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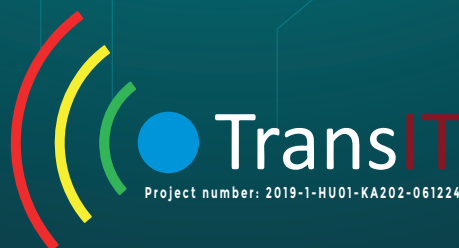


MANAGEMENT TRAINING KIT

FOR THE TRANSITION TO INDUSTRY 4.0

Desk Research Report

Competence Matrix and HR Capacity Development Strategy,
based on a multi-generational approach with competence catalogue





Desk Research
SUMMARY
O1. A1.

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Erasmus+

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INTRODUCTION

The overall purpose of Transit project is to develop a training kit which empowers managers in:

- Leading people in fast changing, uncertain environments
- Motivating people to embrace change vs. opposing
- Incentivizing innovation, create innovation-friendly environment
- Helping employee's transition to the era of Industry 4.0 (up-skilling) vs. "replacing" them
- Keeping their psycho-physical-mental balance vs. living in stress (resilience)
- Understanding the trends of Industry 4.0 and based on this take preventive and forward-looking steps
- Working with different generations all together
- Ensuring the company's healthy work climate and competitiveness.

General objective:

The main objective of O1. A1. Desk Research was to gather valuable background information at national (within the partner countries) and international level regarding the key aspects and competences of successful transition management to Industry 4.0. The research results serve to shape the Transit training strategy; helps to outline the focus points, capacity development strategy and key features of the Transit training material. In this sense, it forms the base of the next intellectual outputs.

Specific objective:

Each partner realized an in-depth background research about the current situation, needs and gaps relating Industry 4.0 skills demand in their country. We found it important to rely on a variety of resources (including professional articles, scientific studies, trends analysis, case studies, national directives, etc.) so as to

STATE OF ART OF INDUSTRY 4.0 IN THE PARTNER COUNTRIES

- What kind of national/regional programs are available relating Industry 4.0 (e.g. subsidies, trainings, declared needs, gaps, etc.)?
- What are the Government's main objectives (e.g. target areas, skills and knowledge, etc.).
- Are there available statistics relating business actors' level of preparation & adaptation to Industry 4.0?
- Is there any cross-sector cooperation facilitating the transition (e.g. between universities, research centers, chambers of commerce and enterprises)?
- Who are the main actors?

HUNGARY

National programs:

- The Hungarian Government has developed a number of interrelated and cascading plans to develop Hungarian industry. These cover a broader area than Industry 4.0; however, the development of Industry 4.0 is an important part of them.
 - The most comprehensive initiative is "Irinyi Plan (2016), which aims to define the directions of innovative industry development" developed by the Ministry of National Economy. Government programs related to Industry 4.0 were integrated into this Plan, also known as "The strategy of Reindustrialisation".
 - Sectors: The most important sectors identified in the Irinyi Plan are: automotive industry, manufacturing of specialised machines and vehicles, medical industry, health economy, tourism, development of „green economy”, IT, SSC, defence industry.
 - Means: The Irinyi Plan has been urging strengthening of innovation-driven industry via industrial digitalisation since 2017. It is promoting Industry 4.0 systems by means of awareness raising, establishing sample plants and technology centres. The directions and professional coordination are implemented through the establishment of the National Technology Platform and the Priority Projects.

- Funds: SME Irinyi Plan defined as priority the creation of an efficient and productive SME sector. The Government provided 2.35 billion HUF funding for the development of the SME sector regarding Industry 4.0.

Education:

- The unprecedented pace of change in information technology requires a shift in knowledge for which the Hungarian education and training system does not yet have ready solutions; the government is determined to create more high value-added jobs through digitalization than the traditional jobs.
- In 2015, the Hungarian Government launched its Digital Wellbeing Programme, which was further developed in 2017 under the title Digital Wellbeing Program 2.0. Its objective is "to turn each citizen and enterprise in Hungary into a winner of digitalisation"; develop digital competences among citizens, businesses and those working in the public sector; and support the digital transformation of Hungarian industry and agriculture, with special emphasis on SMEs (including micro-enterprises).
- The Digital Education Strategy of Hungary⁵ "strategy covers the entire Hungarian education and training system; include public education, vocational training, higher education, adult learning and a number of key horizontal aspects. Urges an open digital educational environment, responding to the challenges of the digital age instead of just serving as a digital version of the traditional solutions, something novel regarding its approach, methodologies and requirements. "The strategy will fundamentally change the way education and training work in Hungary. When implemented, the development of digital skills will not only improve the employability, quality of life and well-being of workers, but will have a significant positive impact on all aspects of the digital ecosystem. "
- The Digital Labour Programme (DLP)⁴ is focused at active-age workers, for whom digital vocational training or retraining may correspond to reintegration into the labour market, or gaining higher-income jobs, or the chance of retaining their current jobs. E.g. drop outs from tertiary education, women, residents of small rural settlements, career changers and workers in free enterprise zones. Since the economic weight of SMEs in the Hungarian economy is very significant, the training, retraining and development of digital competences of SME employees is an essential element of the Program.
- The DLP supports new solutions that further "develop the existing training channels with regard to the labour market and create new channels for target groups that were previously excluded from training."

- It aims to implement basic digital competency interventions for school-age children and adults using resources of the Economic Development and Innovation Operational Programme (GINOP) and the Human Resource Development Operational Programme (EFOP).

State of Industry 4.0 in Hungary

To our knowledge, no statistical survey on Industry 4.0 has ever been conducted.

However, the **Industry 4.0 National Technology Platform Association** (NTP)⁷ conducted a widespread survey in the form of a "questionnaire project"⁸ among manufacturing companies involved in Industry 4.0. The following aspects were assessed:

1. The needs and expectations of (manufacturing) industry and strategic economic management.
2. The current state of awareness related to and the acceptance and implementation of Industry 4.0, both at the level of individual companies and the national economy.
3. The specific R&D and innovation potential of Industry 4.0.
4. Growth potential and its conditions.

Survey Results:

- 50% of respondents do not have any implementation strategy regarding INDUSTRY 4.0.
- 50% do have such a strategy;
- Only 2% have implemented INDUSTRY 4.0.
- The following table summarizes the future importance of Industry 4.0 technologies.

New technology	Not too important ca. %	Important ca. %	Extremely important ca. %
Internet of things	22	36	42
AI	39	33	28
Extended reality	43	40	17
PLM application	21	44	35
MES/ERP/PPS systems	8	34	58
Integration of applications	16	46	38
Machine to machine communication	15	39	46
Embedded IT systems	14	48	38

Cloud infrastructure	22	39	39
Big data analysis	10	18	72
GPS	24	40	36
RFID	20	48	32
Mobile terminals	8	54	38
Sensors	6	33	61

- Efficient Industry 4.0 based manufacturing and logistics require significant investment. That is why the questions related to this priority area inquired about the investments (projects) of the past two years to support the implementation of Industry 4.0 and the areas these impacted. The table below gives the percentages of enterprises planning to develop particular areas.

○

Planned targets of Industry 4.0 projects in 2016-2017 and 2017-2020

Activity	2016-2017 (ca. %)	2018-2020 (ca. %)
Production, manufacturing	40	43
IT	35	41
Employee training	35	37
Quality assurance	35	35
Information security	32	34
Environmental awareness, sustainability	25	32
Production planning	25	32
Research and development	27	32
Logistics	28	30
Internal support activities	25	29
Purchase	13	20
Value chain management	8	20
Finances	23	25

Customer relationship management	17	23
Sales	18	22

Cross-sectorial cooperation

- “The **Industry 4.0 National Technology Platform**⁷ (NTP) with about 40 member organizations (companies, research institutes, universities and professional organizations) was established in May 2016 with the support of the Ministry of National Economy (NGM) and coordinated by the Computer and Automation Research Institute of the Hungarian Academy of Sciences (MTA SZTAKI).
- The Platform's main objective is to promote knowledge sharing and development, based on information exchange, in digitalisation and production as key areas for Industry 4.0, professional consultation and provide advice and guidance to the government and other stakeholders in the Industry 4.0 ecosystems.
- By now a federation, has about 100 members, and it is constantly expanding. The members carry out their duties and cooperate in six working groups." Members:
 - Universities:

Budapest Corvinus University, Budapest Business School, Budapest University of Technology and Economics, Eötvös Lóránd University, Kecskeméti Neumann János University, Miskolc University, Pannon University, University of Pécs
 - Research centers:

Computer and Automation Research Institute of the Hungarian Academy of Sciences (MTA SZTAKI), Centre for Economic and Regional Studies of the Hungarian Academy of Sciences, IQ Kecskeméti Kutató Kft.
 - Chambers of commerce:

Pécs-Baranya Chamber of Commerce and Industry, American Chamber of Commerce , German Hungarian Chamber of Commerce and Industry
 - Associations, federations, non-profit public benefit organizations

Association of IT Companies, IFKA Iparfejlesztési Közhasznú non-profit Kft, Magyar Gépipari és Energetikai Országos Szövetség (Hungarian Association of Mechanical Engineering and Energy Management, MAGEOSZ), Magyar Innovációs Szövetség (Hungarian Innovation Association), Magyar Logisztikai Egyesület (Hungarian Logistics Association), Magyar Szolgáltatásiipari és Outsourcing Szövetség (Hungarian Service Industry and Outsourcing Association), Magyar Járműalkatrészgyártók Országos Szövetsége (National Association of Hungarian Vehicle Part Manufacturers, MAJOSZ)

- **Governmental organisations:**

Hungarian Investment Promotion Agency, National Council for Telecommunications and Information Technology, Municipality of Pest County

- **Enterprises:**

E.g. Aventics Hungary Kft., Ballauf Elektronikai Kft., Continental Automotive Hungary Kft., Electrolux Lehel Kft., Siemens ZRt., T-Systems Magyarország ZRt., etc.

- **Sample factories¹¹:**

E.g. Continental Automotive Kft., Roto Elzett Certa Vasalatgyártó és Kereskedelmi Kft., Eltec Holding Kft., Festo-AM Kft., Macher Zrt.

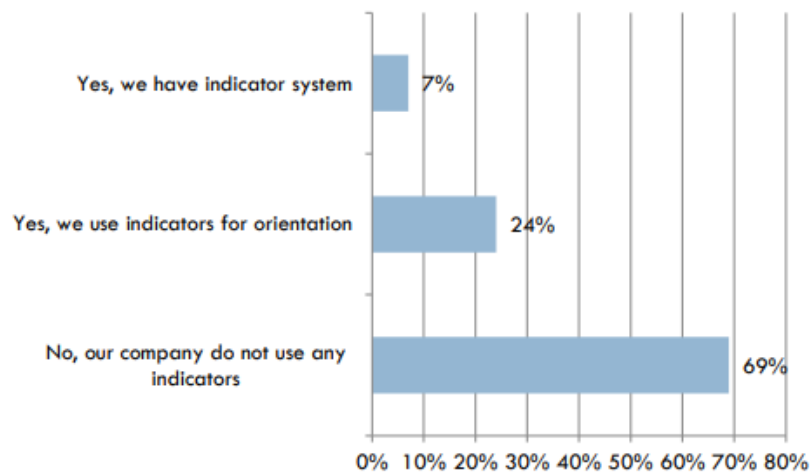
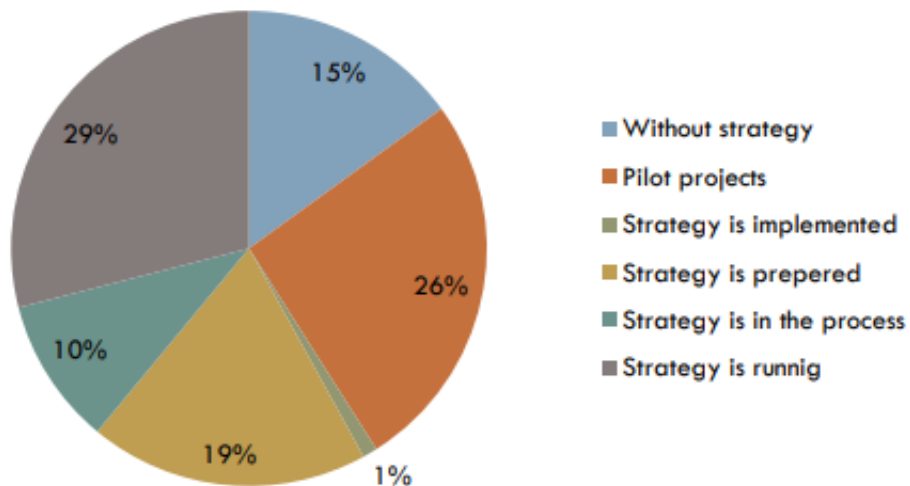
Slovenia

The Slovenian-German Chamber of Commerce recently conducted a survey¹¹ investigating the situation in the field of industry 4.0 in Slovenia. The survey indicated a good basic understanding of the concept of Industry 4.0 in companies in Slovenia and its importance for the future development of industry.

