



Industry 4.0 for the future
of **manufacturing** in the EU

COUNTRY REPORT **SLOVENIA**



Metal Processing Industry Association

CHAMBER OF COMMERCE AND INDUSTRY OF SLOVENIA (CCIS)
Metal Processing Industry Association

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1 INTRODUCTION

The EU manufacturing output stands for 15% of the overall member states' GDP and EU has declared that the goal is to increase this level by 20% by the year 2020. However, since 2008 over 3.4 million jobs have been lost in the metal industry. These data proves that a new phase of EU economic growth cannot come without the involvement of metal and mechanical industry. Industry 4.0 is a new production system resulting from the application of new technologies to manufacturing. Industry 4.0 represent a game changer affecting all the activities linked to manufacturing, from planning to processes, from products to work organisation. While the robotic evolution of production represents an opportunity for the EU economy, as it implies the demand for new professional figures, the process will involve several challenges for the EU labour market, including a loss of low qualified jobs and a lack of high-skilled workers (F. McCrory, Y. Alhammadi, G. Westerman, E. Brynjolfsson, *Racing With and Against the Machine: Changes in Occupational Skill Composition in an Era of Rapid Technological Advance*, 2014).

This report is part of INDUSTRY 4EU (Industry 4.0 for the future of manufacturing in the EU), a project aimed at bringing together social partners and institutions from Italy (ADAPT; FEDERMECCANICA), Germany (NORDBILDUNG), Slovenia (Chamber of Commerce and Industry of Slovenia) and at the European level (CEEMET) in an effort to identify concrete actions to cope with challenges and opportunities of Industry 4.0. Particularly, INDUSTRY 4EU is intended to identify good practices and possibilities for employers to successfully support the implementation of Industry 4.0, especially by the means of social dialogue at all levels, from firm to the European Union. According to the European Commission, one of the goals of the Europe 2020 strategy is "to promote the restructuring of sectors in difficulty towards future oriented activities, including through quick redeployment of skills to emerging high growth sectors and markets" (European Commission, Europe 2020. European strategy for smart, sustainable and inclusive growth, 2010), thus fostering the Renaissance of industry in Europe.

Even though Industry 4.0 has still not been tackled by a joint action within the framework of the European social dialogue, EU social partners are currently demonstrating an increasing interest in this topic. INDUSTRY4EU (Industry 4.0 for the future of manufacturing in the EU) wants to be a stepping stone to put Industry 4.0 on the top of the EU social dialogue agenda. The project is aimed at bringing together social partners and institutions in an effort to identify concrete actions to turn Industry 4.0 challenges into opportunities. The main objective is to improve dialogue between employers' associations in order to create conditions for the spread of Industry 4.0 in the European

countries, thus contributing to reconverting present factories and helping them to be more competitive.

This national report is one of the outputs of the project, aimed to explore the current landscape of Industry 4.0 in Slovenia based on the results of a map of past and existing unilateral programmes, as well as social dialogue initiatives to deal with the skills mismatch arising from the digitalisation of production methods and developing the technical skills necessary for the implementation of Industry 4.0, a mapping exercise conducted by CCIS-MPIA and semi-structured interviews conducted by ADAPT.

2 OBJECTIVES AND METHODOLOGY OF ANALYSIS

The goal of this report is twofold. Firstly, to show the results of a mapping process in order to identify all the initiatives already under way about the issues involved in the process of transition to Industry 4.0 in relation to work and social dialogue. In fact one of the risks of the approach to future issues and scenarios is not to act as a broader system of all the actors involved in the change, in this way, however, is very difficult to build a sufficient critical mass to face the challenges of the transition. Besides that, often businesses and the social partners are not aware of the initiatives already in place and the potential opportunities and fundings related to them. The exercise of mapping exercise conducted and presented in this report wants to be a useful tool for all stakeholders of Slovenia to evolve their business models to the Industry paradigm 4.0. To this end, we conducted a desk research by going to map all the institutional and social partners to sources involved in the innovation processes in Slovenia using websites, social media, institutional communication, and institutional relationships.

The second objective of the survey is to map the level of business awareness both for the theme 4.0 Industry as a whole and in relation to the impacts on the labor market. For this reason, we conducted a survey among companies partners of CCIS-Metal Processing Industry Association and CCIS-Electronic and Electric Industry Association, asking them several questions designed to frame the issue in terms of knowledge of technology, adoption of technologies, expected impact of them, and the forecasts of purchase and investment. Attention then focused in asking what are the impacts on the labor market, particularly with regard to the skills required by the new Industry 4.0 and the impact on work organization. The aim of the survey is to have a complete and representative landscape of the situation of enterprises in Slovenia in order to then develop good transition practices built on the principles of social dialogue.

3 STAKEHOLDER'S INVOLVEMENT

1. Chamber of Commerce and Industry of Slovenia

The **Chamber of Commerce and Industry of Slovenia** (CCIS) is a non-profit, non-governmental, independent business organization representing the interest of its members. With more than 160 years of tradition, it is the most influential business organization in Slovenia.

Over 7,000 member companies of CCIS come from all sectors and all regions of Slovenia. CCIS unites 24 branch associations (e.g. metal and electro industry). CCIS operates a network of 13 regional chambers in Slovenia.

CCIS has the status of a representative Chamber of Commerce and is thus a partner of the government in the preparation of legislation and policy strategies. CCIS is also a member of numerous government bodies, boards and committees in various fields. Supporting governmental bodies with the knowhow and expertise in these fields makes CCIS a key actor at a national level in the formation of national strategies and legislation.

CCIS is a social partner organization and signatory party of more than 20 branch collective agreements, agreements on minimum pay and the Social agreements. CCIS is member of the Economic and Social Council in Slovenia.

As a member of Eurochambres (the European Association of Chambers of Commerce and Industry), the International Chamber of Commerce (ICC), as well as other international associations and organisations, the CCIS is part of an extensive international network with innumerable contacts.

CCIS is involved in numerous national and international projects related to research and development, business and entrepreneurship, internationalization, social issues (equal opportunities, social dialogue...) as well as training and education.

2. Metal-Processing Industry Association

The **Metal-Processing Industry Association** (MPIA) is an independent, professional branch association, organized within the framework of CCIS, representing the interests of companies in the metal sector in Slovenia. Its main mission is to take positions and propose policies relating to social dialogue (signatory party of collective agreement) and industrial relations, legislation and government institutions, assist its members by disseminating different sectoral information and data, provide various consultations, legislation questions, business opportunities, organise training, as well as represent and communicate their proposals. It provides a wide range of services for its members.

3. Electronic and Electrical Industry Association

The **Electronic and Electrical Industry Association** (EEIA) is a professional industry branch association organized within the framework of CCIS, representing the interest of companies in the electro and electronics industry of Slovenia. Its main mission is to take positions and propose policies relating to social dialogue (signatory party of collective agreement) and industrial relations, legislation and government institutions. EEIA supports its member companies with assistance and advice.

4. Chamber of Construction and Building Materials Industry

The **Chamber of Construction and Building Materials Industry** (CCBMIS) is a professional industry branch association (private non-profit organization) organised within the framework of CCIS. Its main mission, in the best interest of the Association's members, is to take positions and propose policies relating to the Slovenian social partners, legislative and government institutions as well as towards their domestic and international associations. The Association's tasks are performed within the system of statutory authorisations vested in the Chamber in accordance with the relevant legislation. The Association collects different statistical sectoral data and prepares different sectoral expert publications. CCBMIS takes positions and proposes policies relating to the position of the branch, to the sectoral social partners, to the legislative and government

institutions as well as towards their domestic and international associations, promoting good sectoral practices.

5. Trade Union of Metal and Electrical industry of Slovenia

The **Trade Union of Metal and Electrical industry of Slovenia** (SKEI) is an independent and representative trade union of workers in the metal and electro industry of Slovenia and the largest and most powerful sectoral trade union in Slovenia.

It is organised within the **Association of Free Trade Unions of Slovenia** (ZSSS), a voluntary and democratic organisation founded in 1990. Its representativeness and efforts to establish a high level of social dialogue give ZSSS the leverage to negotiate the contents of collective agreements and participate in the Economic and Social Council where they, together with the government, coordinate law proposals and other documents affecting workers. Social and other agreements related to salaries and specific economic and social affairs are concluded in the framework of a tripartite partnership. ZSSS has representatives in all social security institutions and three representatives in the national council. It is the only Slovenian full member of the European Trade Union Confederation.

6. School Centre Celje (SCC)

School Centre Celje (SCC) is a public educational institution with over 50 years of experience in the field of vocational education. It consists of:

- Secondary School of Chemistry, Electrical Engineering and Computer Science
- Secondary School of Mechanical Engineering, Mechatronics and Media
- Vocational College
- Business training centre – MIC

It has over 3,000 students of the secondary level each year, 800 students in higher education (tertiary level), and over 1,000 adults over the various programs of formal and informal education and training, over 300 employees, mostly highly qualified teachers in various professional fields.

Over the past ten years, SCC has experienced over 100 national and international projects with the budget of up to €6.7 million as the leading or as a partner organization.

The secondary school for mechanical engineering, mechatronic and media is head of the Association of Secondary and Technical Schools of Mechatronics in Slovenia. The school has also organized or participated in a national Forum of mechatronic several times.

Among its 300 employees, SCC boasts several highly competent and educated experts in mechatronic, along with many other experts indirectly connected with the profession of mechatronics (i.e. mechanical, electronical and informatics engineers).

7. Federation of Workers' Trade Unions of Slovenia – SOLIDARNOST

Federation of Workers' Trade Unions of Slovenia – SOLIDARNOST is an independent and democratic interest organization that represents, promotes and protects the interests of its members. It works on the principle of solidarity ("all for one and one for all"), reciprocity and independently from the political parties and authorities. The trade union SOLIDARNOST is acting alone or in conjunction with other trade unions. Federation of Workers' Trade Unions of Slovenia – SOLIDARNOST stands for respect of international principles of trade union freedom, which provides voluntary approach and the establishment of trade unions or exit from any union.

4 MAPPING EXERCISE

4.1 INITIATIVES ON A NATIONAL LEVEL

On a national level, Slovenia as the third most industrial nation in the EU is engaging in Industry 4.0 in the framework of the **Slovenia's Smart Specialisation Strategy (S4)**¹. S4 covers a broad range of development policies related to innovation, focusing on the promotion of research and innovation, industrial policy, entrepreneurship, education system, rural development, and international relations.

The strategic objectives of S4, with innovation being ranked at the top of political priorities, are:

- I. Developing and positioning Slovenia as an attractive innovative economy, with a focus on the development of medium and high-tech and comprehensive solutions for niche areas where Slovenia has key capacities and know-how to compete in the global market.
- II. Establishing dynamic, strategically guided, responsive, highly advanced, globally up-to-date and connected research, innovative and entrepreneurial ecosystem.

One of the defined S4 priority areas is **Industry 4.0**, focusing on (distributed) production management and control, quality assurance, regulation and data processing, intralogistics, automation, smart machines and equipment, mechatronic systems, actuators and smart sensors.

Technologies to be used under Industry 4.0 priority area are cross-cutting and will be applied in selected Slovenian key economic sectors: **basic and fabricated metal products, electronic and electrical engineering industry, ICT, mechanical engineering, and automotive industry.**

During the entrepreneurial discovery process for Industry 4.0 priority area, 16 initiatives pertaining to the area of Factories of the Future were prepared with an estimated investment value of €950 million. The following eight of them seem to be very promising:

¹ The S4 document can be accessed at the following web address: http://www.svrk.gov.si/fileadmin/svrk.gov.si/pageuploads/SPS_predstavitev/S4_dokument_2015_oktober_eng_clean_lekt.pdf

4.1.1 THE SYSTEM EFFICIENT ENERGY USE AND CONVERSION AND ENERGY EFFICIENT SYSTEMS INITIATIVE

The SYSTEM EFFICIENT ENERGY USE AND CONVERSION AND ENERGY EFFICIENT SYSTEMS initiative outlines guidelines for the strategic development of the Republic of Slovenia (RS) in the fields of:

- ELECTRIFICATION OF VEHICLES AND E-MOBILITY
- EFFICIENT USE OF ENERGY (ELECTRICITY) IN BUILDINGS AND HOMES
- SUSTAINABLE MANAGEMENT OF ENERGY AND ENERGY RESOURCES
- **SMART INDUSTRIAL MECHATRONIC SYSTEMS**

The initiative comprises 45 small, medium and large enterprises employing over 14,300 employees with sales revenues of more than €2.3 billion and all relevant research organisations. Crucial contributions of the initiative build on the systematic upgrades and extensions of the existing value chains with the aim to achieve the highest quality and functional level of the products as well as a higher level of integration and interconnectivity of the products.

