avantgarde Romanian companies such as Modex or NextLab.Tech, who contributed to our enterprise and served as perpetual sources of inspiration. Mariana Nicolae supported us in adapting technological terminology to the beautiful Romanian language, while Dan Gherman designed the image of this Guide – we are grateful to both. We are indebted to our private sponsors: PinkPost and the Romanian Commodities Exchange. Any opinion expressed in this Guide to the Jobs of the Future belongs solely to INACO and its co-authors, and does not bind the public or private sponsors of this project in any way.

Dear learners, parents, and teachers, let us discover together the new career opportunities of the future...

Andreea Paul

President of INACO – the Initiative for Competitiveness


TECHNOLOGICAL
MEGATRENDS

INTRODUCTION

TECHNOLOGICAL MEGATRENDS

Two out of three Romanian pupils believe that the new jobs of the future belong to the fields of robotics, artificial intelligence, computers, and 3D printing, the 2018 INACO end-of-the-year survey shows.

85% of the jobs that will exist by 2030 have not been invented yet, as a recent study by Dell Technologies reveals. It is hard to believe this could happen in less than 11 years, isn't it? However, these are the effects of the hyper-technologized world that has come about and that fascinates us with its various scientific discoveries and economic strategies even today. In Romania, signs of a nearing future are already showing in both the leading industries – such as IT – and traditional fields – such as agriculture. Future job opportunities will be closely linked to the tendencies that are transforming today's world.

Most estimates currently indicate that over 10% of present-day jobs will be automated in the next decade. By 2030, 800 million jobs will have become redundant due to automation, a recent study by McKinsey Global Institute shows. New jobs will, nevertheless, come into being.

Many jobs will be, either slowly or radically, transformed.
65% of future jobs will be different from those we know today, “The Future of Jobs” report by the World Economic Forum argues.
Starting from the most recent and important events, reports, and pieces of information, the present guide aims to introduce young people to the latest tendencies in technology and economy that are already restructuring the labor market.
This presentation is a sketch of our world as it will be in only a couple of years, when every young person will be seeking employment or conducting new businesses in a completely different human, technological, industrial, and commercial context from the one we are living in now.

ROBOTICS

Will robots replace us? As far as some activities are concerned we believe they will - to a significant extent. At the same time, however, new jobs will be created. Within various industries, different types of robots have taken over the production process almost completely.

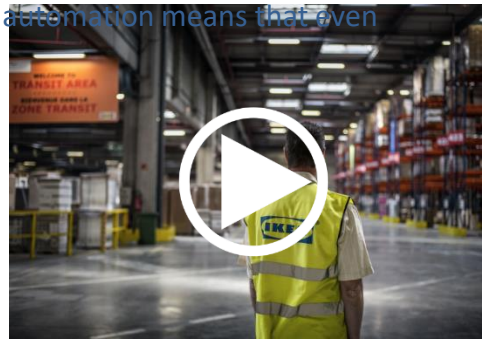
At Midea, the world's biggest air conditioner manufacturing facility, located in China, 800 robots substituted 24,000 workers (Pambuccian, 2017). Robots are becoming smarter, smaller, and more capable. They are walking, sliding, and flying out of laboratories and into houses and businesses at an astounding rate (New Atlas, "Robotics", 2019).

Midea Factory

The first industrial robot appeared in 1961, and the first industrial robot moving in six directions in 1971. Ever since, evolution in the field has been tremendous, especially in the third millennium; from industrial robots substituting workers and completing technological processes at a conveyor belt to robots carrying out extremely complex operations in manufacturing facilities.

The biggest Ikea packaging factory in Sweden is fully automated, and has only one operator. Two years ago, Nike and Adidas built fully automated factories as well.

Evolution in terms of industrial automation means that even manufacturing facilities might become obsolete. Industrial robots can be rented and shipped anywhere on request so as to produce/assemble the desired products “on site”.



Ikea Automated Factory

Armies are becoming increasingly more automated and technologized. Intelligent military robots are already present on the battlefield – the United States, China, and Israel being world leaders as far as their usage on the ground is concerned. More and more voices are urging UN states to enact international legislation regulating the production of autonomous military robots, without reaching global consensus.

Military Robot

In agriculture, autonomous tractors/combine harvesters have been introduced. They are supervised by a single operator controlling tens of agricultural machines from a computer. Such tractors are already being used in Romania for agricultural work in Banat, Bucovina, or Insula Mare a Brăilei.

Currently, large farms are contributing significant sums to the construction of robots to pick fruits: strawberries, cherries, oranges etc.

In the near future, human labor in fields implying repetitive actions, physical effort, risks, and particular precision will be automated almost completely.

Vertical agriculture, meaning the production of foods or crops stacked vertically, increases productivity and may further strengthen national economy.

Agriculture Robot

Autonomous tractor

Farmers as we know them now will become a memory in a couple of years. Agricultural drones can not only oversee extensive cultivated land, but also spray them with pesticide or fertilizer. Soil, water, or crop sensors, weather-predicting software, or satellite imaging can certainly help. What will farmers do, in this case? They will guide the machines remotely and control the drones from a computer in a variety of agricultural processes, using the data gathered, once again, by the drone – which will analyze the land from above so as to calculate the quantity of pesticides or fertilizer it must use for every square meter of land. Robots can also permanently supervise livestock, self-charging by means of solar panels.

Agricultural Drones

Dairy farms, for example, are implementing new technologies, such as the smart collar which monitors the well-being and fertility of cattle. This device can be connected to a smart phone or laptop, enabling farmers to track the animals' behavior and to attend to or feed them on time. Owing to this monitoring system, we can increase farm productivity and generate a greater profit from goods sold.

Robots threaten even lawyers. The software program developed by Kira Systems reduces the time spent on documentation by 60%, including document-scanning and highlighting the most relevant arguments.

Humans were replaced by robots under water, in the parking lots of big cities, in security companies. Functional robot surgeon prototypes came out in 2017, and the precision, flexibility, and safety of robotized surgical procedures refined until now reduce risks to patients, while increasing recovery speed.

8 recent robots

Will waiters be supplanted by robots? Not really. But multipurpose robot networks have already been introduced into fully automated restaurants where there are no waiters or cooks. Robot policemen? They will soon replace officers. In 2017, Great Britain made the first arrest on the basis of automated face recognition. In the same year, the first robot policeman began patrolling touristic areas in Dubai for increased safety. The UAE government intends to replace 25% of police officers with robots by 2030. In 2017, Dubai also inaugurated taxi drones.

Who is building industrial robots? The largest manufacturers in the world are Japan, EU, KUKA (with majority Chinese shareholders) (Pambuccian, 2017). Robot programmers and designers for every field of activity are already notably sought after.

Robots Cafe

Taxi-drone

Robo Cop

THE NEW GENERATION OF HUMANOID ROBOTS

New generations of robots will look and act as human-like as possible so as to be accepted by people more easily. Every detail that can improve non-verbal communication between robots and human beings is taken into consideration; robots will match the breath of their interlocutors, their eyes will move, they will be able to blink or even shed tears, and their facial expressions will be further refined so that they may convey basic emotions.

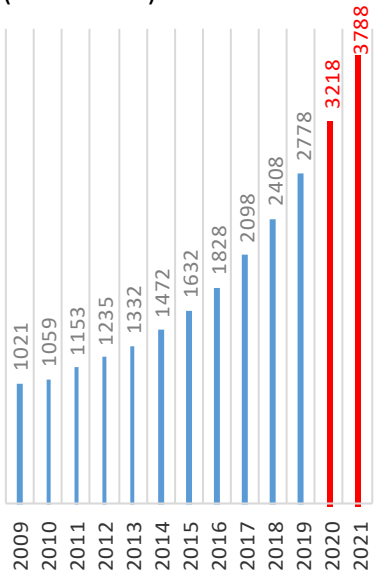
The automotive industry is using almost half of the active industrial robots in the USA and a third of the world's active industrial robots, being the most extensively automated industry by far.

By comparison, a Romanian worker in the car industry produces 3 cars per year, while a Spanish worker produces 16 by using robots.

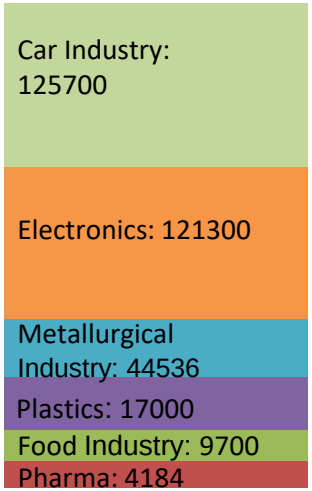
Surprisingly, introducing robots in the automotive industry has actually led to an increase in the number of newly-created jobs – jobs which require new abilities, such as using programming languages and cloud technologies, analyzing vast databases, and expressing ideas in digital media, even in the case of salespersons too.

THE GLOBAL INDUSTRY OF INDUSTRIAL ROBOTS

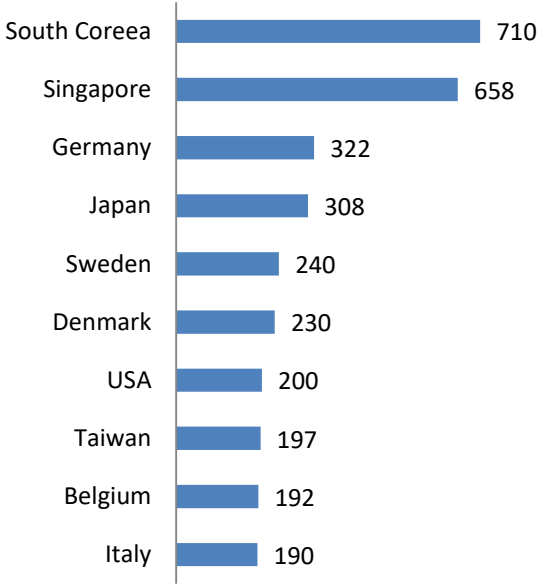
The number of functional industrial robots in the world and forecasts until 2021 (thousands)



Industries with the largest numbers of robots in the world 2017 (no. of robots)



Top countries by number of robots per 10,000 employees



Source: INACO, on the basis of data provided by the International Robotics Federation, August 2019

According to the International Federation of Robotics, more than 3.7 million industrial robots will begin operating by 2021, which indicates an average annual growth rate of more than 16%.

By 2021, the number of robots in services – agriculture, medicine – and personal use will also show an 18% annual increase.

Last year, there were 85 industrial robots for every 10.000 employees in the world. Globally, the countries making most use of robots are South Korea, Singapore, Germany, Japan, and Sweden.

Industrial Robots–International Federation of Robotics

Robots - International Federation of Robotics

In Romania, there are 18 robots for every 10,000 inhabitants, twice as many as in 2014, but much fewer than in other European countries: Slovakia (151), the Czech Republic (119), Hungary (78), Poland (36). The EU average is almost six times greater than ours (106 robots for every 10.000 employees).

ROBOTIC AUTOMATION IN ROMÂNIA

DACIA-RENAULT PLANT

"At the end of 2018, **more than 800 robots had been installed in the two plants of the Dacia industrial platform in Mioveni.**

"*More than 5% of the Dacia vehicle plant has been automated. In order to meet the quality requirements imposed by our clients, certain processes must be automated. Our percentage is still very low in comparison with both those of other builders and those of other plants in our group.*

A couple of examples would be: at the painting station, in order to be meticulous, the paintwork can only be carried out by a robot. Certain junctures in the bodywork also require the precision of a robot. We have yet to automate other sectors where the processes are very demanding (welding, manipulating car parts etc.)".

What will the role of human beings be among all these robots?

"*Robot automation also implies the creation of new jobs because these robots have to be programmed, maintained, supervised. Therefore, new jobs come into being or, if they already exist, vacancies arise...**We aim to further the automation process gradually, so as to reach 20% by 2020***" (Yves Caracatzanis,

CEO DACIA).