Survey results

We resumed in the below charts the most important findings.

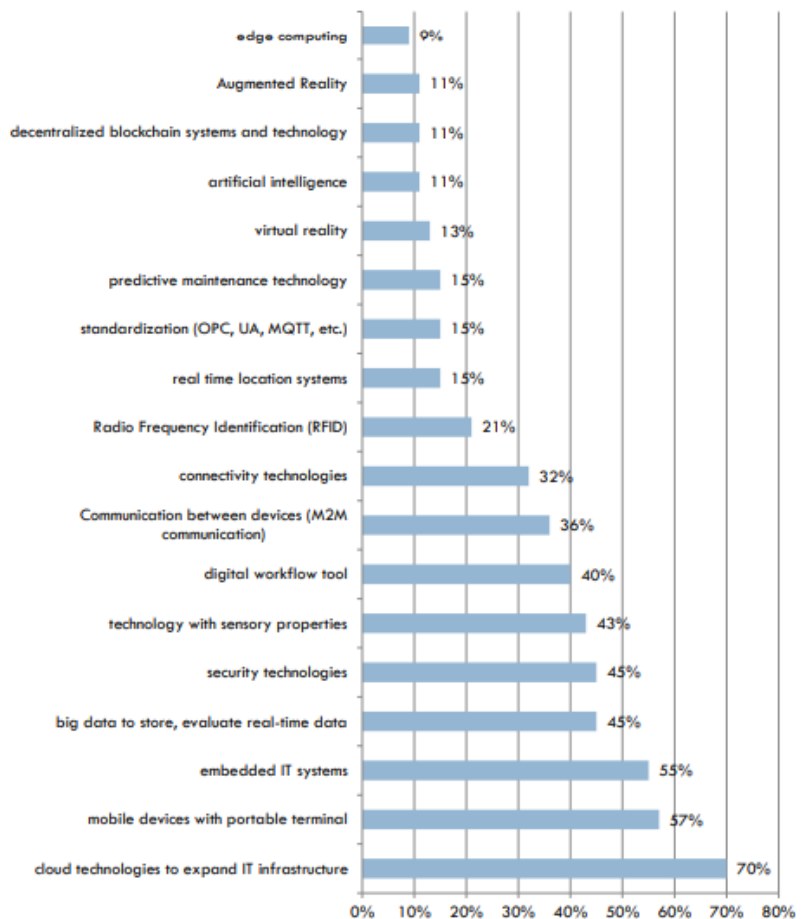
- Most of the surveyed companies in Slovenia, 26% of participating companies carry out some kind of pilot project relating i4.0, 15% doesn't anything yet, while the other companies have i4.0 at some stage. Only 1% of companies has a fully implemented strategy.
- The majority of the surveyed companies don't use indicators to measure the level of implementation of i4.0 strategy.



- Most companies in Slovenia are on they way towards i4.0, but there are huge differences. More than two third of the surveyed firms use cloud technologies for IT infrastructure expansion (70%), and more than half, (57%) apply mobile devices with portable terminal. On the other hand much less companies apply device communication and connectivity technology.

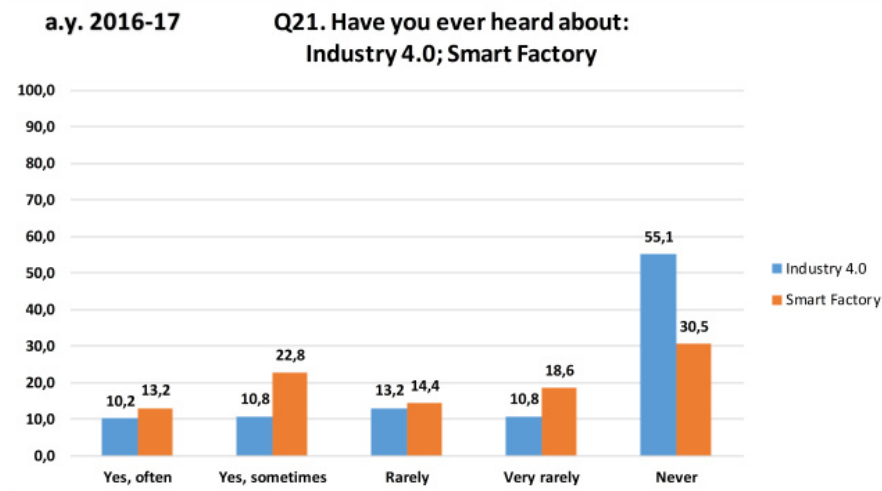
Only very few companies (11%) use artificial intelligence, blockchain technology or augmented reality. As the graphs show, companies have quite different technological and strategical preparation level for i4.0.

- The survey also studied whether companies are systematically managing technology and innovation. Results revealed that less than half of the companies (48%) manage IT and innovation systematically in the IT sector, and even less in the manufacturing (30%) and product development (28%) area.

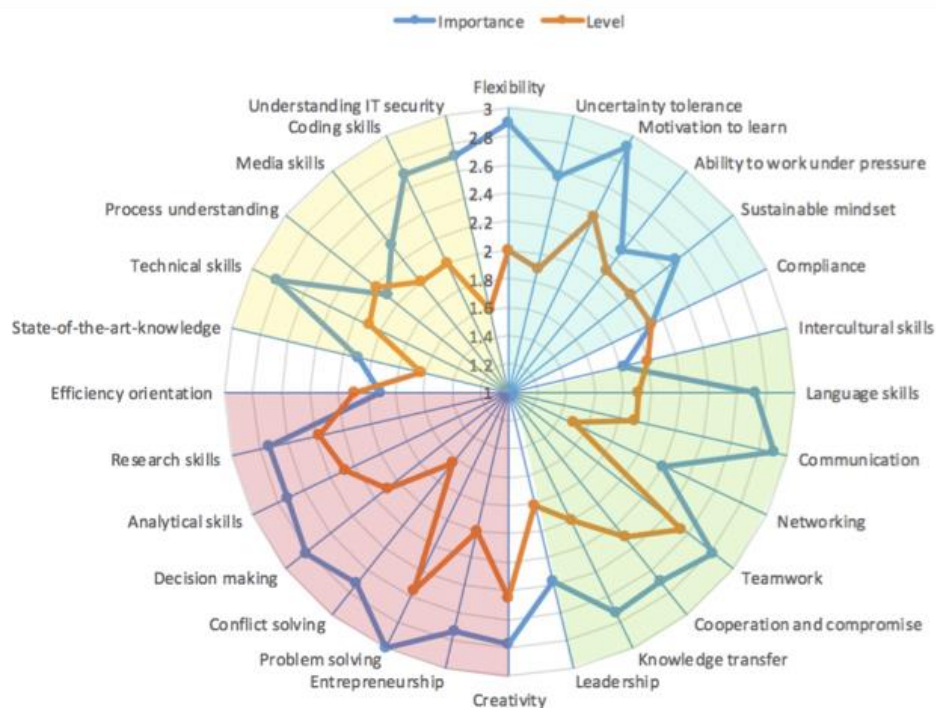


IRELAND

- **FRAMEWORK:** In the Industry 4.0 Strategy 2020-2025 the Irish Government's department of Business, Enterprise and Innovation highlighted "the importance of the manufacturing sector and it's supply chain to Ireland's economy, and the likely disruption caused by new digital technologies, it is important that Ireland sets out its ambition to support firms to adopt digital technologies and its commitment to develop a globally competitive business environment for Industry 4.0."



- Experts are urging advanced technologies for companies to remain competitive in Industry 4.0. E.g. Ireland is one of the biggest exporters of medical products in Europe, with annual exports worth €8.5 billion. To keep so, life science companies must be able to adopt new technologies.
- “The knowledge of the most relevant terms for the Industry 4.0 framework (Industry 4.0 and Smart Factory) showed that there is still a lot of work to be done for making young people aware to these new issues and giving them more structured information”. These results (right¹²) may suggest the need to create a broader and better structured knowledge of the basic concepts related to this new industrial revolution.
- The below chart resumes the findings of another survey¹⁴ about the perceived importance of various skills and competences in i4.0 and the same skill’s self-reported level by the survey participants. The two are matching in case of a few competences only, while there is significant difference between them in case of e.g. flexibility, communication, conflict solving, IT security, knowledge transfer, decision making, uncertainty tolerance.



BULGARIA

According to the last Digital Economy and Society Index (DESI) for 2019 Country Report, Bulgaria is ranked below the EU medium the European Commission Digital Economy and Society Index.¹⁵

The report analysed the EU countries along five factors:

1. connectivity, 2. human capital, 3. the use of internet services, 4. integration of digital technology and 5. digital public services

Bulgaria overview

	Bulgaria		EU
	rank	score	score
DESI 2019	28	36.2	52.5
DESI 2018	26	35.5	49.8
DESI 2017	27	32.4	46.9

Digital Economy and Society Index (DESI) 2019 ranking

According to the country report

Bulgaria performs relatively well in

connectivity, especially regarding the wide availability of ultrafast and mobile broadband networks. It has also made significant progress with the e-government dimension, with growing number of users and a high score for the provision of digital public services to businesses.

However, Bulgaria scores well below the average in Human capital, its overall level of digital skills being among the EU's lowest. People with at least basic digital skills account for 29% of the total Bulgarian population, against an EU average of 57%. Only 11 % of people have skills that are above basic, which equals almost one third of the EU average. Bulgaria also performs well below the average in integrating digital technology. Companies are not yet taking full advantage of the possibilities offered by online commerce: 6 % of SMEs sell online (against the 17 % of the EU average), 3 % of total SMEs are selling cross-border and an only 2 % of their turnover comes from the online segment.¹⁵

In the recent empirical research on the readiness of Bulgarian SMEs to implement Industry 4.0 is stated, that only 31% of the managers are fully aware of the challenges their business will face. 24.5% are partially aware, and 20.0% have low to basic knowledge on Industry 4.0 changes, and 1/4 of the managers do not understand the situation at all.

National and regional programs:

Following Protocol Decision No. 37 of August 30, 2017, the Council of Ministers endorsed the Concept for Digital Transformation of Bulgarian Industry (Industry 4.0) as a basis for development of a Strategy for Bulgaria's participation in the Fourth Industrial Revolution and in implementation of a decision of the National Economic Council of September 11, 2017, established a working group to develop a Strategy for Bulgaria's participation in the Fourth Industrial Revolution.¹⁶

- Bulgaria has a National Programme linked to the programming of EU structural funds called "Digital Bulgaria 2025"¹⁵, which outlines some measures to improve of connectivity, public services and private sector integration of digital technologies. However, this is not an overarching strategy to support digital transformation in the country.
- Although some measures are planned to support the take-up of digital technologies by business, the Bulgarian economy would benefit from an overarching strategy addressing digital transformation. The Concept note of a Strategy for Bulgaria's participation in the 4.0 Industrial Revolution was also elaborated based on the survey about the knowledge, status and readiness of Bulgarian business to be involved in the technological trends outlined by Industry 4.0, but is still a draft. Focuspoints:
 - "Strengthening the link between science and industry in the country and accelerated integration of Bulgaria into European and international programs, initiatives and networks related to the development and implementation of Industry 4.0."
 - "Technological renovation of the Bulgarian economy through: introduction of standards, infrastructure building, development of concrete mechanisms for stimulating the development

and market introduction of technological innovations (new products, services and production processes) through the technologies of Industry 4.0.”

- Building human, scientific, organizational and institutional capacity for the development of Industry 4.0 in Bulgaria
- Bulgaria is committed to investing strategically in digital technologies through EU-coordinated programmes (such as EuroHPC Joint Undertaking). EU funds are dedicated to finance four centres of excellence and nine centres of competences, specialising in disciplines including mechatronics, clean technology and IT. In parallel(still under establishment), another EU-funded project will help set up regional innovation centres, which will encourage cooperation between businesses and research centres. These projects were designed to facilitate knowledge transfer, help create university spin-offs, and attract capital. Their sustainability and performance are vital for future investments, both in terms of infrastructure and soft measures. Meanwhile, the flagship Sofia Tech Park continues to face challenges. The underutilisation of its scientific infrastructure, governance issues and long-term financial sustainability are some of the concerns.¹⁵
- Another project managed by the Bulgarian SME promotion agency from 2019 set up a voucher scheme benefiting up to 450 SMEs in Bulgaria that are willing to acquire digital infrastructure.¹⁵
- Although Bulgaria is a signatory to the Declaration of Cooperation on Artificial Intelligence, measures to encourage the take-up of artificial intelligence applications in the public and private sector are lagging behind. Bulgaria's cybersecurity strategy, adopted in 2016, aims to combat cyber-crime, engage in international cooperation, establish an incident response capability and raise public awareness of cybersecurity risks. On this last point, cyberhygiene awareness-raising campaigns have been run in 2018 for children and business.¹⁵
- A project Digital Skills for Bulgarian SMES ended in 2018, piloting a group of Bulgarian libraries to be centres for acquiring modern digital skills from the owners and employees of Bulgarian SMEs.

