

D.T1.2.1: MAPPING REPORT THE 9 ELEMENTS OF INDUSTRY 4.0 COMPARED TO SMES NEED IN EACH RIS3 REGION

D.T1.2.1 Mapping Report the 9 elements of Industry 4.0 compared to SMEs need in each RIS3 region

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1. Introduction of the 4STEPS project

Objectives & Activities:

4STEPS project is addressing the main challenge of Industry 4.0 (I4.0) as tool towards a new, digital industrial revolution holding the promise of increased flexibility in manufacturing, mass customisation, increased speed, better quality and improved productivity and its development is supporting the RIS3 in the target regions in the different sectors. SMEs in the target regions are lagging behind in the adoption of innovative tools and solutions proposed by I4.0 revolution and need to increase transnational collaboration in facing this challenge.

The main project objective is to support the successful RIS3 implementation applying the I4.0 to all the industrial sectors identified by each region. The innovative elements of 4STEPS will be the methodology applied based on the involvement of all the actors of the quadruple helix, thanks to a bottom up approach. SMEs will be the main target and they will be involved via the CE network of the Digital Innovation Hubs (DIH)- including also the relevant stakeholders of the R&D sector, governance actors, society thanks to a holistic approach. 4STEPS will lead to an improved level of innovative productive methods and application of I4.0 thanks to a Catalogue development of main possible services offered, a Technology Maturity Level Index development, Transnational Action plan and the creation of the Digital Innovation Hubs, tested during the pilot actions. Within this approach of networking 4STEPS will include also a solution preparing the CE citizen towards the digital future during targeted workshop for digital skills improvement. The project approach developed within the 4STEP S project will consider the Industry 4.0 plans applied in CE countries which is are linked to the digitalised production system that will result in a wide range of changes to manufacturing processes, outcomes and business models.

The current Mapping Report (D.T1.2.1) is prepared in the framework of the first thematic work package (abbreviated as WPT1) of the project. WPT1, which is led by PP6 Pannon Business Network Association, includes identifying the different methodologies oriented to enable the approach of RIS3 small companies to the issues of Industry 4.0. These methodologies include mapping the contents of Industry 4.0, focusing in particular on the priorities of the national and regional plans, as regards the needs of SMEs, i.e. a correlation among the **9 technologies of Industry 4.0 (Big Data, Augmented Reality, Simulation, Internet of Things, Cloud Computing, Cyber Security, System Integration, Additive**



Manufacturing, Autonomous Systems) and their redefinition as regards needs, prospects and scenarios of RIS3 business sectors.

1.1 Objective of this report

This current report **shall map and compare the SMEs needs** focusing in particular the priorities of the national plans, i.e. a correlation **among the 9 Industry 4.0 technologies** and their redefinition as regards needs, prospects and scenarios of SMEs.

The Lead Partner, PP2 and PP6-as WPT1 leader- preliminary developed a common structure to the current report, and this proposal was distributed among the partnership. Following that the partners provided some valuable feedbacks how to modify the report, and these inputs were integrated to the proposal, and then the **common structure of the mapping report could be finalised.**

Every partner (LP+PP2 are working together) will prepare a separate mapping report based on the results of their own SME involvement in their regions.

Since the quantification target of the Mapping Report according to the project requirement (D.T1.2.1) is 8, partners will be working in their own report document following the common structure, and the 8th document will be a transnational summary/comparison, which will present a comprehensive picture about all results in the partnership. This transnational summary will be prepared by the WPT1 Lead Pannon Business Network based on the separate results provided by the partners.

2. Introduction to the regional context

- 2.1. General context

The Czech Republic belongs to countries with a very long industrial tradition. The Fourth Industrial Revolution thus brings a great opportunity that can help the Czech Republic to be competitive in the international environment in the long term. The Czech Republic is very dependent on the economic situation in other countries, such as Germany in particular. Since



2013, industrial production in the Czech Republic has been growing steadily, mainly due to the automotive, rubber industry and also to the production of computers and electrical and optical devices.

Foreign companies, which are, for example, shareholders in Czech companies or, for example, foreign development centers, have a significant influence on the introduction of technologies into Czech companies. Examples of such “support” are, for example, automotive companies that have motivated the introduction of elements of industry 4.0 their own subcontractors, mainly because of international standards and mandatory certifications.