The initiative is fully focused on innovative products that will reach the TRL 9 until 2020. The initiative incorporates only technological areas and product families where Slovenian companies already have an established global presence or those where Slovenian companies feature a realistic potential to achieve a global breakthrough. It thus builds on established high quality products on one side while outlining the strategy to launch high quality high added value niche products on the other side.

In the frame of the initiative, 400 new products are to be developed that will increase export of the selected companies within the initiative from €1.6 billion in 2014 to €2.4 billion in 2020. A strong commitment to success originates from the fact that the initiative comprises a large majority of Slovenian companies in the field of efficient energy use and conversion and energy efficient systems as well as all relevant and leading research organisations which all have actively contributed to this initiative and their strong commitment to strengthen synergetic and integrational aspects of the product development.

4.1.2 AN INTEGRATED INITIATIVE ON A WIDER AREA OF PROCESS CONTROL TECHNOLOGY

The INTEGRATED INITIATIVE ON A WIDER AREA OF PROCESS CONTROL TECHNOLOGY has been formulated within the frame of Technology Network Process Control Technology (TN PCT, TM TVP) with its Competence Centre for Advanced Control Technologies (CC ACT, KC STV).

Consequently, it focuses on those Technology fields and Fields of application in which the members of the Technology network and/or partners of the Competence centre play a central role or represent the integrative player, which made possible or indeed initiated the preparation of individual initiatives for Technology fields or Fields of application thereof in the frame of this integrative initiative. It should be pointed out that the main asset of integrative initiative resides in the synergy of individual Technology fields and Fields of application and in the horizontal cross-flow of knowledge between these fields. The essential element is also the connection with Technology field outside of control technology, which can take place in a more organized and effective manner within the frame of integrative initiatives.

The initiative focuses on three domains:

- In the domain “Smart buildings and home” (2 Technology fields), the emphasis is on products for home automation and on products that enable construction and make part of active smart operating room.
- In the domain “Networks for transition into circulatory economy” (6 Technology fields), there is a strong emphasis on Smart Grids, and the other Technology fields address biological processes, water and alternative sources of energy.
- In the domain “**Smart Factories**” (6 Technology fields), the initiatives address the topics of holistic management and control of production; control and supervision of individual devices and machinery; and of tools and building blocks, which are essential for the implementation of the concept of smart factories.

All initiatives address the fields within the priority areas of the Slovenian RIS3 and connect practically all research capacities in Slovenia in the field of control technologies, and large majority of most prominent engineering companies in the field of automation in Slovenia, together with several leading industrial companies;

the latter mostly as users or carriers of vertically organized offer of products on the market.

The proposed initiatives contain Fields of application/Fields of products, which are at the level of technology readiness at least TRL3 or further beyond that level. The estimates show that the initiatives have large potential market and that with investments in the range of €60 million in five years – with the condition of uninterrupted and bumpless execution of Fields of application/Fields of products within their development cycles and in between consecutive technology cycles – we can expect the increase of gross added value by approximately €160 million and the increase of export sales by €430 million.

4.1.3 THE ACS4ICOMP INITIATIVE

The ACS4ICOMP INITIATIVE, led by the Automotive Cluster of Slovenia, brings together the Slovenian companies and R&D institutions in the achieving of the strategy for **implementing smart factories in the automotive industry**.

The initiative focuses on the highly successful results achieved by the Slovenian automotive sector in the past years, its economic and social significance for the country, its inclusion in the latest technological trends in the European automotive industry and its robust response to the last global economic crisis, which the Slovenian automotive industry overcame more successfully than until then any other significant Slovenian industrial branch. The improvement of the Slovenian automotive suppliers in the last 15 years has been outstanding. The involvement of a wide range of stakeholders from the economic as well as the R&D sphere shows that the effects of the initiative will have additional multiplying effects on the technological development, employment trends in the country and a healthy economic growth, which will significantly increase exports.

The initiative is in line with all key national and EU strategic documents, as well as the priority areas of Smart specialization strategy, and at the same time is based on the targeted EU strategy for the development needs of the automotive, medical and aviation industry based on smart technologies, smart manufacturing processes and products that will be more productive, sustainable and controlled.

For a breakthrough in niche markets with increased added value, for maintaining contact with the best in the world, and providing competitive advantages of the

Slovenian automotive industry, a systematic and planned development is required. The aim will be to raise the complexity in the direction of "High-Tech" products and processes and in this way to increase added value.

The effects of new technologies, processes and tools will enable a more efficient, faster and cheaper production, which will be centrally controlled and will allow a new professional orientation and employment, especially of young experts.

Intelligent "i" technologies and "i" processes want to be upgraded with electronic components, data management systems and highly productive materials based on a top Slovenian knowledge, all with the aim to satisfy the future needs of customers. The added value will be greater, whereas technology, processes and tools will be more economical and environmentally accepting and last but not least more ergonomic.

The process of design, development and production of the product by means of a competitive (i.e. simultaneous) engineering will allow the customer a faster response to the market. With integrated computerized systems, the customer will actively monitor the status of processes and on the one hand provide the required level of quality and safety of processes and on the other hand their efficiency. It will be possible to monitor the current status of orders, the status of process parameters, wearing out, fractures and other defects, the number of pieces and other indicators. The final effect of the initiative is to establish systems for smart factories, which will develop and produce competitive products on a significantly more demanding technological level, which will ensure a better position in the European and global automotive supply chain and the placement of Slovenia as a "High-Tech" region in the car industry.

4.1.4 THE SMARTTOOLS INITIATIVE

The main aim of the SMARTTOOLS INITIATIVE is focused on the tool-making and machine engineering technology field and covers the production field of **Smart mechatronics tools and control of production machines and processes.**

Further development of the technology field has strategic importance for tool-making and machine engineering to preserve global competitiveness of Slovenian stakeholders. Industry 4.0 concepts and global leaders dictate a substantial increase of product complexity in the field of multifunctionality, sensors systems, mechatronics

and smart control, which requires an entire technological adaptation of the traditionally oriented toolmakers.

The overall assessment of the state of play in the technological field currently reaches TRL 6 and should be raised to TRL 8-9. Of course, some areas are still under developed and reaching TRL 3, therefore further development is essential.

Until 2020, the main impacts of the initiative predict an increase of investments in: research and development by €15 million, modernization of production equipment by €40 million, and marketing by €4 million. On average, the employment of development personnel will be increased by 33%, which will lead to an increase of added value by 17% per employee, while the number of new products will be increased by 6%. The current 70% export share will be increased by an additional 15%.

The initiative is in line with the priority field (S)INDUSTRIJA 4.0 and application field Smart Factories and is in accordance with the European strategic directive Industry 4.0 and Factories of the Future. The initiative includes stakeholders in the value chain that are responsible for the manufacturing of industrial tools and other equipment needed by OEM producers and provides an international integration of commercial as well as development partners.

The implementation of the planned activities that are focused in applicative development of solutions and products (smart mechatronic systems, automation and upgrading of development services) is essential in the following four years; otherwise, a large gap in the technological field will be created in comparison with the leading players. With respect to the current state of play, the realisation of the objectives is realistic.

4.1.5 THE INNOTECH 2020 INITIATIVE

The main goal of the INNOTECH 2020 INITIATIVE is the improvement of the competitiveness of partners based on knowledge, competences and capacities, which will enable them to exploit market opportunities on global markets, based on competitive advantages, i.e. a favourable performance/price ratio, their own R&D, and flexibility in the satisfaction of specific customer needs.

The prospective areas of applications are smart machines, devices, tools, components and systems, mainly for the automotive industry as well as production systems and devices for other selected industries. These areas represent the core of smart

factories and the (S)INDUSTRY 4.0 Initiative is in line with EU orientations in the area of advanced production technologies, as defined in the programme Europe 2020, Horizon 2020, initiatives Manufuture and EFFRA, and especially the public-private partnership FoF – Factories of the Future. Partners of the initiative collaborate with leading European R&D institutes, companies are suppliers of the leading European automotive producers like Mercedes, BMW, Audi, Volkswagen, etc. and leading world companies in the selected industries.

Regarding the technology fields, the initiative is positioned mainly in TRL 5-7 and in TRL 7-9 regarding areas of application, which indicates realistic market orientations of the initiative.

Expected impacts of the initiative are an improved competitiveness of companies, which will result in an increase of sales and exports and a substantial increase of the value added per employee, which is estimated at €50,000 per employee in 2020 at the level of the initiative, with the leading companies exceeding €100,000 value added per employee.

The initiative is positioned in the core of the priority area (S)INDUSTRY 4.0 – Smart Factories, with partners being involved in global value chains as development suppliers of automotive industry as well as development partners of other industries.

The activities which are foreseen for the implementation of orientations are applicative R&D, marketing, technological investments, ICT investments, training of employees, application of new business models, and production, with effects realised already in the period 2016–2020.

4.1.6 THE IOT MICRO, NANO ELECTRONICS AND PHOTONICS INITIATIVE

The IOT MICRO, NANO ELECTRONICS AND PHOTONICS INITIATIVE is aimed at the establishment of an infrastructure centre facilitating R&D companies in the field of microelectronics, nanoelectronics, and photonics. The Centre would encompass an advanced lab for thin films, a measurement lab, cleanrooms, capacities for the production of specific fibres, and a production process for system miniaturisation and the integration of heterogeneous technologies with the goal to **develop and industrialise smarter (predictive, reactive and cognitive) and energy autonomous systems**. Such capacities are currently lacking in the eastern cohesion region. The main research activities include an increase in the level of modular integration and

combination of new functionalities at the micro and nano level through cost reduction, increased predictive and cognitive functions, and increased energy autonomy on the basis of energy management and energy production from the working environment. The Centre would thus facilitate core support for the development and introduction of these technologies in companies and potential start-up/spin-off incubation. Research results are aimed at application-specific fields of the Internet of Things (IoT), smart meters, biometrics and biomedicine, nursing and cyber-physical interfaces.

4.1.7 ROBO++

The industrial production in Slovenia is becoming less profitable due to the relatively high labour costs. Its preservation requires increased automation, which can be achieved through the introduction of advanced robot technologies, such as more flexible and adaptive robot systems. In Slovenia, there are several research groups conducting research in this area and collaborating in major European and international projects.

On the other hand, there are many enterprises in Slovenia that produce robot work cells and automated production lines, both for the domestic industry and for export (this export is the direct impact of ROBO++). In addition, numerous companies, most of them export-oriented, have been working on the introduction of robot technologies into their production lines. Together, these research groups and companies form the value chain of ROBO++.

ROBO++ brings into the area (S) INDUSTRY 4.0, domain intelligent factories, existing national and international competences and results to **introduce robot technologies for intelligent automation**. Twenty robot technology areas have been identified as the most promising to achieve this goal. The envisaged products include new sensor and actuator technologies, innovative robot periphery and grippers to complete industrial robot systems.