Cross-sectorial cooperation:

Besides the clusters that support the cross-sectoral cooperation, the Chambers of commerce (Bulgarian Industrial Association, Bulgarian Chamber of Commerce and Industry, Association of Industrial Capital and Confederation of Employers and Industrialists in Bulgaria), and the Sofia Tech Park, the cooperation between the science and industry is mainly pushed at local level, or by the Operational Program "Innovation and Competitiveness", managed by the Ministry of Economy.

PORTUGAL

National programs:

- In order to generate favorable conditions for the development of national industry and services in the digital age the Ministry of Economy launched **Portugal i4.0** in 2017. The program declared three central objectives:
 1. Accelerate the adoption of Industry 4.0 technologies and concepts in the Portuguese business fabric;
 2. Promote Portuguese technology companies internationally,
 3. Make Portugal an attractive pole for investment in the Industry4.0 context.

Portugal i4.0 was launched based on a bottom-up approach, counting with the participation of companies operating in the market. A special knowledge-sharing space was created as well, involving various non-business entities as well as a strategic committee. This committee, including some international entities with proven experience in Industry 4.0, was assigned to guide and supervise the results.

Over 100 relevant Portuguese entrepreneurs and institutions joined the initiative. They were organized into working groups according to four ranks: Automotive, Fashion and Retail, Agrifood and Tourism. These ranks, selected according to their 1.) Contribution to the national economy, 2.) Relevance in the national SME fabric and 3.) Susceptibility to digital transformation, served as pilot industries in the first phase of digital transformation.

Education:

- Since 2017 the public Institute for Supporting PMIs and Innovation (IAPMEI) has been giving informative trainings all over the country¹⁹, bringing the concept of Industry 4.0 closer to companies of different size and location.
- The Entrepreneurship Association for Innovation (COTEC) also launched a project called **Plataforma Portugal i4.0** with the main objective to fill gaps and deficiencies relating the understanding and implementation of Industry 4.0 concepts and technologies. The project is contributing to reinforce management and innovation skills, thus strengthening companies' competitiveness, promoting collaborative innovation and helping to transform knowledge into economic value.

- The platform aims to over bridge existing information and knowledge gaps, raise awareness, mobilize SMEs for the potential application of available technologies, establish implementation roadmaps, create tools to accelerate and facilitate transition to Industry 4.0, help the formulation of innovation strategies and digital transformation.
- Universities also play an important role in the training field. The main Portuguese universities, such as the University of Coimbra has been in active cooperation with the Ministry of Economy relating two training areas.
- In the one hand, they have been working on the creation of a non-degree interdisciplinary training offer on Industry 4.0 in the Interdisciplinary Research Institute. This concentrates on human resources training.
- On the other hand, in the context of the financing / investment support training axis, the main objective is to develop and deliver awareness-raising sessions for the industrial and business fabric on specific i4.0 topics.
- Further to the above-mentioned programs, based on our desk research we found private courses offering trainings for companies and organizations. We list here the main issues at which these courses focus: lean management in the creation of Intelligent Factories, theory of Industry 4.0 compared to the former industrial revolutions, promotional campaigns to adapt Industry 4.0. We didn't find courses or training focused on the motivational management aspect of transition, change management to Industry 4.0 nor trainings strongly combining the former with innovation aspects.

Survey results:

However various trainings are available focused on different aspects of Industry 4.0., industry 4.0 can still be considered as a new topic in Portugal. According to the **Industry Project 2027**, developed by the National Confederation of Industry (CNI), only 15.1% of the surveyed companies disposed of a formal action plan for the digitization of processes in 2018.

GREECE

According to the World Economic Forum, Greece is classified as emerging in terms of readiness to take part in Industry 4.0.

Education:

Industry 4.0 has been just very recently but dynamically introduced to the Greek education.

- There are i4.0 centered courses on NTUA, IVEPE and UOA while a significant number of similar themed seminars have taken place in educational institutions such as AGPM, Easy Education, Regeneration and M F.
- Moreover, a range of conferences, discussions and implementation events have been realised by stakeholders like Sev, Mediterranean College, Ahk, Infocom, Tour Market, Diavlos, Uniwa, Greece Lean Six Sigma and Led. These initiatives often count with cross-sectorial cooperation.
- Despite all the above mentioned initiatives, which focus mostly on regional level, at national level there is still much less activity. Nevertheless, the Eye@RIS3 Platform is a good example of initiatives at national level.

National programs:

Greece has declared its main Innovation Priorities regarding the implementation of Industry 4.0 standards which are listed below by industry:

1. The initiation of an e-health platform.
2. Digitising the agrifood-nutrition industry through smart and additive manufacturing.
3. In the energy sector, cleaner environment & efficient energy networks and low energy computing along with an Internet of Things implementation.
4. In transports, the inauguration of 5G and other communication networks, sustainability for urban areas through Smart City programs and finally the upgrade of location-based technologies.
5. For culture & tourism there's a plan for New media & easier access to cultural contents.
6. In informatics, we have upgrade announcements for Artificial Intelligence systems, augmented and virtual reality appliances, gamification & interaction technologies and of course data mining and database management. There are also plans for more energy efficient networks, lower computing energy consumption and finally the incorporation of Internet of Things and Smart Systems.

Despite the aforementioned plans, the long economic recession from which the country is just recently recovering along with a high rate of brain-drain, are slowing the development processes significantly. The country is still stuck at Industry 3.0, having completed only the 25%-30% of it (industry 3 or industry 4?)

Industry 4.0 development will be pushed by the newly established National Council of the Infrastructure and Construction Industry, which will be responsible for the implementation of the Industry 4.0 standards into these industries. The Council was established by a cross-sectorial collaboration between STE, SEGM, STEAT along

with research institutions and universities. Following its establishment, partners have submitted a proposal for the creation of an Innovation Cluster named Hellenic Digital Construction.

Statistics

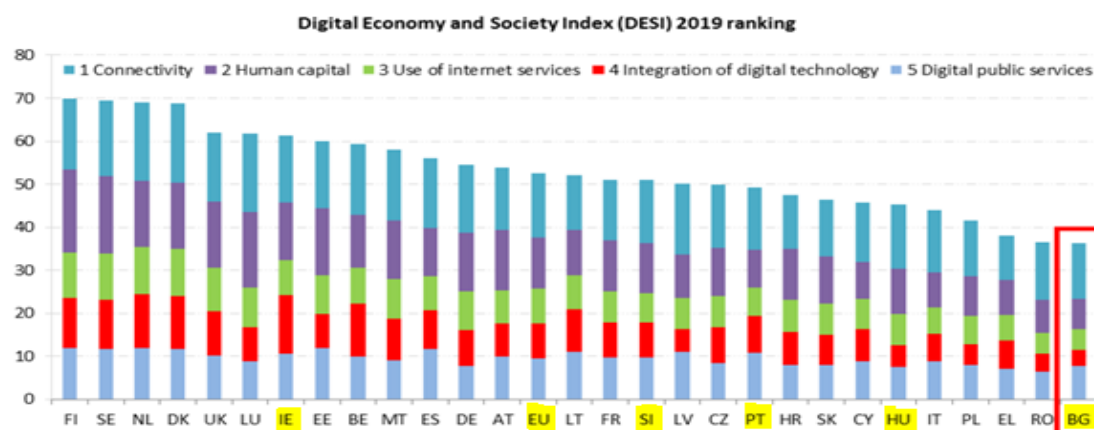
According to the Digital Economy & Society Index (DESI), Greece is 27th out of the 28 EU states regarding its digitalization progress. At the same time, it holds the lowest percentage of Information and Communication Technologies specialists (1,4%) which in combination with its 16,2% percentage of 20-29 years old STEM graduates, reveals its high brain-drain. Regarding enterprises, according to a SEV generated statistic, Greek companies come 26th in the EU regarding their “technological maturity.

On the brighter side, in compliance with data gathered from EKETE during the 2014-2016 period, the innovative companies percentage reached 57,7%, achieving this way a 6,7% improvement compared to the previous three years period. In addition, an EKETE research shows that investing in innovative practices summed up to over 2 billions (an increase of more than 432 millions). There were also increases in indicators of new/significantly improved procedures (+10%), new methods of organization and marketing (+6%) and the establishment of cooperations aiming at innovation development (+8%). Finally, R&D investments reached 1,75 billions, which was the highest amount ever achieved. Therefore, although the enterprise world is left behind in the Industry 4.0 evolution, there have been some significant progress steps.

INTERNATIONAL COMPARISON

The below chart from an international survey ¹⁵ from 2019 reveals important information about the level of various aspects of digital economy and society in the Europe. The countries of Transit partnership are dissipated along the ranking.

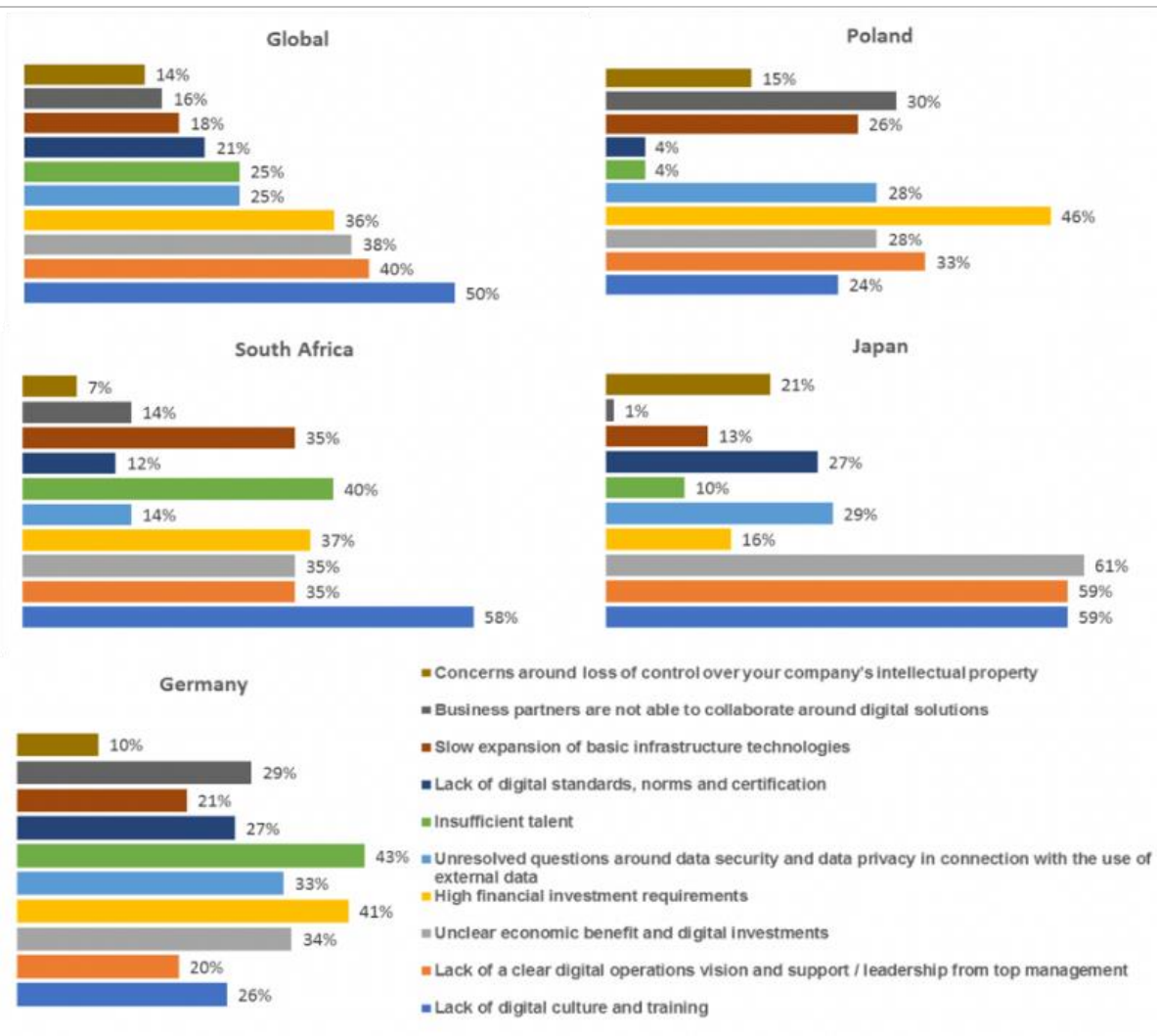
This comparison highlights 1. connectivity, 2. human capital, 3. the use of internet services, 4. integration of digital technology and 5. digital public services, as key factors.



However it is not strictly related to the partner countries it is very useful to

share the findings of an international survey regarding the level of preparation to i4.0, from 2018. The below chart¹³ tells about the biggest challenges and inhibitors for building digital operations capabilities in an international comparison.