Relatively successful small and medium-sized enterprises in introducing innovations are just those that focus on delivering products and services to significant national or multinational companies. These companies are motivated by greater competitiveness vis-à-vis foreign companies. Such innovations then come either from their own resources or through cooperation with external development centers.

Despite their lack of information on this topic, the following 3 factors may be the biggest motivation of Czech companies for the introduction of industry 4.0:

- Increasing labor productivity
- Human resources deficit
- Pressure of business partners or foreign owners

- 2.2.National and regional priorities regarding I4.0

The Czech Republic is a thriving, technologically advanced, digitally friendly, industrial country with open innovation ecosystems and a good reputation abroad.

A very positive phenomenon among Czech companies is that up to 85% of them consider Industry 4.0 as an opportunity to develop their own business. Planned investment in Industry 4.0 technology and tools is also a big promise, but many companies face a common problem, especially the lack of qualified staff.

- The National Research and Innovation Strategy for the Smart Specialization of the Czech Republic is a comprehensive conceptual document backing oriented and applied research in the Czech Republic in close relation to the National R & D & I Policy. This National RIS3 Strategy defines the so-called key areas of change (horizontal objectives) for the Czech Republic. The key areas for the Czech Republic are: Higher innovation performance of companies
- Improving research quality



- Increasing the economic benefits of public research
- Better availability of human resources in number and quality for innovative entrepreneurship, research, and development
- Development of eGovernment and eBusiness to increase competitiveness (development of ICT and digital agenda)
- Strengthening and making better use of social capital and creativity to address complex societal challenges

These activities are supported across industrial areas, but the following are selected as key areas of support for the Czech Republic:

- Mechanical engineering - mechatronics
- Energetics
- Metallurgy
- Industrial chemistry
- Electronics and electrical engineering in the digital age
- Digital economy and digital content
- Automotive
- Railway and rail vehicles
- Aerospace industry
- Pharmaceuticals, biotechnology, medical devices
- Traditional cultural and creative industries
- New cultural and creative industries
- Sustainable management of natural resources
- Sustainable agriculture and forestry
- Sustainable food production
- Ensuring a healthy and quality environment, biodiversity and ecology of natural resources
- Sustainable construction, human settlements and technical environmental protection
- Security research; Health care research; Labor, soc. services and pension system

In the case of the Liberec Region, the emphasis is placed on development in accordance with the principles of sustainable development, based on innovative companies that are able to stand up to the global market. Emphasis is placed, for example, on supporting all levels of education, promoting research and development cooperation, but creating space and favourable conditions for new companies.



Specific industrial areas important for the Liberec Region which are included in the regional RIS3 strategy are as follows:

- Production of engineering technologies
- Optics, decorative and utility glass
- Advanced separation and sanitation technologies
- Advanced materials based on textile structures
- Progressive metallic and composite materials
- Components for transport equipment

If we are talking about the horizontal priorities of the Liberec Region, the focus is on 3 areas.

1. Human resources for innovation, science and research

In this area we would mainly include an increase in the number of R&D personnel in companies, research institutions and schools, but also an increase in the quality of education at all its levels.

2. Innovative business environment

In the case of support for the business environment, the support is aimed primarily at increasing the number of innovative start-up companies and increasing the intensity of cooperation between companies, R&D institutions, schools and other important actors.

3. Strengthening the ability of R&D centers and specialists to create applied results

The last but equally important goal is to increase the ability of R&D centers to apply their results.

- 2.3. S3 Strategy in the next programming period (regional or national level according to the partner)

Among the most important strategic documents in the case of the Czech Republic, we talk about the National Research and Innovation Strategy for the Smart Specialization of the Czech Republic. This document was prepared for the period 2014 - 2020 and its last update was carried out in 2018. It is a comprehensive conceptual document backing oriented and applied research in the Czech Republic. The purpose of this document is primarily the effective targeting of European, national, regional and private financing.



The same applies to the strategy for the Liberec Region. The most important document for our region is the "RIS3 strategy of the Liberec Region", which was also updated in 2018 the same as a national strategy.

Another very important document that is currently being prepared is the "Strategy for the Development of the Liberec Region 2021+". This is a medium-term strategic document that, based on knowledge of the territory, social conditions and development trends at the EU and Czech level, defines the basic strategic objectives of the development of the Liberec Region.