Intelligent, robot-supported automation means leaner production, suitable for small and medium batch size production, where automation is still minimal. This will result in and increased quality of products and competitiveness in export markets. Advances are expected especially in the automotive industry, in machine building, as well as in glass and food industries (this is an indirect impact of ROBO++). With a sizeable investment and an increased number of application projects to transfer newly

developed technologies into the industry, the technology readiness level is expected to raise from application research (TRL 4-6) to systems operational in real environments level (up to TRL 9) within 5–7 years.

4.1.8 THE NANOTECHNOLOGY INITIATIVE

Nanotechnology-based products have exploded in the last decade and are becoming omnipresent in anything from cosmetics to smart phones and cancer detection, most of which we are not even aware. The Slovenian industry is mainly focused on the use of various nanomaterials in chemical technology, in various sensors and devices, and in components. Slovenian researchers have shown a world-class track record in nanotechnology in recent years, which gives an excellent starting position for new applications in the industry.

The proposed Nanotechnology Value chains follow the guiding principles of focused smart specialization by identifying four emerging technology areas of industrial interest arising from product lines in the leading Slovenian companies in the field, which can be expected to lead to competitiveness on a world level:

- 1) Smart nano/bio/chemo sensors in environmental, industrial and medical applications;
- 2) Smart surface coatings from medicine;
- 3) **Industrial components in smart factories** and in medicine;
- 4) Smart nanotech-based systems for sustainable environmental and energy.

The listed technology areas are based on numerous product directions displaying high values of Technology Readiness (TRL): four product directions indicate TRLs of 6-9, the rest being 4-6.

The Nanotechnology initiative brings together leading exporting industry partners with world-class research groups in research institutes, existing research infrastructure in centres of excellence, and university departments into focused (smart) specialization teams grouped around the identified product lines. It is expected to lead to the establishment of long-term product value chains in the four priority technology areas, enhancing the technology development, and linking the technology platforms in the field with leading industry players with the aim of enhancing product added value through increased technological innovation with visible indicators within five years.

The Nanotechnology initiative directly links to specific segments in all three priority areas in the Smart Specialization Strategy of Slovenia, with special emphasis in high added value segments related to medical applications and in high-volume nanomaterials applications as final products or within coatings, raising the average added value from the current value of €60,000 per employee to a realistically estimated €85-95,000, based on current projections.

4.1.9 STRATEGIC DEVELOPMENT AND INNOVATION PARTNERSHIPS

The S4 initiative aims to reach its goals by establishing **Strategic Development and Innovation Partnerships (SDIPs)**, which are private-public partnerships of all nationally relevant and investment-ready stakeholders for specific priority area. The purpose of these partnerships is to implement activities to eliminate regulatory barriers and well as speed-up the process of issuing and/or priority treatment of permits or consents within its jurisdiction, namely for investments and projects falling under the identified priority areas. Measures to improve the regulatory environment are also planned to be implemented which will eliminate administrative burdens. The introduction of the SME test will ensure consistent implementation of assessing the impacts of regulations on the economy.

The institutions currently engaged in Industry 4.0 priority area involve government bodies, research institutes, scientific centres, universities, clusters, social partners, and strong representatives of the global industry value chains.

Slovenia will, also on the basis of the received proposals prepared in the framework of strategic partnerships and/or National Innovation Platform (NIP),

4.2 SOCIAL DIALOGUE INITIATIVES

The Social dialogue initiatives aimed at developing the technical skills necessary for the development of Industry 4.0 in Slovenia are performed by various institutions. Below are some of the identified initiatives:

4.2.1 The Chamber of Commerce and Industry of Slovenia

The **Chamber of Commerce and Industry of Slovenia** has launched its own initiative for the advancement of the economy called **Slovenia 5.0**. Its mission is to raise awareness in different public spheres on the importance of industry and the necessity of its advancement based on development programmes with the best chance of succeeding on the market. For this purpose, Slovenia 5.0 brings together stakeholders who know best how, where, and to whom new products, services, or technologies could most successfully be sold, which is also the goal of smart specialisation strategy.

In order to achieve its goals, the initiative focuses on five key areas: smart state, smart taxes, smart HR management, smart internationalisation and **smart development**, which are presented in the CCIS's **Industrial Policy Manifesto** (see APPENDIX II: SLOVENIAN INDUSTRIAL POLICY MANIFESTO).

4.2.2 The Metal Processing Industry Association of Slovenia and the Electronic and Electrical Engineering Association of Slovenia

The **Metal Processing Industry Association**, organised within the CCIS, is actively involved in the Industry 4.0 discussion on various levels, groups and events, such as the yearly ASM conference or the Association's Management Board. Another branch associations of CCIS actively involved in Industry 4.0 discussion is the Electronic and Electrical Engineering Association (EEIA). They were involved in Slovenian Smart Specialization process from the very beginning and helped frame the basic Industry 4.0 idea into the Slovenian manufacturing base. Their current activities are focused toward raising the awareness of the digital transformation among Slovenian companies by organizing best practice exchange events, regulatory and legislation workshops, digital academy for top management, and developing digital competence tools for carrier planners.

4.2.3 SKEI

For the purpose of the Industry 4.0 project, SKEI, the representative Slovenian trade union of metal and electrical industry, prepared a **statement** summarizing their point of view, current endeavours and future plans relating to the topic of **Industry 4.0 in Slovenia**:

“

1. *Firstly, it is important to acknowledge the fact that many trade unions do not have the necessary professional capacities to fully engage in this significant topic.*
2. *Even though this also holds true for SKEI, we are aware of the importance of establishing an open dialogue in the field of Industry 4.0 with branch employers' associations as well as with companies.*
3. *We are undoubtedly witnessing a new momentum in the development of the industry through digitalisation, but it is important to note that the so-called fourth industrial revolution cannot be achieved without employed workers.*
4. *What we are seeing is a digitalization of value-added chains, necessitating a new organisation of labour produced by workers by interconnecting different technological components.*
5. *Yet people will continue to organize the production and supervise the machinery, not vice versa.*
6. *In the future, this will require more qualified workers through adequate education and training, which will in turn require the expansion of social dialogue, all of which supports SKEI's current endeavours to include provisions concerning lifelong learning and the transfer of knowledge into the Slovenian branch collective agreement.*
7. *Changes in workplace will also occur: instead of working at the employer's premises, workers will be able to perform certain tasks outside of the facilities. This is an additional argument supporting SKEI's efforts to supplement the branch collective agreement with a provision on remote work.*

8. *The protection of industrial production will always be relevant; however, what is needed is a strengthened social dialogue on the need to increase investments in development, research, and innovation processes.*
9. *Additionally, communication processes will also transform and evolve. Social dialogue needs to ensure the social security of workers, which might become threatened due to reduced personal contact with employers (with information and communication technologies becoming the prevailing means of communication).*
10. *All of the above raises questions on how to provide job security in the light of digitalisation. It is necessary to establish social dialogue that will protect the interests of workers in the complex framework of the meaning of decent work, while further limiting precarious forms of employment.*
11. *SKEI will address the issues and challenges concerning Industry 4.0 in the scope of the Vienna Memorandum Group (which also includes the metalworkers' unions of Germany (Bavaria), Austria, the Czech Republic, Slovakia, and Hungary), as well as the European trade union IndustriALL. SKEI will inform Slovenian employers' associations on all issues relevant for social dialogue.*
12. *Trade unions of the Vienna Memorandum Group will continue to be involved in the field with specialized foundations supporting research (especially the Friedrich Ebert Foundation), and will inform representatives of employers on all findings.*
13. *With respect to available capacities, SKEI wishes to remain an equal partner in the research and social dialogue on Industry 4.0 in order to ensure a balance of interests of capital and workers.*

”

— Bogdan Ivanovič
SKEI Secretary

4.3 UNILATERAL PROGRAMMES AIMED AT DEVELOPING THE TECHNICAL SKILLS NECESSARY FOR THE DEVELOPMENT OF INDUSTRY 4.0

4.3.1 *knowME PROJECT*

In 2012 and 2013, **five European national sector organisations** (CCIS-MPIA, CCIS-EEIA, MASOC, LINPRA, ZEP RS) **from the metal and electro industry** carried out the EU-funded project on **skills and knowledge management knowME²** to explore the state of affairs in their industry sector.

The aim of the project was to **analyse the needs and requirements for better and future-oriented skills and knowledge management in the Metal and Electro Industry (MEI)** in the four project participating countries of Slovenia, Latvia, Slovakia and Lithuania, and to improve the capacity of social partners in the participating countries in **anticipating and managing change** in their sector as well as strengthen their cooperation on the European level.

For this purpose, interviews with companies and a survey were carried out in the four participating countries in skills and knowledge management. One of the most significant problems for companies of all sizes in the participating countries detected was that there are **not enough highly skilled workers on the labour market** and not enough apprentices from VET institutions available. Small and medium-sized companies (SMEs) have only limited capacity and personnel to provide the necessary trainings to respond to the newly upcoming qualification and skill requirements.

It was established that especially SMEs often lack the resources and the know-how to develop HR and training strategies to respond to current and future skill needs. In cooperation with the University of Applied Science Bielefeld (*Fachhochschule des Mittelstands*), a guidebook was produced to inform SMEs about the most important knowledge management practices.

The main result of the knowME project was an increased awareness of the need for effective skills and knowledge management among SMEs in MEI and the tools and methods available. The improved management of skills and knowledge in SME in the participating new member states, oriented to future skill and job needs, made an important contribution to better working conditions, better employability and productivity of workers in this sector, thus securing existing jobs. The involved social partners increased their capacity to support companies in anticipating, preparing for

² <https://know-me.gzs.si/vsebina/Project-publications>

and managing industrial and demographical change. A stronger cooperation of social partners on the national and European level was established and the project made a quality input on management of change for the European debate.

4.3.2 skillME PROJECT

The Skills in the Metal and Electro sector – *skillME* project³ is a three-year (2014-2017) project co-funded by the Erasmus+ Programme of the European Union and led by CCIS-MPIA. The core aim of the project is to **identify the most pressing and widespread skill gaps in the industry of today and tomorrow and to design tools to help fill those gaps.**

Due to the rapid development of technology and knowledge, companies in the European metal and electro sector are finding it increasingly difficult to find competent workforce that could meet the requirements of their production processes, as out-of-date educational systems and the lack of flexibility are responsible for the widening skill gaps. Workers, on the other hand, are facing the challenge of keeping up with the ever-changing requirements of the industry so as to remain employable, competitive, and productive.

In order to fulfil the goal of reindustrialisation of Europe, extensive measures need to be taken in order to meet the demands of the market. The skillME project is designed as a response to those needs. It is a collaborative project between vocational education and training (VET) providers, national regulatory partners, and representatives of the metal and electro industries of the EU member states Croatia, Latvia, Slovakia and Slovenia, with the aim of **identifying the most endemic skill gaps in the metal and electro industry, develop state-of-the-art curricula to fill those skill gaps, and permanently integrate them into VET education systems** in project participating countries and throughout Europe.

As the skillME project strives to improve competencies in the metal and electro industry in the long term, its aim is not only to determine the most current and widespread skill gaps of today, but also to **identify the areas of competencies that are going to be most sought-after in the future.** As a result, the project will enhance competencies in the respective industries Europe-wide and foster cooperation of worlds of education and work by cooperation in curriculums design between the industry and VET providers.

³ <https://www.gzs.si/skill-me>

5 OUTCOMES

5.1 ANALYSIS OF SURVEY RESPONSES

For the purpose of mapping the adaptation of Industry 4.0 technological innovations in the Slovenian metal and electro companies, the detected changes in skills and competencies connected with them, and Industry 4.0 expectations, a questionnaire titled “Industry 4.0 – A survey to build the future together” has been designed and distributed among member companies of the Metal-Processing Industry Association and the Electronic and Electrical Industry Association of the Chamber of Commerce and Industry of Slovenia via an online form and implemented in face-to-face meetings. All information regarding participated companies is kept strictly confidential.

In total, **54 companies of the Slovenian metal and electro industries** participated in the survey on Industry 4.0.

