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

FINAL VERSION
03/2020

Pannon Business Network – PP6 -Hungary

Project Number	CE1492
Project Name	Towards the application of Industry 4.0 in SMEs
Project Acronym	4STEPS
Work package	WPT1-The SME towards the scenario and themes of Industry 4.0
Activity	Activity 1.2-RIS3 SMEs and Industry 4.0
Deliverable	**Deliverable D.T1.2.1**-Mapping Report the 9 elements of Industry 4.0 compared to SMEs need in each RIS3 region
WP responsible partner	Pannon Business Network
Dissemination Level	Public
Date of Preparation	1. Template: 12.2019 prepared by PBN 2. Finalised version: 03.2020 prepared by PBN
This document must be referred to as	Mapping Report the 9 elements of Industry 4.0 compared to SMEs need in each RIS3 region- Pannon Business Network- PP6-Hungary
Author	Martin Dan
Contributors	Balázs Barta, Péter Mátyás

Table of contents

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 4STEPS 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 West Transdanubian region is located on the Western part of Hungary, (Figure 1) bordered by the Austria, Slovakia, Slovenia and Croatia. It includes the counties Győr-Moson-Sopron, Vas and Zala. The population is 989.343 which is 10% of the whole Hungarian population.

Figure 1: The location of West Transdanubian region in Hungary

The territory of the region is 11 183 km2 that includes 12 % of the territory of Hungary but the population density of the region is highly heterogenous, densely populated urban areas and remoted rural areas with decreasing and aging population. The volume index of GDP per capita in Purchasing Power Standards (PPS) is 21.900 EUR (Eurostat, 1st December 2019.), it means the 2nd place in the Hungarian regions but it is just 70,6% of the EU28. The economy structure is divided as Industry and Service sector give 48-48% and the agriculture take only 4% of the GDP. The R&D Spending per GDP in Hungary is 0,72 % (Eurostat, 2018) which is cc. half of the EU28 (1,37%). 5% of the R&D spendings comes from our region and the value is divided among the counties: 66% Győr-Moson-Sopron county, 25% Vas county and 9% Zala county. This distribution shows that there is a big gap within the region and the Northern part of the region is overrepresented due to the automotive sector (Audi in Győr). The number of R&D sites is 260 R&D sites in the region where 3587 researchers worked in 2018.

- 2.2.National and regional priorities regarding I4.0

Hungary's last Smart Specialisation Strategy was published in 2014, and now the updated strategy is being prepared and expected to be finalised and published within 1-2 years. On regional level, no such comprehensive strategy has been prepared.

The main visions of the current strategy are the followings:

- Increase the performance of all actors of the domestic, scientific, technological and innovation (STI) system
- According to the vison of the Hungarian S3, by 2020 internationally competitive knowledge bases and intensive knowledge flows shall be implemented
- Public administration, the economy and the civil society, (stakeholders) jointly manage adaptation in the rapidly changing world of technology and markets, which results in the corrective or better responsiveness of the STI policy.
- Internationally competitive specialization-learning-alignment process

The current Hungarian S3 Strategy is differentiating three national smart specialisations namely: System Science; Smart production and sustainable society.

Furthermore, the Hungarian S3 has defined two horizontal priorities:

ICT & Services:

The following elements belong to this horizontal priority:

- smart business,
- big data
- data mining
- cloud computing
- bioinformatics
- "Internet of things"
- 3D printing
- 5G technologies

- numerical modelling and simulation
- machine learning
- data centres, data transmission networks

Inclusive and sustainable society, viable environment:

The following elements belong to this horizontal priority:

- Create an inclusive and sustainable social model to every citizen.
- Comply with the newest innovation model directions with „Quintuple Helix model"

The above mentioned elements have shown that Industry 4.0 principles are supported in the HUN RIS 3 in a horizontal way.

Apart from the horizontal priorities, the Hungarian S3 has also defined and differentiated six sectoral priorities which are the followings:

- Healthy Society and Wellbeing
- Clean and Renewable Energies
- Advanced Technologies in Machine Industries
- Sustainable Environment
- Healthy Local Food
- Agricultural Innovation

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

National Smart Specialisation Strategy (S3) - 2021-2027

In accordance with the main objectives of the Cohesion Policy, it is a priority to use the Cohesion Fund in a way that makes Europe smarter through innovation, economic transformation and modernisation. Key areas of implementation:

- Enhance research and innovation capacities and the uptake of advanced technologies;
- Reap the benefits of digitisation for citizens, companies and governments;

- Develop skills for smart specialization, industrial transition and entrepreneurship;
- Enhance the growth and competitiveness of SMEs.

Within Europe, Hungary is currently a moderate innovator. It is a national target to make the country an innovation leader in Europe by 2030. In addition to increased spending on R&D, success also demands proper criteria for the optimal use of public funds. This is facilitated by the Smart Specialization Strategy (S3), intended to contribute to the objective of a smarter Europe by the following means:

- identifying the strengths specific to the area;
- defining the competitive advantages;
- outlining the specialisation priorities;
- monitoring implementation and providing feedback.

The development of a Smart Specialisation Strategy for the EU's 2021-2027 programming period is a prerequisite for drawing down EU funds for research, development and innovation.

S3 helps RDI policy to support RDI processes and compliance with the territoriality principle more effectively: it highlights strengths and areas for improvement for RDI stakeholders. During the implementation of the S3, Hungary now places greater emphasis on promoting international cooperation, helping to partner with foreign organisations and companies.