3. Description of the sample

-3.1 Criteria for the sample's selection

Survey aimed to reach companies located in the territory of our region (Liberec) which meet the criteria for inclusion among small and medium-sized companies (10 - 250 employees), it means small enterprises (10 - 50 employees) and medium enterprises (50 - 250 employees) and annual turnover, which does not exceed EUR 50 million.

- 3.2 Economic sectors represented

Given the lack of interest in engaging in mapping, it was not possible to concentrate only on certain sectors, which led to a greater diversity of the companies involved. This diversity can be seen in the table below, which shows statistics describing to which industry the companies involved in the survey belong. The largest representation in our survey are companies dealing with Metal products, except machinery - 14.43%, followed by Machinery and equipment - 12.37% and the third highest representation of companies then belongs to areas Scientific research and development - 11.34%

However, in monitoring these results, it is important to keep in mind that most companies do not focus on just one industry, but mostly focus on more areas.

Figure 1: Economic sectors represented

Food products	1,03 %
Aerospace	1,03 %
Nautical industry, ships and boats	0 %
Automotive	8,25 %
Textile, clothing, footwear, fashion	3,09 %
Wood and furniture	1,03 %
Publishing activities	1,03 %
Plastics materials	6,19 %
Glass, ceramics, stone	2,06 %



Engineering and architectural activities	4,12 %
Electrical equipment	2,06 %
Construction of buildings / plants	2,06 %
Commerce & trade	8,25 %
Tourism / catering	0 %
Transport, logistics, warehousing, postal activities	0 %
Computer, electronic and optical products	4,12 %
Computer programming, consultancy and related activities	3,09 %
Mining	1,03 %
Chemicals	6,19 %
Metal products, except machinery	14,43 %
Pharmaceutics	0 %
Medical devices	1,03 %
Machinery and equipment	12,37 %
Railway locomotives and rolling stock	1,03 %
Other transport equipment	0 %
Consumer goods	0 %
Civil engineering	3,09 %
Broadcasting activities	0 %
Financial service activities	0 %
Scientific research and development	11,34 %
Office administrative, office support and other business support	0 %
Public administration	0 %
Defence	0 %
Education	2,06 %
Libraries, archives, museums and other cultural activities	0 %

- 3.3.Size

As SME mapping became a very difficult task, with the awareness of SMEs on the topic of Industry 4.0 very weak - usually, relevant for large companies and only rarely for smaller companies with less than 50 employees, a total of 40 SMEs meeting the inclusion criteria of size and turnover were involved in the survey.

We have managed to involve companies of different sizes in our mapping in a fairly balanced way. About 50% of companies with less than 50 employees were involved in our investigation and the other about 50% was made up of companies with more than 50 employees.

- 3.4 Geographic distribution

Geographically, our sample included finally not only SMEs from the Liberec region (the second smallest region according to the number of inhabitants) but also SMEs from the neighbouring Hradec Králové region, for which involvement in the project might also be geographically interesting for later implementation purposes. Nevertheless, 98% of the companies involved



come from the Liberec Region. In project, only 2% of the companies involved from the Hradec Králové region are from Jičínsko area.

4. The SMEs and the 9 pillars

Specific to each region

Mapping of the attitude of the interviewed SMEs towards the 9 enabling technologies

The situation regarding the use of 9 enabling technologies varies widely between the companies surveyed. There are companies that do not use any technology or even consider its use, but at the same time, mapping has involved companies that are unique thanks to the use of such technologies and these technologies are not new to them.

Also in this case some companies fall into the category of both end users and suppliers, which should be reflected when looking at the statistics in the table.

4.1. In case of end users:

Level of adaptation

The areas of industry 4.0 we have asked are not unknown to the participants in our survey, but we must confirm that they are not very widespread. There are many companies around us that do not address these topics at all or they work just very little with them. In any case, there are companies in the Liberec region that work with new technologies and use these technologies in their production.

It can be said that companies are most concerned about their safety. Many companies work with automotive companies that have strict rules. These companies also emphasize cyber security for their suppliers. It can be said that companies are most concerned about their safety. Many companies supply products and equipment to the automotive industry, where they have very strict rules. These companies also emphasize cyber security for their suppliers.