5.1.1 COMPANY FEATURE, TYPE AND SIZE

- **Respondent companies' structure**

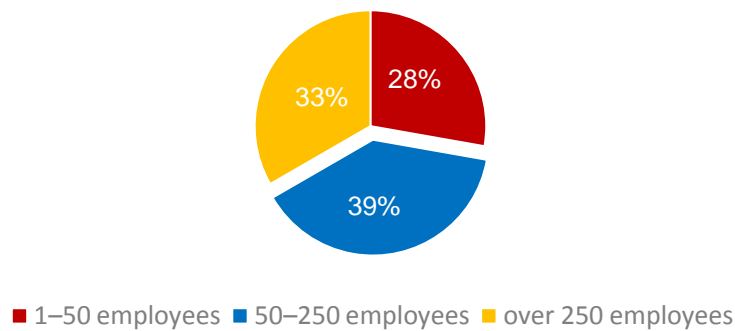
Nearly 40% of the Slovenian companies that participated in the survey come from the NACE sector C25 – Fabricated metal products. 22.2% of the respondent companies are active in the sector C27 – Manufacture of electrical equipment and a further 22.2% in the sector C28 – Machinery and equipment. The remaining companies come from the field of C29 – Manufacture of motor vehicles, trailers and semitrailers (5.6%), C33 – Repair and installation of machinery and equipment (5.6%), C24 – Manufacture of basic metals (3.7%) and C26 – Manufacture of computer, electronic and optical products (3.7%). 13% of the respondent companies are active in the field outside of the C24 through C33 sectors.

The majority of the participating companies either produce finished products to the market (38.9%), supply components (37%), and/or produce finished products for industrial customers (31.5%). The remaining responses represented less than 20% of all received survey answers.

In terms of **company size**, the respondents are **distributed quite evenly among micro and small companies, medium-sized companies, and large companies**, as can be seen

from Figure 1. Most respondent companies are medium-sized, with the number of employees between 50 and 250 (38.9%). On average, companies employ **28 graduates in tertiary education**.

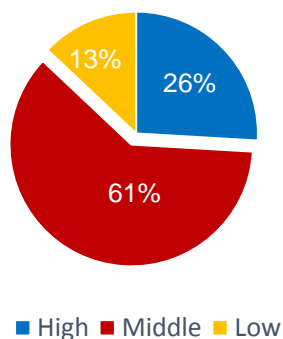
Figure 1: Company size



- **Digitalisation level of companies**

According to the companies' self-assessment, **61.1% of them consider their digitalisation level to be medium**. High level of digitalisation has been noted in a quarter of the surveyed companies, whereas the remaining 13% stated the digitalisation level of their company is low, as seen in Figure 2. It is important to stress that no definition was provided as to what constitutes a low, medium, or highly digitalised company; therefore, the assessment is based purely on self-evaluation of the surveyed companies.

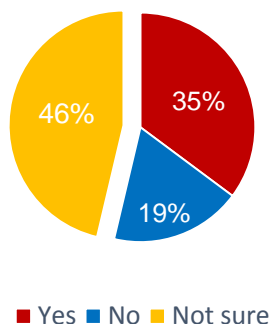
Figure 2: Level of digitalisation



- **Collaboration relationships with Universities or Research Centers**

Almost half of the companies (46%) do not yet know or are not aware if they will be participating in public funding projects on Industry 4.0 for research and development, contrary to 35% who do intend to take part in such projects (Figure 3). Just under a fifth (19%) of the companies indicated that they will not participate in such public funding projects. A decisive majority of two thirds (67%) of respondent companies foster collaboration relationships with Universities and Research Centers.

Figure 3: Planned participation in public funding projects on Industry 4.0 for research and development



5.1.2 TECHNOLOGICAL INNOVATIONS

In the second part, companies were surveyed on the 10 technological innovations pertaining to Industry 4.0, detected by the Industry4EU project literature review. More specifically, the questions related to the companies' knowledge on innovations and their usage, their investment in these technologies, and the companies' benefits deriving from the use of the presented technological innovations. These technologies are **Mechatronics, Robotics, Internet of Things, Big Data/Data mining, Cloud computing, Cybersecurity, Additive Manufacturing, Systems of virtual simulation, Nanotechnologies, and Smart Materials.**

- **Knowledge about technological innovations**

The answers showed that companies are acquainted with all presented technological innovations. They are **most familiar with mechatronics, robotics, and cloud computing** (94.4%), followed by the internet of things (87%), cybersecurity (74.1%), virtual simulation systems (64.8%) and data mining (63%). Responses showed that companies are the least familiar with nanotechnologies and additive manufacturing (55.6% positive answers).

- **Usage of different technological innovations**

In the next step, respondents were asked to specify where the presented technological innovations are used in their company.

In 60.4% of cases, companies use **Mechatronics** for production purposes and 32.1% for the development of products. **Robotics** is used mostly in production (66%), but 22% of companies answered that they do not use this kind of technological output.

Regarding the **Internet of Things**, almost half of the respondents (45.1%) replied that they are not using this type of innovation, however the other half uses IoT mostly for production (19.6%), development (13.7%), and commercialisation of products (15.7%).

Most of the surveyed companies stated that **Data mining** is quite unusable for them (63.3%), as only 20.4% of companies use this kind of output in production and 10.2% in the development of products. The rest is used for commercialisation purposes (6.1%).

Companies are also not inclined towards **cloud computing**, as almost half of the surveyed companies (43.1%) stated that they do not use it. Companies that do use it use it mostly for development (19.6%), production (15.7%), and commercialisation (15.7%). **Cybersecurity** is not in use in 44.7% of surveyed companies. This innovation is mostly used for production (31.9%) and product development (19.1%).

Additive manufacturing is not used in the majority of the surveyed companies (71.4%). As seen in previous answers, this innovation is mostly used for production (14.3%) and development of the products (10.2%). **Virtual simulation system** is used mostly for product development (47.1%), whereas the other half of the companies responded that they do not use this innovation either in production, development, commercialisation, or service.

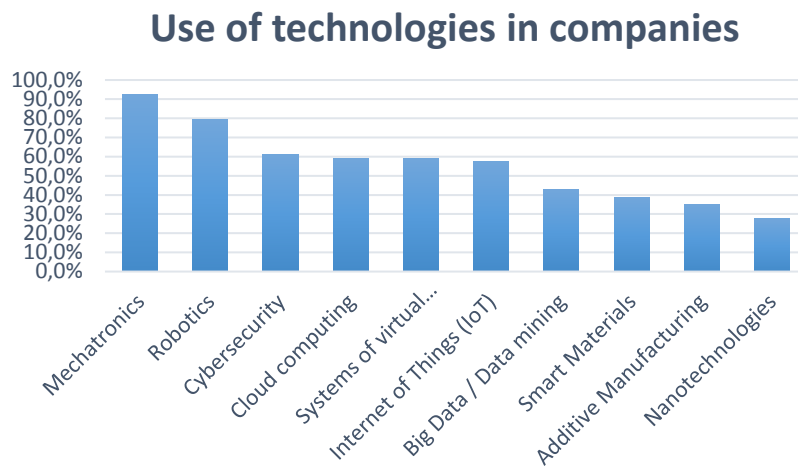
Moreover, as much as 79.6% of surveyed companies answered that they do not use **nanotechnologies**. Only 12.2% of companies have this type of technology in their production development.

Smart materials are little used in production (16.3%) and in product development (16.3%), 67.3% of companies replied that they do not use this kind of innovation in their production.

To sum up, the survey showed that the **least used technologies** are **nanotechnologies**

(the share of companies that do not use them is 79.6%), followed by **additive manufacturing** (71.4%), **smart materials** (67.3%) and **data mining** (63.6%), which is in line with the companies' feedback on the knowledge on technological innovations, whereas the **most used technology** are **mechatronics** (used by 93% of companies) and **robotics** (used by 80% of companies). Interestingly enough, although 94.4% of the companies are familiar with the technology of **cloud computing**, only 59% actually make use of it.

Figure 4: Use of technological innovations in companies



- **Planning and investing in the following technologies**

Companies were asked whether they plan to invest in any of the technologies either short-term (within the next year), medium-term (1 to 5 years), long-term (in more than 5 years), or do not plan to make any investments in the indicated technologies at all.

Over 80% of the companies stated that they are planning to invest in the development of **mechatronics** in their companies. The majority will do so **within the next year** (48.1%), and a further 35.2% will invest in this technology in the medium term of 1–5 years.

Companies displayed similar plans in the field of **robotics**. Only 11% of companies do not plan to make any investments in this field, whereas the majority plan to do so either **short-term** (53.7%) or, to a lesser degree, medium-term (29.6%), making this the most desirable technology for companies.

Regarding **IoT**, a third of the surveyed companies (33.3%) are not planning to invest in this

technology, but the remaining companies are planning to invest in it in the near future, either in the **short term of one year** (38.9%) or in the medium-term period of 1 to 5 years (24.1%).

57.4% of the companies are not planning to invest in **data mining** technology. Of the remaining companies, 31.5% are planning to do so in the one-year period. However, 63% of companies are planning to invest in **cloud computing**, be it short-term (38.9%), medium-term (20.4%) or long-term (3.7%).

40.7% of companies do not plan to make any investments in the field of **cybersecurity**. However, 38.9% of the respondents are planning to invest in it in the period of **less than one year**. 16.7% of the companies replied that this type of technology is interesting to them, but they are planning these investments to be made in the period of 1–5 years.

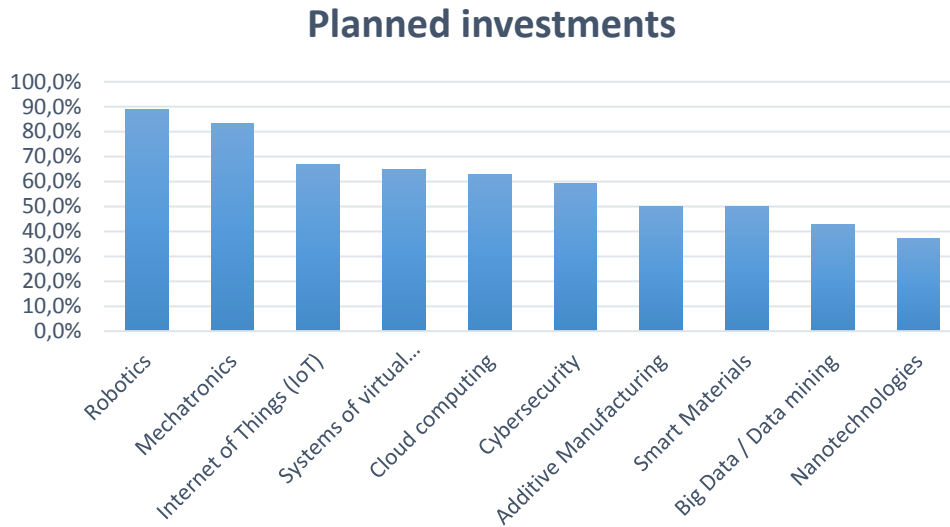
Exactly half of the surveyed companies are planning to invest in **additive manufacturing**, mostly in the following year or in the medium term of 1-5 years (jointly 38.9%). The same share of companies plan to invest in **smart materials**, mostly also in the medium term (31.5%).

Investment into **virtual simulation systems** is not interesting for 35.2% of the companies, however 40.7% of the surveyed companies are planning such investments in the **one-year period**, and a further 20.4% of the companies are planning to invest in virtual simulation systems in the period of 1–5 years.

Out of all the indicated technologies, **nanotechnologies** seem to be the least interesting for companies as 63% of them will not invest in these technologies either short, medium or long term. Most of the companies that do intend to invest in nanotechnologies plan to do so in the period of 1–5 years (20.4%).