- Most surveyed professional think that the biggest challenge is the lack of standards, norms and certifications, followed by the lack of appropriate leadership, vision and support from the top management.
- More than the third of the quested managers believe that the unclear economic benefit of the digital investments, followed by the strong investment intensity of these projects, creates an obstacle.
- Every 4th survey participants think that the lack of talent is an important problem and that data security issues create difficulty.



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MANAGEMENT NEEDS IN THE NEW ERA

- What manager and employee skills, competences and knowledge has been identified as “missing assets” (e.g. by HR experts, research centers, Government, Chambers of Commerce, NGOs, business development and training organisations) relating Industry 4.0 (preparation, introduction, transition, management)?
- What are the key management challenges in the new era/transition period (e.g. technology; people management; innovation; psychology/behavior; inter-generational cooperation; learning and adaptation, resistance to change, etc.)?
- What are the most important manager competences in changing environment & Industry 4.0?

Challenges

Industry 4.0 is impacting the world of work, it extends to all business units that are involved the development, production, transportation and sales products. The work environment of the employees of new era is defined by the presence of artificial intelligence (AI); additive manufacturing; simulation; systems integration; internet of things (IoT); big data and analytics; machine to machine processes (M2M), human-machine interaction, cloud computing; IT security, augmented (AR) and virtual reality (VR). The list of the above factors will longer, for sure, within short time. We will have advanced robotics and autonomous transport, artificial intelligence, advanced materials, biotechnology and genomics.

In the new era the overall goal is for the humans and digital technology/robots to best complement eachothers' skills and assets. The workforce is being replaced by machines, but there is a great need for human skills, ideas, creativity, intuition and organization. Automatisation does not replace human work, but robots appear as team assistant, colleagues. ***Leaders have to manage mixed (human+cyber) teams in the future.***

In order to harness the transformative potential of the Fourth Industrial Revolution, business leaders across all industries and regions will increasingly be called upon to formulate a comprehensive workforce strategy ready to meet the challenges of this new era of accelerating change and innovation. In this situation, the role of the classical management and employees will both change. ***The most important question for leaders is how to re-invent themselves.***

The World Economic Forum identified 4 main skill based challenges:

1. The skills upgrade that the workers have to go through.
2. New jobs will be created while at the same time some existing ones will become obsolete.
3. Constant technological advance requires constant and up to date education.
4. Due to the rapid changes, many labor force members will have a difficulty of changing their mindset towards these advances, something with which consequently their companies will have to deal.

According to the figures below, "there are *number of factors very critical for Industry 4.0* including lack of skilled workforce, aging society, resource efficient and clean urban production, mass customization, increasing product variability, shorter product life cycle, dynamic value chain, volatile markets and cost reduction

pressure. All these factors need specialized management to cope up with challenges. Even the world's big economies are facing these challenges.”

(Figure on the left: S. Shamim et al, 2016. Figure on the right: Holistic approach for Human Resource management in Industry 4.0” by F. Hecklau, et al.)

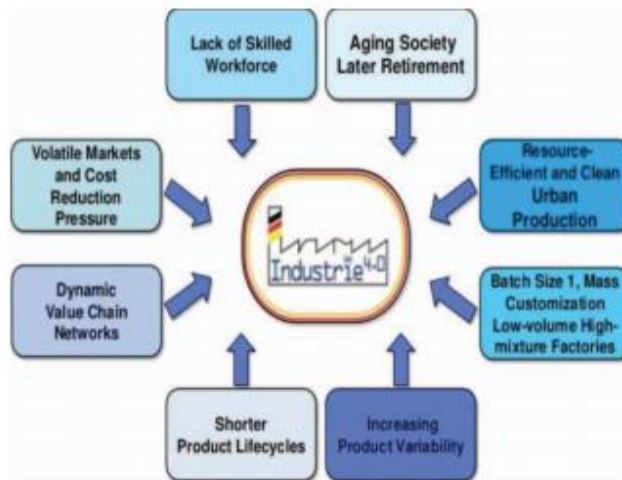


Figure 1, Socio economic triggers of industry 4.0

Source: <http://www.slideshare.net/SPRICO/MUNICA/basque-industry-40-the-fourth-industrial-revolution-based-on-smart-factories>

We need to look up the characteristics of Change and Transformation which have a direct impact on the value drivers of Industry 4.0 Change and Transformation.

- **Social challenges:** One of the most influencing social challenges is the demographic change. Less young people are entering the labor market to replace those retiring. Thus, strategies need to be developed to attract young people, whilst retaining the knowledge from older employees. Moreover, younger generations express contrary social values, such as the growing importance of a good work-life balance. That goes in hand with the growing employee flexibility due to changes in work organizations. However, boundaries need to be set up to restrict the continuous availability of employees, so that their work life does not interfere with their private life. Increasing virtual work and flexible work topics also require new forms of lifelong learning. Additionally, processes are becoming more complex, which leads to an increase of jobs with higher qualifications and a loss in jobs requiring lower qualifications. Therefore, companies need to

Economic challenges	<i>Ongoing globalization</i> Intercultural skills, language skills, time flexibility, networking skills, process understanding
	<i>Increasing need for innovation</i> Entrepreneurial thinking, creativity, problem solving, work under pressure, state-of-the-art knowledge, technical skills, research skills, process understanding
	<i>Demand for higher service-orientation</i> Conflict solving, communication skills, ability to be compromising, networking skills
	<i>Growing need for cooperative and collaborative work</i> Ability to be compromising and cooperative, ability to work in a team, communication skills, networking skills
Social challenges	<i>Demographic change and changing social values</i> Ability to transfer knowledge, accepting work-task rotation and work related change (ambiguity tolerance), time and place flexibility, leadership skills
	<i>Increasing virtual work</i> Time and place flexibility, technology skills, media skills, understanding IT security
	<i>Growing complexity of processes</i> Technical skills, process understanding, motivation to learn, ambiguity tolerance, decision making, problem solving, analytical skills
Technical challenges	<i>Exponential growth of technology and data usage</i> Technical skills, analytical skills, efficiency in working with data, coding skills, understanding IT security, compliance
	<i>Growing collaborative work on platforms</i> Ability to work in teams, virtual communication skills, media skills, understanding of IT security, ability to be cooperative
Environm. challenges	<i>Climate change & resource scarcity</i> Sustainable mindset, motivation to protect the environment, creativity to develop new sustainable solutions
Political and legal challenges	<i>Standardization</i> Technical skills, coding skills, process understanding
	<i>Data security & personal privacy</i> Understanding of IT security, compliance

qualify their employees for more strategic, coordinating and creative tasks with higher responsibilities.

- **Technical challenges:** As a result of an exponential growth of technologies companies must be able to efficiently deal with a huge amount of data (big data). Thus, extensive IT infrastructures, like communications networks and internet protocols, need to be built and implemented. To ensure the unproblematic exchange of data between partners within a network, it is further necessary to develop standardized interfaces and open architectures, which enables collaborative work together on different platforms. The storage of large amounts of data on external servers raises the additional problem of cyber security, as data must be protected from unauthorized access. Employees must further acquire the skills to be prepared for the increase in virtual work, e.g. with virtual glasses.
- **Environmental challenges:** One main challenge concerning the environment is the ongoing climate change. Conditions in biospheres continuously change, which has an impact on all living organisms within the system. In addition, the efficient utilization of natural resources becomes more critical, considering most of them are scarce. As a result, companies recognize their role in driving sustainable solutions.
- **Political and legal challenges:** The most evident political challenge is the increasing need for funding of research programs. Governments need to support organizations with the development of new technologies as well as the integration of those technologies in the existing environment. Moreover, governments need to establish legal parameters for the usage of big data. The most important concern is the protection of privacy, because data will be collected on everything while interacting with smart objects. Growing work flexibility further requires the establishment of regulations for work times and safety to protect employees.”

In the course of a Slovenian survey they analyzed the expectations of companies in the field of Industry 4.0. The most frequently received responses were: optimization of business processes, operations, increase of efficiency, productivity, transparency and competitiveness. Faster operations, rationalization / optimization / process automation; Improving / increasing efficiency / productivity / transparency / competitiveness; Paperless business; Process control / monitoring; Controlled elimination of losses / failures / errors; Additional business opportunities / business growth.



Missing assets

However we already know a lot about the upcoming challenges, one of the most important missing assets is the overarching understanding of the present situation. A Bulgarian empiric research focused on SMEs detected an important problem and it's more than sure, that Bulgaria is not the only country facing it. **The majority of the respondents claim that the main obstacle in front of the transition to Industry 4.0 is the lack of understanding or vision in the general management.**

When thinking about missing assets, we should keep in mind that the i4.0 work tasks probably won't consist of repetitive functions, on the contrary, will require contextual and creative solutions. It is expected that the work processes and activities will become more complex, efficient and creative. Based on our desk research we identified some of the missing assets / week points relating to the new leadership challenges:

- Communication: leaders have to manage multiple changes at the same time
- Fast process, appearance the new machines and tools: keeping pace with the rapid and continuous evolution of the technology is very hard for the manager and workers as well.
- Accelerated decision making: faster decision making is required, supported by artificial intelligence (based on mass data analysis), at the same time the decision-making authority is switching.
- Diverse, new types of work-teams: a cut of fulltime workforce is foreseen, as well as more use of flexible and remote work arrangements and independent contractors. This requires efficient communication and new coordination style.
- Overcoming generation gap: young people enter the labour market earlier than the previous generations' retirement age is reached. (The retirement age keeps on being extended.)
- How to build social capital: one of the best countermeasures to overcome the problem of lack of people is to mobilize relational capital.

- Atypical employment: remote/distance working has become part of the daily life. Technologies to facilitate remote teamwork has been developed and it's crucial to be able to use them well.
- Employee commitment: the emotional attachment of workers to their company is weakening, while they are more confident in their job prospects year after year: today nearly two-thirds of workers are not worried about losing their job and feel confident about their chances in the labour market. The cost of the hiring a new employee means spending millions.
- Lack of strategy or a must do attitude, resistance to change and pace of change.
- Employer branding: companies must proactively communicate with their existing and prospective employees through the right tools.
- Management function is shifting: their responsibilities are less and less planning and rather acting as educators and supporters. To plan and manage the re-skilling and up-skilling of employees is crucial.
- Accelerated adaptation processes – require efficient communication, reduction of employees' resistance by means of motivation and influencing, quick decisions, transparency, cooperation, understanding of global systematic and technical questions, extended cooperation (international, interdisciplinary, inter-departmental).
- Up-skilling: Companies will have to up-skill their workforce via in-house or external training centers. For example, an assembly line worker involved in manually fitting a part will be required to operate a robot or other tools to do so. He / she should develop the skills to be able to operate the new tools efficiently.
- Re-skilling: Industry 4.0 is expected to result in job displacement to a certain extent. A number of jobs will cease to exist. And a number of new jobs will be created. Companies will have to make the investment in re-skilling of the labor force to prepare for this expected shift.
- Continuous Learning: Technologies will become obsolete at a faster rate. Continuous professional development strategies will be required to easily adapt to the changes that technological advancement brings.
- Mindset change: Given that the labor force will have to adapt to a number of changes, they will resist and oppose implementation of newer technologies. This will require companies to plan for mindset change of its employees to facilitate smooth transition to advanced manufacturing processes.
- Mentoring: to increase personal and workplace efficiency/ organizational culture.
- SMEs internal digital and training culture: should adapt, change, develop.
- Seize opportunities and introduce new business models: companies should be prepared for it.

A Slovenian survey focused on identifying problems regarding the implementation of Industry 4.0. Respondents cited lack of

- know-how, competences and skills of staff;
- financial contribution, investments, resources associated with the implementation;
- change in understanding or the need for a different mindset.

Key competences

We can conclude that managing fast changes, owing information and leading diverse teams (age, cyber-human, cross-departments and cross-countries) in virtual space requires other competencies and techniques, whether it is the leadership or the cooperation with the groups.



Skills and competencies can be categorized in many ways. A qualitative field analysis of recommended management competencies for i4.0 identified three main classification categories.

- 1.) Technical Competencies : “all job-related knowledge and skills for example media skills, coding skills, knowledge management, and statistical command. Technical skills are abilities an individual acquires through practice and learning”.
- 2.) Managerial Competencies : “all skills and abilities for problem solving and decision making, such as analytical and research skills, conflict and problem solving, creativity. Ability to make business decisions and lead subordinates within a company, negotiations tactics and response behaviour”.
- 3.) Social Competencies : “individual’s social values and motivations, ability to transfer knowledge, leadership skills, ability to work in a team, building relations with the expectations for future interaction, realistic perceptions about one’s own behaviour”.

Personal competencies include motivation to learn, ability to work under pressure (PANOS FITSILIS1, 2018). Necessary skills required by the managers are Creativity, Entrepreneurial thinking, Problem solving, Analytical skills, Efficiency orientation, Decision making, conflict solving, Research skills.