Dacia CEO interview

3D PRINTING/ADDITIVE MANUFACTURING

3D designers, 3D printing engineers and technicians represent new positions that young people may consider. They are already very desirable.

One characteristic of the 4.0 industry is its emphasis on technologically-complex products which are manufactured by small and creative teams of experts who are the products of transdisciplinary education. 3D printing makes additive manufacturing possible, which is much more profitable than subtractive manufacturing. This procedure presupposes building three-dimensional objects of any shape by adding layer upon layer of material (plastic, resin, metal etc.). Traditional industrial manufacturing creates objects through operations which cut out –that is, subtract – material, thus wasting a significant amount of raw materials. For example, in order to create a wooden object, traditional industrial manufacturing would carve a larger piece of wood into the desired object. Conversely, additive manufacturing creates the same object by stacking several layers of material that is extruded (melted and pressed out of a mould) with the help of a 3D printer.

3D Motor

3D printing

CUSTOMIZATION BY ADDITIVE MANUFACTURING

Nowadays, 3D printers are used to rapidly print intricate car or airplane parts, or any other building pieces that could not be produced otherwise. Non-metallic pieces are also commonly being 3D-printed. In fact, in fashion and the arts, 3D printers are used to create dresses. Being quick and customizable, unlike industrial manufacturing, the process of 3D manufacturing a variety of objects is sure to become common practice across the globe. Ideally, everyone will be able to create unique objects, from earrings to appliances, for personal use out of different materials. Cell-stem organs, custom-made for every patient and potentially accepted by the patient's bodies, have already been 3D-printed. Bones, ears, bladders were built in this manner, and experts are now working on printing a kidney. Future innovation means that every person could have their own, customized, "spare" organs.

3D printed organs

3D Art

THE FIRST 3D-PRINTED HEART USING HUMAN TISSUE

Scientists hope that they will soon be able to create transplantable human hearts. The Tel Aviv University is close to attaining this goal, having succeeded in 3D-printing a heart using human tissue and blood vessels. The organ, only as big as a rabbit heart, is not yet the size suitable for humans. The 3D-printed heart cannot pump blood for now, but researchers are seeking solutions to then test on animals. For this reason, it clear that 2019 has seen a remarkable leap forward in the field.

3D printed heart

Various types of nutritious food can also be printed in customizable quantities.

Moreover, intelligent food or digital drinks, intelligent packaging or virtual lemonade – with electrodes for flavor and LEDs for color – are not only successful experiments, but true start-ups.

3D food

Virtual Lemonade

THE DEVELOPMENT OF 3D PRINTING WILL BE SIMILAR TO THAT OF THE INTERNET

In construction, entire neighbourhoods, complexes, and office buildings can be printed more rapidly than ever.

Who builds 3D printers? The largest manufacturers in the world are USA and Germany (Pambuccian, 2017). Designers, engineers, and technicians are needed to identify the right structural models, select the best components or composite materials, or create 3D infographics. These are future-oriented.

3D Offices

3D mansion, built in 45 days

3D houses, 10 houses built per day

BIOTECHNOLOGY

The ability to combine engineering with technology, biology, medicine, and biochemistry will be one of the most valuable professional capacities, integral to the careers of the future. Beyond the agricultural, nutritional, or pharmaceutical use of biotechnologies, research on the human genome and increased refinement in the application of technological advances to genetics have yielded spectacular results in numerous fields.

Synthetic meat has already been produced – meat that does not belong to any animal, but was made by cultivating muscle cells in the laboratory – in an attempt to solve issues related to food shortages or animal sacrifice.

In 2015 began the production of phosphorescent plants. Now, research looks into ways of growing luminescent trees to be used for natural street lighting.

Synthetic meat

Fosforecent plants

Body parts design will combine aesthetics and bioengineering know-how in order to develop a wide array of custom-made body parts which perfectly match the skin tone, muscle mass, and overall body color of the person wearing them. The finished product will also function astoundingly.

Genome editing or hacking represents a medical procedure from the field of genetic engineering through which the DNA contained in the genome of an organism is substituted, altered, removed, or inserted elsewhere. Genome editing possibilities extend from perfecting medicine to preventing incurable diseases. In the future, by focusing on the amplification of human capacities, genome editing could even transform biotechnology.

Freelance biohackers – tomorrow's bioscience pioneers – will assist in discovering treatments for depression, schizophrenia, autism, and Alzheimer, playing a key role in major projects – from developing the new generation of antibiotics to the creation of genetically-modified organisms. Although their activity allows them to work from home or from specialized centres, they will undoubtedly be courted by the research departments of the world's most prestigious universities and by the leading pharmaceutical companies; the answer to next decade's most difficult questions, the treatment for cancer, and the latest vaccines, on the basis of DNA, will lie in their hands.

Bionic foot

Biohacker handbook

Specializing in the replacement of outdated solutions with biotechnological products, the customized design of bio-components, and the substitution of synthetic components by bio components is a valid and valuable career path. Medicine such as penicillin or insulin is already being made from genetically modified bacteria.

Likewise, the first synthetic organisms – viruses, microbes, bacteria made by scientists from artificial DNA – are common at this point. Procedures of damaged DNA extraction and replacement with healthy fragments have paved the way for the potential extension of human life by decades. The bionic eye or ear have long become reality.

Biotechnologies tackling digital manufacturing are working at the intersection between additive production, model projection, synthetic biology, and materials engineering. Scientists are now working on the symbiosis between microorganisms, bodies, and, even buildings.

As pharmaceutical technologies evolve, so do the resources required by industries. Microbial technologies for the bio-reduction of environmental pollution factors and the bio-production of clean energy, fuel, and ecological chemical compounds are being employed against pollution and energy consumption. Today, industrial biotechnology, bio-fuels, and bio-energy are growing exponentially.

THE BRAIN-MACHINE INTERFACE

In 2007, a cortical implant established the first link between the nerve cell and a machine. By means of direct connection to the brain, with the help of special headphones, researchers have recently managed to mentally control various devices, such as drones. In 2016, refined neural connections enabled paralysed patients who had never walked to do so for the first time. Current research is headed towards telepathic communication between two human brains.

Now, in 2019, Elon Musk's Neuralink is rapidly leading the way to a blending of human and artificial intelligence. The company is designing "brain-machine interfaces" which will connect humans and machines in the future.

Mentally guided drone

Neural movement

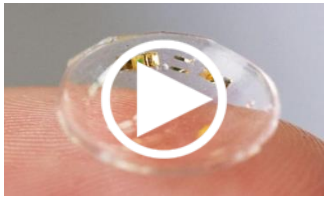
The next step in human-technological evolution is a transition from **“on the body”** to **“in the body”**. For example, consider, how revolutionary would a concept like “silent speech” be? (Futran Solution, 2019)

Medical assistance nanobots, or microscopic robots, can monitor and tend to our health by scanning our bodies, monitoring us internally, and eventually treating us for certain illnesses. Similarly, they can repair deteriorated organs or even perform complex, delicate surgical procedures – which can also render a traditional, invasive, procedure unnecessary. This could mean spending less time in the hospital, less time recovering, as well as fewer scars (Pocket-lint, 2019).

Implantable medical devices can include a radio-frequency identification chip that broadcasts medical information about the patient or a subcutaneous sensor that continually monitors blood chemistry. Once swallowed, they will serve their role in the gastrointestinal tract, from administering treatment to isolating foreign bodies.

Intelligent contact lenses will be covered in thousands of biosensors and developed so as to detect cancer and other diseases early. The lenses that are currently being designed will one day be able to check blood sugar levels in tears, so as to help diabetes sufferers manage their diet and drugs (National Geographic, 2019).

The future of smartphone technology may not require carrying a device in your pocket, but having an implant (Pocket-lint, 2019).



ARTIFICIAL INTELLIGENCE

What is artificial intelligence (AI)? The most advanced technologies actually draw inspiration from natural phenomena, and AI is the branch of computer science that builds intelligent machines by modelling human intelligence – even the movements and reactions of living beings in general.

Contemporary technological innovations have created computers with an AI that exceeds any prediction. At the same time, questions regarding the moral and ethical implications of using artificial intelligence have started to arise. The self-driving cars that will have filled the streets of the world by 2020 (Mercedes and BMW own billion-dollar projects) will choose to sacrifice their passengers if an accident with potentially more victims than those in the car may occur. The proposal to ban artificial intelligence in drones and autonomous military robots is being keenly debated within the UN. Furthermore, there is a global ban on having intelligent robots assemble other robots – assembling is only made by humans so that robots do not self-reproduce.

Amsterdam Smart City

The cities of the future will be *Cyber Cities* where the actions of every inhabitant will be tracked, using artificial intelligence to ensure public safety, furnish utilities and services when needed. Alongside automation, AI will have a tremendous impact on the labor market, especially the way in which consumer behavior analyses and predictions are being made. **Facial recognition** has been used in airports, in security cameras, and in hypermarkets for a long time so as to combat terrorism and increase customer satisfaction. In 2017, Great Britain made the first arrest using automated facial recognition software.

Facial Recognition

THE INTELLIGENT SHOP

Imagine an immense supermarket where you can enter by scanning your mobile phone at one of the entry points and then wander freely, choosing any item you want from the shelves, putting them in your basket – with as much room for indecision as needed, and then you leave. Meanwhile, you will have met no cashier, security guard, or assistant. Naturally, you receive the bill on your smartphone at the exit, but without having to wait in line. No, this is not mere fantasy! In January 2018, Amazon opened a shop called Amazon Go where it is precisely like this; everything is automated and there is no need for human staff on the premises. In November 2018, Lenovo Go – small, fully automated shops that are equipped with face-recognition technology – were inaugurated in Beijing.

Artificial Intelligence already shows great potential in its use for business and administration. More and more, call centres are being replaced by AI software that answers empathetically to calls and will eventually substitute clerks at the counters. Estimates show that, in China alone, AI and automation will replace 100 million employees in the next decade. The Unilever company organized a campaign where the customers' questions concerning hair care and styling – *All Things Hair* – were answered via email or phone. At the end of the campaign, Unilever revealed that the answers to those questions had been given by an intelligent computer. Virtual assistants, such as *Alexa, Siri* or *Google*, can respond to every enquiry and may replace secretariats in the future. They can even help with homework.

In the United States, at the University of Georgia, Professor Watson was voted Professor of the Year. Watson replied to every student enquiry via email or phone as well. However, the Professor was an artificial intelligence software developed by IBM.

Research in machine learning estimates that, by 2025, routine human occupations (in translations, commercial driving, retail) will be automated. For non-routine work, the approximate year is 2040. By 2060, artificial intelligence will be able to carry out any work-related task.

Professor Watson

ARTIFICIAL INTELLIGENCE TODAY

Sophia, the empathetic humanoid

The Care-O-Bot in healthcare

The Parrot drone in agriculture

Traffic optimization through *Google Maps*, *Waze Navigation*, and *Life Traffic*

ARTIFICIAL INTELLIGENCE REGLEMENTATION

A number of personalities, such as Stephen Hawking, Elon Musk, Steve Wozniak, and Bill Gates have expressed their concern over the exponential development of artificial intelligence. Two scenarios have been identified (Future of Life Institute, 2019):

1. Artificial intelligence programming can have devastating consequences, and intelligent weapons are becoming increasingly more difficult to control.

2. Artificial intelligence programming can have beneficial effects, but the way in which it is employed can be destructive as well.

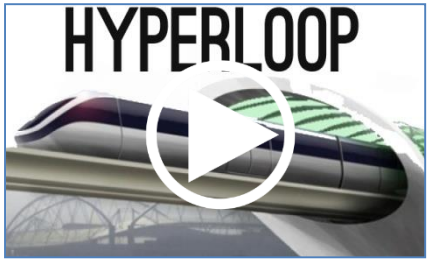
All developed states in the world, including the European Commission, are elaborating their own national and regional strategies, and are working on the regulation of artificial intelligence so as to protect humanity from potential dangers. A century ago, when the number of automobiles participating in traffic augmented, a similar situation occurred – the change was accompanied by risks that had to be mitigated with the help of a Traffic Code.