In short, the survey showed that the technologies which are the most attractive to companies in terms of investment are robotics, with a total of 89% of companies stating that they are planning to invest in this field in the future, followed by mechatronics (83.3%), the internet of things (66.7%), systems of virtual simulation (64.8%) and cloud computing (63%), whereas the technologies that companies mostly do not plan to implement into their production systems are nanotechnologies (37%) and data mining (42.6%). Additive manufacturing and smart materials will be implemented in exactly half of the surveyed companies, as seen in Figure 5:

Figure 5: Share of companies planning investments in technological innovations



- **The advantages companies benefit from by using technological innovations**

The advantages from which companies mostly benefit due to the use of technological innovations outlined above are, in a decreasing order:

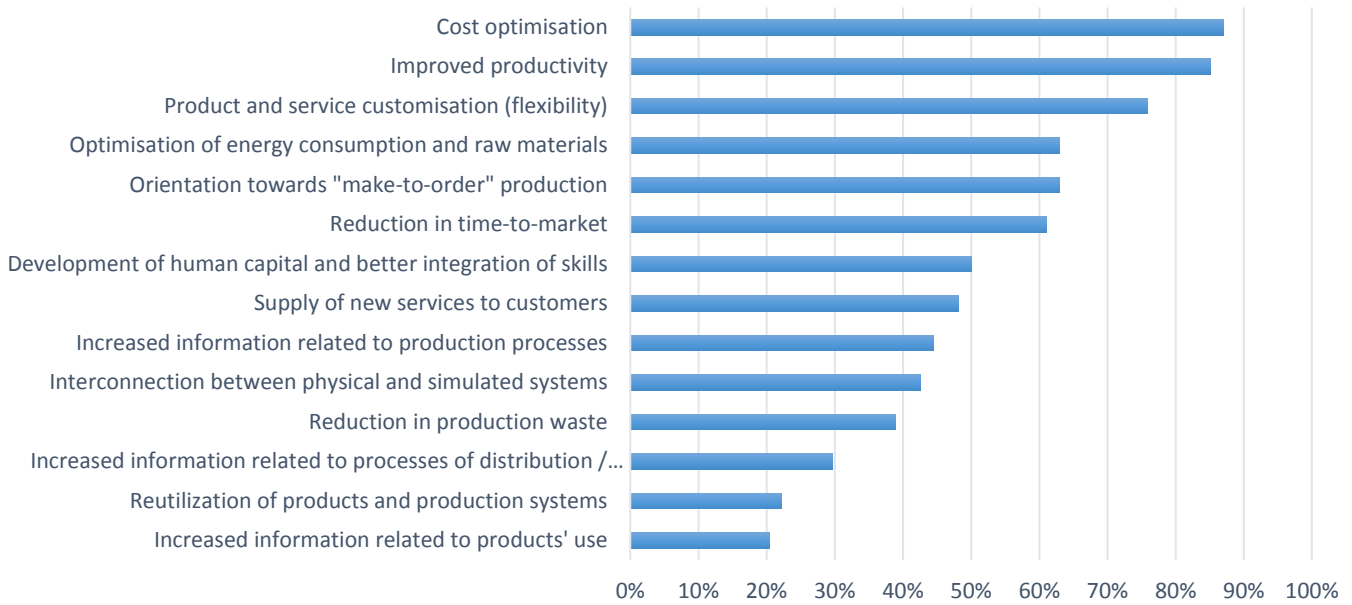
- Cost optimisation (87%),
- Improved productivity (85.2%),
- Product and service customisation (flexibility) (75.9%),
- Optimisation of energy consumption and raw materials (63%),
- Orientation towards "make-to-order" production (63%), and
- Reduction in time to market (61%).

Increased information related to products' use and reutilization of products and production systems are kind of disadvantages of using upper technological innovations, seeing as in these fields, the benefit for the companies is quite low, as seen in Figure 6.

Half of the companies answered that a positive aspect of the use of technological innovations is the development of human capital and a better integration of skills. 49% also see another benefit in the supply of new services to customers.

Figure 6: Benefits for companies stemming from the use of technological innovations

Benefits of technological innovations for companies



5.1.3 SKILLS AND COMPETENCES

An important part of the survey was the section aimed at investigating skills and competences in relation to technological innovations. The survey showed that on average, companies spend app. **24 working hours pro capita annually on skills development through training**. The question that was raised referred to how much have soft skills changed after the introduction of technological innovations in the surveyed companies, evaluating the changes on the scale of 0 (no change), 1 (modest change), 2 (some change), 3 (noticeable change) to 4 (significant change).

- **Soft skill changes after introduction of technological innovations in surveyed companies**

In over 75% of the companies, the introduction of technological innovations caused some to significant change in the **interdisciplinary approach**. Over 60% of the companies have faced some notable changes in the **team building approach** and in over 75% of the companies, the introduction of technological innovations caused some notable changes in the **leadership approach**.

In most of the companies (76%), the introduction of technological innovations caused some to significant change regarding **autonomy, accountability, flexibility and proactivity** among workers, and 74% of the companies registered a change towards **fast and focused decision-making and problem-solving**.

On the other hand, nearly half of the companies noticed that the introduction of technological innovations did not have any significant effect on **interpersonal relationships and empathy**. Only 27.8% of the companies noted a significant change in this respect. Half of the companies also noted that with the introduction of these innovations, **emotional intelligence** did not change considerably, with only 14.8% of companies marking a noticeable or significant change.

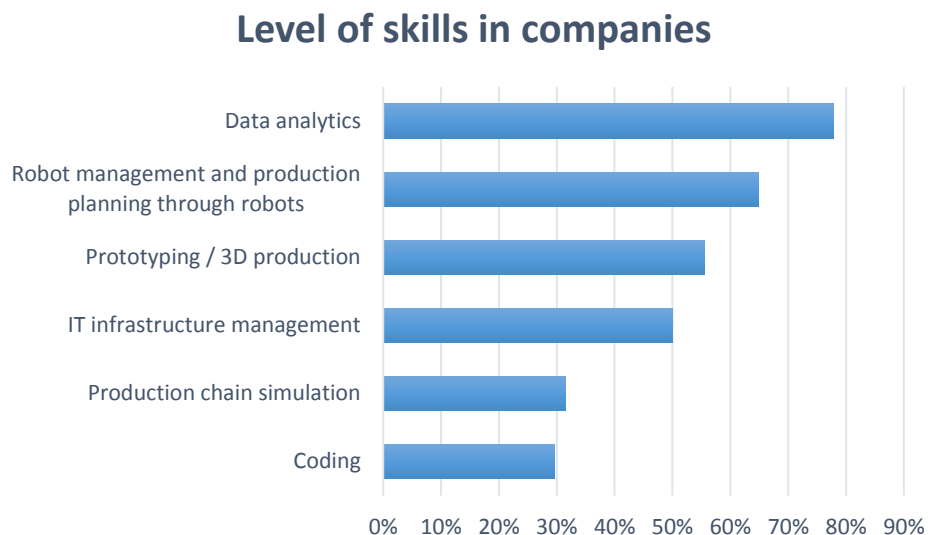
On the other hand, in most of the companies (51.9%) **team working** did change noticeably or significantly, perhaps due to the interconnected nature of technological innovations. Nearly 40% of the companies also noticed that **visual communication** improved noticeably to significantly after the introduction of technological innovations, which especially also holds true for **digital communication** (55%).

Overall, the most significant change in soft skills among employees was noticed in the field of digital communication and team working, whereas the least change was marked in the field of interpersonal relationships/empathy and intrapersonal relationships/emotional intelligence.

- **Advanced skills applicable within the company**

As presented in Figure 7 below, 78% of companies have staff skilled in **data analytics** and 65% skilled employees in **robot management**. 56% of the companies stated that the employ staff who are skilled in prototyping and 3D production, 50% in IT infrastructure management and only 31% in coding and 30% in production chain simulation.

Figure 7: Level of skills in companies



- **"Data analytics" skills usage in companies**

"Data analytics" skills in surveyed companies are mostly used for **decision making** (82.2%), **reporting systems** (82.2%), and **quality control** (80%). They are less applicable for predictive maintenance (37.8%) and the distribution chain smart management (22.2%).

- **Use of "IT infrastructure management" skills**

IT infrastructure management skills in the surveyed companies are mostly being used for

the purposes of IT security management (93.5%). They are also used extensively in cloud, sensors and server management (77.4%) as well as for prevention (71%) and the solution of anomalies (64.5%).

5.1.4 JOB ORGANISATION

The next set of questions referred to the field of **job organisation in companies**. It opened a question on how much has the introduction of technological innovations in companies influenced the job organisation, evaluating the changes on the scale of 0 (no change), 1 (modest change), 2 (some change), 3 (noticeable change) to 4 (significant change).

Results show that the introduction of the presented technological innovations in the surveyed companies had a notable influence on job organisation in the field of **smart working**. 27.8% of the companies noticed some change, whereas 50% of the companies answered that innovations caused noticeable to significant change.

The introduction of technological innovations in surveyed companies also exerted quite a big influence on job organisation in the field of **knowledge sharing**. More than 90% of the surveyed companies answered that innovations led to changes regarding knowledge sharing: 9.3% of the companies noticed modest change, 33.3% some change, 40.7% noticeable change, and 9.3% significant change.

5.1.5 INDUSTRY 4.0 EXPECTATIONS

The penultimate set of questions was aimed at assessing the **companies' expectations** in the field of Industry 4.0 for the future. The companies were presented with various statements and asked to indicate their level of agreement with them on a scale of 0 (total disagreement), 1 (agreement), 2 (neutral), 3 (agreement) to 4 (total agreement).

Over 42.6% of the companies (totally) agree that **Industry 4.0 can be implemented gradually with contained investments**, even without radical changes in the basic technology normally used. The majority of companies (81.5%) do not share the opinion that **Industry 4.0 is unsuitable for SMEs**. 27.8% of the companies (totally) agreed and at the same time 24.1% of the companies (totally) disagreed that Industry 4.0 **requires important investments**. The rest (48.1%) were indecisive regarding this point.

Only 18.5% of the surveyed companies share the fear that **Industry 4.0 will allow big companies to be more agile and therefore "threaten" SMEs**, whereas more than half of the surveyed companies (51.9%) (totally) disagree and are of the opinion that big companies do not have such an advantage over SMEs due to Industry 4.0.

Similarly, only 14% of the companies see Industry 4.0 as an advantage for SMEs, agreeing with the statement that **Industry 4.0 will allows SMEs to be more efficient and competitive in the market, thus "threatening" big companies**. 55.6% of the companies on the other hand (totally) disagree with the statement. This goes to show that companies do not think the size of a company is a major factor in determining the benefits of Industry 4.0 for the companies' competitiveness and successfulness.

Most of the companies (70.4%) however either agree or completely agree that **Industry 4.0 enables product customisation which can amplify competitive strength** and do not deem Industry 4.0 to be a passing trend (64.8%).

The question on whether **Industry 4.0 requires skills that the companies do not possess** showed interesting results: a third of the companies (33.3%) (strongly) agreed with this statement, a third disagreed, whereas a third could not decide on this question at this point. This means that two thirds of the companies do not yet feel fully prepared for the challenges of Industry 4.0 in terms of knowledge and would need extra training or additional qualified staff to successfully implement the Industry 4.0 technologies.

Finally, companies were asked whether they agree with the statement that **companies which will fail to grasp the opportunities offered by these innovations are likely to be excluded from the market**. The answers were mostly positive, with 31.5% of the companies agreeing and 24.1% completely agreeing with the statement, whereas 22.2% remain unsure and a further 19.2% of the companies not seeing Industry 4.0 technologies as a crucial part of their success in the future.

5.1.6 CORPORATE CULTURE

In this segment, evaluations of the actions that companies must take in order to put into practice and facilitate the change towards Industry 4.0 were addressed. The companies were presented with actions and asked to indicate the level of their relevance on a scale of 0 (not relevant), 1 (marginally relevant), 2 (somewhat relevant), 3 (relevant) to 4 (highly relevant).