In the 2021-2027 planning process, the scope of the S3 will expand beyond research and innovation: it will define new priorities addressing cross-sectoral challenges, such as globalisation, climate change or the emergence of new technologies. Also, in addition to promoting physical investments, it will also focus on related developments (skills, intangible assets or software). Future applicants for RDI funds will continue to be required to comply with S3 priorities.

S3 priorities are developed using the Entrepreneurial Discovery Process (EDP) method. This bottom-up process enables a wide range of stakeholders from the business sector, academia, research institutes and social actors to contribute to the planning process. With the Territorial Innovation Platform initiatives launched by the NRDI Office in 2019, the ERD process is already underway.

As an important element in planning the priorities, the NRDI Office has designed an online questionnaire which empowers every stakeholder to directly share their ideas and views with RDI policymakers and propose strengths and specialisation directions. Stakeholders had the

opportunity to fill in the questionnaire until mid-March, and now their contributions might be integrated into the upcoming S3 Strategy of Hungary.

3. Description of the sample

-3.1 Criteria for the sample‘s selection

According to the project requirement every partner of the 4STEPS project was supposed to involve at least 50 companies of different RIS3 sectors, mainly manufacturers and only SMEs. PBN has fulfilled this requirement, due to the fact that 50 Hungarian SMEs conducted the common Industry 4.0 questionnaire. As the next chapter shall present is detail, the majority of the involved Hungarian companies are operating in the metal products and machinery field, but some additional areas have been also covered (e.g.: plastic materials, wood and furniture industry..) As far as the geographical coverage is concerned, the involved SMEs are operating in almost every region of Hungary, not only in the West part of the country where PBN is operating. Regarding the size of the firms, the data analysis has shown (detailed explanation shall be seen at Section 3.3) that almost 90% of the involved companies have 10-249 employees, and few involved companies are micro whereas further few are employing little bit more than 249 people.

- 3.2Economic sectors represented

As far as the economic sectors are concerned, the involved companies, based on the NACE classification, were requested to indicate their own industrial sector(s), where they are operating. but besides, they were also asked to choose their suppliers’ and their customers’ industrial sectors as well.

Based on the results of this question, three different figures have been prepared which demonstrate the industrial sectors of the companies, their suppliers and also their customers.

At this question companies had the opportunity to choose more than one answer at every sub-question, since it may happen that one company and their clients are also operating in different fields.

As Figure 2 reflects, the involved Hungarian companies are operating in 10 industrial sectors, but from these ten sectors, the “metal products” sector is the most represented with 61,8% of the total answers. Following the “metal products” 12.7% of the companies are dealing with Machinery and 7.3% of the firms are operating in the “plastics materials” and “wood and furniture” sectors. The rest of the sectors are represented in a minor extent.

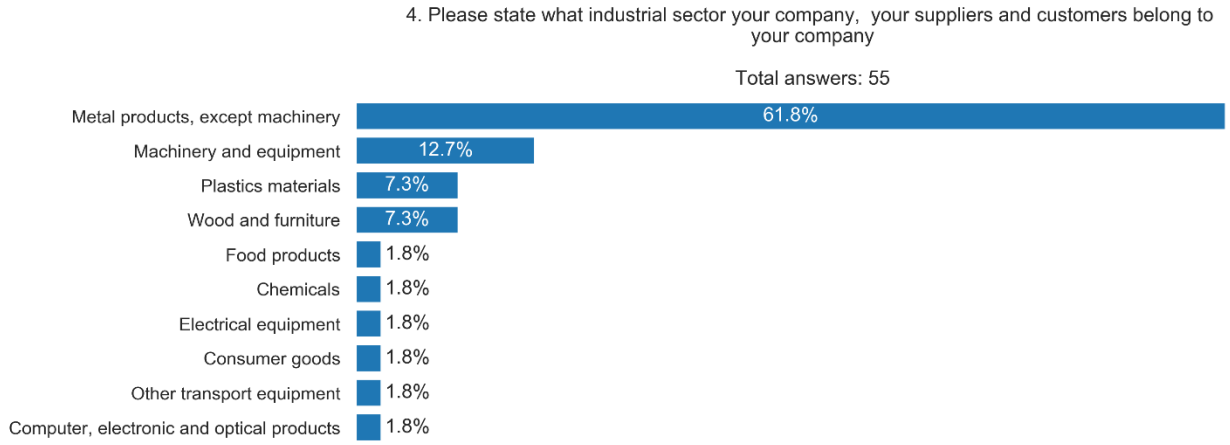

Figure 2: The distribution of industrial sectors of the involved Hungarian companies

When we analyse the results of the ratio of the suppliers from different sectors, the results are not surprising, since it has turned out that the sectors of the companies and the sectors of the suppliers are closely correlating. Figure 3 also points out that the metal product sector is outstanding when suppliers’ sectors are scrutinised.

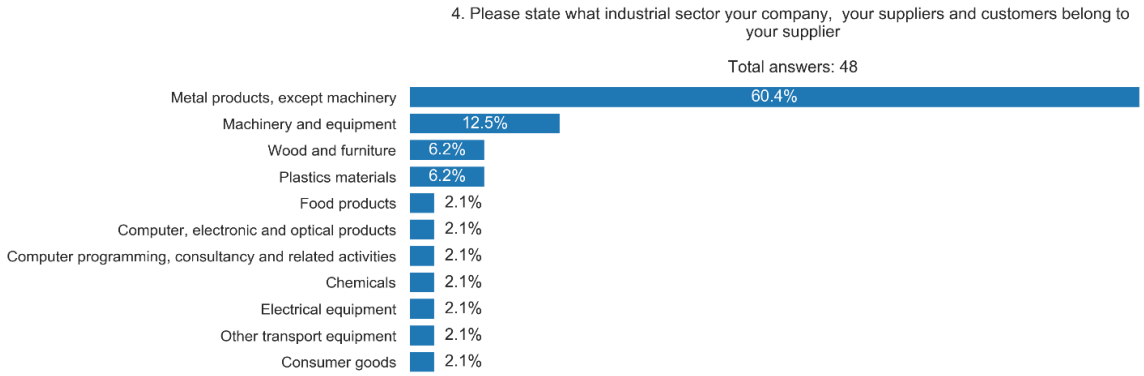

Figure 3: Distribution of the involved Hungarian companies’ suppliers’ industrial sector

The third sub-question regarding the economic sectors was asked the economic sectors of the customers of the involved companies. The results are not surprising, and Figure 4 clearly shows that the majority of the companies' customers are operating in the metal product sector so as the companies themselves.