Approaching AI ethically, ensuring cybersecurity, fostering talent and competencies in the field, and supporting lifelong learning are among the major objectives of the Artificial Intelligence European Strategies. Careers in the AI industry will be bolstered by next decade's European investments, while Romanian educational programs should be adjusting quickly too.

THE BUSINESSMAN OF THE FUTURE

ELON MUSK

Today, Elon Musk represents the prototypical visionary businessman, as were Steve Jobs, Bill Gates, or Mark Zuckerberg not long ago. Musk's enterprises outline tomorrow's world almost completely. He created the PayPal paying system.
He is also the founder of Space X – a space agency that re-uses rockets with the purpose of sending people to the Moon and to colonize Mars – and of Tesla Motors, the company that produces self-driving AI electric automobiles. He is also the founder of Neuralink, a neurotechnology company. His Solar City will manufacture the most efficient batteries/solar panels at an industrial scale in the world. His Hyperloop business is designing a train that will travel at speeds of more than 1000 km/h through vacuum tubes. Musk's other company, Open Artificial Intelligence, is committed to providing artificial intelligence software that observes the ethical and moral principles of the future.



Hyperloop train

Tesla plant

BLOCKCHAIN

Blockchain is thought to be as revolutionary as electricity and the second greatest invention after the internet. Due to its advent, notaries, public accountants, banks, and health or pension funds may become a thing of the past.

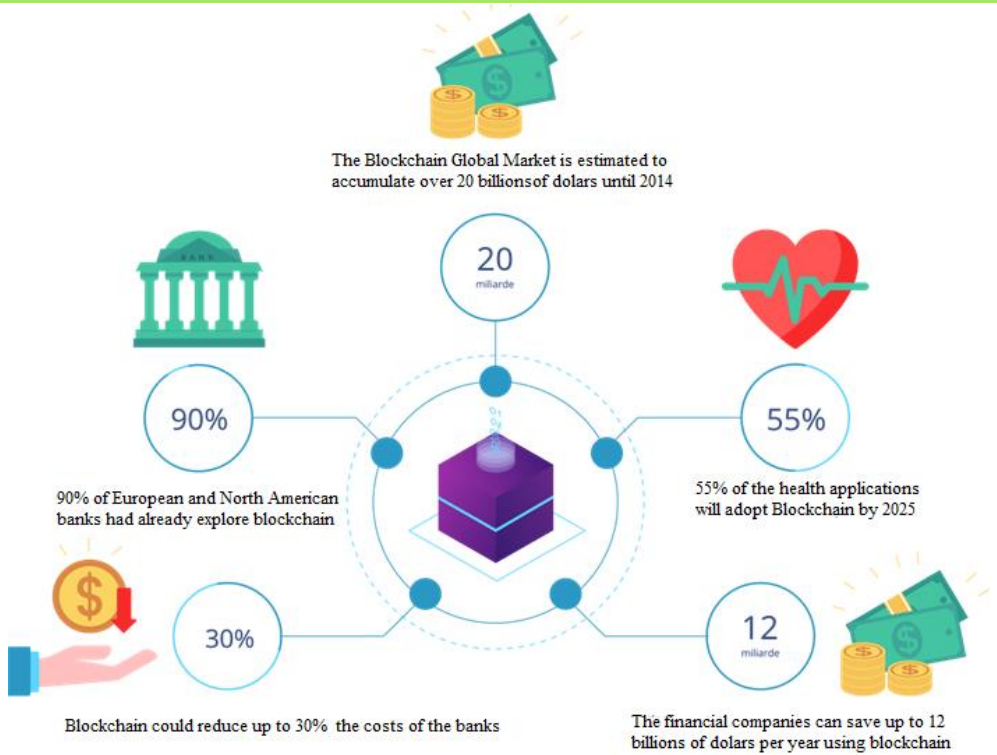
A message sent via the internet usually carries the sender's signature and represents a copy of the original message that reaches the receiver. Additionally, a copy is maintained online as well. The Blockchain system, instead, encrypts the message so that it is sent anonymously and uniquely to the receiver alone. The transactions are secured and data protection is guaranteed. This is exactly what financial transactions, among others, require. This is also how cryptocurrency (such as Bitcoin and Ethereum), where the buyer's identity is concealed, came to be. When transfers of this sort are possible, notaries or public accountants are not needed – contracts are sent directly via Blockchain, without intermediaries. Likewise, we can input our votes anonymously and uniquely via the Blockchain electoral system without having to physically cast our ballot.

At present, the world's most sophisticated public administrations use Blockchain whenever personal data protection is at stake, be it within the public health, pension, or population register systems. Certain countries intend to partially turn the national currency into virtual currency of the Bitcoin type. For this to happen, however, improvements must be made to the system, seeing as the internet can only encrypt a limited number of virtual coins. Cryptocurrency is also be vulnerable to the emerging supercomputers (quantum computers, for instance) that may be able to decrypt any code, including those inscribed in virtual coins.

Blockchain development is, therefore, another function of the future that will make e-transactions, financial and otherwise, private and secure. This type of technology will change the world as much as the internet itself did.

55% OF HEALTHCARE APPS WILL ADOPT BLOCKCHAIN BY 2025

Owing to its unique features – immutability, security, and decentralized control –, Blockchain will become the foundation of healthcare apps. According to Forbes, 95% of financing, healthcare, or logistics companies (within fields such as cybersecurity, agriculture, and government infrastructure) that invested in Blockhain pilot projects in 2018 have reached the implementation stage. Statistics published in March 2019 show that 55% percent of healthcare apps will adopt Blockchain technology by 2025; financial enterprises can save up to USD 12 billion yearly by using Blockchain; Blockchain can lead to a 30% reduction in costs incurred by banks; 90% of European and North American banks have experimented with Blockchain technology; the global Blockchain market is expected to accumulate USD 20 billion in revenues by 2024.



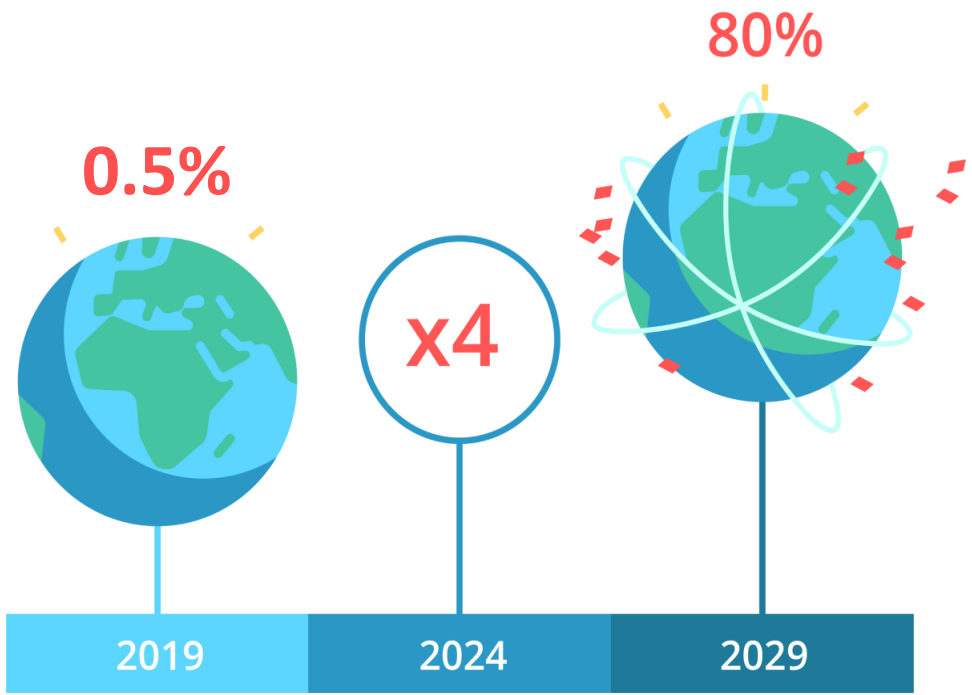
80% OF WORLD POPULATION WILL USE BLOCKCHAIN IN A DECADE

Statistics show that 0.5% of the world population is now using Blockchain, which amounts to 40 million people. According to even the most conservative estimates, this number will be four times greater 5 years from now; in 10 years, 80% of the population will be using, one way or another, Blockchain technology.

On a global scale, there are currently approximately 25 million software developers, of which only 0.1% can use the Blockchain coding language. Fewer than 6,000 people are qualified and experienced enough to deliver high-quality products.

In 2017, a Blockchain developer earned USD 150,000-200,000 annually. A senior developer earned twice as much, while a world specialist earned three times as much. The hourly rate varies from USD 40 to 200 or more.

The training period of a Blockchain developer lasts an average of 18 months.



NEW OPPORTUNITIES FOR BLOCKCHAIN SOFTWARE DEVELOPERS

Blockchain employment divides into:

- Software developer, engineers, tester, web developer, project manager positions within companies that make use of Blockchain technology. These positions require typical technical knowledge of languages such as C ++, Java, JavaScript, NodeJS, C #, Go RESTful, API, React, Solidity, Truffle, CSS and HTML, not extensive Blockchain expertise.
- Blockchain expert positions within specific software-building companies that rely on Blockchain platforms such as Ethereum, Hyperledger, Corda, Bitcoin, or Stellar.

The years to come will be marked by a visible increase in Blockchain-related jobs. The first 3 countries seeking to employ Blockchain developers are the USA, India, and Great Britain. At present, 75% of Blockchain positions are located in the USA. According to BurningGlass, in 2012, there were only a couple of Blockchain-related positions, but their number increased to 1,838 in 2016. In 2017, there were 3,958. At present, Forbes indicates that there are approximately 6,000 Blockchain professionals.

THE BLOCKCHAIN SYSTEM

PRACTICAL CASES

IT giants are already providing clients with Blockchain solutions: IBM has introduced a blockchain-based payment system; Amazon intends to include blockchain in its AWS application suite; Microsoft has integrated “Blockchain as a Service” into its Azure cloud platform.

Blockchain agriculture. In March 2018, the Louis Dreyfus company collaborated with ABN Amro and ING Groep on the first blockchain agricultural commodity transaction for the sale of 60.000 tons of American soybeans to China Shandong Bohi Industry Co (Garner, 2018). By using the blockchain system, delivery time decreased by 80%, while processing time was halved, taking less than a week to complete.

Digital documents and automatic, real-time data delivery eased the formerly manual, error-prone, paper-based process. In 2018, we awakened to the necessity of intelligent blockchain contracts and product quality sensors. Within global commerce, this technology has the potential to decentralize entire industries now dominated by towering multinational companies.

What is the position of the EU? The European Commission acknowledges the innovation potential of this technology. As early as 2017, in the Digital Single Market report, the EC upheld the significance and relevance of blockchain-based technologies to public administrations, institutions, and

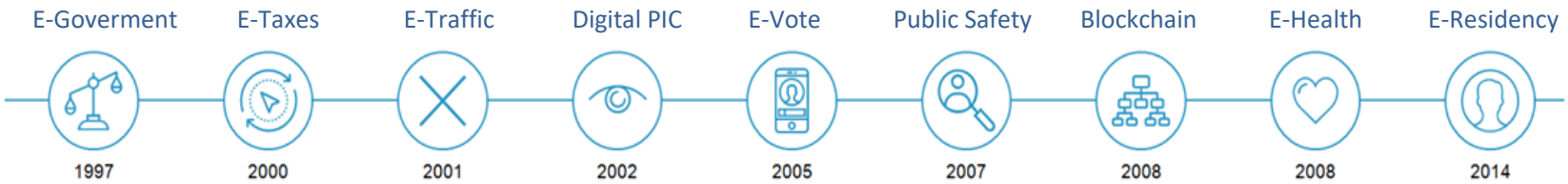
society in general. The Commission ratified the respective funding programmes and created the Blockchain Observatory in 2018.