87.1% of the companies find it somewhat to highly relevant to **start to create synergies throughout the value chain, both horizontally and vertically, optimising the relationships with territorial networks.**

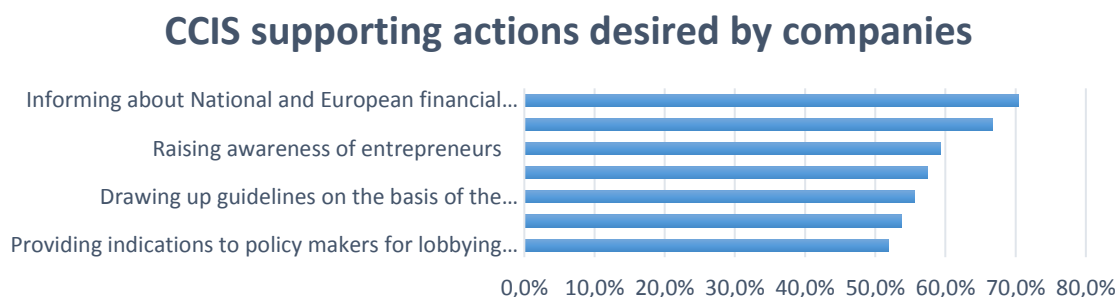
As much as 94.4% of the surveyed companies also somewhat to highly agree that **staff lifelong learning** is an important measure for the successful implementation of Industry 4.0 technologies.

77.8% of the companies think somewhat to strongly that they a **reorganization of its structure** will be necessary in order to ease the development of innovation, whereas 22.2% of the companies do not find this measure relevant. Similarly, the same share of companies are in favour of **facilitating a transition to the managerial culture.**

5.1.7 FURTHER ACTIONS WHICH SHOULD BE DEVELOPED BY CCIS-MPIA

As we can see in Figure 8, companies' replies on the desired assistance and support by CCIS are quite evenly distributed among the available options. All actions are deemed quite important, but in their opinion, the most important action that CCIS should develop is **informing companies about national and European financial instruments on presented topic** (70.4%). Surveying territorial initiatives about Industry 4.0 is the second matter of importance (66.7%). Other actions such as raising awareness of entrepreneurs (59.3%), developing a communication campaign, identifying and disseminating best practices (57.4%), drawing up guidelines on the basis of the introduction of new technologies, skills and organizational models (55.6%), coordinating and promoting the interaction of companies with technology clusters, research centres and institutions (53.7%), and providing indications to policy makers for lobbying on the topic (51.9%) are also fairly equally important to companies.

Figure 8: Desired CCIS support actions

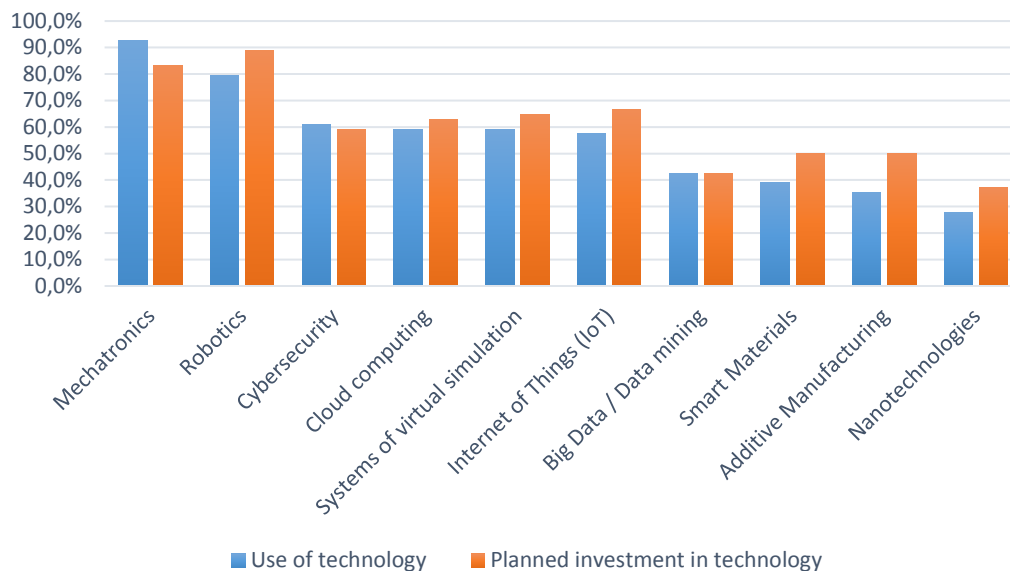


5.2 REMARKS EMERGED BY THE ANALYSIS

It can be said that 54 responses on the survey is a great feedback and is also a clear indication that Industry 4.0 is currently a hot topic in the Slovenian industry. The business activities, company size and type of company are represented in the same proportions as can be seen on the national level; hence, this survey was able to get the real standpoint of industry.

It is clear that CEOs of Slovenian companies know technology innovations like Internet of Things, Cloud computing, Cybersecurity and are in general also knowledgeable about the application usage of these technologies in their companies. However, for a CEO knowing about a technology is not the same as embracing and/or investing in it. The analysis seems to show that companies only intend to invest in those technologies that they are already using, such as mechatronics and robotics, but not to the same extent in the technologies that are in general not in use, such as additive manufacturing or nanotechnologies, as seen in Figure 9.

Figure 9: Comparison between the use of technologies in companies and planned investments by companies



It could be said that the digital transformation of Slovenian industry is still at the starting point with first adopters trying to integrate new technologies while the **majority of companies are still only observing** the innovation activities within their particular domain.

The advantages and benefits of technological innovation recognized by Slovenian industry indicate that **the main focus is not towards acquisition and/or development of Key Enabling Technologies (KETs) but more towards upgrading and enhancing already established role in the global value chains**. Flexibility, "make-to-order", shorter time to market and energy and resource optimization emerged as top issues that are and should be addressed first within the digitization process.

Investing in these technologies is also not the norm in Slovenian companies. Technology solutions for production, maintenance, testing or R&D are more common business terms and they **usually combine several technologies from Industry 4.0 list at different levels and at different investment cycles**.

The downside of the survey seems to be that for an average CEO, this survey was too long and too technical. A number of CEOs quit before the end of the survey because they were asked to provide estimates on usage and future plans for particular technologies, **numbers that are not immediately available to an average CEO**. However, the results show that companies are aware of the changes in the production system that are and will be brought on by Industry 4.0 and serve as a good platform on which to build further support actions for the facilitation of innovative technologies implementation.

6 PROBLEMS EMERGED WITHIN THE MAPPING EXERCISE

The mapping exercise of Industry 4.0 initiatives in Slovenia has proved that **Smart specialization process** could be the right framework for the formulation of initiatives during the entrepreneurial discovery and for helping them to produce market relevant results.

Eight promising initiatives were established during this process. Most of them were able to **group balanced triple helix stakeholders around fairly narrowed market niche** with the focus on applicability of key enabling technologies rather than developing them from scratch.

Ideally, these initiatives would now be picked up by national competence centres, business clusters, demo factories and industrial associations to quickly and effectively evaluate state-of-the-art technologies, develop business ready project proposals, establish value chain partnership and win the politicians support.

Such business support environment is unfortunately not available and is **the first challenge** the needs to be addressed in the near future. The **second challenge** is **the willingness and readiness to experiment** and to learn by doing. Otherwise, the Slovenian industry could miss the digital transformation wave and end up on the sideway.

7 PERSPECTIVES OF ANALYSIS

Results of the European Industry4EU project survey, interviews, round tables, and individual meeting findings are in line with our knowledge about opportunities and challenges of Industry 4.0 technologies, gained from daily communication with Slovenian metal processing and electro companies and discussions within the CCIS-MPIA board of directors. They will certainly lead to further discussions on company, national and regional levels between key actors – stakeholders as they are defined in Chapter 3.

Upcoming changes and technological developments will deeply affect labor market and ways of conducting business. Disruptive manufacturing and dispersed manufacturing sites will demand different business approaches. New value chains will be formed across sectors and as a result, new business models will have to accommodate ways of doing business globally.

Companies majorly perceive industry 4.0 to be an evolution instead of a revolution, so that its features can be implemented gradually. Major challenges are perceived to be in the fields of adequate competencies. For them to be implemented in the work process in time, the life-long learning principles should be incorporated firmly into the culture of the organisations, educational bodies should reinvestigate their organisational schemes and should find new innovative ways and models of transmission of knowledge as soon as possible. It appears to be imperative to increase the collaboration between educators and companies, enhancing teacher experiences of the workplace training.

The CCIS-Metal Processing Industry Association has been deeply involved into finding solutions to challenges of Industry 4.0. Currently, we are coordinating the EU project *skillME*, which tackles the most endemic skill gaps in the metal processing industry. We identified the four major skill gaps for which we already developed curricula following the EQAVET and ECVET requirements, three of which are directly connected to industry 4.0, which confirms the thesis that the challenges of industry 4.0 have been very important for some time now.

MPIA is also very concerned about the demographic changes occurring in EU and especially in our country, where the retirement age is increasing rapidly. An especially vulnerable group are older, low-skilled workers, who have not been involved in any upskilling/educational process and have been working in the same workplace for decades. Their workplaces are in jeopardy because of the technological development of production

processes or because of legislative limitations to their work (night work, physical strains...). On top of all, we have identified surprisingly strong aversion towards “going back to school”. The results that have been reached with the Industry4EU mapping exercise will only enhance our understanding of the state of Industry 4.0 implementation in Slovenian metal processing companies and serve as a strong platform in further orientation of the CCIS actions to facilitate companies’ needs and expectations.

8 FINAL CONCLUSIONS AND REMARKS

The findings of the report are fully in line with **CEEMET's findings on digitalisation (Digitalisation and the World of Work, 2016)**, which state that digitalisation is sweeping both industry and society with full impact. The automatisation and robotisation we have seen in the past has sped up. Digitalisation has a continuous and unprecedented impact on how companies operate. It influences all aspects from development to production and logistics and is challenging business models and changing the work place and the way we carry out work. That is why a well-developed infrastructure and skilled workforce are pivotal factors in successfully transforming industry. Expectations are high, but only through a truly digital Europe – and a digital single market – will industry be able to reach the set goal of contributing 20% of EU GDP by 2020, whereby Slovenia has already reached this goal as its industrial contribution to GDP represents 23%.

From the employer perspective, qualification is a key Industry 4.0 challenge and one that needs decisive action. The skills challenge in the manufacturing sector is becoming more pronounced as industry becomes more digitalised. Manufacturers' plans to drive productivity improvements and to capitalize on the digital industrial revolution could be derailed because many countries across Europe are struggling to provide the right quantity and quality of skills to meet the sector's needs.

The digitalisation of products and of processes, as well as the digitalisation of work organisation, is leading to changes in the demands in MET industries workforce skills and competences. The skill sets required in both old and new occupations in the MET industries are changing. For some jobs and occupations this transformation will be rather slow while for others change comes more rapidly. There is already today on the labour market a high demand and need for people with IT competence.

Engineers and programmers are lacking, but other occupations will also require increased digital literacy – and being a digital native will not be enough. IT skills are becoming more relevant at all levels, but other skill demands also emerge. For instance, there is a pronounced need for digital leadership with an understanding of how to create business models and business processes for the digital world.

Digitalisation and the demands it places on education and training in particular cannot be seen in isolation from other, broader societal developments. The demographic development in Europe is a major factor in terms of skills and competence in the MET industries, as the average age of the MET workforce is higher than in many other sectors.

Together, these factors intensify each other. Therefore, developing the right pipeline of talent for the future will be crucial. Businesses must work closely together with governments and other stakeholders to map a future view of skill demand versus supply and together consider what a curriculum for the future might look like.

Trying to determine how skills and competence profiles will change for certain occupations in the MET industries is important, but it is perhaps more pressing to ask how we can deliver training that will meet the rapidly emerging demands, both in the existing workforce as well as in the education and training systems as a whole. As it stands, the educational systems around Europe are not fully prepared to meet the demands of new skills and emerging jobs. The lack of sufficient skills and competences as well as sufficient resources for technological equipment and updating or upskilling teacher qualifications at educational institutions are major challenges that urgently need to be addressed through reform.