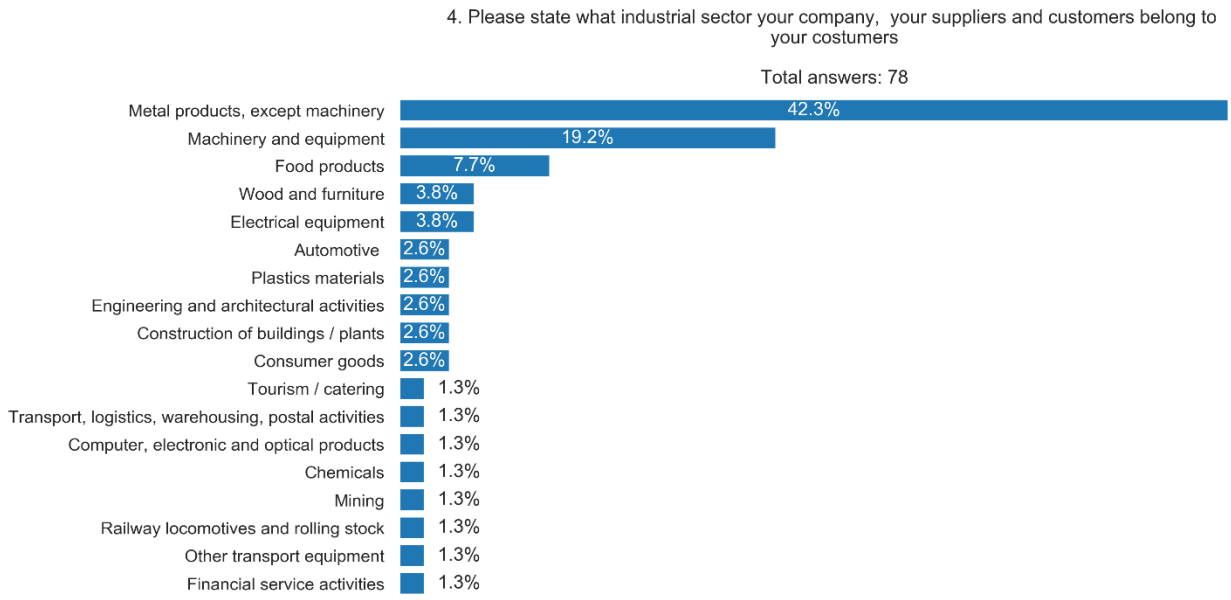

Figure 4: Distribution of the involved Hungarian companies' customers' industrial sector

- 3.3.Size

From the Hungarian side, 50 companies took part in the survey with filling the Industry 4.0 related questionnaire (D.T1.1.2→ Transnational tool for analysis) which was commonly accepted by the partnership.

Regarding the number of employees of the involved companies, Figure 5 points out that the majority of the involved Hungarian companies (88%) have between 10 and 250 employees, and micro companies were not represented in a large extent in this analysis. The figure also shows that only three (6%) Hungarian companies employ more than 249 people.

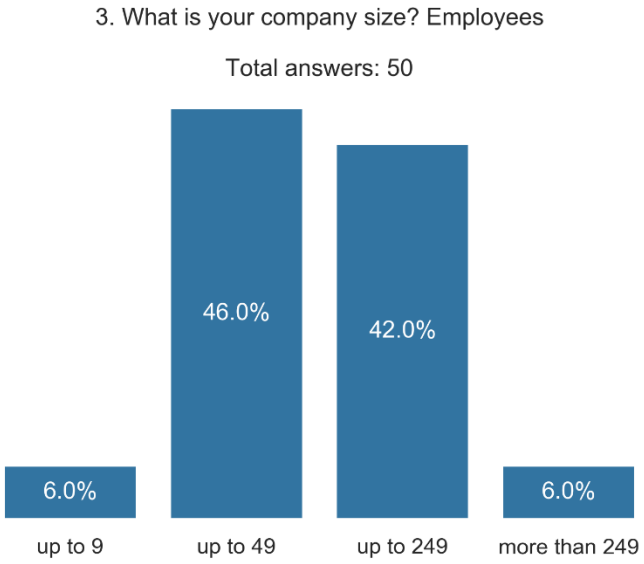

Figure 5: Distribution of number of employees of the involved Hungarian companies

The questionnaire also asked the yearly turnover of the involved companies. Figure 6 illustrates that 70% of the Hungarian companies have a yearly turnover between 2-10 million EUR/year. As it can be seen on the Figure, 22% of the Hungarian companies (namely 11) companies have less than 2 million Euro turnover/year, and only four companies (8%) belong to a group which contains companies between 10 and 50 million EUR per year.