In a summer 2019 report, the EU encouraged governments and companies to develop blockchain-based projects by 2020, offering a total of EUR 340 million in grants to this end (Horizon 2020).

The United States and China are both committed to research in blockchain technology, the former going so far as to include it in its USD 700 billion defense bill.

ESTONIA: A DIGITAL SOCIETY

Estonia, the Baltic state that is situated at a distance of 1,500 km from Romania, is a digital society. By the end of 2017, all Estonian citizens possessed a digital identity, approximately 99% of governmental services were available online 24/7, and data integrity was ensured by blockchain technology. Estonians can now use digital medical prescriptions, and pay taxes or even buy an automobile online, without having to register it in an office. However, online services are unavailable for marriages and real-estate transactions.



HOW WE CAN BENEFIT FROM BLOCKCHAIN IN EVERYDAY LIFE

There is a comprehensive range of practical uses for blockchain technology:

- **Online reviews** – studies have shown that 85% percent of travellers trust online reviews as much as trust recommendations made by friends. Websites such as Yelp or TripAdvisor represent just two of the platforms where users publish reviews, but some people doubt their authenticity. If blockchain technology is applied to review platforms, those who read those reviews can be sure the accounts haven't been modified to serve certain personal or commercial interests.
- **Distribution network management** – many of the distribution processes are slow and, to a great extent, rely on printed documents – meaning that errors can easily occur. On the other hand, blockchain can keep a digital record of orders, deliveries, and other logistic data, considerably reducing the number of possible errors.
- **Decentralized cloud storage** – data or information storage on cloud has become a popular method among organizations and consumers, but only a couple large companies (Google, Microsoft etc.) can control these storage spaces. The blockchain alternative enables us to store data in a decentralized *open-source hub*. This means that, instead of being controlled by corporations, data stays with the users.

- **Keeping track of medical history –** electronic medical files contain a patient's full medical history and evolution. By integrating blockchain in this domain, the confidentiality and security of such sensitive personal information is maintained.

- **Intelligent contracts** – by their nature, these smart contracts employ blockchain technology without the mediation of a third party. As soon as all data requirements specified in the contract have been fulfilled, payment is made automatically.

- There are still other cases which foreground the superiority of blockchain technology and the advantages it brings to its users: it can act as a barrier against ransomware attacks; it can improve processes and documentation pertaining to land or property titles; it can optimize KYC – Know Your Customer processes; it can help spot counterfeit items; it can improve tourism and airline activities, as well as inventory management within distribution processes, and even optimize the internet.

INTERNET OF THINGS (IoT)

All objects and people on Earth tend to connect to one another via the global network that is the internet. Therefore, these billions of interconnected pieces of information, sets of data, objects, and people can be put to use in business, pollution management, terrorism, and so on. Thus, by making personal actions more efficient within a greater context, technology can also make the life of every inhabitant of our planet easier.

On a small scale, the Internet of Things will transform the experience of every single citizen – intelligent kitchen appliances will be able to read a handwritten note of the time and preferred food for lunch.

The fridge will defrost precisely the ingredients needed for every dish after selecting the ideal recipe off the internet, the stove will preheat itself at the appointed time, and the family members will receive customized messages before lunch time.

An app called Macroscop (a descendant of the Telescope or the Microscope), which will actually be the computer itself in connection with every other computer and "thing" in the world, will be able to provide its users with summaries of data from every field.

Therefore, we will instantly find out, for instance, how many people in the world, in a chosen town, or in our neighbourhood are drinking coffee at a certain time.

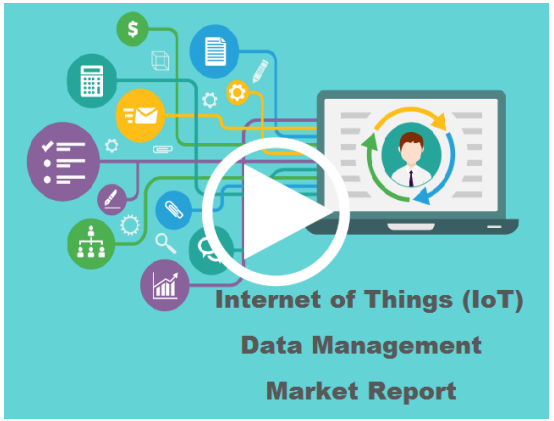
IOT DATA MANAGEMENT

IoT data analysts will be the professionals in charge of daily analyzing millions of data items generated by gadgets on our clothes or in our houses, cars, and offices in order to devise significant ways of translating this information. They will be integral to the future development of extensive networks of interconnected devices and the distillation of essential data.

Data analysts will have to possess three key qualities:

- The ability to recognize patterns,
- The ability to ask astute and difficult questions,
- The ability to create synthetic accounts.

Pattern recognition will be paramount to this position. Likewise, identifying key information in collected data, turning it into 3D and VR (virtual reality) infographics teaching us how to better care for ourselves, build better houses, and drive our cars safely, will be vital.



IoT data analysts

Cloud robotics comes with a series of potential benefits derived from its combination of cloud computing, storage, and internet use which permits robots to transfer data between themselves. Additionally, robots can collaborate with other machines, with intelligent objects, and with people. The global market for cloud robotics is predicted to see an increase of more than 32% by 2022 (Timestech.in, 2019).

TRANSPORTATION OF THE FUTURE

AI puts driving jobs at risk, but in exchange for time that we can spend working or creating something else.

In the future, transportation will be underpinned by self-driving AI, while cars and motorcycles will be linked by the IoT.

Self-driving cars will begin to conquer the highways of the world in the next decade. The greatest changes will occur in freight transportation, with self-driving trucks forming convoys on the highways. In the United States, where professional driving is the most popular employment, more than 3 million people will be made redundant when drivers are done away with.

Some cities have already introduced self-driving busses, controlled solely by the artificial intelligence of a dashboard computer; an automated pilot who decides how to go from one point to another while navigating through traffic in a city like Helsinki.

Track with automated pilot

Automated bus Helsinki

Automated motorcycle

Mining enterprises across the globe are rapidly adopting the latest technological innovations so as to update their practices. In Australia, four iron oar mines are now using 73 self-driving trucks 24 hours a day, 7 days a week. Employees of the mine supervise the trucks from the

Rio Tinto station, situated at a distance of 1.200 km, in Perth (Interfeca, 2019).

High-speed trains, along with an underground high-speed railway system, are currently being built and tested in the USA. The first route that has been planned will go from Los Angeles to San Francisco. Another route intends to span the distance between New York and Washington DC in 29 minutes, as opposed to 2 hours and 56 minutes, as much as the ride lasts at present (Pocket-lint, 2019).

THE FUTURE OF DRONES

Drones will fly on hydrogen-based fuel – hydrogen being the most abundant resource in the Universe – that can generate energy when needed.
A drone's capacity for visual identification and recognition, in addition to the capacity to react, so as to increase in-flight, can operate a definite shift in our perspective.
New generations of drones show an affinity with animals, having to rest and recharge as the latter do (Murison, 2019).

The lifeguard drone

FUTURE RESOURCES

In the near future, our priorities concerning natural resources will be transformed too. Oil is, at present, and will continue to be in an overproduction crisis, considering the alternative fuels that can substitute it. Oil will slowly, but surely, become only “raw material”, not fuel – being used not only to propel the car, but also manufacture the tyres, the dashboard, the paint etc.

Alongside alternative fuels, nowadays there are projects that aim to obtain fuel out of, for instance, **genetic engineering**. Scientists, having first deciphered the human genome and produced the first synthetic cells, are putting the knowledge acquired thereby into research for the Exxon Mobil company and developing ample projects focused on the production of fuels by **microbes** and **algae.**

We have also mentioned Elon Musk’s 5-billion-dollar project – Solar City –, the largest solar panel producer in the world. Solar panels can be concealed by slates set on the rooftop of a house, as in the Teslar Solar Roof, but some companies are developing ways to integrate battery-charging solar panels in the rooftops of cars (Pocket-lint, 2019).

The field of renewable energy will be dominated by **experts in chemistry and materials science** with strong entrepreneurial instincts who will extend the life-span and autonomy of batteries in order for them to satisfy the energy requirements of a growing digital world.

Their role will become very relevant, especially in light of the climatic changes and fuel depletion that will push us into the post-carbon era by mid-2020s. One of the main foreseeable obstacles barring our way to fully-sustainable energy resources will be energy storage on days when the wind is not blowing and the sky is overcast.

Exxon

Solar City

Some of the countries extracting “classic” natural resources – such as oil or coal – are already being dethroned by countries which have adjusted their type of resources to the new technologies. For example, all batteries of the future contain lithium, meaning that countries rich in lithium deposits – Argentina, Portugal, Zimbabwe – may become tomorrow’s richest.

In order to furnish the adequate resources to emerging technologies, China “conquered” certain countries in Asia, Africa, and South America, exporting mining know-how and entering into agreements with countries rich in special deposits – ytterbium, yttrium, terbium – that are essential to high-tech products. China controls 90% of the world’s rare earth supplies.

Some of the countries rich in deposits that can benefit technology – beryllium, palladium, iridium, osmium, tantalum, cobalt etc. – are: Canada, the USA, Mexico, Congo, Brazil, Russia, and Australia.

Romania’s riches lie in rare deposits of germanium, titanium, cobalt, gallium etc. that are mixed with gold, silver, or uranium.

Soon, because rare deposits are very limited, scientists are considering asteroid mining by means of unmanned space probes.

Mining on asteroid

EVOLUTION OF THE ENVIRONMENT

The major changes to the environment we are witnessing will have a decisive influence on the way in which the economic activity takes place in the future. Even now, millions of people in countries from Asia or Oceania are facing the consequences of rising sea levels. There are now “climate refugees” – very numerous communities that are forced to move away from the ocean shores in Asia and the islands in Oceania. Solutions to the everyday housing and employment plights of these refugees, who are joined by those suffering as a result of global warning, must also take into consideration the pre-existing overpopulation issues in the affected countries – such as Bangladesh and India.
It is very likely that global warming will soon enough result in a new ice age, a subsequent violent cooling of the global climate, seeing as desalinization and increasing ocean temperatures tend to block the circulation of underwater currents which normally balance global temperatures. In this case, populations will begin to shift from the north to the Equator.
The UN, the EU, and developed Asian countries, regard environmental changes and pollution due to overpopulation as potential obstacles to economic growth and the future labour market.
People will no longer be able to work in agriculture, fishing, tourism etc. and might have to abandon extensive areas, in the Middle East or Oceania, that are affected by climate change.

Energy Outlook for 2040

VIRTUAL REALITY

Virtual reality (VR) has been around, one way or another, for decades, but only recently has technology reached a point where VR is functional and beneficial. VR does not belong to gamers alone, but is actually becoming an educational and entrepreneurial tool that will help people work more efficiently and train employees or clients remotely, from a great distance.

Technology significantly eliminates physical barriers to human exploration. For example, VR Google Earth enables users to fly over cities, sit on mountaintops, and even travel to space. More and more educational programs have begun to make use of VR, making learning more interactive and realistic. Art and design are being re-imagined. So is the workplace.

VR Google Earth

By 2025, virtual reality will be the digital space in which tens of people will be spending a great part of their time – be it to work, play, or learn. This VR future is already taking shape. In 2019, according to CCS Insight market researchers, estimates show that more than 22 million virtual reality headsets will be sold. Moreover, according to Techjury, the VR industry will exceed USD 209 billion by 2022.

Therefore, by 2025, **virtual habitat designers** will be enjoying the most exciting and creative career opportunities in an industry that will create millions of jobs globally. Virtual habitat designers will represent true pioneers in the industry, creating revolutionary spaces in fields where people will have fun, work, and learn – their job becoming thus an interesting mixture of architecture and psychology so as to transform virtual reality into *reality*.