Manufacturers will also need to increase investment in training existing employees – in line with company needs – to keep up with new processes. A major challenge is to increase the digital skills of current workers, and in particular older ones, which means creating an offer of training on digital skills. That reflects the needs of the company.

The trend to acquire future skills through work-based learning will continue, with a focus on ensuring that training provision meets the changing demands of manufacturing in the future. Work-based learning is a central part of excellent vocational education and training (VET) that benefits both companies and students. It is also an effective way of getting digital skills into the workforce, not least by creating bridges in companies between young learners with a high degree of digital literacy and their senior colleagues and instructors. Work-based learning and ongoing qualification of employees in many countries has kept pace with all the technical developments in recent decades. What is different today for training in the workplace is the speed of technological development. Speed is one of the central drivers of change in digitalisation and one of the main factors that sets it apart from previous technological development, automation and robotisation. It will also be a crucial success factor in reforming education and training in Europe – speed in investment and speed in creating training for the new jobs.

APPENDIX I: SLOVENIAN INDUSTRIAL POLICY MANIFESTO



INDUSTRIAL POLICY MANIFESTO

Mission:

Intensive involvement of the most competent industrial stakeholders with regard to global development, production and marketing.

Challenge:

Achieving the optimal development of industry as the key driver of exports and the economy by the year 2020/2030, while forging strong links with related non-industrial branches.

Objective:

Raising the value added in Slovenia's strongest industrial branches to 80% of EU average by 2020, implying an actual increase of 2 percentage points per year.

WHY AN INDUSTRIAL RENAISSANCE?

Last year the European Commission called on the member countries to recognise the role of industry in creating new jobs and growth. The Commission subsequently published a document titled »For a European Industrial Renaissance«. Key authorities – business owners, managers, and experts – in leading developed countries are as such intensively debating the industry of the future. In Germany the initiative is called »Industrie 4.0«, while it is known as the »Smart Manufacturing Leadership Coalition« in the USA.

A significant lack of discussion on the development of our industry has been observed by the Chamber of Commerce and Industry of Slovenia (CCIS), despite industrial and related activities being the biggest contributors to Slovenia's exports. Exports have been mitigating recent crisis conditions, due to which it is crucial to debate not only the industry of the future but also how to ensure optimal conditions for an industrial renaissance. In Slovenia this is not only limited to technological development but is also linked to the broader business environment, from taxes and administration to development and education.

Due to this the project of reaching goals of industrial renaissance has been titled »Slovenia 5.0«.

SLOVENIA 5.0 AND INDUSTRIAL POLICY MANIFESTO

The mission of the CCIS Slovenia 5.0 Strategy Group is to raise awareness in different public spheres on the importance of industry and the necessity of its advancement based on development programmes with the best chance of succeeding on the market. For this purpose, Slovenia 5.0 brings together stakeholders who know best how, where, and to whom new products, services, or technologies could most successfully be sold which is also the goal of smart specialisation strategy.

The parties involved in the Slovenia 5.0 project are facing one all-important question: how to achieve optimal development of industry as the key driver of exports and the economy by the year 2020/2030, while forging strong links with related non-industrial branches.

This year the most important document in the framework of Slovenia 5.0 is the »Industrial Policy Manifesto«. It will be presented by CCIS at the Slovenian Business Summit. The main authors of the document are members of the Slovenia 5.0 Strategy Group, particularly members of its executive board:

Chairman:

Marjan Mačkošek (Štore Steel).

Members:

dr. Janez Bešter (IER),

Radovan Bolko (Kolektor),

Andrej Božič (Steklarna Hrastnik),

Alojz Burja (Lip Bled),

Marko Derča (AT Kearney),

Bojan Kos (Akripol),

Marko Jagodič (Papirnica Vevče),

Andrej Kranjec (LTH Castings),

Marko Lotrič (Lotrič meroslovje),

dr. Blaž Nardin (Gorenje Orodjarna),

Toni Pogačar (BSH Hišni aparati Nazarje),

Andrej Poklič (GKN Driveline),

dr. Jožica Rejec (Domel),

Branko Rožič (Količevo karton),

dr. Tomaž Savšek (TPV),

Tone Stanovnik (Špica International),

Janez Škrabec (Riko),

Vojmir Urlep (Lek),

dr. Otmar Zorn (Iskra zaščite),

Rok Svetek (Adria kombi) and

dr. Matjaž Polak (Helios TBLUS).

Heads of the five sections of the Industrial Policy Manifesto:

- Smart state:
Marko Jagodič (Papirnica Vevče)
- Smart taxes:
Alojz Burja (Lip Bled)
- Smart HR management:
Toni Pogačar (BSH Hišni aparati Nazarje)
- Smart development:
Marko Derča (AT Kearney)
- Smart industrialisation:
Janez Škrabec (Riko)

Sources:

Proposals from members of the CCIS Slovenia 5.0 Strategy Group (July, August 2015)

CCIS Agendas (Business Memorandum, November 2014; Business Agenda for the New Government of the RS, July 2014; Small Industry Agenda, June 2014; How to Create New Jobs, June 2014)

Proposals from the 1st Slovenia 5.0 conference (May 2015)

Other proposals from business leaders (strategic group of representatives of foreign owned companies and other business leaders; July, August 2015)

IMPORTANCE OF MANUFACTURING FOR SLOVENIA



18,000 ENTERPRISES (SI)
21 MIO ENTERPRISES (EU)

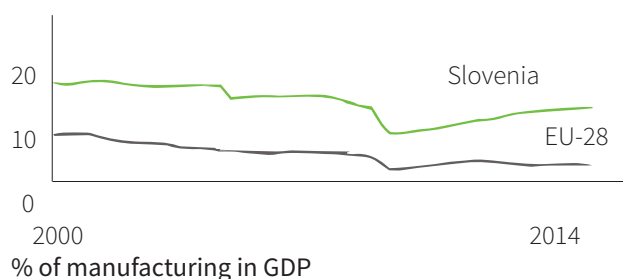


188,000 EMPLOYEES (SI)
32 MIO EMPLOYEES (EU)

JOBS AND DEVELOPMENT

- Manufacturing accounts for 30-55% of jobs in services like sales, marketing, transport and logistics (McKinsey).
- Each EUR of sales in manufacturing creates 20 cents of sales in service companies.
- 10 jobs in manufacturing create 5 to 20 new jobs in other sectors (IPTs, 2012).
- 4 of 5 private investments in R&D are from the manufacturing sector.

SLOVENIA: THIRD MOST INDUSTRIAL NATION IN EU

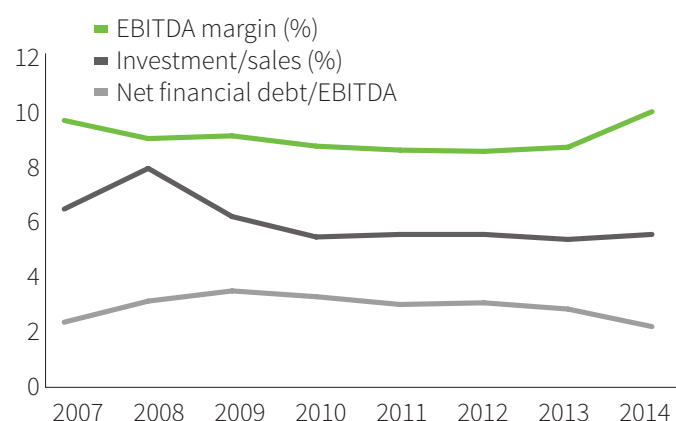


SUCCESSFUL INDUSTRIAL SECTORS

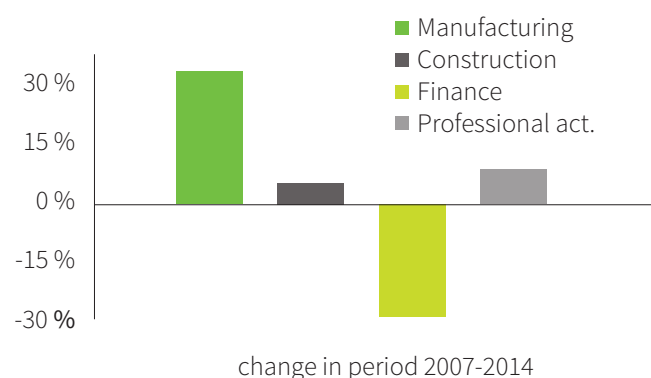
Sector	Value added per employee	2014/2009 (in %)	As of EU-28 average
pharmaceuticals	104,400	15%	75%
chemicals	62,600	46%	77%
electric equip.	37,800	31%	72%
rubber & plastics	39,200	23%	77%
vehicles	40,600	12%	79%
machines	36,700	30%	62%
metal	45,500	98%	71%
paper	43,700	9%	66%
non-metal	44,800	40%	77%

Source: KAPOs GZS, based on annual financial account from Ajpes, Eurostat

IMPROVED PROFITABILITY, STABLE INVESTMENTS, LOWER INDEBTEDNESS



MANUFACTURING IS THE ENGINE OF VALUE ADDED GROWTH PER EMPLOYEE



1. SMART STATE (BUSINESS ENVIRONMENT)

The key areas where public administration has an opportunity to improve the business environment are spatial legislation, attractiveness for investors, priorities in strategic infrastructure investments, and labour market flexibility.

Days to receive
construction permit

213 **183**

Slovenia Visegrad

Source: Doing Business 2015

Labour market efficiency
(rank)

99 **78**

Slovenia Visegrad

Source: World Competitiveness
Report 2014/2015, WEF

Inefficiency of red tape
(bureaucracy)

2nd most
problematic
factor
(1/6th of
companies)

Source: World Competitiveness
Report 2014/2015, WEF

1.1. Spatial legislation. Swift reduction of red tape following the principles of “Make it simple” and “One-stop shop” for businesses based on the best solutions in comparable countries. Responsibility for implementation at administrative units should be allotted to individual personnel, opting for sanctions in the event of violations:

- for obtaining building and other permits needed by investors. Short-term objective: a measurable 20% decrease of the average time required to obtain a building permit by 1st of January 2017.

1.2. Strategic infrastructure. Implementation of a golden investment rule allowing the development of strategic infrastructure without high financial oscillation, for at least 5 years in advance. Establishing national priorities for strategic infrastructure investments with a timeline and formation of financing models by the end of March 2016, based on the needs of business.

- Priority: smart logistics infrastructure (railways, roads, port) between industry and buyers and broadband internet in all economic zones.
- Continued infrastructure development: bridge repairs, motorways connections to industrial centres, better supply of electricity.

1.3. Increased flexibility for employers:

- Increased flexibility for terminating employment contracts (urgent adaptation to market conditions should enable the possibility of terminating employment contracts of up to 3% of all employees per year without cause; the only condition protecting older employees from termination of employment should be the number of years they need to meet the conditions for a full pension, etc.).
- The right to a 50% unemployment benefit for three months in event of a consensual termination of the employment contract.

- Legalizing special forms of employment contracts for seasonal work.

1.4. System for attracting investors. Procedures for attracting and implementing private domestic and foreign investments following the principle of “One-stop shop” with special focus on the marketing of industrial zones. Objective of measures:

- to establish a system of rapid response and support for interested investors;
- to make it easier for municipalities to successfully attract investors and expand industrial zones, for instance by establishing a more flexible system of land prices.

1.5. Public administration at the service of economy. Reduction of red tape:

- administrative procedures of national and local administration: introduction of the SME test by the end of June 2016 and increase in efficiency of public administration by 5% per year, including deregulation where required;
- procedures for placement of business facilities with the objective of sustainable development in areas protected by Natura 2000;
- optimisation of public administration by rationalising processes, proper allocation of responsibilities of public officials and concrete measures.