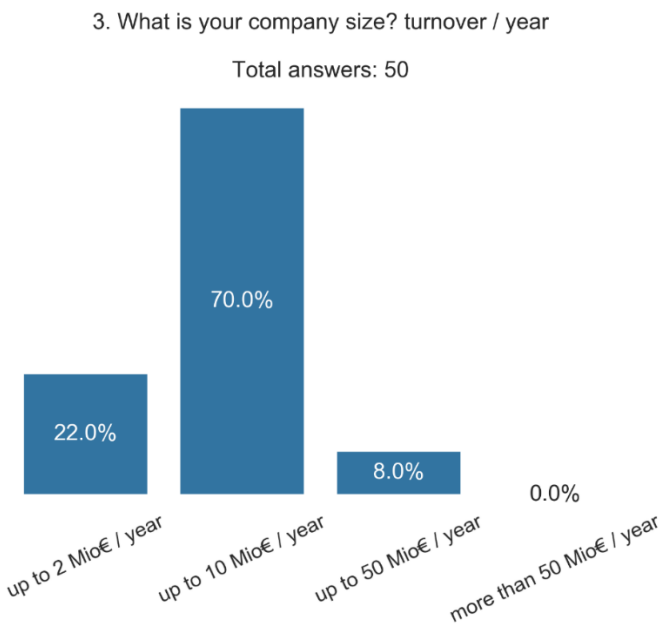

Figure 6: Distribution of the yearly turnover of the involved Hungarian companies (million EUR)

Apart from the yearly turnover, the questionnaire was dealing with the total balance as well on a yearly basis. When the two figures (Figure 6 and Figure 7) are compared, the similarity of the results is significant, and it can be stated that the results of the yearly turnover and the yearly total balance closely coincide.

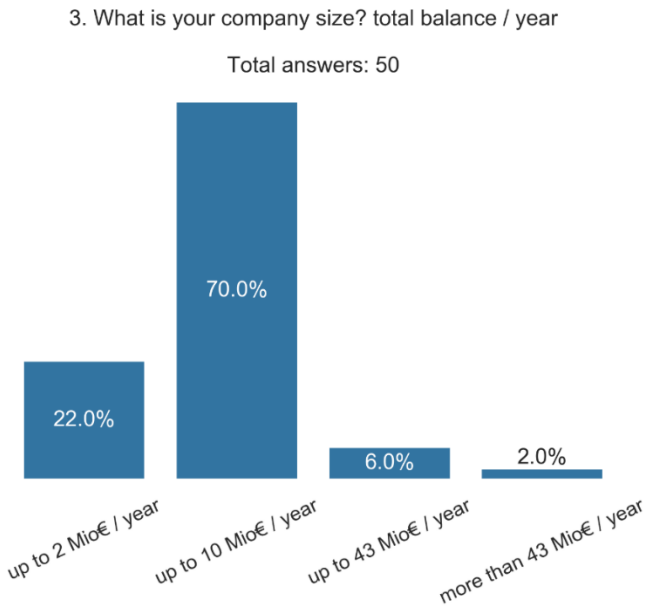

Figure 7: Distribution of the total balance of the involved Hungarian companies (million EUR)

- 3.4 Geographic distribution

As far as the geographical coverage is concerned, the involved 50 SMEs are operating in almost every region of Hungary, not only in the West-Transdanubian region of the country where PBN is operating.

4. The SMEs and the 9 pillars

Mapping of the attitude of the interviewed SMEs towards the 9 enabling Industry 4.0 technologies.

The questionnaire has differentiated between the end user and suppliers of Industry 4.0 products and services. Based on the results, 42 out of the 50 Hungarian SMEs belong only to the end user group, five companies indicated themselves as suppliers and three companies have chosen that they can be considered as both end users and suppliers of Industry 4.0 technologies. As a result, 45 (42+3) companies answered to the questions related to end-users, and 8 (5+3) companies replied to the questions concerning suppliers.

4.1. In case of end users:

Question 13: Level of adaptation of Industry 4.0 technologies:

As it can be read from Figure 8, the vast majority of the involved Hungarian companies are not using the listed 9 elements of Industry 4.0 technologies at all, mainly AR, autonomous robots, and big data analytics are rarely used by the involved Hungarian companies. It is also visible on the Figure 8 that horizontal and vertical systems integration is used at least a few extent by the

majority of the involved firms. Nevertheless, there are few outstanding companies who have adopted some of the nine I4.0 pillars, especially cybersecurity and Industrial IoT.

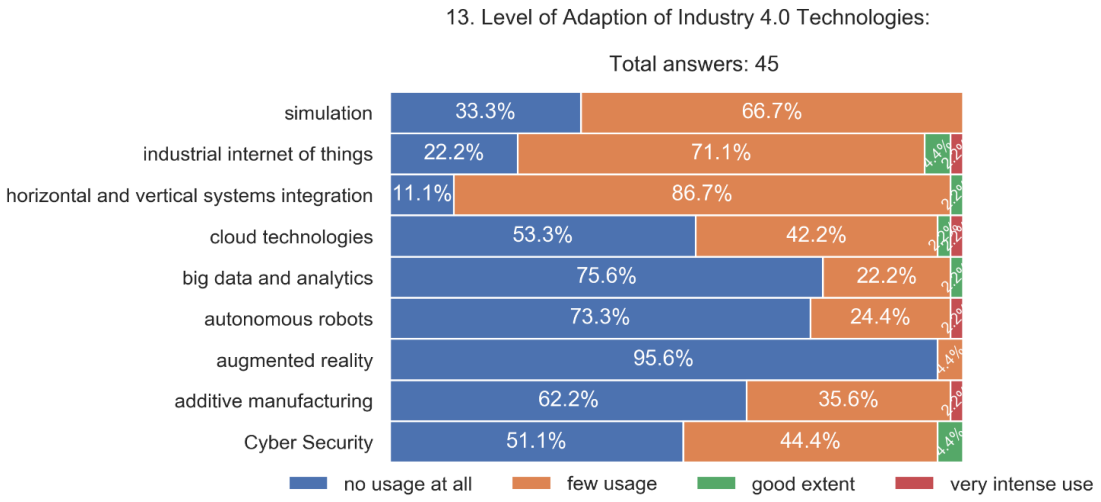

Figure 8: Level of adaptation of Industry 4.0 Technologies of Hungarian end-user companies