THE ROLE OF MAKERSPACES IN INDUSTRY 4.0 AND CYBERSECURITY

Makerspaces are transdisciplinary spaces where technologically-complex objects can be designed in a creative and collaborative way, using robots, 3D printers, 3D scanners, or drones. They are the labs of the future, in which transdisciplinary experts are able to operate or build cyber-physical systems. Significantly, one of the foremost characteristics of makespaces is transdisciplinarity, which presupposes simultaneously engaging several levels of the world surrounding us.

Makerspaces are essential to implementing industry 4.0 because they represent the spaces where new products and services based on advanced technologies and materials can be created. The number of makerspaces is actually small, but they will replace traditional industrial assembly lines when the number of robots increases. In the future, makerspaces will become the main production site for marketable goods and services.

Makerspace cybersecurity is vital to the success of communities basing their competitive advantages on advanced technologies. A potential attacker does not have to physically destroy a makerspace in order to cause damage. It is enough for them to modify the software or to imperceptibly extract data that constitutes the fruit of the experts' creative work in the respective makerspace. Having bypassed research and development costs, the attacker could launch cheaper products on the market. Investments in cybersecurity are crucial and experts in the field are extremely valuable.

EDUCATIONAL DEVELOPMENTS ON THE BASIS OF 4.0 TECHNOLOGY:

Intelligent digital education labs – SMART LAB 4.0 –, created by INACO in 2019, are the equivalent of industrial makerspaces in schools – transdisciplinary spaces in which educationally-complex objects or projects can be created in an imaginative and collaborative fashion, using robots, 3D printers, 3D scanners, VR headsets, smart boards, and digital educational apps. Learning in Smart Lab 4.0 – is exponential, practical, interactive, intergenerational, and occurs outside the classroom.

Educational developments on the basis of 4.0 technology:

- Collaborative learning – young people nowadays are born into a digital world and, in some cases, adjust to new technologies more effortlessly than their teachers. Technology has enabled us to be in touch with the entire world, and especially with one another. We discuss certain situations and measures collaboratively, within group activities. The content of eBooks can be enlivened with the help of videos, augmented reality, audio etc. Seeing as data management is a core element of the educational system, professors benefit from a complete analysis of a student's performance.
- Learning outside the classroom – mobile devices have taken learning outside the conventional classroom. As mLearning and eLearning methods gain popularity, pupils can learn at their own pace. This is an efficient way of offering and receiving educational information that allows pupils to go through their notes anywhere, at any time. Using augmented reality as part education technology turns learning into an even more convincing experience.


FUTURE JOBS

FUTURE JOBS

People will still be at the centre of automation strategies, but the new technologies play an essential role in increasing work productivity. Following the new wave of technological changes, current jobs will be subject to reorganization as well. Some employees will either re-qualify within the same industry or choose a different a field of activity. Robotization, AI, VR, 3D etc. can generate jobs that are more effective and are paid more, but it is companies and schools that must develop cyber-physical systems that bring satisfaction to employees and pupils.

Technological evolution, scientific research, and the digital revolution that are unravelling before our eyes must not catch us unawares. We must match the pace of these accelerated changes. Each of us – the entrepreneurs, the workers, the unemployed, the professors, the youths, as well as the state itself, has to adjust to this transformation. Irrespective of age or gender, we have to work towards adaptation intensely and permanently. *The present concern is not the potential lack of employment opportunities, but the existence of vacancies that cannot be filled due to underqualification*.

Young people who are only starting their journey must be guided to a sustainable future in a sustainable manner. Vocational schools, which are still necessary today, will cease to be so in the future and will be subjected to automation as well. Tinsmiths are being replaced by tireless robots more and more. McDonald's intends to eliminate kitchen staff starting with their restaurants in the United States; later on, even cashiers will be replaced – naturally – by robots.

WHAT CAN WE DO?

The Global Economic Forum, the EU, and experts in the labor market are discussing

- *Re-qualifying*
- *Lifelong learning*

Change and flexibility will be the foundation of tomorrow's labor market. Under pressure from technological, climatic, and social changes, the employee or the entrepreneur will have to adapt easily to future permanent changes in offer and demand

INACO believes that education and school should become exponential. For this to happen, we have to build intelligent digital education labs – SMART LAB 4.0 – in both vocational and theoretical school so that children may become accustomed to the workplace of the future.

KEYWORDS FOR TOMORROW'S EMPLOYEES:
CREATIVITY / ADAPTABILITY / TRANSDISCIPLINARITY / COMPUTATIONAL THINKING

The jobs that will *not* disappear will be those demanding creativity. And "creativity" does not refer to art or advertising, but being creative in whatever a person does and a machine cannot do. Being creative at work or in business means providing original and sellable services and goods. It means adding surplus value to what a machine – be it one endowed with artificial intelligence – or a competitor in the same field could offer.

Computational thinking implies, first of all, possessing computer programming skills. Soon enough, city halls, tax, fee, or insurance collector's offices , the banking system etc. will all become digital structures, operating without clerks. There will no longer be "safe" jobs from which one can retire after 40-years' work. When the economic field, the company, or the position in which we work transforms, we must also adapt, change, re-qualify, and find a new position or start a new business.

Those who possess vast knowledge and multifarious skills will find it particularly easy to adjust. Transdisciplinary approaches will be central to the most advanced domains – biotechnology, nanotechnology, biochemistry, and so on, but also to the most common activities – in which familiarity with IT and knowledge of foreign languages or marketing will be mandatory.

Companies and schools must make a concerted effort to furnish valuable specific competencies to the young, but the young must also understand what challenges future economies will bring and consequently cultivate those valuable features in themselves.

We have yet to find out who, precisely, will subsidize these programs. What we do know is that the financial burden should not be shouldered by the individual alone.

10 KEY ABILITIES FOR FUTURE CAREERS

1. Creativity
2. Emotional intelligence
3. Critical thinking
4. Active learning
5. Decision-making
6. Interpersonal communication
7. Leadership skills
8. Cultural intelligence
10. Adaptability

Sursa: Forbes (2019)

The OECD estimates that 14% of current jobs are being automated (which is less than most specialized studies show) and, at the same time, indicates that new jobs are being created at a much higher rate than they are destroyed. The new employment strategy elaborated by the OECD urges us to move away from the cumbersome traditional education model and create, instead, a system where competencies are continually updated throughout our professional live so that we may easily embrace change (OCDE, 2019).

AN EMPLOYEE'S NECESSARY SKILLSET WITHIN TOMORROW'S LABOR MARKET

Influenced by technological and social factors, those who will seek to work satisfactorily and be paid accordingly in the future have to consider developing a set of skills that today may seem exceptional.

In the near future, perhaps the next decades, the Crimson Education organization maintains the following skills will become the norm:

MENTAL FLEXIBILITY AND COMPLEX PROBLEM SOLVING ABILITIES – in a world where unforeseen businesses, mentalities, and consumption habits will emerge, thinking out of the box will be fundamental to accommodating new employment opportunities.

CRITICAL THINKING – a quality entrepreneurs or employees must possess in order to make the type of uniquely human decisions that cannot be automated.

CREATIVITY – more than alternative thinking; abstract, creative thinking is a human feature that robots have not been able to emulate yet.

SOCIABILITY – yet another human quality which, mind you, must be practiced with both colleagues and machines.

TRANSDISCIPLINARY KNOWLEDGE – as mentioned before, the more familiar we are with a variety of domains, from both the humanities and science, the more employment opportunities will we have at our disposal.

COMPUTATIONAL THINKING – the capacity to understand the world via modern, cyber-physical, technologies.

STEM – SCIENCE, TECHNOLOGY, ENGINEERING, MATHEMATICS – fields that we must master in order to keep up with the innovations that surround us.

SMAC – SOCIAL, MOBILE, ANALYTICS, CLOUD – more recent than STEM; the new definition of sociability in digitized media.

The Fast Company publication, citing a number of studies, enlists the following elementary guidelines:

VALUE THE EDUCATIONAL ROLE OF THE HUMANITIES – namely, the arts or the philosophy that enable creative young people to compete with intelligent machines, which are at a great disadvantage in this respect.

BROADEN YOUR SCOPE – embrace multidisciplinary approaches.

BECOME FAMILIAR WITH TECHNOLOGY – foster that which sets you apart from other creative, but less savvy candidates.

According to the Institute for the Future, these practices are complemented by the main features of a successful employee or businessman:

A PERSONAL BRAND – one's signature, showing exactly who one is and who they aspire to become. For example: Cornel Amariei, Ionuț Budișteanu, Denis Tudor, or any other entrepreneur from Forbes România "30 under 30" list.

DIGITAL LITERACY – familiarity with information technology.

ONE'S OWN SOCIAL NETWORK – extended through social networking; an advantage over those less engaged.

AN UNDERSTANDING OF COMPLEX PHENOMENA – linking business, financing, sales, clients can transform an insignificant working situation or enterprise into an intricate project.

ADAPTABILITY – once again, the capacity to function and think flexibly within organizations, the labor market etc.

IN THE FUTURE, WE MUST WORK SMART, NOT HARD

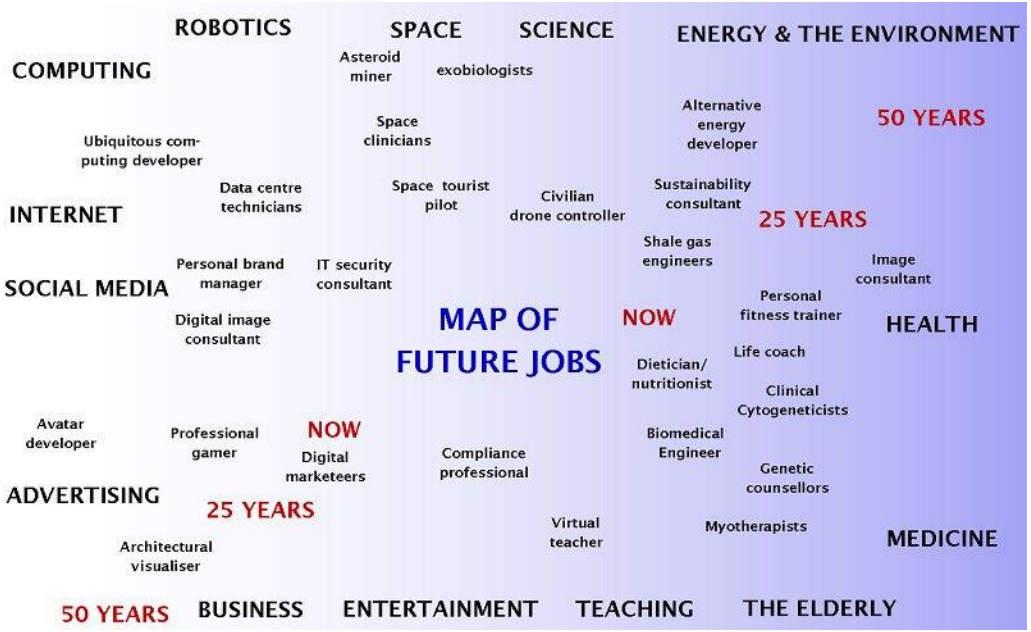
THE 8 NEEDS AND TENDENCIES OF THE FUTURE LABOR MARKET

1. The need to reduce time spent at work
2. The need to develop a more flexible work schedule
3. The need to increase workplace satisfaction
4. The need to reduce costs
5. The need to create products more rapidly
6. The need to make products that are easier to use
7. The need to create safer, more reliable products and services
8. The need to diminish environmental damage

In the future, working in an office from 9 to 5 will be the exception, not the rule. We will be able to work from home or from any other place in the world, at any time of the day (or night). Employees will have online profiles; they will become more connected to one another, more mobile, and more agile. Research conducted by Deloitte has proven that more than 30% of work spaces remain untouched during a day of work. Therefore, companies pay for unused spaces and utilities or elements associated with workplace infrastructure. On the other hand, workspaces will have to accommodate the collaboration between human being and intelligent devices (Deloitte, 2019).