2. SMART TAXES (TAX POLICY)

International comparisons show that the tax burden on labour in Slovenia is too high. The aim of the tax reform should be to create more quality jobs in the economy, including industry. However, this cannot be achieved without lowering the burden on labour, requiring lower current public spending.

2.1. The introduction of a development cap in the first half of 2016. Highly qualified human resources lead to the renaissance of industry. Imposing an upper limit to social security contributions means a lower burden on employment income for highly qualified expert human resources.

Alternative: indirect inclusion of the cap in the new income tax scale, enabling higher net salaries for experts without imposing an excessive burden on businesses.

2.2. Redefinition of the income tax scale in the first half of 2016. In combination with the development cap, a redefinition of the income tax scale:

- to introduce more tax brackets and a more even range between them;
- to introduce lower income tax rates (including removing the 50% income tax rate).

2.3. Lowering of environmental and energy excise duties, contributions, and other levies. Comparable with the EU average level based on the gross value added, taking into account the carbon footprint through the ETS scheme. Lower duties causing high final prices of petroleum products. Maintain competitive electricity prices, which should be lower than in competitive countries.

2.4. Maintaining the level of tax reliefs and allowances for businesses:

- Maintaining tax reliefs and allowances at their current level, increasing them for investments and research and development, and reconsidering existing ineffective tax reliefs;
- A more flexible administrative procedure for research and development tax reliefs (currently a full description of the project is required along with the budget, record of working hours for each employee, copies of all invoices, etc.).

2.5. Tax stability and security:

- Clear and consistent interpretation of tax legislation by all competent authorities. A stable tax system without constant (un)foreseen changes or last-minute changes (e.g. in November/December for the following year);
- Active assistance from public authorities for taxable subjects in case of doubts, no avoidance of responsibility when clarifying or instructing that should be provided by legally regulated deadlines (short – a few days); It is essential to introduce changes that will make binding tax rulings more useful for taxpayers.
- Time limit on duration of tax inspections, which can currently last several years;
- A fairer regulation of possibilities for correcting tax returns, for self-declarations and tax inspections (revision of deadlines, late payment interest). Examples: a) a taxable person can correct his/her tax return within a period of 12 months, FURS can carry out a tax inspection for the past 5 years, b) late payment interest in case of self-declaration is higher than in case of inspection, c) fines are time-barred after 2 years;
- Advance pricing agreements within the framework of legislation on transfer prices should be introduced as soon as possible.

Marginal tax rate*
(in %)

60.4 45.3 47.3

Slovenia Visegrad OECD

* at 167 % of average salary, single person, w-o children. Source: OECD

Effective taxation of energy in industry and energy transformation
(in %)

17.4 8 9.4

Slovenia Visegrad OECD

Source: Taxing Energy Use, 2015, OECD

Social security contributions in GDP
(in %)

14.8 13.3 10.9

Slovenia Visegrad EU-15

Data for year 2013. Source: OECD Economic Surveys, May 2015

3. SMART HR MANAGEMENT (HR POLICY)

It is essential to implement an action plan for adapting education programmes to focus more on occupations in shortage and the anticipated HR needs of industry in the future.

Expenses for active labour incentives (in % of GDP)

0.28 0.37 0.45

Slovenia Visegrad EU

Simple average, 2013. Source: Eurostat

Employment rate of young people 3 years after graduation (in %)

65.2 71.3 68.6

Slovenia Visegrad EU

15-34 years after finished studies, 2014. Source: Eurostat

Share of graduates from technical fields (in %)

31.6 40.2 34.9

Slovenia Visegrad EU

Engineering, manufacturing, construction. Source: Eurostat, 2013

3.1. Scholarship policy:

- More scholarship for business-related occupations in shortage.
- Scholarships for young researchers in industry (co-financed by the state) with deadlines for conclusion of studies.
- State scholarships in the form of refundable funds. The recipient returns the scholarship after a set period of time from concluding his/her education/studies. If within a set period after concluding his/her studies the recipient finds employment in Slovenia for at least the same length of time as the duration of studies, he/she is exempt from returning the scholarship.
- Company-sponsored scholarships in form of refundable funds, co-financed by the state in equal amounts as state scholarships. The company adds an equal or higher amount. The recipient returns the scholarship after a set period of time from concluding his/her education/ studies. If within a set period after concluding his/her studies the recipient finds employment in the company for at least the same length of time as the duration of studies, he/she is fully exempt from returning the scholarship. If the recipient finds employment in a different company within the set period, he/she is required to return a proportional share of the scholarship to the partner company.

3.2. Incentives for youth employment:

- 2-year relief for their first employment, extended after 1st of January 2016.
- A more flexible Early Stage Researcher project. It is essential to give companies a trial period for early stage researchers, allowing them to replace any unsuitable candidates.

3.3. HR training at all levels in accordance with employers' needs:

- Appropriate planning and limiting of university enrolment would lead to positive selection, reducing the large number of graduates who are unable to find employment.
- Planning the scope and contents of study courses in accordance with long-term predictions of qualification requirements by employers.
- A longer period of work placement in companies (this is already an option through the open curriculum in secondary schools or the introduction of optional subjects in short-cycle colleges and higher education institutions).
- Providing better vocational information and career orientation for youth at all levels of education.

3.4. Specialised programmes. Public funds should be used to support and develop specialised education programmes that should not be limited solely to Slovenia.

3.5. Transfer of knowledge from the academic sphere to the economy.

- In public institutions and universities: greater importance (including when it comes to occupational status and promotion) should be assigned to cooperating with the industry. Project results in real business rather than articles in journals should be evaluated.
- Internationalisation of programmes, at least 10% of foreign lecturers.

4. SMART DEVELOPMENT (DEVELOPMENT POLICY)

It is essential to mobilise society towards a new paradigm: a development policy means a stronger role of knowledge and development in Slovenian society with the aim of creating valued added for the economy. Objective: Slovenia as a reference to developing innovation.

4.1. Smart specialisation:

- Linking into value added chains. Establishment of innovative solution hubs (ISH) linking institutions of knowledge and companies able to offer and sell innovative products on foreign markets (examples: ISH.AUTO, ISH.PHARMA, ISH.ROBOT, ISH.MEDICAL, etc.). Setting ambitious goals for new clusters/strategic partnerships and foundations for multiple competence centres (IT, pharmacy, energy, mobility, etc.). More support from cohesion funds for projects launched by industrial companies.

Objective: To raise value added per employee from 39,500 to 43,500 EUR in 2020.

4.1. Industry digitalisation. Taking advantage of digital innovations, business models, and infrastructure for stimulating growth in industry. Promoting innovativeness through cooperation and digitalisation, including related branches such as logistics, design, etc.

Objective: To increase the number of new patents in ICT from 13 to 20 in 2020.

4.2. Cross-border research and development incentives (development centres). The aim is to enhance export orientation and competitiveness in Slovenia and abroad:

- Development centres: increasing cooperation between institutions involved in financing, realising, and commercialising innovations.
- Increasing the international cooperation of Slovenian universities, thus also increasing the flow of ideas and human resources into Slovenia, rewarding the comparative success of universities.
- Providing infrastructure for functioning of development centres and enabling flexible employment of highly qualified people. Promoting the linking of Slovenian development centres with foreign ones.

Objective: International ranking of Slovenian universities in 2020 better than place 500 (currently between 551 and 600).

4.3. Smart distribution of development funds:

- Centralisation of development investment decisions and financing in one expert and independent technological agency for the distribution and monitoring of the use of funds for development.
- Active attraction of strategic investors with the aim of increasing export and competitiveness. Promotion of Slovenian development departments in foreign owned companies as regional and global development centres.
- Increasing research voucher funds.
- Reintroducing the instrument for strengthening the development organisation of companies (KROP). Encouraging employment of new researchers and promoting further in-depth education of employees.

4.4. Launch of healthy company cores. Establishing the conditions for the sustainable operation of companies demonstrating development competences.

- Identification of companies suffering from a non-operational business unit burden or unstable financial constructions despite successful central performance and a healthy development core. Establishing a programme for healthy core re-launch including it in development centres/clusters while offering systematic support with financing.

Innovation efficiency ranking

53 **39**

Slovenia Visegrad

Global Innovation Index 2014

% of sales from innovation

85% of EU average

Innovation Union Scoreboard 2015

Innovation readiness

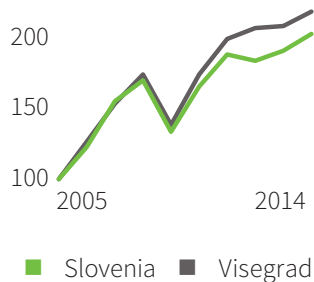
15 lost places in last 5 years

Source: World Competitiveness Report 2014/2015, WEF

5. SMART INTERNATIONALISATION (PROMOTION OF INDUSTRY ON FOREIGN MARKETS)

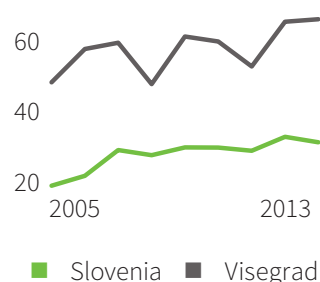
Support for Slovenian companies to develop breakthrough business models, including the redefinition of their role in international value chains, with the aim of significantly increasing value added. Improved ties between stakeholders: CCIS, Ministry of Foreign Affairs, SPIRIT.

Slovenia's export after 2007 behind its peers



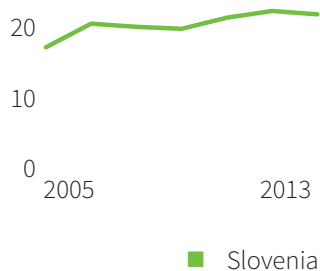
Source: Eurostat

Foreign (incoming) direct investment (in % of GDP): diverging trend



Source: UNCTAD

Stagnating high-tech exports



Source: SURS

5.1. Strengthening of business internationalisation programmes:

- Preparing a coordinated programme of internationalisation support of all institutions involved: CCIS, Ministry of Foreign Affairs, Ministry of Economic Development and Technology, SPIRIT. The programme should include:
 - target markets and activities to be performed there, as well as activity operators;
 - a review of needs of Slovenian companies by type of support services;
 - employee training of people in support services to ensure they have the qualifications to provide services that companies need.

5.2. Increasing support for participation at fairs abroad:

- A significant increase of funds for this purpose. EUR 1 million is currently available. This amount should at least double.
- Financial support for establishing Slovenian showrooms, including virtual, in close cooperation with embassies.

5.3. Stronger diplomatic support:

- Overhaul of the system for recruiting economic advisers at embassies abroad. Economic advisers should have at least some years of experience in the economy so that they are able to cope with potential enquiries and business opportunities effectively.
- Regulation and updating of the visa regime for business partners. Engaging specialised agencies dealing with issuing visas on the markets where Slovenia has no embassy.

- Opening Slovenian embassies on high-potential markets in the former Soviet Union (Kazakhstan, the Caucasus region, Moldova). Re-opening the embassy in Iran. Opening an embassy on the Arabian Peninsula.
- Support for establishing companies and locations abroad.

5.4. Enhancing the services of the Slovenian Export and Development Bank (SID bank) towards offering additional support for projects on foreign markets, following the example of banks such as the German development bank KfW. Increasing the SID bank contingency reserves. Positioning the SID bank as the entry bank for business transactions using EU investment funds (e.g. from the Juncker Plan, etc.).

5.5. Strategic integration in international associations:

- The integration of Official Development Assistance as facilitator of Slovenian export companies breaking through to developing markets. An increase of the very modest sum for companies to EUR 3 million for the current year and annual increases of EUR 1 million.
- Slovenia should join the Asian Development Bank (ADB). This would open new opportunities for Slovenian companies to participate in projects financed by ADB in Central Asia or across the Asian continent. The condition for participating in these projects being that the general contractor's and subcontractors' country of establishment is a member of ADB.