Question 14: Motivation for the digital transformation

Apart from the currently using Industry 4.0 methods and technologies, the end user companies were asked to share their motivation in connection with the digital transformation with answering the following statements seen on Figure 9. As Figure 9 describes, 93.3 % of the end user companies partly or mostly agree that their business model changes because of the digital transformation. Further interesting result is that 71.1% of the end user companies partly agree that they might remove existing products and services from the market due to digital transformation. In general, it can be stated that the majority of the Hungarian companies partly or mostly agree with the statements mentioned at this question, and they are aware of the fact that the foreseen digital transformation would play an important role in their future work.

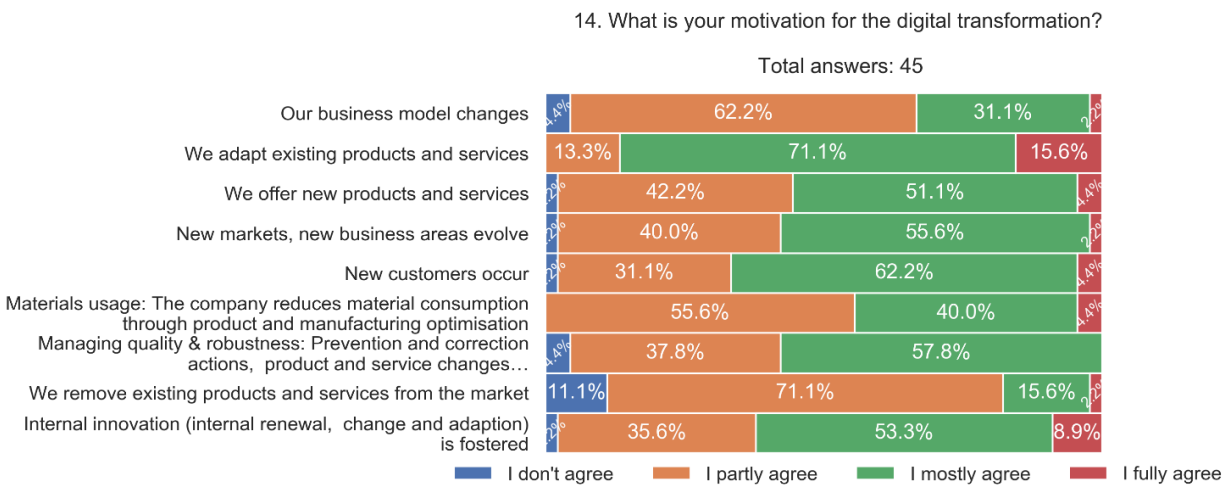

Figure 9: Distribution of the motivation of Hungarian companies for the digital transformation

- Question 15: Strategy for digital transformation

In the analysis, companies were asked not only t heir motivation in relation with digital transformation, but also they were asked about different internal strategies for digital transformation. As Figure 10 clearly presents, similarly to the questions concerning motivation, the majority of the involved Hungarian companies are partly or mostly agree with the strategies listed in connection with digital transformation. As it can be seen on Figure 10 the most outstanding result is that almost 65% of the Hungarian companies partly, and further almost 29% mostly agree that risk assessment for I4.0 is available which is a remarkable result.

Furthermore, 97.8% of the Hungarian companies stated (partly or mostly) that Industry 4.0 technology strategy is crucial for the future work.

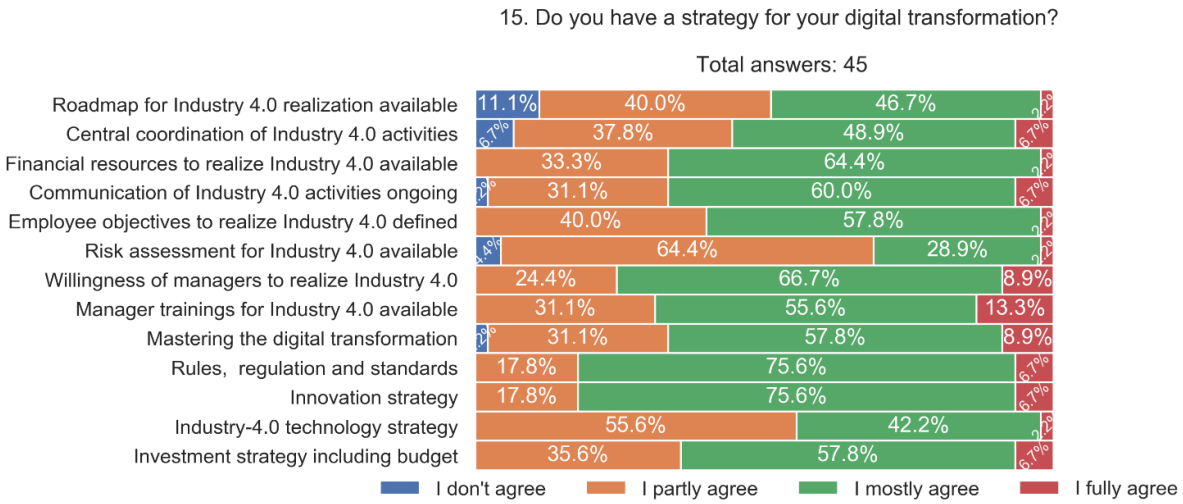

Figure 10: Distribution of the strategy of Hungarian companies for their digital transformation