THE MAP OF JOBS IN THE 2050s

This is the map of future jobs, as designed by the University of Kent, in Great Britain. Please refer to the atlas of emerging jobs, designed by the University of Skolkovo, in Russia or look here for the universities which can offer you skills for the future.



These representations underline that, in the next 25 to 50 years, the main jobs will belong to the field of Computers/Robotics/Space exploration/Energy and the Environment/Healthcare/Medicine/Old age consultancy/ Education/Entertainment/Business/Advertising/Social media and the internet.

Let us briefly look into some of them:

THE FUTURE OF MEDICINE: As populations continue to grow and age, medical assistant, nurses, occupational therapists, accompanied by medical robots, will become increasingly more in demand. Crimson Education will manipulate DNA. Genetic counsellors will appear. Biomedical engineers will create organs out of stem cells. Crimson Education estimates that shortage of transplantable organs will eventually incentivize scientists to create organs and body parts out of stem cells or other materials – even parts that may not even exist today.

What type of training will we need? Recruiters of "organ-builders" will seek candidates who are trained in molecular biology, tissue engineering, or biomedical engineering. Current innovations in neuroscience and technology might enable us to transfer a human mind onto a computer or on cloud platforms. Special chips might offer benefits such as telepathy, augmented memory, and treatments for paralysis. Moreover, memory surgeons will be able to remove negative memories so as to treat depression and other psychological disorders. Advanced training in neuroscience will also be necessary. Dietitians, nutritionists, and nutrition researchers will be fundamental as well. Seeing as technology can easily become addictive, experts in digital detoxing, possessing a robust understanding of both psychology and technological innovations, will be needed – along with occupational therapists.

THE FUTURE OF TOURISM: developers of VR travels will be in charge of "designing, writing, creating, calibrating, transforming video game tourism, building, and – most importantly – customizing tourism", the Cognizant report states. The requirements of this job are: a diploma awarded by a film school, considerable experience of online multiplayer games, as well as a great degree of familiarity with top equipment pertaining to this domain. Such experts will turn elements from *Total Recall* (creating dream vacations through brain implants) and *Westworld* (android hosts in theme parks) into reality.

ROBOTICS: Drone pilots or robot programmers, supervisors, and technicians will become common positions. Any type of repetitive action that requires physical effort will be taken over by humanoid robots, created by engineers and researchers who will be permanently updating their functions. The manager of a mixed team of humans and robots will play the key role of establishing each member's place, the rapport between members, and the way in which they must synchronize so as to fulfil a task. This role calls for candidates who possess knowledge of experimental psychology or neuroscience, as well as IT, engineering, and human resources. In 2030, robots will play an even greater role in furnishing home care and personal services than they do now. When robots are used on a daily basis to assist elderly people, AI counsellors will provide guidance as to the choice of a suitable bot for the family. Furthermore, the counsellor will examine the way in which the family members interact so as to identify their lifestyle and needs and make a suitable suggestion.

AUTONOMOUS TRANSPORTATION: autonomous cars from manufacturers such as Waymo, GM, Daimler-Bosch, and Ford will drive themselves, but will not be able to repair themselves. The mechanic of the future will repair autonomous cars, combining a passion for cars with technology.

BUSINESS AND LAW: Numerical and quantitative analyses made using artificial intelligence will animate financial markets and notaries' or lawyers' practices. Legal experts in robots or the ethics of genetic engineering will emerge. Experts in AI ethics will be tasked with establishing and managing the moral and ethical framework of new technologies, with defining the legal branch concerned with robots and intelligent machines, with integrating them into the human legal structure. They will also enact AI policies. Considering the growth in popularity of cryptocurrency such as Bitcoin, Litecoin, Ether etc., investors now have access to undeniable opportunities arising from unregulated financial instruments. According to CST, "*cryptocurrency counsellors specialize in this type of currency and they show people how to manage their fortune by keeping all systems in balance*". Data security studies, financial management, accounting know-how, and an understanding of digital currency become crucial.

SpaceX starhopper - the highest flight
The Starhopper prototype of the SpaceX Starship and Super Heavy spacecraft was launched on the highest flight on August 27, 2019.

SPACE EXPLORATION: Space tourism, with all the adjacent activities, will be introduced. So will space mining. Alternative energy consultants will become ever more important in the next decade. Exobiologists will produce plants and animals in simulated extraterrestrial settings. Doctors will study the consequences of living in space. Space pilots will become ever more popular, and this type of job will require knowledge of astrophysics and astronomy. The SpaceX is progressing at a rate that would have been unimaginable a couple of years ago – so commercial pilots might soon surpass familiar limits and fly into space.

POWER AND THE ENVIRONMENT: The number of workers in renewable-energy power plants – powered by the sun/wind/algae or microbes (instead of miners or hydropower plant workers) – will grow too. Recycling firms will begin to operate in the ocean. It is also in the ocean that deep sea miners will dig for rare minerals, as those on meteorites. Biodiversity, the study of species preservation within genetic research will coexist with research into new possible forms of life or nourishment. In order to become an extinct species revivalist, one must study biology, evolutionary biology, and animal biology.

TAXI DRONES: The field has developed at an astounding pace in the last years, and today drones are used to film, to monitor neighbourhoods for security reasons, or to deliver packages. Soon, we will have taxi drones; in 10 years, they will probably be everywhere around us. Specialists will be needed to supervise flight corridors and optimize drone traffic. NASA has already taken this project into consideration and, along with the Federal Aviation Administration and other partners from the same industry, has developed a drone-traffic management system.

EDUCATION: Intelligent interactive digital applications are already entrenched in our lives, and virtual learning with the help of virtual teachers will become a common alternative. Development schemes for online educational resources – much like Open University, Moodle, Blackboard, Web CT, MOOCs (Massive Open On-line Courses) – will issue globally-recognized diplomas.

SOCIAL NETWORKS: Personal brand content generators will act as social media managers, creating and managing personal brands upon request. There will also be virtual personal assistants who will attend to people inasmuch as their virtual presence is concerned.

COMPUTING AND THE WORLD WIDE WEB: The number of webpages and applications will increase. There will be 3 times as many vacancies in the IT industry. Many fields of activity will adopt a virtual existence (in sales, marketing, banking, and education); the need for cybersecurity and digital identity protection will become more pressing. Data and information protection will be channelled into big data, which means that data specialists who can understand and convey data will also be in demand. Likewise, many fields will seek to employ cloud computing specialists, IT security consultants, or digital marketing specialists. 3D design, architecture, projection, specialists in the management of intelligent cities, computational linguistics, and brain-machine interfaces already generate notable and promising revenues for the near future. For the slightly more distant future, scientists are working towards the digitalization/scanning of the human brain, and even the extraction of AI consciousness.

ENTERTAINMENT: While the internet is slowly replacing television, bloggers and vloggers will come to replace the reporters and editors of entertainment shows. Online editors or multi-format journalists, even in robot form, will replace journalists and reporters. Physiotherapists and kinetotherapists will draw more and more attention as people come to value sports more. Digitized books will become prevalent; the number of professional computer players or arena boosters – those who bring the avatar of a paying user to higher levels – will grow.

CORPORATE DISRUPTER: the specialist who attacks the rigid structures of a company or public institution so as to make it more flexible and adaptable during crises.

15 JOBS OF THE FUTURE – A SKETCH

The 15 jobs of the future gathered by the Centre for the Future of Work, and presented in the Cognizant report on the next 10 years, are:

1. Walker/Talker (interaction with the elderly (walking/conversation assistant and personal memory curators)
2. AI-Assisted Healthcare Technician
3. Genetic Diversity Officer
4. Quantum Machine Learning Analyst
5. Cyber City Analyst (data gathered by intelligent cities)
6. Virtual Store Sherpa
7. Data detective
8. Personal Data Broker
9. Artificial Intelligence Business Development Manager
10. Fitness Commitment Counsellor
11. Highway controller (of highways used by self-driving cars)
12. Digital Tailor
13. Augmented Reality Journey Builder
14. Man-Machine Teaming Manager
15. Ethical Sourcing Officer

Cognizant Report

PERSONALITY PROFILE FOR SOME OF THE FUTURE JOBS

DATA DETECTIVE:

- detail-oriented
- asks many questions
- perfectionist
- has many new ideas
- enjoys analyzing phenomena in depth
- easily bored by repetitive activities
- enjoys teamwork

AUGMENTED REALITY JOURNEY BUILDER:

- enjoys drawing, writing, or moulding
- empathetic
- likes helping those around them
- likes being up-to-date
- motivated by the presence of a team
- reinforces personal freedom, especially in teams

PERSONALITY PROFILE FOR SOME OF THE FUTURE JOBS

CYBER CITY ANALYST:

- believes details and information are important
- enjoys repetitive activities
- tends to thoroughly analyze everything
- curious by nature
- passionate about technological processes and finding where problems lie

GENETIC DIVERSITY OFFICER

- thinks of how to customize processes and technologies that they use
- motivated by a team
- thoroughly analyzes every detail they notice
- enjoys competing with other people
- impatient
- believes in the importance of precise information and implementation

PERSONALITY PROFILE FOR SOME OF THE FUTURE JOBS

MAN-MACHINE TEAMING MANAGER:

- enjoys working in companies with a clear hierarchy and knowing who makes the decisions
- team-player
- natural communicator
- interested in progress – their own and of those around them
- follows others' progress and contributes to increased performance
- enjoys giving advice
- good listener
- enjoys and follows the newest technologies
- driven to lead people and processes, but needs guidance

DIGITAL TAILOR:

- cheerful, enjoys being the centre of attention
- enjoys competing with other
- impatient, seeks immediate results
- has a multitude of ideas that they often forget
- skilled public speaker
- can adjust a message in accordance with different audiences
- thoroughly enjoys and requires freedom

PERSONALITY PROFILE FOR SOME OF THE FUTURE JOBS

WALKER/TALKER:

- empathetic
- regards people around them as family members
- enjoys talking to those they know
- not afraid by repetitive tasks
- enjoys the process more than the result
- traditionalist, prefers to do things as they have always been done
- enjoys team-work

AI-ASSISTED HEALTHCARE TECHNICIAN:

- motivated by team-work
- enjoys repetitive tasks
- sociable
- believes processes have to be *logical*, first of all
- progresses through repetition; passionate about novelties

PERSONALITY PROFILE FOR SOME OF THE FUTURE JOBS

PERSONAL DATA BROKER:

- strives to fulfil set objectives
- trusts figures and hard data, not mere words
- works spotlessly and rapidly
- starting from a good idea, they can elaborate a successful results-oriented strategy
- resistant to monotony – enjoys repetitive processes
- seeks to offer and receive impeccable information

HIGHWAY CONTROLLER:

- dislikes wasting time
- particularly focused on results
- enjoys changing interlocutors in conversation – easily bored by the same person
- enjoys mathematical operations, which they can analyze well
- pays attention to details, and has high expectations of themselves and others.

JOBS THAT ARE NOT UNDER THREAT YET

Over the course of time, some jobs, such as lamplighting, disappeared. Others evolved (apothecaries became pharmacists). Some jobs are threatened by the progress made in their field (typography). Others have only just emerged (biotechnology or blockchain technology). Still others will emerge in the future (space medicine experts).

We believe that the jobs which are not likely to disappear belong to domains related to healthcare, dentistry, nutrition, physiotherapy, personal trainers, theatre, film, music, education, restaurants, beauty salons, auto repairs, technical maintenance services of various types, constructions, luxury shops and their artisans etc.

Traditional carpenter, plumber, electrician, barber, auto mechanic, or dentist jobs are difficult to automate, although not impossible, in the long run.