HR directors and the leading recruitment strategy developers were interviewed about the key competences. They highlighted the top 10 recruitment goals and key competences to search or cherish:

- Troubleshooting complex problems
- Critical thinking
- Creativity: taking advantage of the advanced technology, flexible working terms as well as the rapidly appearing, diverse range of new products.
- People management
- Coordinate with others
- Emotional intelligence
- Decision making and discernment
- Service orientation
- Negotiation
- Cognitive flexibility

According to another ranking the **key management skills** will be:

- complex problem solving;
- critical thinking;
- creativity;
- people management;
- coordinating with others;
- emotional intelligence;
- judgement and decision-making;
- service orientation;
- negotiation;
- cognitive flexibility;
- lean management;



Since the business and technological environment is fast changing, the agile management should be ready to sense and realize when their investments, experience and knowledge become “old”, and invest in acquiring new resources. It is a risk that in order “to save the current knowledge, and investment, organization may ignore the new methods of working, or new technology, which can lead to a bigger disaster.”

According to the studies and the forecasts the i4.0 professionals will be individuals with:

- multidisciplinary and flexible training,
- mastery of new tools,
- knowledge of various languages
- advanced emotional skills
- ability to adapt easily to a new business culture
- ability to deal with diverse work tasks
- ability to approach tasks and new problems in an innovative way, seeing the bigger picture
- resilience and stress management
- facing challenges as something natural, part of the daily routine, interesting, learning possibility
- good socially skills to perform collaborative work.

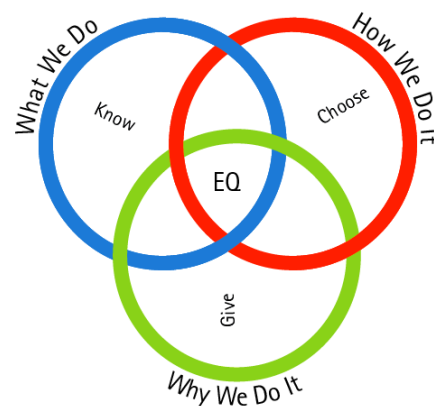
The most important **employee skills** in i4.0 will be:

- team working;
- share the space and work with robots;
- collaboration;
- monitoring;
- error detection;
- decision making;
- preventing maintenance
- empathy
- positivity
- conformation
- inspiration

According to The World Economic report, by 2020 there will be a greater bidding war for employees with social abilities including persuasion and emotional intelligence compared to more limited technical skills like programming or equipment operation and control.

In his books, 'Emotional Intelligence: Why It Can Matter More than IQ and Working With Emotional Intelligence', Daniel Goleman presents five categories of emotional intelligence.

1. Self-awareness: If a person has a healthy sense of self-awareness, he understands his own strengths and weaknesses, as well as how his actions affect others. A person who is self-aware is usually better able to handle and learn from constructive criticism than one who is not.
2. Self-regulation: A person with a high EQ can maturely reveal her emotions and exercise restraint when needed. Instead of squelching her feelings, she expresses them with restraint and control.
3. Motivation: Emotionally intelligent people are self-motivated. They're not motivated simply by money or a title. They are usually resilient and optimistic when they encounter disappointment and driven by an inner ambition.
4. Empathy: A person who has empathy has compassion and an understanding of human nature that allows him to connect with other people on an emotional level. The ability to empathize allows a person to provide great service and respond genuinely to others' concerns.
5. People skills: People who are emotionally intelligent are able to build rapport and trust quickly with others on their teams. They avoid power struggles and backstabbing. They usually enjoy other people and have the respect of others around them.



The Deloitte Global Millennial Survey 2019 has found that millennials (defined by the researchers as those born between January 1983 and December 1994) and gen Z-ers (born January 1995 to December 1999) are mistrustful of businesses that prioritise their own agendas over their impact on society.

14.0 demands a new type of leader to engage passion, principles and capabilities. Efficient leadership requires **mastering and blending both left- and right-brain thinking**. This approach blends what's traditionally been considered “left-brain” (scientific) skills that draw on data analysis and critical reasoning

with “right-brain” (creative) skills that draw on areas like intuition and empathy. Bringing the two together intentionally to drive deeper levels of problem-solving and value creation is critical.

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BEST PRACTICES

- What are the best practices relating management in the era of i4.0 (e.g. change management; inter-generational diversity management; innovational management; motivational management)?

We start the presentation of our desk research results regarding best practices with the assumptions and recommendations resulting from international studies. Following this generic part we present the experiences of a concrete field study carried out by our Hungarian partners.

- A qualitative field analysis of management competencies for i4.0 in the car and the pharmaceutical industries - both industries are self motivated and characterized by product / process innovation - highlighted the importance of continuous development of skills and competencies. From the results of the qualitative questionnaire further managerial skills and competencies emerged. (We list them in among the competences below).
- A research group conducted a meta-analysis regarding the best management approaches for industry 4.0., back in 2016. They found that the success in industry 4.0 largely depends on the enterprise's innovation capability.
- In this sense, the better is the more innovation-supportive leadership style. "Leadership is the skill to influence over others, inspire, motivate and direct the activities to achieve the organizational goals." According to most of the case studies success it is not due to the technical skills of a CEO but due to his/her leadership skills.
 - There are numerous different leadership styles, among these the *transformational leadership style* is considered to be the best starting point for i4.0 since it promotes innovation and learning in the organization. „The transformational leaders works with teams to identify needed change, creating a vision to guide the change through inspiration, and executing the change together with committed members of a group; they enhance motivation, morale,



and job performance of followers through a variety of mechanisms; these include connecting the follower's sense of identity and self to a project and to the collective identity of the organization; being a role model for followers in order to inspire them and to raise their interest in the project; challenging followers to take greater ownership for their work, and understanding the strengths and weaknesses of followers, which allows the leader to align followers with tasks that enhance their performance. It is also important to understand the qualities a transformational leadership can bring to a work organization. Transformational leaders are strong in the abilities to adapt to different situations, share collective consciousness, self-manage, and be inspirational while leading a group of employees.” However, it was found that it could be further developed in terms of influencing, inspirational motivation, intellectual stimulation, and providing vision.

- Under the following bulletpoints we sum up the key features of transformational leadership:
 - balancing the tension between efficiency and reliability;
 - creating and sustaining trust;
 - actively managing the process of change;
 - involving workers in work design and work flow decision making;
 - creating a learning organization;
 - transformational leaders practice taking personal accountability;
 - transformational leaders connect with their strengths, purpose and values;
 - transformational leaders are willing to experiment with new behaviors and take action;
 - transformational leaders bring a mindset of curiosity rather than judgment;
 - transformational leaders look for the opportunity in change.
- It could be more suitable for i4.0 combining the *transformational and transactional* (Transactional leadership is a style of leadership in which leaders promote compliance by followers through both rewards and “punishments”. Through rewards – bonuses, rewards, recognition, etc.- and punishments system, transactional leaders are able to keep followers motivated for the short-term) leadership. E.g. testing and then adding innovative role modelling, stimulating knowledge diffusion, supportive behaviour, delegation, consulting, and mentoring, thus strengthening knowledge oriented leadership.
- Professors from the University of Economic in Ljubljana stressed out **5 approaches enhancing employee's motivation:**
 1. **Teamwork** - Globally successful companies like Toyota or McDonalds reward successful teams. These are examples of team-oriented organizations that have, over the years, gained

leadership in the market of activities in their field. In European and Western organizations, they are introducing team approaches in almost all sectors, and many organizations are also drawing on their competitive advantages. It is social learning as employees develop their skills through observation and interaction with other members. The members must be satisfied with the team work and see the opportunity for their personal development in order for the team to work effectively. This will allow individuals to see teamwork as a positive experience and be prepared to do so in the future, flexibility, trust between members and information flow. Members adopt a leadership style, and the leader ensures that teamwork is dynamic and collaborative.

2. **Empowerment** - There are two types of empowerment in the literature, the first being organizational or structural empowerment, and the second is psychological empowerment. The first refers to the various mechanisms within an organization that transfer powers from higher to lower levels of employees. Another type of empowerment relates to the motivation to perform tasks, which increases with psychological empowerment and to the improvement of the employee's perspective on self-efficacy. Employees are the most important resource for the organization, so they need to be constantly motivated to follow the goals of the organization. Global business practices and technological advancements require changes and adjustments in management, and empowering employees has proven to be an extremely important factor. We give employees the ability to make decisions, thereby encouraging them to use all their knowledge and ability to do certain work in their own way and have the authority to respond to certain changes in the market.
3. **Goal Setting** - Goal setting in companies is one of the important techniques for motivating employees. The goals set must be high, well-defined and achievable for the employee. If the employee does not know how to achieve the goal, then goal setting does not matter roles in motivation. In order for an employee to achieve the goal, he must also know exactly how he will succeed. In addition, employees must also be prepared to put their efforts into the work, and they will only be prepared to do so when they believe that they have sufficient skills and resources to achieve their goals. The goals should be set appropriately according to the job and the employee. The goals we set for the person give impetus to the work, if they are in accordance with the interests and values of the person, as well as if it is a job that he enjoys and is interested in, which is an autonomous motivation.
4. **Gamification** - Gamification systems are useful in various fields. They are used in business, marketing, education, healthcare, data collection and elsewhere. They are a means of influencing behavior and thus performing activities. Playing games can make daily routine

work more popular. This is a new design that has been created for digitally literate generations. It is about using computer mechanisms in a non-gaming environment, or using a computer mindset. Modern organizations use gameplay to motivate them in various fields, such as in business, sports and education. An example of such technology is found in simulators for pilots, firefighters and other occupations, where individuals can gain some knowledge and train their skills by using technology that virtually imitates realworld situations.

5. **Leadership** - The leadership style used in an organization has a major impact on employee satisfaction and motivation and, consequently, on work performance. Authentic leadership is a modern approach where the leader acts in accordance with his or her beliefs and values, has a strong character, is fair and confident, cares for good relationships in the organization and influences the employees with his optimism, while being aware of his / her abilities and weaknesses. In ethical management, in addition to behaving morally ethically, the leader must also promote moral behavior in employees. The decisions made in the organization are based on ethical standards; the leader presents the employee with a role model to perform work in accordance with morally ethical rules. The educational leader seeks to motivate employees to put common interests before the individual interests of the individual. Their motivation is influenced by their charisma, positive attitude and ability to inspire their employees. It fosters intellectuality through the achievement of creativity and overcoming challenges and personal growth of employees.
- Focused on bring out the best from employees and maximise the productivity, experts suggest the following **motivational hints and tips to managers**:
 - Learn and acknowledge your employees' personal career objectives;
 - Retain high-quality employees through sound management practice;
 - Affirm job security through managerial support in every aspect of the employee's job;
 - Create an atmosphere and culture where people want to work;
 - Show employees respect through consistency and empowerment;
 - Redefine job requirements to provide interesting and challenging work for successful employees;
 - Provide mentorship opportunities;
 - Create a dialogue of feedback with each employee to encourage, challenge, and inform each other;
 - Recognise significant performances, or achievements, publicly;
 - Provide additional training and educational opportunities for upwardly mobile individuals.

- There are several initiatives and campaigns in Greece focused at accelerating the digital transformation of the industry, such as the “innovation marathon” named Industry 4.0 Now Hackathon where companies are invited to submit their ideas for accelerating a digital transformation of the industry. The top 3 participants received fiscal prizes. The TAP OPEN 2.0 Bootcamp aims to develop innovative applications in the culture sector, using Disruptive Technologies, while the Go 4.0 Green Cropwdhackathon is targeted at innovative green practices. Such initiatives could be realized at micro level as well, within an organization. It would be quite motivating and efficient.
- Beside’s motivational strategies, an organization’s workforce, skill resource as well as worker’s attitude depends largely on its HR strategy. Training, staffing, performance appraisal, compensation and job design has to be designed to facilitate innovation and learning. This should be the flagship of i4.0 training policy. The meta-analysis recommends the following training approaches:
 - enable employees for multitasking;
 - increase the variety of skills, some of these might not be straightly connected to the role;
 - ongoing trainings, continuous development;
 - enhance team building and team work skills;
 - mentoring should be a routine activity of managers;
 - enhance problem solving skills

The compensation system in industry 4.0 should:

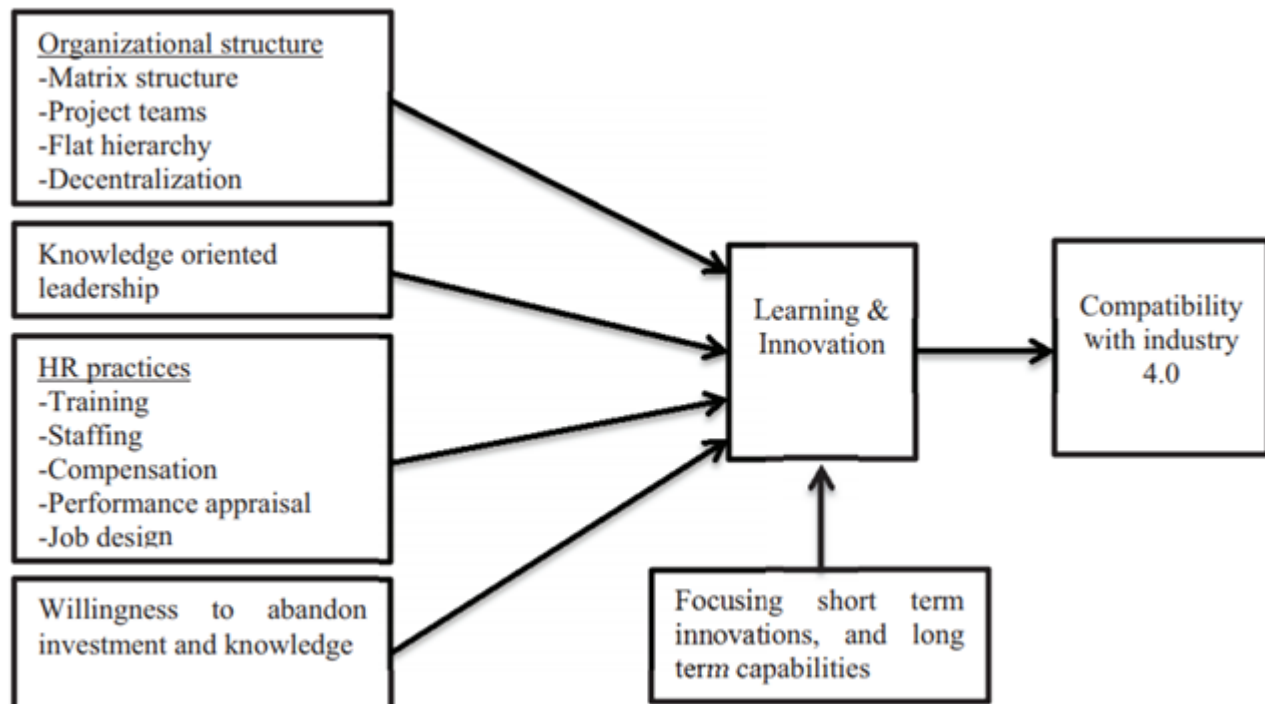
- reflect the contribution of employees to the company, based on individual, group, and organizational performance, i.e. profit sharing, and additional incentive pay.
- be focused on employee development, results, and behavior to facilitate learning and innovation
- provide regular feedback on employee’s performance.
- work with objectives and quantitative evaluation matrixes, well established performance standards, clear communication of the expectations, transparent measurement of the actual performance and comparing it with the standards, discussing the appraisal with the employee, and initiating the corrective action where necessary.
- Management by objectives (MBO) is one of the most popular approaches, it refers to “a performance appraisal method that includes mutual objective setting and evaluation based on the attainment of the specific objectives. Managers and employees set the goals and the ways to achieve the goals by mutual discussion and consensus. Time line is also defined for each goal, and there is ongoing feedback in the MBO program.”

Job design should also promote the climate of innovation and learning by appyling.

- job rotation,

- flexible assignments in multiple areas,
 - extensive transfer of tasks and responsibilities to the employees.
 - facilitation of teamwork and collaboration,
 - job requiring skills variety.
- When acquiring new talents, a variety of skills and heterogeneous knowledge is desirable and should be tested in the screening process. This can make the selection process more complex. Hiring should prioritize:
 - Innovativeness. “To hire innovative employees recruiters should focus on identifying the attributes necessary for innovative behavior such as openness to experience through psychometric testing, active imagination, inner feeling attentiveness, variety preferences, intellectual curiosity, creativity, and flexible thinking.”
 - Goal orientation, e.g. learning and performance orientation. High learning orientation is a plus since “employees with learning goal orientation prefer to engage in challenging tasks, are eager to improve themselves, develop a new set of skills, and tend to achieve mastery.”
 - Future potential of the candidate.





Source: Shamim et al, 2016.

Four Hungarian companies helped us in a semi-structured interview about best practices. We present the most **important conclusions of the field research** below.

Company designation	Company ownership background	Industry	Schedule of interview subject	Region	Headcount
V1	Hungarian	electronics	group leader	Central Transdanubia	75 people
V2	American	car	manager	Central Transdanubia	1500 people
V3	German	car	manager	South Plains	900 people
V4	German	car	group leader	North Mo.	5000<people

The results are not generalizable, but it gives a good feedback, based on **real life**, on **what Industry 4.0 means to companies**. The companies listed in the table include a majorly Hungarian-owned holding company operating in the electronics industry, two large multinational companies in the automotive industry and an automotive multi-system integrator. **There are many ways companies can relate to Industry 4.0.**

- Some do just the necessary improvements, they don't "run ahead", they don't pilot, they take advantage of the technology what is easy to access.
- Two interviewees work for pilot factories within the company group; they do brainstorming, they are working on transforming, developing solutions; what works in the pilot factory is being taken to the other factories afterwards. These are local, independent initiatives and a lot depends on the dynamic leaders.
- There was also a factory that had long been known for its innovation activities - not only within its group of companies, which had been moving towards digitalization before the German High-Tech Strategy came out - but globally. It's a German company, they consider as their mission to lead.

Thus, **three different attitudes** were observed among the surveyed companies. 1.) Progress can be served with cheap and current solutions. 2.) Very strong internal motivation, which helps the subsidiary to achieve outstanding results even in a multinational group. 3.) The company could be socialized in an innovative environment, where a high degree of innovation is present, in which all members of the group participate, and the results are applied together worldwide.

What **stages a company goes through when it comes to preparing for and integrating into Industry 4.0** was a key issue in all four cases.

1. The first step is to collect data.
2. The second is the conversion of the collected data into decision supporting information. It should be noted here, that there are very few specialists in the field of data analysis, interpretation and the ability to use the results obtained from data, and there is a great shortage of specialists in this field.
3. They also need a very well-trained workforce to carry out the necessary reprogramming of software, hardware, write new software or algorithms, and thus develop systems further.
4. In addition, professionals need decision algorithms and decision makers who can incorporate this information into their decisions and achieve their purpose of real-time data access and analysis

For this reason, **brain drain** has become a very crucial issue.

Everyone agreed that the **interaction between human resources and digital development** became a key aspect of corporate life. There are two very important reasons for this. In on hand, most employees are afraid

of digital solutions because robots are taking their jobs. On the other hand the workforce is being liberated by the proliferation of automation (robotization) which opens other opportunities at the enterprise (in a lucky case). Most of the interviewees reported that they had tried to familiarize their employees with the new technologies and their necessities. Where this was successful, they adopted the new tools and technologies, but it did not work. They encountered resistance: employees did not follow the instructions and they did not deter from the destruction of the technical tools, in which case, their restoration was costly. As a result, executives at this company have switched to an autocratic leadership style that has made it clear that anyone who is unwilling to work with new tools can look for another job. At the same time, despite the changed leadership method and the resilience, there has been no mass exodus, even though it is an area rich in industrial facilities.

Analysing the interviews, it was found that in the case of companies with American and German ownership, the process of **switching from employee to employee (?)** resulted in acceptance and cooperation, while in Hungarian-owned companies the opposite was the case. This is clearly related to **corporate culture, leading methods and tools**. It is important to clarify and inform employees that as technology advances and they learn how to apply it, will have a direct impact on their performance, which can make a positive impact on the amount of pay they receive. Good performance is thus recognized and will motivate people to increase their performance. It promotes a **fairer system of recognition**.

The **quality of public education** is also very important for companies (higher education, but also with primary and secondary education). In case of Hungary to companies were generally satisfied with the level, but they missed people with stronger mathematical-statistical skills, problem-recognition and problem-solving skills, independence and the ability to sell ideas. Confidence in the use of different systems in the digital world, continuous learning and further training, and the internal need for it are also essential. Experience has shown that the lack of digital culture and training is the biggest challenge for companies.

Finding and retaining well-qualified employees is therefore a major challenge in the human resources field. It is also very important that these disciplines are developing dynamically, so that they will also have to keep up the training levels. According to one of the company's team leaders, Industry 4.0 will change the **organization structure** as well. Since many things will be automatic, mechanized, robotic, the trained workers will only serve these machines at most. The machine managers stand above them; they program them and keep the machines well functioning on a daily basis. The next level is for professionals who are experts in a particular process to analyse data, look for patterns, write algorithms and possibly software for optimization. On top, there will be a narrow layer of executives who will coordinate and manage processes, and this layer is expected to be less extensive than today.

Investigating the relationship between human resource and digitization is another important source of information to **collect data** from; not only about performance, which we then display in performance pay, but also about the specifics of working. This also raises serious **privacy issues**. In one of the factories of the field study, a pilot project was planned, which included equipping workers with a smart watch, or a clothes sensor, which always told when and where they were, and what task they were doing. This method will cause legal doubts regarding the protection of personal data. According to the system of another company, a worker who logs in to a machine to work, immediately sees whether he has the right to perform the given production activity, whether he is qualified or not. If not, the system directs him/her to an e-learning interface to quickly complete the training, e.g. about operating a particular machine. Both methods are designed to increase the productivity and efficiency of the human workforce, just as we intend to increase our machines using the achievements of Industry 4.0.

Determining the desired and necessary level of development of companies is very important for the success of Industry 4.0. It is quite certain that many of the solutions and technologies needed for the transition will not spread in a lightning strike. Companies have to go through many stages while embracing all the achievements of the Fourth Industrial Revolution. It is not necessary for everyone to achieve everything, the opportunities offered by digitalisation and integration offer several degrees and depend on what can and cannot be achieved in a given industry.

There is a strong advantage for companies belonging to multinational enterprise groups, which receive financial and motivational (inspiration, encouragement) support from their parent company. It is often an express requirement of a foreign owner to **start a pilot project related to this topic**. In two cases of international enterprise groups, the management methods applied by the Hungarian leader made the factory successful in this regard. Each of the factories under review has an Industry 4.0 workgroup that seeks opportunities and selects projects to start from. Projects are characterized by slow progress, projects that are island-like, and difficult to link across the organization. The first step was to equip the production lines with the tools needed to collect data, but no examples of smart products were mentioned. Since the pilot projects are island-like, most of the developments based on them are in the process of being integrated horizontally. Two companies already have examples of vertical integration, pilot projects with suppliers or with customers, but this is not routine.

Every company is working hard in **expanding the IT team**, software development, data analysis software, and developing applications. The basic IT system is advanced at each company, which is supplemented by a number of proprietary systems within the group.

Several interviewees have pointed out that digitalisation will be successful if **both suppliers and customers are members of the digital ecosystem**, which can only be achieved through **standard platforms and interfaces**, which is not yet the case. Data collection and management, and in particular security and risks, are priority topics for all companies. Many people still rely on their own server fleet or enterprise group cloud, but some use a global cloud provider. As this issue is also sensitive to the partners, there is also a joint discussion to reassure them. Organizational culture is changing. Most use the method of involvement, sometimes where manual workers themselves are involved in brainstorming and exploring the possibilities of digitization. The international background has a positive influence here too, the ideas from foreign subsidiaries and the idea competitions inspire the employees of the domestic factory as well.

All in all, the interviews helped to illustrate technology solutions that are often theoretically difficult to grasp. Based on the experience of the interviews, further research questions arise:

- How can the currently quite production-oriented developments and the data that it generates be channelled into the entire enterprise information system so that their analysis can support decision-making processes in other enterprise areas?
- What will encourage companies to collaborate with their partners to extend data collection and sharing across company boundaries?
- How can companies create data security, how to think about, develop and apply solutions?

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- Polona Zavrtanik, mag. Živa Juriševič, prof. dr. Sandra Pengler, V VISOKO TEHNOLOŠKIH PODJETJIH IN POMEN TEHNIKE AKTIVNEGA POSLUŠANJA. Reač on 31/10/202 at <https://www.hrm-revija.si/sodobni-pristopi-motiviranja-v-visoko-tehnoloskih-podjetjih-in-pomen-> Page 10 tehnike-aktivnega-poslusanja
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- <https://www.ikee.lib.auth.gr>

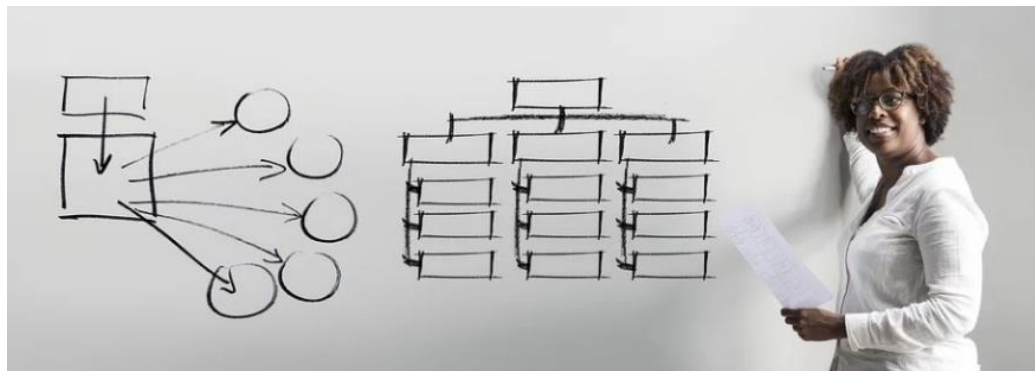
BUSINESS AND ORGANISATIONAL CULTURE

- Which leadership style prevail in your country? How does it affect the transition to Industry 4.0 (e.g. decision-making process, openness to change, risk taking, HR policy - upskilling instead of replacing-, etc.)?
- What are the most popular corporate & leadership training modalities/scenarios (timing and intensity)/methodologies?