Companies involved in our survey are also using other technologies and the table shows their individual representation.

Figure 2: Level of adaptation (Q13)

Total 33 companies	no usage at all	few usage	good extent	very intense use
1. autonomous robots	84,85 %	3,03 %	9,09 %	3,03 %
2. simulation	45,45 %	21,21 %	18,18 %	15,15 %
3. horizontal and vertical systems integration	51,52 %	18,18 %	21,21 %	9,09 %



4. industrial internet of things	72,73 %	3,03 %	9,09 %	15,15 %
5. cybersecurity	39,39 %	24,24 %	15,15 %	21,21 %
6. cloud technologies	45,45 %	36,36 %	15,15 %	3,03 %
7. additive manufacturing	78,79 %	6,06 %	9,09 %	6,06 %
8. augmented reality	81,82 %	15,15 %	0 %	3,03 %
9. big data and analytics	66,67 %	24,24 %	3,03 %	6,06 %

The motivation for the digital transformation

Speaking the motivation of our SMEs, most companies have put forward several reasons for digital transformation. It was rare that companies give only one or two reasons, but the main motivation of companies for digital transformation is to offer new products and services.

When it comes to more successful companies with sufficient financial resources, very often companies also mentioned support for internal innovation, as they often said, that they do not want to stay behind their competitors. Overall, however, it can be summed up that companies care about reducing costs, whether in terms of quality control, saving materials, but also human labor.

Figure 3: Motivation for the digital transformation (Q14)

Total 33 companies	I don't agree	I partly agree	I mostly agree	I fully agree
1. Our business model changes	60,61 %	27,27 %	6,06 %	6,06 %
2. We adapt existing products and services	39,39 %	18,18 %	15,15 %	27,27 %
3. We offer new products and services	24,24 %	27,27 %	12,12 %	36,36 %
4. New markets, new business areas evolve	24,24 %	15,15 %	36,36 %	24,24 %
5. New customers occur	21,21 %	21,21 %	39,39 %	15,15 %
6. Materials usage: The company reduces material consumption through product and manufacturing optimisation.	27,27 %	21,21 %	27,27 %	24,24 %
7. Managing quality & robustness: Prevention and correction actions, product and service changes, transfer processes and manufacturing feasibility tests are all documented and feed into KPI's for new products, processes and services.	39,39 %	18,18 %	18,18 %	24,24 %
8. We remove existing products and	72,73 %	21,21 %	3,03 %	3,03 %



services from the market.				
9. Internal innovation (internal renewal, change and adaption) is fostered.	21,21 %	15,15 %	33,33 %	30,30 %

Strategy for the digital transformation

The survey clearly shows that the companies that participated in our survey are not so well prepared for the transformation towards Industry 4.0. However, it is important to note that some companies are taking advantage of some principals of I4.0 and often do not realize that their path to digital transformation is already underway.

It turns out, that the finance for many companies are not obstacles, but very often it is rather the attitude of entrepreneurs. Very often we met with answers like: It does not concern us; We are too small company and so on. Very often, we also met with reasoning that their company is engaged in custom manufacturing and therefore it is not possible to make the transition to I 4.0 in their company. However, not all entrepreneurs have this view because some of them have been aware of the opportunities that I4.0 brings for custom manufacturing companies.

Figure 4: Strategy for the digital transformation (Q15)

Total 33 companies	I don't agree	I partly agree	I mostly agree	I fully agree
1. Roadmap for Industry 4.0 realization available	81,82 %	15,15 %	3,03 %	0 %
2. Central coordination of Industry 4.0 activities	81,82 %	15,15 %	3,03 %	0 %
3. Financial resources to realize Industry 4.0 available	30,30 %	36,36 %	24,24 %	9,09 %
4. Communication of Industry 4.0 activities ongoing	42,42 %	24,24 %	21,21 %	12,12 %
5. Employee objectives to realize Industry 4.0 defined	87,88 %	6,06 %	6,06 %	9,09 %
6. Risk assessment for Industry 4.0 available	81,82 %	3,03 %	0 %	15,15 %
7. Willingness of managers to realize Industry 4.0	24,24 %	30,30 %	27,27 %	18,18 %
8. Manager trainings for Industry 4.0 available	60,61 %	6,06 %	30,30 %	3,03 %
9. Mastering the digital transformation: The digital transformation is managed and forms a part of the company's DNA.	75,76 %	12,12 %	6,06 %	6,06 %
10. Rules, regulation and standards: The company actively deals with both existing as well as new rules,	21,21 %	0 %	30,30 %	48,48 %



regulations and standards.				
11. Innovation strategy	33,33 %	21,21 %	24,24 %	21,21 %
12. Industry-4.0 technology strategy	48,48 %	27,27 %	12,12 %	12,12 %
13. Investment strategy including budget	39,39 %	3,03 %	30,30 %	27,27 %