We will continue to deliver products by means of human workforce until intelligent infrastructure systems that can communicate with machines and intelligent robots appear – which is comforting to drivers or mechanics, but cannot ultimately last.

Jobs in physical shops will begin to decline as well once online shopping is fully integrated in our routine, but they will not disappear completely. Nevertheless, they will diminish more and more. Regular checkouts will see a sharp decline when self-checkout machines, scanners, electronic payment, and others, are introduced on a large scale. In fields such as marketing or law, only the best will maintain their position within the market; mediocre agents will disappear.

Overall, machines have to be created, repaired, and supervised by human beings. Let us not underestimate human imagination and resourcefulness. There are certain things only people can do.

Skills Panorama, a tool developed by the European Union, describes job fluctuations and the dynamics of fields of activity in **Romania**, between 2016 and 2030, thus:

Decrease in employment

By sector:

Constructions: -30.1%

Wastewater and waste treatment: -23.3%

Agriculture, forestry, and fishery: -13%

Mining: -11.3%

Manufacture: -2.2%

Telecommunication: -1.2%

Shipping and storage: -0.2%

By occupation:

Craftsmen: -25%

Agricultural workers: -21%

Managers: -2%

Increase in employment in Romania

By sector:

Professional services: +91.4%

Healthcare and social services: +66.7%

Education: +20.4%

Administration services: +20.1%

Arts and recreation: +17.9%

Energy resources: +17%

Public sector and defense: +14.6%

By occupation:

Experts: +30%

Customer service representative and salespeople: +20%

Technicians: +18%

Unqualified workers: +14%

Clerks: +12%

Operators and assemblers: +6%

Risk issue: Only 20% of the labor market's need for professionals in science, technology, and engineering is currently covered in Romania. There is an even deeper gap between university offers and the jobs of the future. Slower adjustment to the skills required by the labor market, mismatch between local training and the dynamic labor market, the migration of native workforce, and skill underutilisation in Romania means one of four employees will continue to be underqualified, Cedefop cautions us through the European Skills Index. In terms of basic digital competences, Romania has not improved much since last year, and the EU average is almost twice as great (57%), the DESI 2018 report underlines.

As a point of comparison, these are the global occupational tendencies for the 2015-2020 period, according to the already-mentioned study by the World Economic Forum (“The future of jobs”) concerning the primary fields where necessary workforce will increase or decrease:

Decrease in number of jobs

Office work and administration: -4,759,000 jobs

Manufacturing and production: -1,609,000

Constructions and resource extraction: -497,000

Arts, Design, Entertainment, Sports, and Media: -151,000

Law: -109,000

Plumbing and building management: -40,000

Increase in number of jobs

Business and finances: +492,000

Management: +416,000

Computer Science and Mathematics: +405,000

Architecture and Engineering: +339,000

Sales: +303,000

Education and Training: +66,000

Top jobs that will disappear in the U.S. in the coming years:

- Drivers
- Agricultural workers
- Post Office employees
- Tailors
- Telephone operators
- Fast-food cooks
- Data operators
- Door-to-door salesmen, market stall sellers
- Assembly line workers
- Typographers
- Computer operators
- Oil rig workers
- Bank tellers

Top successful jobs in the U.S. up to 2020:

- Medical assistants
- IT app developers
- Physiotherapists
- Medical managers
- Marketing analysts
- Financial advisors
- Speech therapist

(A selection from the U.S. Bureau of Labor Statistics

WHAT WILL PEOPLE WHOSE SERVICES ARE NOT NEEDED DO?

Opposition from trade unions and protective laws is still postponing the stage of automation when employees are replaced by robots, but, faced with fierce competition, productivity losses, and the bankruptcy of entire sectors of the economy, the states, trade unions, and companies will eventually yield and purchase technology.

In this context, an "unemployable" – a term that was introduced by the anthropologist Yuval Harari in 2013 – class of people will appear – people who will have no occupation, but will be financially supported by the state, which is aware of their predicament. There is an ongoing public debate regarding potential financial help for those in this situation. Countries which are more advanced from a technological point of view have put forth pilot projects targeting the issue of unemployment, and there are heated discussions with respect to the guaranteed minimum income that might be derived precisely from the increased productivity of automation and robot tax.

Short speech

THE PERCEPTIBLE FUTURE OR “THE STATE OF THE FUTURE”

THE PERCEPTIBLE FUTURE OR "THE STATE OF THE FUTURE" IN THE VISION OF UAE'S MINISTRY OF THE FUTURE

A Ministry of the Future was established in the UAE, with the brightest, the most trained and educated officials in the most important universities in the world, which creates special funds in special "drawers", for "the day after tomorrow". The reality of sci-fi port cities like Dubai, Abu Dhabi, Doha, Manama are proof. They elaborated a report of The State of the Future", „in the vision of the world's smartest people, supported by petrodollars.

In Europe, only Sweden has a Ministry of the Future. All of the countries have work groups or committees for the economy or the jobs of the future.

In the following paragraphs we will be presenting a "Work Agenda" for the various "drawers of the Future" which we will allow ourselves to comment, eventually complete one or another program of the future.

The fields for which drawers of the future were made are:

- **Energy**
- **Health**
- **Education**
- **The future of water**
- **Transport**
- **Technology**
- **The future of Space**

To these we have added a new one, the future of **food**, because, don't forget, by 2050, according to UNESCO, between 9.2 and 9.8 billion people will be living on Earth alongside IT and robots.

THE FUTURE OF ENERGY

A few actual parameters: in 2016, the company Tesla spent 2.6 billion dollars for Solar City; at the moment, there are 440 nuclear fission reactors working on our Planet; in the tokamaks from Cadarache (France) and from China the temperature of the plasma will reach 150,000,000° Celsius; but also in 2016, 1.3 billion people did not have access to electricity, and the European central heating systems have poured 40 billion tonnes of CO_2 in the atmosphere; solar energy has exceeded coal-based energy, the number of wave power stations, of roofs and walls lined with photovoltaic solar panels has been rising; the South Pole control station signalled the highest level of carbon dioxide in the last four million years.

THE FUTURE OF ENERGY

THE AGENDA OF THE FUTURE IN ENERGY – THE MAIN PLANETARY PROJECTIONS

2020: solar energy will be less expensive than the one produced by coal and could cover at least the needs of China, India, and Brazil;

2023: the beginning of the decentralisation of the energetic network;

2025: renewable energy will satisfy the needs of 15%-20% of households on the planet;

2027: the year in which the global demand for petrol will reach its peak;

2030: massive action for lining roofs and walls with solar panels; it will also be the year with the highest demand for energy per capita;

2035: the fourth generation of fission nuclear reactors;

2040: new high performance technology for recycling energy; crisis in powering computers; hexagonal energy islands, combining energy production with water desalination; energy satellites on circumterrestrial orbits;

2044: energy providing becomes general/ universal (walls, roofs, roads, bridges etc. will produce energy);

2050: nuclear fusion becomes profitable;

2054: moment of singularity in energetics: the energy transfer will be done by cellular networks for each plant, household, device; plus the complete decentralisation of energy production.

THE FUTURE OF HEALTH

A few actual parameters: in 2016, 2356 genetic therapies were successfully studied; a hand reconstructed on a 3D printer has dropped to the price of just 50 dollars; an ultraperformance exoskeleton, however, costs 70,000 dollars; the ZIKA virus (transmitted by mosquito bite, causes serious illness for humans) is still undefeatable in 67 countries; the eldest person identified alive reached the age of 122; CRISPR-Cas9 is already in use, a very promising genetic technology; AI has become a current collaborator of the medical world.

THE FUTURE OF HEALTH

THE AGENDA FOR FUTURE IN HEALTH – THE MAIN PLANETARY PROJECTIONS

2020: the bionic eye; household kit for tracing cancer;
2025: current genetic therapies, gene editing and construction of organs become routine; nanoparticles are released in the battle against cancer;
2026: successful experiments on animals for slowing down aging;
2028: genetic engineering becomes current technology for fighting against a large spectrum of conditions;
2030: important steps in treating Alzheimer;
2033: anti-aging therapy for humans;
2035: genetic engineering in embryos;
2040: eradication of cardiovascular diseases;
2042: artificial uterus; advanced technologies for protecting premature newborns;
2045: anti-aging therapies become current technologies;
2048: gene therapy replaces vaccines;
2054: avatars (!!!) of the patient will be presented at the doctor's office;
2057: dramatic increase of longevity;
2059: the first model of optimal health.
Jobs? Tens of millions, perhaps hundreds, for people with a thorough education, of course.

THE FUTURE OF EDUCATION

A few actual parameters: currently in the world there are around 750 million illiterate people (10% of the world population doesn't know to write, read, calculate); 6.7% of people on Earth graduated from a University; the planetary learning market (107 billion dollars in 2016) is huge; 20% of the workforce of the planet (mainly women) works in the educational field; in basic education, programming language is added to reading, writing, calculating; the decision of the European Union to offer free access to all scientific work and all patents is important; virtual reality is becoming school technology; Open University, from the famous Massachusetts Institute of Technology (MIT) offers 2300 different courses on the Internet (STEM); great teachers (such as Abshok Goel, from Georgia Institute of Technology) use robots as assistants; education is becoming personalised; a curriculum for each pupil/ student; 60% of today's children will have professions and jobs that do not exist yet; also 60% of today's children have a computer in their classroom.

FUTURE OF EDUCATION

THE AGENDA FOR THE FUTURE IN EDUCATION – THE MAIN PLANETARY PROJECTIONS

2020: all European scientific works are exposed for free, for public availability;
2022: pupils and students have free access to virtual reality;
2024: personal tablets/ iPhone connects the pupil/ student to their school and parents;
2025: explosive rise of distance learning;
2026: free universal access to education, to all classes and courses, through the Internet;
2030: the human brain will be connected to the cloud (the cloud of information that floats around Earth); the brain and the learning process will be aided by chemistry and pharmocology; the map of the brain, completely deciphered, will accelerate learning;
2031: "IT" teachers; personalised education, all through life;
2035: artificial microbes will bring, on demand, the information directly to the brain;
2036: classic classes disappear, therefore so does classic school;
2036: any type of exams disappears;
2043: a new Education Model; this will become omnipresent;
2050: the learning of reading and writing disappears, as they become reflexes of the human brain; direct neuronal interference with information.

THE FUTURE OF WATER

A few actual parameters: the water problem is becoming vital, even dramatic in a world which will exceed nine billion inhabitants by 2050. On Earth we only have 133,000 billion square metres in total, out of which only 3.5% is “fresh” water; it is important to note that 1.25 billion people learned how to use the power of flowing waters through hydroelectric power stations; however, by 2050, the number of plastic waste in the seas and ocean will be equal to that of living creatures! On the surface and in the depths of the oceans there have been installed sensors, and from above the stratosphere the guardian-satellites watch over the tidiness of the oceans of the Earth.

THE FUTURE OF THE WATER

THE AGENDA FOR THE FUTURE OF WATERS – THE MAIN PLANETARY PROJECTION

2020: each consumer will have the daily analysis of the water they drink within reach;
2025: at least half of the infamous and scary Indian Ocean Garbage Patch (towards which it appears garbage carrying currents converge) will be eliminated; new, surprising technologies will be released to help recover cosmic waste;
2030: the year in which the quality of the water will significantly improve, but also the year in which (fresh) water will be declared the most valuable resource of the planet; the mapping of the bottom of the ocean will end;
2032: through development of the "vertical farms", the water demand for agriculture will diminish; "Water Economy" will be defined;
2035: geneticists promise technologies which will allow plants to grow with a lower water consumption;
2040: most likely the year in which the ice of the Arctic Ocean will be fully melted; also the year of access to potable water for all inhabitants of the planet; only this year can we talk about a decrease of the price of desalinisation;
2050: in the oceans, there will be more plastic than beings, but, as a result of the lower desalinisation price, the danger of the war on water disappears.
The water kingdom, actually the one of planet cleanliness, will be the second most offering job field, after Education.