Question 16: Needs of Industry 4.0 Technologies

Question 16 of the common questionnaire was concentrating on the needs of Industry 4.0 technologies. The question was divided into two sub-questions, namely the desired intensity of usage of each technology, whereas the planned time of implementing these technologies in their businesses. Figure 11 and 12 together point out that augmented reality and big data analytics are not planned by the vast majority of the involved Hungarian end-users in the upcoming five years. Nevertheless, the other seven technological pillars are planned by the majority of the companies at least on a few extent. When we scrutinise the planned time of usage starting, it turns out that horizontal and vertical systems integration can be considered and urgent development plan for SMEs since 73% of them would like to introduce it within maximum 1-2 years.

Regarding mid-term plans of the companies, the implementing of simulation, industrial IoT, and additive manufacturing can be considered mid-term goals, since according to Figure 11 and 12, the majority of Hungarian companies are contemplating to introduce these technologies within five years.

The figures also suggest that the introduction of cybersecurity and cloud technology belong to long-term plans (more than 5 years) of approximately 70% of the companies.

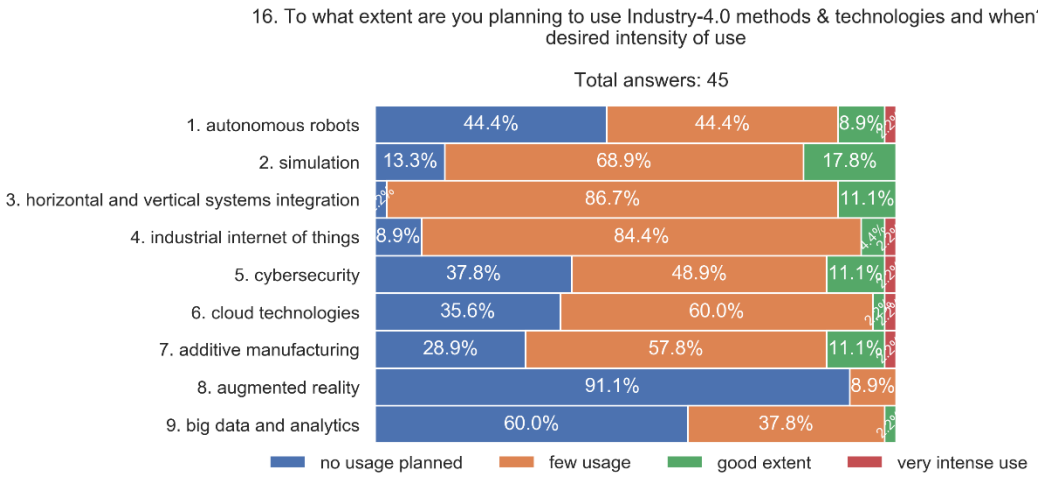

Figure 11: Industry 4.0 Technological needs of Hungarian companies (extent of planned usage; end-users)

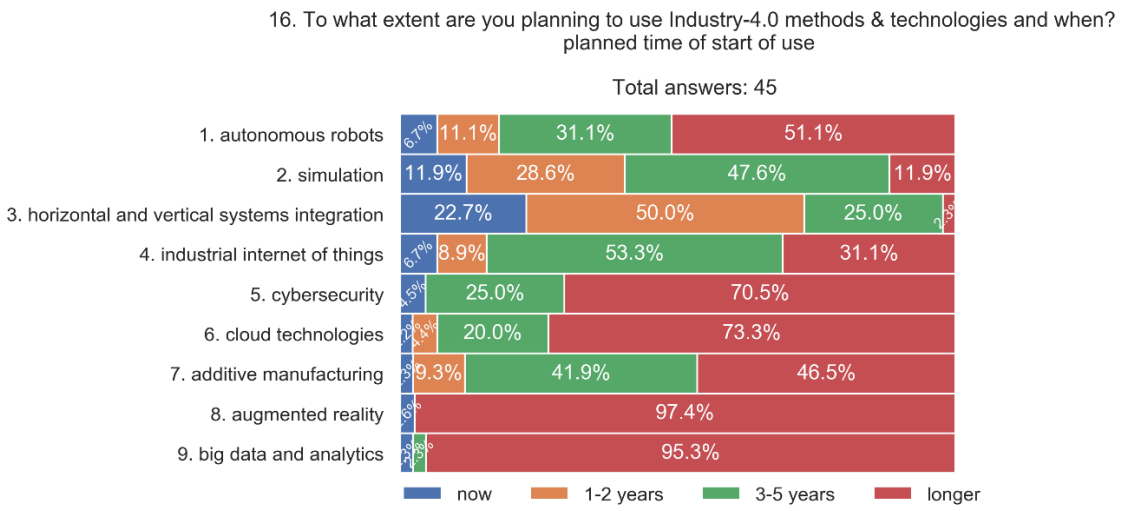

Figure 12: Industry 4.0 Technological needs of Hungarian companies (planned time of start of use ; end-users)

- Question 17: In what extent are SMEs prepared for digital transformation

Question 17 of the transnational tool was dealing with how the employees of the companies are prepared for the digital transformation. In connection with the preparedness, nine statements were listed in the questionnaire. According to the Hungarian results, (Figure 13) what is a significant result is that neither of the Hungarian companies has indicated the "do not agree" option with the statement that their employees are open to new technologies. Further remarkable result is that 1/3 of the Hungarian companies fully agree that they know their employees' digital competences.