Needs of industry 4.0 technologies

Companies are showing their growing interest in technology. We see a very significant difference between the already used technologies and the planned ones in the simulation and additive production and 3D printing. Simulation is already used in the addressed companies compared to other areas already, but it is nevertheless clear that companies want to deal with this technology in the near future even more.

We can also see a big increase in the case of Additive manufacturing. In this case, it is a very good promise for cooperation with DIH, which arises in Liberec. In our DIH we want to focus on 3D printing and related activities, which is very good news for using DIH. Another promise is the direction of some companies to use IOT. In this case it will again be possible to use the equipment that DIH already offers or plans to offer in the future.

Figure 5: Needs of industry 4.0 technologies (Q16)

Total 33 companies	no usage at all	few usage	good extent	very intense use
1. autonomous robots	69,70 %	9,09 %	15,15 %	6,06 %
2. simulation	45,45 %	21,21 %	6,06 %	27,27 %
3. horizontal and vertical systems integration	51,52 %	12,12 %	27,27 %	9,09 %
4. industrial internet of things	48,48 %	27,27 %	15,15 %	9,09 %
5. cybersecurity	45,45 %	15,15 %	21,21 %	18,18 %
6. cloud technologies	36,36 %	42,42 %	18,18 %	3,03 %
7. additive manufacturing	69,70 %	3,03 %	27,27 %	0%
8. augmented reality	81,82 %	15,15 %	6,06 %	0%
9. big data and analytics	66,67 %	18,18 %	9,09 %	6,06 %

In what extent are SMEs prepared for digital transformation



This was a voluntary question and therefore we do not have an answer from all the companies surveyed. Therefore, it is possible to see for each question of how many companies answered a specific question.

On this question, most respondents responded very differently and it is difficult to highlight some answers as more significant. However, it is worth noting the first question, which is “openness to new technologies”. In this case, almost 56% of respondents answered positively, that their company is open to new technologies. Overall, it is also worth mentioning that more than 50% of the answers to the questions in this section were mostly positive (mostly agree and fully agree), which can be a great promise for their future development.

Figure 6: In what extent are SMEs prepared for digital transformation (Q17)

	I don't agree	I partly agree	I mostly agree	I fully agree	Total
1. Openness to new technologies	23,08 %	11,54 %	19,23 %	46,15 %	26
2. Competence with modern ICT	0 %	31,82 %	45,45 %	18,18 %	22
3. Awareness of non-IT-employees for meaning and value of digital data	18,18 %	27,27 %	36,36 %	18,18 %	22
4. Awareness of non-IT-employees for cyber security	9,09 %	40,91 %	31,82 %	18,18 %	22
5. Willingness to flexibilize work arrangements	13,64 %	36,36 %	36,36 %	13,64 %	22
6. Autonomy of shop floor workers	4,76 %	14,29 %	23,81 %	57,14 %	21
7. Willingness for interdisciplinary work	9,09 %	9,09 %	45,45 %	36,36 %	22
8. Willingness for continuous training, education and qualification towards industry 4.0	9,09 %	27,27 %	27,27 %	36,36 %	22
9. We know our employees' digital competences	20,69 %	20,69 %	31,03 %	27,59 %	29

4.2 In case of suppliers:

Level of adaptation

In the case of suppliers, this was a small research sample, but these answers also brought some interesting findings to be mentioned.



However, this was perhaps more a negative finding. It is quite strange to find that these companies are closely concerned with only one area of industry 4.0.

However, the results faithfully suggest that each company we involved with our measuring, is focused on a different area of industry 4.0. In our research are companies specializing in the production of autonomous robots and autonomous lines, industry IOT, simulation, and also companies that specialize in additive manufacturing and augmented reality.