THE FUTURE OF TRANSPORT

A few actual parameters: In 2016, automobiles with no driver already covered more than 230,000 kilometres, UBER, the auto company which owns no vehicles, was already available in 70 countries.

460,000 drones authorised by the proper authorities were used for researching package transport.

THE FUTURE OF TRANSPORT

THE AGENDA FOR THE FUTURE FOR TRANSPORT – THE MAIN PLANETARY PROJECTIONS

2020: UBER is generalising in all countries of the world and will take orders for transport by helicopter, small planes, drones;
2024: Hyperloop, the high-speed train from Dubai to Abu Dhabi begins operating;
2025: UBER and Volvo release the first completely autonomous vehicle;
2025: a first big company will fire all of its drivers; the transport of parcels by drone will be generalised; Americans stop buying automobiles; massive transition of the auto industry to electricity and renewable energy;
2028: like in the tales, “flying cars”; the data of all transport on Earth will be collected on a global platform;
2030: a new generation of aircrafts, probably reaching speeds higher than 6100 km/h, which is more than Mach5;
2035: the binding of the roads will be done directly in specialised plants (severe warning for road constructors... Perhaps this way the Pitesti – Sibiu motorway will be finished...);
2036: absolute victory of electric and autonomous automobiles; flights with no turbulence, controlled by IT;
2040: there will be no more car owners on Earth;
2050: translucid aircrafts; stratospheric transport.

THE FUTURE OF NEW TECHNOLOGIES

A few actual parameters: engineers are moving even faster than the imagination of SFwriters.

As we can see, the internet will have the same fate as the electric current: it will disappear. IT will be ubiquitous, it will infiltrate in everything around us. The need for a Hippocratic Oath for IT workers is already visible.

The need for inventing what could be called the Ethics Paper of IT, an extension, if you may, of Isaac Asimov's Robotics Laws, with Holberton – Turing arguments (taking into consideration the dangerous consequences of elaborating any soft-expert or building any hard complex).

THE FUTURE OF NEW TECHNOLOGIES

THE AGENDA FOR THE FUTURE – THE MAIN PLANETARY PROJECTIONS

2020: the virtual reality market will be worth 150 billion dollars; soldiers will be replaced by robots;

2021: Moore's Law is abolished, a sort of barrier in the way of miniaturisation is reached;

2025: virtual reality and normal reality (common sense) are uniting;

2026: IoT becomes a thousand billion dollars industry;

2030: quasi-instant communication between people (Ray Kurzweil's premonition becomes reality, IT unites with Homo Sapiens from protoplasm); identity chips in the skin of each citizen of the planet;

2036: each human with its robot;

2037: democratisation of quantic computers;

2040: IT begins to break human law;

2042: IT members enter the administration committees of companies;

2045: half of Earth's work force is made up of robots;

2048: emergence of IT supraorganisms;

2050: everyone lives in smart houses and flats (which will fully solve household problems for all 9.8 billion humans)

THE FUTURE OF SPACE INVESTIGATION

A few actual parameters: 2030 exoplanets were discovered (found by the observatory-satellite Kepler), 30 NASA missions, 27 “second hand” rockets retrieved by Space-X, Elon Musk’s company; the price of a Falon launch decreased to approximately 9 million dollars (10 times less than the “competition” - NASA, ESA, Roscosmos, JAXA – less money than the amount spent to make the film “Gravity”);

The ISS made around 400 research actions in 2016. Let’s take into consideration the success of the New Horizons space probe, which gave us images of the dwarf planet Pluto, as well as the spectacular photographs of Jupiter provided by JUNO; to be mentioned that gravitational waves are no longer only a hypothesis, because they have been “felt” by the machines of the astronomers; that Enceladus, satellite of Saturn, proved that underneath the surface layer of ice there is an ocean, that the ExoMars “spy” landed quietly on the circummartial orbit and is looking for signs of life on the Red Planet (Mironov, 2018).

In the space agenda the power of private investors is and will continue to grow bigger, from the moment when the “Gold Rush” will be triggered, as the rocket engine builder Bogdan Marcu said, graduate of the Bucharest Polytechnics University, once an employee of Elon Musk; “gold” means actual profits from cosmic industry business.

For a dollar invested in “cosmic economy”, today’s profit is 8 dollars, the Romanian Space Agency (ROSA) informs us. Over 40 business projects on the Moon are waiting for the green light from the authorities. Jeff Besos from Amazon.com, Richard Bransos, owner of the Virgin holding, Russian, Chinese, Indian billionaires are completing the list of NASA, Roscosmos, ESA, JAXA – and are developing businesses in the Solar System.

Jobs? Galore.

THE FUTURE OF SPACE INVESTIGATION

AGENDA FOR THE FUTURE OF SPACE – THE MAIN PLANETARY PROJECTIONS

2018: the launch of a Space-X rocket to Mars: Elon Musk's launch was a success, he retrieved two engines but, sadly, the "aim" was not very good, the rocket became a satellite of the Sun and is headed towards the asteroid belt;

October 2018 (maybe 2019?): the launch of the James Webb space probe – working in infrared, a hundred times more sensible than any telescope ever built;

2020: China will launch the Tiangong-3 space station;

2023: Miners will try to exploit the remains of an asteroid;

2024: the Osiris-Rex rocket, launched in 2016, will return to Earth with samples from the Bennu asteroid; Space-X will send the first human crew to Mars;

2025: Astrophysicists will finally explain what "dark matter" is; NASA will send a rocket to Europa, a satellite of Jupiter, where astronomers estimate there is three times more water than on Earth;

2030: ESA (European Space Agency) installs the first human colony on the Moon; HDST (High Definition Space Telescope, capable of distinguishing structures situated at distances greater than 330 million light years) will be sent on the orbit;

2033: life in space will be discovered;

2036: nano space crafts that are powered by solar energy will be sent to close stars, situated at a distance of 30 light years from us;

2040: the New Horizons space probe will pass the Kuiper Belt and exit the Solar System;

2045: Roscosmos establishes the first Russian lunar colony; more human colonies on Mars and the Moon.

THE FUTURE OF FOOD

We saved for last one of the most important “drawers”, the Food Agenda, omitted by the Ministry of the Future from the United Arab Emirates, because, perhaps, in their vision food is too inexpensive to be worth their actual involvement, but also because in the future technologies proposed by Genetics, Medicine, Biochemistry will permanently solve the food problem.

Hunger, violence, diseases have been the main problems of the human society. They will be solved gradually, futurists assure us. The food problem will be the first to leave the baggage of needs of the citizens of the Planetary Village; to support the idea, we will give just two examples:

THE VERY DEBATED GMO – genetically modified organism, resistant to diseases and capable of huge production will be inevitably generalised, although current regulations of the EU ban them formally with resistance – but after 50-100 million emigrants will be added, most likely, to the 500 million citizens of the EU, the need for food will force us to be more pragmatic.

The second example: THE DEVELOPMENT OF STEM CELLS collected from animals, which can be grown in a laboratory.

Be it 9 billion people in 2050 or 14 billion in 2075, they all need food. The special qualities of the Romanian chernozem, of the air, and of the waters that are still (almost) clean, autochthonous traditions in biotechnology and bioeconomy deserve to be valued in the Grupul de Lucru pentru Economia Viitorului (GLEV) which INACO has proposed ever since last year to all Romanian deciders, to offer as many chances to younger generations as possible (Paul, 2008). The signing of the protocol for the creation of GLEV with the Ministry of Economy was only possible in 2019.

IN CONCLUSION…

...PREDICTING THE FUTURE IS EASY, PREDICTING IT CORRECTLY IS HARDER

Mankind has seen many predictions or technological reservations which proved to be wrong. The future is the only one which can prove us right or wrong. It is important not to be surprised by the future and not to be caught with our eyes closed by it.

Here are the funniest wrong predictions of important personalities of their time and how important the capacity to sense and then adapt to technological advances is:

1876: *"Americans need telephones, but we do not. We have enough messengers."* William Preece, president of the British Post Office

1876: *"The telephone has too many flaws to be considered a mean of communication."* William Orton, president of Western Union

1889: *"The attention offered to alternative current is a waste of time. No one will ever use it."* Thomas Edison

1930: *"Innovations such as electricity will have such a profound impact that they will change the work market completely and people will spend most of their time only doing things that they enjoy."* John Maynard Keynes, British economist

1943: *"I believe that on the global market there is only space for five computers."* Thomas Watson, president of IMB

1946: *"Television will be on the market for six months at most. People will get bored of watching TV every evening."* Darryl Zanuck, 20th Century Fox

1955: *"Nuclear powered vacuums will be a reality in ten years."* Alex Lewyt, president of the Lewyt Vacuum Cleaner Company

1961: *"Practically, there are no chances for satellite communications to lead to telephones or better radio and TV in the USA."* T.A.M. Craven, Federal Communication Commission

1977: *"There is no reason why a person would wish to have a computer at home."* Ken Olsen, founder of Digital Equipment Corporation

1978: *"Until 1988, a quarter of the work force of Australia will be endangered as a result of technological changes."* Ian Turner, historian

1981: *"Surely mobile phones will not replace classic landline telephones."* Marty Cooper, inventor

1995: *"I predict that the Internet will have a spectacular evolution like a supernova and in 1996 it will collapse."* Robert Metcalfe, founder of 3Com

2006: *"Everyone is asking me when will Apple come to the market with a mobile phone. My answer is probably never."* David Pogue, New York Times

2007: *"There is no chance that an iPhone will have a significant market share."* Steve Ballmer, Microsoft CEO

2011: *"You can't develop serious portable apps on an Android."* Ray Lane, president of HP

2013: *"I believe in five years there will be no reason to have a tablet."* Thorsten Heins, Blackberry CEO

YOU, THE YOUNG PERSON OF TODAY AND THE WORLD OF TOMORROW

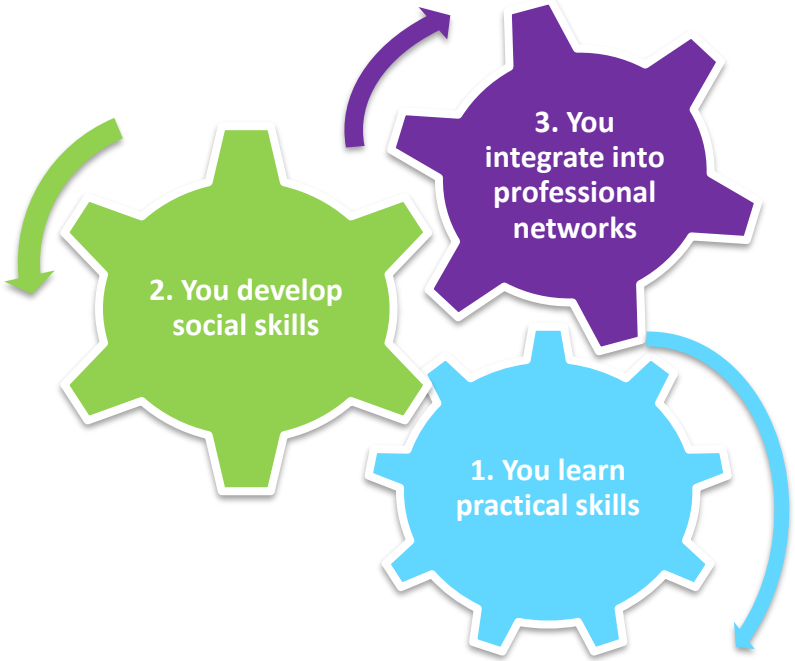
THE ROLE OF VOCATIONAL AND DUAL EDUCATION

Social integration skills in the team will be required in **60%** of the professions

General education is required in **40%** of the professions.

Updating practical knowledge is necessary in **any profession**. Changes will occur through the emergence of technological innovations.

Practical skills are as unique as our signatures on documents. Once acquired they will give the person added value in society.



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