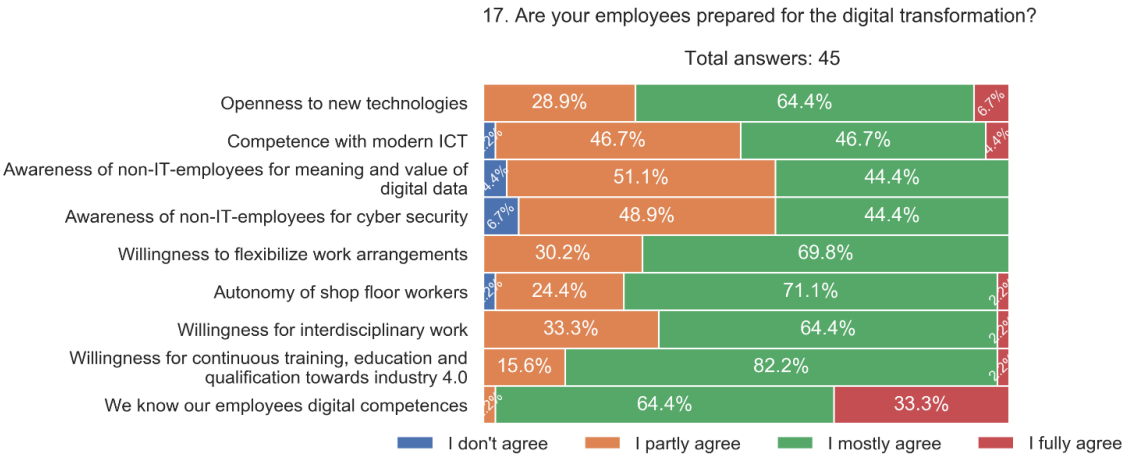

Figure 13: Hungarian SMEs' employees' preparedness for the digital transformation

4.2 In case of suppliers:

Question 18: Level of adaptation

As it has been anticipated earlier in the previous chapters, companies were requested to choose whether they are end users or suppliers of Industry 4.0 methods and technologies. According to the results, five Hungarian companies out of 50 identified themselves as suppliers and further three companies have selected that they are both end users and suppliers. As a result, these eight companies had to answer to the questions concerning suppliers (question 18-19).

Question 18 was asked at what extent companies are currently offering Industry 4.0 products and/or services, whereas question 19 was dealing with the planned services.

As far as the currently offered Industry 4.0 services are concerned by Hungarian companies, Figure 14 illustrates that cloud technologies, augmented reality and big data analytics are not widely offered by supplier companies. In contrast, based on the responses, supplier companies offer horizontal and vertical systems integration as well as additive manufacturing at least on a few extent. What is outstanding is the extent of autonomous robot offer, since five Hungarian companies out of 8 have replied that they are currently offering this service at a good extent, as it can be seen on Figure 14.

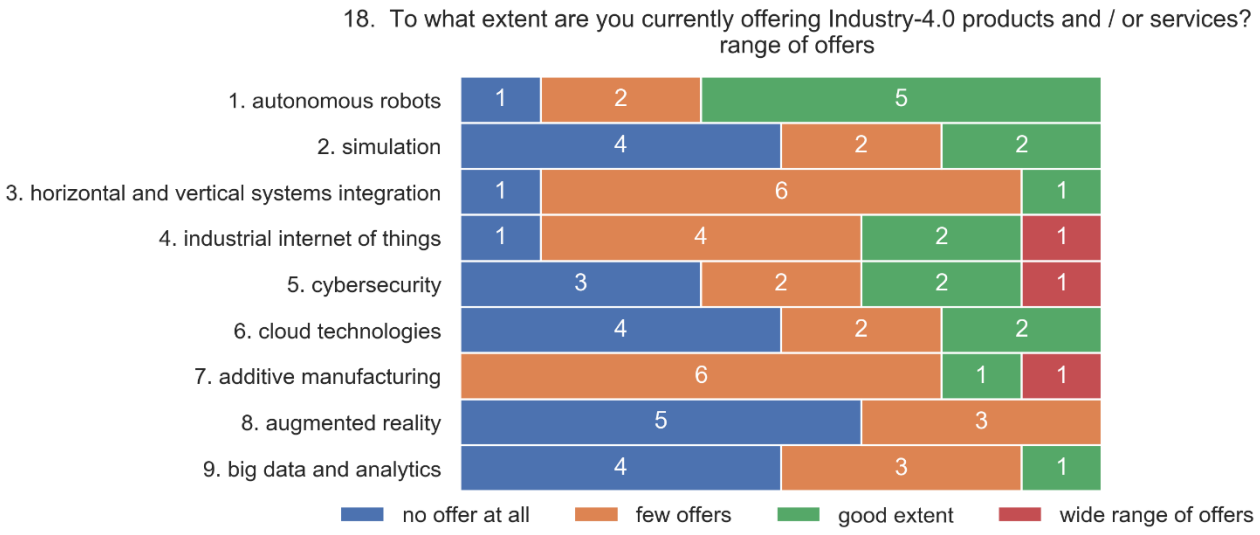

Figure 14: Level of adaptation of Industry 4.0 Technologies of Hungarian supplier companies

Question 19: Needs of Industry 4.0. technologies

Regarding question 19, companies were asked to share their plans in terms of the offer of the nine technological pillars. On the one hand, companies were asked to express at what extent they are planning to offer the services, and on the other hand, they were also asked the planned time of launch of such services. Figure 15 illustrates that the majority of the Hungarian supplier companies are not thinking of expand their offering portfolio neither with augmented reality, nor with cloud technologies and big data analytics, since companies have chosen that they are not planning to offer services at all in these technological pillars. Nevertheless, it can be read from Figure 15, that Hungarian supplier companies are willing to offer autonomous robots and simulation and cybersecurity in the future.