Figure 7: level of adaptation (Q18)

Total 8 companies	no usage at all	few usage	good extent	very intense use
1. autonomous robots	75,00 %	12,50 %	0 %	12,50 %
2. simulation	50,00 %	25,00 %	12,50 %	12,50 %
3. horizontal and vertical systems integration	37,50 %	12,50 %	25,00 %	25,00 %
4. industrial internet of things	50,00 %	25,00 %	25,00 %	0 %
5. cybersecurity	87,50 %	12,50 %	0 %	0 %
6. cloud technologies	50,00 %	37,50 %	12,50 %	0 %
7. additive manufacturing	50,00 %	25,00 %	12,50 %	12,50 %
8. augmented reality	87,50 %	12,50 %	0 %	12,50 %
9. big data and analytics	0 %	0 %	0 %	0 %

Motivation and Plans

The same was true of the responses related to company plans. Strangely, however, it remains that there have been absolutely no changes in this case and companies do not plan to develop in other areas of I 4.0. Most companies plan to further develop activities in the areas they are already working on. However, after a long debate, some companies have indicated that they would like to focus on also another area in the future, but such plans remain without detailed concrete plans.

Figure 8: Motivation and Plans (Q19)

Total 8 companies	no usage at all	few usage	good extent	very intense use
1. autonomous robots	75,00 %	12,50 %	0 %	12,50 %
2. simulation	50,00 %	25,00 %	12,50 %	12,50 %
3. horizontal and vertical systems integration	37,50 %	12,50 %	25,00 %	25,00 %
4. industrial internet of things	50,00 %	25,00 %	25,00 %	0 %
5. cybersecurity	87,50 %	12,50 %	0 %	0 %



6. cloud technologies	50,00 %	37,50 %	12,50 %	0 %
7. additive manufacturing	50,00 %	25,00 %	12,50 %	12,50 %
8. augmented reality	87,50 %	12,50 %	0 %	12,50 %
9. big data and analytics	0 %	0 %	0 %	0 %

5. Other enabling factors

Description of the SMEs position with regards to other factors considered enabling for innovation (Related variety; Human resources; Fundraising capacity; Development, others...)

Most innovations are driven by market demand and are created directly by companies, all the more so in areas where there is creative interaction between research organizations, companies and other actors. National RIS3 pays special attention to support innovations in which the greatest scope for exploiting the research results. This is specifically contributed to by the 2014-2020 Concept of Support for Small and Medium-Sized Entrepreneurs. Support for SMEs in the 2014-2020 programming period emphasizes strengthening their competitiveness through the creation and dissemination of innovation.

If we look at the statistics published by the Ministry of Industry and Trade of the Czech Republic, which focus on SMEs, we find that the number of SMEs in the total number of active business entities in 2017 was 99.8%. However, it is important to mention that there are also many large and multinational companies in the Czech Republic, which to their extent will cover up to half of the production. However, in recent years family businesses have become a big promise, and they have also experienced a big boom and, like as SMEs, most of the added value of these businesses remains in the Czech Republic.

Despite these positive aspects, not all of these SMEs are able to innovate and expand their business and very often stagnate and do not attempt to develop further. Based on the analyses carried out by the Ministry of Industry and Trade, problem areas have been identified which hinder further development and the emergence of innovations in early SMEs.

1. Poor level of entrepreneurship and insufficient endogenous business sector
2. High dependence of the Czech economic development on the activities of foreign companies
3. The instability of the regulatory framework and the administrative burden of complying with regulatory rules
4. Persistent underestimation of the digital agenda in business

However, if we are to build on our mapping of SMEs, the general problem is the lack of qualified employees. Human resources are a general problem for all sectors across the Czech Republic. The unemployment rate has been so low in recent years that for a lot of them it is not possible to recruit new, and not at all qualified, employees.



However, one really important problem arose from the interviews, which is also described in other surveys. It is mainly about low interest and weak information of some entrepreneurs. For many of them, the theme of Industry 4.0 is either a totally misunderstood theme or, until the end, completely unknown. During the meetings, a relatively significant percentage of businesses appeared that did not consider this topic important and, according to them, is a distant future that does not concern them at all.

On the other hand, we have also found very progressive businesses that try to refute this observation, which is very positive and such businesses are promising for the future.