Organizational structure and culture plays key role in the development of a climate which is suitable for learning and innovation. "Industry 4.0 is characterized by an unstable changing environment, and is compatible with the organic design of organization which is characterized by decentralization, empowerment, few rules and formalities, horizontal communication, and collaborative team work"- However there is no one best suitable organizational structure for all types of businesses and business situations, given the above general circumstances the study recommends a few options for industry 4.0 environment:

- *Matrix structure*: in such structure people and resources are grouped by function and product simultaneously, using a dual reporting system, this way the activities are aligned among more than one authority lines. Each employee has to work with two bosses, one product manager, and other functional manager. It's very flexible, thus it can promptly respond to the need of change.
- *Project teams*: "A team-based structure puts different processes and functions in single group to peruse a common objective It breaks down the functional and departmental obstacles, speeds up the decision making process, enhances generalist skills, and supports the learning in the organization To improve the innovations, new knowledge and new routines are required. Project teams, especially in a learning environment, can be a facilitator of knowledge sourcing, and reuse. However, knowledge source and reuse for innovation in project teams is dependent on group member's goal orientation. So project managers should motivate the group members to learn by tolerating the mistakes, or by adopting a capability oriented supervision." (Shamim et al, 2016)

- *Flat hierarchy*: “In a flat structure there are fewer managerial/staff levels in hierarchy but number of employees reporting to one manager is usually higher than a tall structure, where number of levels are high. It facilitates quicker communication, and reduces the distance between employees and the top management, increases the chances of employee participation in discussions and decision making. It also increases the chances of employee learning and also quick and noise free feedback to top management.” (Shamim et al, 2016)
- *Decentralization*: In such systems, the authority and knowledge of activities lies with the employees instead of supervisors or top management. “Lower managers and non-managerial staff have the authority to take their decisions, for example how to use organizational resources. It allows the employee to take the timely decision, to change the direction, with the change in the business environment. This kind of system facilitates quick decision and learning.”



We tried to understand what is the “traditional” organisation cultural approach in the partner countries. However we didn’t find in depth up to date information in case of all the countries, we gained a glimpse on the cultural environments where our training material will have to work. It will be important to consider the cross-cultural factor as well at the development of the Transit kit, e.g. when planning the training’s communication strategy.

Trompenaars elaborated a well-known model about **national culture’s effects on organizational cultures**. He identified two key dimensions: 1.) Egalitarian vs. hierarchical structure. 2.) Person vs. task oriented approach. Based on this he defines 4 types of organizational culture, which key features are highlighted on the below chart.



Source: Trompenaars/Hamden-Turner

2013, Raj Mehta - rajk.com

Based on Trompenaars' model of intercultural differences (Trompenaars, 1955) Portuguese companies traditionally belong to the “Family” organization culture (people-oriented + centralized/hierarchical), which is more focused on relations, hierarchy. Though it is changing and there are a lot of companies with new different organisational culture (startups, multinationals, SMEs as well), Portuguese business culture still gives quite an importance to building relationships. Over centuries, the family has remained the foundation of the country's social order. Family members help and support each other, to a degree that loyalty towards the family actually comes before loyalty towards business. Many enterprises and organisations have hierarchical structure, where age and seniority are important. From a manager, the staff expects leadership and guidance. Independent decision-making is highly uncommon. Usually every staff member receives a distinct role. Furthermore, direct criticism can fall on deaf ears, even in cases where it might seem justifiable. The Portuguese are very thorough and have an eye for detail, which makes them careful and considerate planners. Long-term as well as short-term influences and developments are taken into account, while establishing long-term relationships with clients, suppliers, partners, etc. is among most business peoples' primary objectives. Compared to some Northern European countries, the tolerance for change and unconventional solutions in Portugal appears more limited.

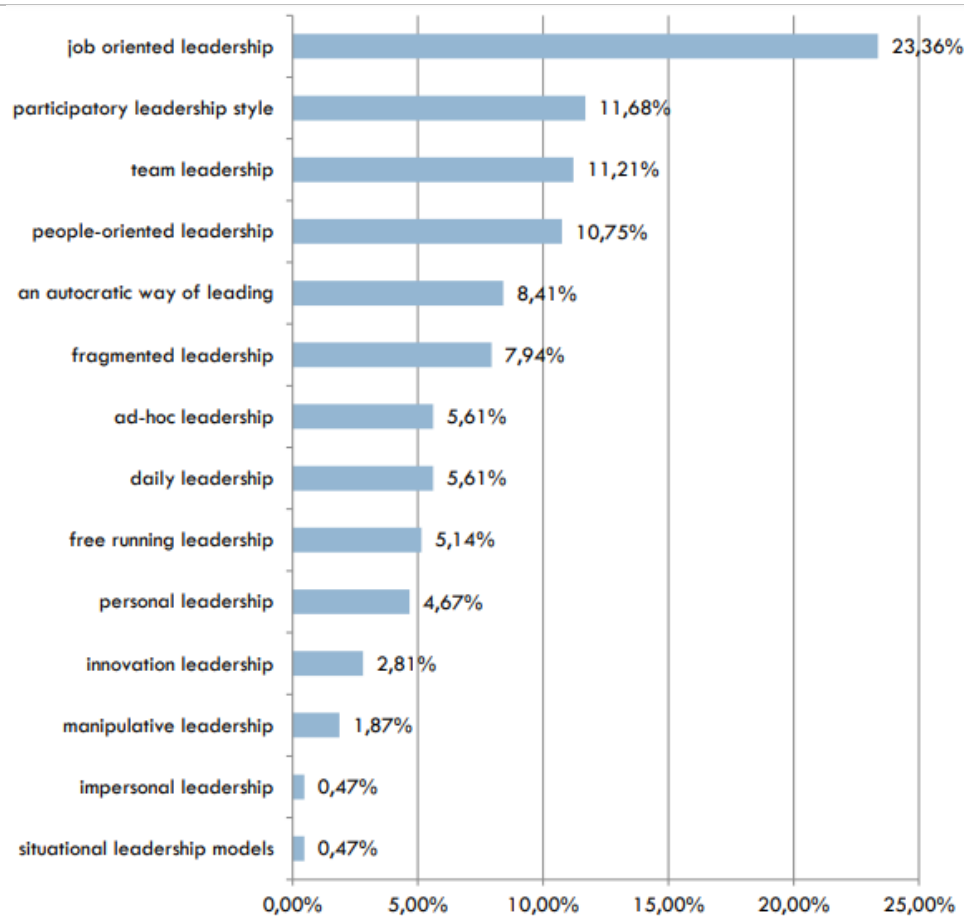
Traditionally, Hungarian companies also fall into the “Family” type of organizational culture.

Greek companies generally follow the “Eiffel Tower” model with clear hierarchy between the various levels of responsibility. At the same time, because of the deeply-rooted value of family within Greek society along with the general lack of ownership-management separation (especially during past decades), Greek managers tend to interact with their subordinates in a paternalistic manner. The workspace is often viewed as

an extension of each employee's family space, which results in the managers developing a more personal connection to their subordinates and even discussing their family matters with them. In general, Greek people tend to be individualistic, mistrust others and having problem cooperating unless they're given a proper explanation. Moreover, there is a direct and active role of the management in the decision making processes where lower level executives are monitored and many interferences from above take place. Finally, greek managers tend to be multitaskers, having a non-linear way of accomplishing tasks, dealing with many of them at the same time and jumping from one to the other. Timetables and deadlines are fluid, arrival on appointments is almost never punctual (due to the nation's polychronic culture) and managing structures are seen more as artificial constructs which rarely have an actual effect on real life challenges.

In terms of organisational culture Ireland most probably belongs to the "Guided Missile" category. As far as leadership style, the Transformational Leadership style is popular, where the leader works with the team to identify the change, guide the team and executing the change. This style of leadership gives a competitive edge to the country for transition towards Industry 4.0 as from the literature and the conclusions, the characteristics in the current Leadership style if imbibed by the project managers will make a huge difference in transitioning to a digitalized and Highly advanced industry.

In case of Slovenia an earlier study from 2007 showed that companies tend to have more than one leadership styles at the same time. The graph shows that work-oriented leadership is predominant (23%), followed by people-oriented leadership (10%) and various situational leadership models, mainly participatory and team-based (12%), and also the autocratic leadership method is used (9 %). Which means that managers in Slovenia still devote too much time and attention to work tasks or production / business issues, and only a small part to managing employees.



We haven't found relevant information about organizational styles in Slovenia and Bulgaria. On the other hand we have found an interesting survey summary about the prevailing forms of competency development for companies' key individuals in the former country. Training and workshops are predominant, followed by external seminars and self-education. Individual coaching and the circulation of key personnel across different sectors, seems less popular based on the survey results. Two-thirds of organizations do not design individual development plans for their key (managerial, professional) personnel (individual development plan contains a career and education plan).

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ANNEX

KEY TRANSIT COMPETENCES AND KNOWLEDGE FIELDS

Under “Management needs in the new era” we presented various lists of i4.0 key competences that we found in relevant scientific studies, papers and professional articles. This competence catalogue is complementary to the former chapter, it provides definitions and further explanations to some of above listed skills. Hence, the present catalogue doesn’t organize competences according to their importance.

I. MANAGERIAL COMPETENCES

Flexibility

Cognitive flexibility: The ability to switch between different types of thinking and change the mindsets. The flexibility covers the ability to work across multiple disciplines and extract concepts from different fields. Implies the use of both left and right brain hemispheres.

Intrinsic flexibility: Multifunctional as well as efficient problem solving and employee’s contribution to the core-business by means of creative and efficient solutions and cross-department innovations. The job/role itself can change depending on the actual needs and on the employee’s skills. New functions can be invented and created which are different from the previously known roles. These ongoing changes will be organic part of the work.

Sources: <http://www.Delivered.Dhl.Com/En/Articles/2017/02/Skills-For-Industry-4-0.Html>

<https://computerworld.com.br/2018/07/27/quais-competencias-o-profissional-da-industria-4-0-deve-ter/>

Ambiguity tolerance

Ability to operate effectively in an uncertain environment.

Source: Hecklau, F., Galeitzke, M., Flachs, S., Kohl, H. (2016). *Holistic approach for human resource management in Industry 4.0*. Elsevier B.V.

Adaptive thinking

To communicate and be in sync with the change that is foreseen, being open to changes, both with technology and with different methodologies.

<https://computerworld.com.br/2018/07/27/quais-competencias-o-profissional-da-industria-4-0-deve-ter/>

Sustainable mindset

Willingness to support sustainability initiatives.

State of art knowledge and process understanding

Knowledge about the level of development (as of a device, procedure, process, technique, or science) reached at any particular time usually as a result of modern methods. In-depth understanding of the company's processes and their interaction.

Source: Hecklau, F., Galeitzke, M., Flachs, S., Kohl, H. (2016). *Holistic approach for human resource management in Industry 4.0*. Elsevier B.V.

Multidisciplinary education, transversal skills

Diverse knowledge, including technical, entrepreneurial (self-representation), communication, project management, data protection skills. Requires continuous training, curiosity, readiness to learn.

Source: <https://computerworld.com.br/2018/07/27/quais-competencias-o-profissional-da-industria-4-0-deve-ter/>

Building good image

Every leader is a rolemodel who sets an example for the standards of professionalism within the organization. For the new generations the positive role model counts even more, since they care less about hierarchy. Managers have to become real leaders, inspire, set the norms (professional behavior, attitude, communication, EQ, outlook, etc.) represent the organization's objectives and culture, keep integrity even when confronted and show self-assurance.

Source: <https://www.forbes.com/sites/forbescoachescouncil/2019/03/22/seven-key-competencies-to-develop-future-leaders/>

Integrity

Leadership behavior is a reflection of the organization. Integrity must be kept no matter what challenges occur. Learning from failures and admitting mistakes is also part of an integrated personality, even as a manager. Transparency is a key to integrity.

Source: <https://www.forbes.com/sites/forbescoachescouncil/2019/03/22/seven-key-competencies-to-develop-future-leaders/>

Horizontal and vertical perception

The multidisciplinary, multitasking and flexibly changing work tasks require the general awareness of the main processes, company goals. Both systematic and specific (technical) understanding is necessary.

Source: <https://computerworld.com.br/2018/07/27/quais-competencias-o-profissional-da-industria-4-0-deve-ter/>

Complex thinking and problem solving

Mental elasticity to solve the unforeseen problems and being able to relate them to the landscape that's changing rapidly and getting more complex. It involves both analytical and creative skills. Analytical or logical thinking includes skills such as comparing, evaluating and selecting. It provides a logical framework for problem solving. The leaders need to have the ability to differentiate between facts, perceptions, assumptions and interpretations.

A collection of self-regulated psychological processes and activities necessary in dynamic environments to achieve goals that cannot be reached by routine actions. Complex problems usually involve knowledge-rich requirements and collaboration among different departments/persons.

Sources: <https://absjournal.abs.edu.in/abs-Journal-volume-6-issue-2-december-2018/abs-j-v-6-i-2-december-2018-article-11.pdf>. <https://www.forbes.com/sites/forbescoachescouncil/2019/03/22/seven-key-competencies-to-develop-future-leaders/>. <http://Induce-Project.eu/Activities-Outputs/> - Induce 4.0: State Of The Art Analysis On The Knowledge And Skills Gaps On The Topic Of Industry 4.0 And The Requirements For Wbl

Entrepreneurial thinking

Non-traditional and experimental thinking.

Entrepreneurial thinking skills refer to the ability to identify marketplace opportunities and discover the most appropriate ways and time to capitalize on them. It is more like a state of mind that opens your eyes to new opportunities.

Sources: Katarzyna Grzybowska, and Anna Łupicka (2017). Key competencies for Industry 4.0 , Economics & Management Innovations, :250-253.

Hecklau, F., Galeitzke, M., Flachs, S., Kohl, H. (2016). Holistic approach for human resource management in Industry 4.0. Elsevier B.V.

Prioritizing

It's about being able to carry out a the core work keeping in mind the goal to reach regardless of how complex or diversified the situation/task is; at the same time doing the necessary adaptations and changes. Managers need to keep long-term focus, fulfill the related work tasks, at the same time they have to define the sub-tasks and delegate. In fast changing, versatile work environment this skill is a basic asset.

Source: <https://www.Forbes.Com/Sites/Forbescoachescouncil/2019/03/22/Seven-Key-Competencies-To-Develop-Future-Leaders/>

New ways of people management

Traditional managerial/leadership frameworks and methodologies are gradually losing relevance and have to be revamped. New management style is necessary (e.g. transformational leadership). Effective communication and team collaboration skills will be a top demand among job candidates in any industry.

Source: <http://www.Delivered.Dhl.Com/En/Articles/2017/02/Skills-For-Industry-4-0.Html>

Creativity and innovation

The ability to perceive the world in new ways, to find hidden patterns, to make connections between seemingly unrelated phenomena, and to generate solutions. Today Robots can be helpful to us in many respects but creativity in humans cannot be replaced by them; on the other hand, people have to be creative to draw the benefits from changes.

Source: <https://absjournal.abs.edu.in/abs-Journal-volume-6-issue-2-december-2018/abs-j-v-6-i-2-december-2018-article-11.pdf>

Data analysis

Data Analysis is the process of systematically applying statistical and/or logical techniques to describe and illustrate, condense and recap, and evaluate data. An essential component of ensuring data integrity is the accurate and appropriate analysis of research findings. It embraces: 1. Data Cleaning and Preparation, 2. Data Analysis and Exploration, 3. Statistical Knowledge, 4. Creating Data Visualizations, 5. Creating Dashboards and/or Reports, 6. Writing and Communication Skills, 7. Domain Knowledge, 8. Problem-Solving.

Source: Slovensko-nemška gospodarska zbornica: Spletna anketa industrija 4.0 (7. november–11. december 2018)

II. TECHNICAL COMPETENCES

Critical thinking

People who can turn data into insightful interpretations will be in high demand due to the complexity and interconnectedness of various fields like computer science, engineering and biology-

Source: <https://absjournal.abs.edu.in/abs-Journal-volume-6-issue-2-december-2018/abs-j-v-6-i-2-december-2018-article-11.pdf>

Service orientation

People who know the importance of offering value to clients in the form of services and assistance will be in demand as businesses would want to provide solutions to the problems of society. The growing importance of cooperation between humans and robots is foreseen in this field; it has to be integrated into customer service.

Sources: <http://www.Delivered.Dhl.Com/En/Articles/2017/02/Skills-For-Industry-4-0.Html>

<https://absjournal.abs.edu.in/abs-Journal-volume-6-issue-2-december-2018/abs-j-v-6-i-2-december-2018-article-11.pdf>

Technical entrepreneurship

Include a lot of types of skills, for example risk taking, persistence, marketing savviness and coding.

Source: <http://www.Delivered.Dhl.Com/En/Articles/2017/02/Skills-For-Industry-4-0.Html>

Technical skills

The abilities and knowledge needed to perform specific tasks. They are practical, and often relate to mechanical, information technology, mathematical, or scientific tasks. Some examples include knowledge of programming languages, mechanical equipment, or tools.

Source: <http://Induce-Project.Eu/Activities-Outputs/> - Induce 4.0: State Of The Art Analysis On The Knowledge And Skills Gaps On The Topic Of Industry 4.0 And The Requirements For Wbl

IT security

Awareness of cyber security. The dynamic and ever-changing nature of electronic communication technologies brings brand new opportunities for quick access to extensive information and communication through integrated channels. On the other hand such dynamic nature paves the way for new challenges and concerns regarding electronic communications security. Both national and international sector regulators and policy-makers are encountering new threats for security of electronic communications while trying to adapt to convergence and the ongoing tendency for Internet Protocol ("IP") based digital networks. It embraces fields like: 1. Security engineering 2. Encryption 3. Intrusion detection and breach response 4. Firewall development 5. Vulnerability analysis 6. Penetration testing 01. A1. Page 15 7. Security information and event management 8. Cybersecurity: HTTPS, SSL, and TLS 9. Endpoint Threat Detection & Data Loss Prevention (DLP) 10. Data loss prevention (DLP)

Source: Hecklau, F., Galeitzke, M., Flachs, S., Kohl, H. (2016). *Holistic approach for human resource management in Industry 4.0*. Elsevier B.V.

Slovensko-nemška gospodarska zbornica: Spletna anketa industrija 4.0 (7. november–11. december 2018)

Protecting the communication: Data protection and security measures under telecommunications regulations in the digital age Author links open overlay panelGönençGürkaynakIlayYilmazNazli PinarTaskiran <https://doi.org/10.1016/j.clsr.2014.01.010>

System skills

Sophisticated capacities used to understand, monitor, and improve socio-technical systems.

Source: [Http://Induce-Project.Eu/Activities-Outputs/](http://Induce-Project.Eu/Activities-Outputs/) - Induce 4.0: State Of The Art Analysis On The Knowledge And Skills Gaps On The Topic Of Industry 4.0 And The Requirements For Wbl

Research skills

Ability to search for, find, collect, analyse, interpret and evaluate information that is relevant to the subject being studied.

Source: Hecklau, F., Galeitzke, M., Flachs, S., Kohl, H. (2016). *Holistic approach for human resource management in Industry 4.0*. Elsevier B.V.

Cognitive analytics

A field of analytics that tries to mimic the human brain by draw inferences from existing data and patterns, draws conclusions based on existing knowledge bases and then inserts this back into the knowledge base for future inferences - a self-learning feedback loop.

Source: [Http://Induce-Project.Eu/Activities-Outputs/](http://Induce-Project.Eu/Activities-Outputs/) - Induce 4.0: State Of The Art Analysis On The Knowledge And Skills Gaps On The Topic Of Industry 4.0 And The Requirements For Wbl

Content skills

Content skills, also known as technical, job-specific or vocational skills, include those that relate specifically to someone's line of work.

Source: [Http://Induce-Project.Eu/Activities-Outputs/](http://Induce-Project.Eu/Activities-Outputs/) - Induce 4.0: State Of The Art Analysis On The Knowledge And Skills Gaps On The Topic Of Industry 4.0 And The Requirements For Wbl

Data alysis

Ability to collect, structure and analyze data to support decision making and use adequate tools supporting this.

<https://computerworld.com.br/2018/07/27/quais-competencias-o-profissional-da-industria-4-0-deve-ter/>

Motivation to learn

Willingness to learn new things and to expand knowledge and skills.

Source: Hecklau, F., Galeitzke, M., Flachs, S., Kohl, H. (2016). *Holistic approach for human resource management in Industry 4.0*. Elsevier B.V.

III. SOCIAL COMPETENCES

Emotional intelligence

Qualities that relate to emotional intelligence such as empathy and curiosity will be a big consideration factor for hiring managers of the future. It has elements of self-awareness, self-management, intrinsic motivation, empathy and social skills; in addition to IQ and CQ, EQ has great importance. Ability to build and nurture social relations in the organization as well as to manage emotional reactions in an assertive and appropriate way, enabling cooperation and teamwork, beyond inter-departmental, inter-age groups and international differences.

Source: <http://www.Delivered.Dhl.Com/En/Articles/2017/02/Skills-For-Industry-4-0.Html>

<https://computerworld.com.br/2018/07/27/quais-competencias-o-profissional-da-industria-4-0-deve-ter/>

Collaboration

Organizations have to work with people from different cultures in different countries, areas and time zones. Besides, interdisciplinary and inter-generational cooperation is also needed. Managers have to create a sense of community, be able to connect with others, stimulate intrinsic loyalty, engagement and a new level of cooperation.

Source: <http://www.Delivered.Dhl.Com/En/Articles/2017/02/Skills-For-Industry-4-0.Html>

Diversity and inclusion management

Diverse workgroups are highly valuable to organizations. Leaders have to be able to recognize workplace dynamics and stimulate positive changes. They must bring diverse groups together, select and coordinate team members' skills, as well as help to engage diverse approaches.

Source: <https://www.Forbes.Com/Sites/Forbescoachescouncil/2019/03/22/Seven-Key-Competencies-To-Develop-Future-Leaders/>

Open-Mindedness

Means being receptive to new ideas, solutions, considerations – sometimes quite different from the good old ways or one's own way of thinking. It requires being able to fulfill tasks in an innovative, creative, new way. In technology intensive, quickly changing work environment or in fields characterized by large variety of tasks and possible solutions people need to be able to apply new solutions, tools and methods regularly; and work together in different project teams, diverse groups.

Source: <https://www.Forbes.Com/Sites/Forbescoachescouncil/2019/03/22/Seven-Key-Competencies-To-Develop-Future-Leaders/>

Social intelligence and media skills

The application of social and non-formal platform for beneficial outcomes; ability to use and work with smart media. It involves spotting right areas at right time and understanding the need and use of such platforms for different purposes and also as alternatives to connect for innovation and creative linkage.

Sources: <https://absjournal.abs.edu.in/abs-Journal-volume-6-issue-2-december-2018/abs-j-v-6-i-2-december-2018-article-11.pdf>

Hecklau, F., Galeitzke, M., Flachs, S., Kohl, H. (2016). *Holistic approach for human resource management in Industry 4.0*. Elsevier B.V.

People skills – “Happiness coaching”

Irrespective of how many jobs get automated and how advanced AI becomes, employees will always be a most prized resource. Humans are more creative, better at reading each other and able to piggyback on ideas. On the other hand humans also get sick, demotivated or distracted. So, it is important that managers and team leaders are aware of how to motivate their respective teams, maximize their productivity and respond to needs. Thus, knowing how to delegate and plan the tasks as to available resources in sync with business needs. It also considers the proper use of resources, fulfilling their needs and demands and also retention of resources.

Source: <https://absjournal.abs.edu.in/abs-Journal-volume-6-issue-2-december-2018/abs-j-v-6-i-2-december-2018-article-11.pdf>

Conflict management

Avoiding conflicts in an organizational format, identifying conflicts if any and resolving them is a key skill for a Manager. It requires emotional maturity, self -control, and empathy. It can be developed and practiced.

Source: <https://absjournal.abs.edu.in/abs-Journal-volume-6-issue-2-december-2018/abs-j-v-6-i-2-december-2018-article-11.pdf>

Intercultural skills

Understanding different cultures, especially divergent work habits, when working globally.

Source: Hecklau, F., Galeitzke, M., Flachs, S., Kohl, H. (2016). *Holistic approach for human resource management in Industry 4.0*. Elsevier B.V.

Language skills

Ability to understand and communicate with global partners and customers.

Source: Hecklau, F., Galeitzke, M., Flachs, S., Kohl, H. (2016). *Holistic approach for human resource management in Industry 4.0*. Elsevier B.V.

Networking skills

Ability to make contacts and build strong relationships

Source: Hecklau, F., Galeitzke, M., Flachs, S., Kohl, H. (2016). *Holistic approach for human resource management in Industry 4.0*. Elsevier B.V.

Stress management

Ability to deal with pressure and stress with positive coping mechanisms.

Source: Hecklau, F., Galeitzke, M., Flachs, S., Kohl, H. (2016). *Holistic approach for human resource management in Industry 4.0*. Elsevier B.V.

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In these dynamic and uncertain circumstances, managers must adapt to challenges of Industry 4.0.

The TransIT Project was specifically designed to facilitate managers to successfully transition to this new era.