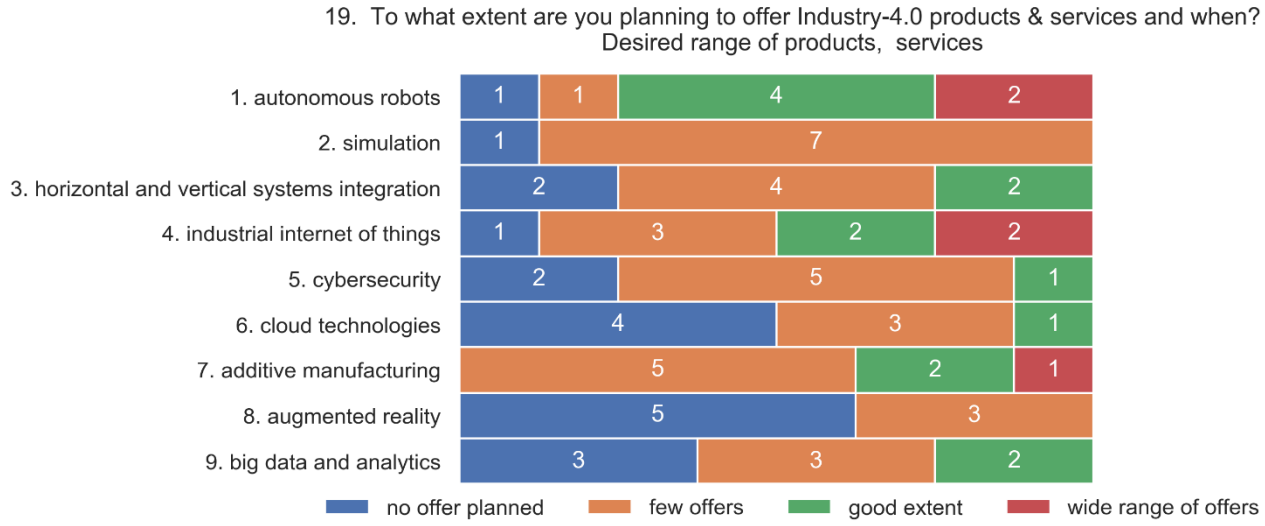

Figure 15: Industry 4.0 Technological needs of Hungarian companies (desired range of products; suppliers)

The other sub-question of Question 19 asked the planned time of implementation of the nine technological pillars.

Figure 16 is in accordance with the previously depicted Figure (15) in many cases. As Figure 15 previously illustrated, Hungarian supplier companies are planning to offer additive manufacturing, and Figure 16 depicts that they would like to complete their offer with this service now. Furthermore, as it was concluded at the previous figure, augmented reality and big data analytics are not planned to be launched by the Hungarian supplier companies. Figure 16 strengthens this result, since it illustrates that these services are planned more than a year basis. What is more, regarding AR, 50% of the supplier companies are planning to offer this service more than five years later.

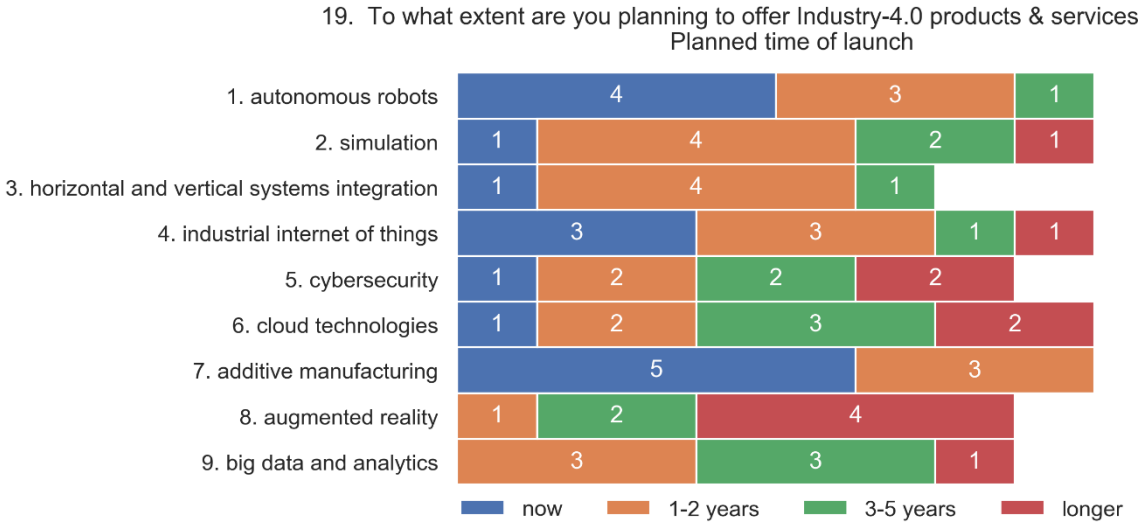

Figure 16: Industry 4.0 Technological needs of Hungarian companies (planned time of launch; suppliers)

Question 19: Technology Readiness Level of suppliers

In the framework of Question 19, supplier companies were requested to estimate their TRL (Technology Readiness Level) on a 1-9 scale according to this interpretation: *TRL (Technology Readiness Level) is an index used to assess the level of readiness of technology, according to this scale :1 (definition of basic principles); 2 (technology concept formulated); 3 (experimental testing of concept); 4 (technology validated in laboratory); 5 (technology validated in real space environment); 6 (technology demonstrated in real space environment); 7 (prototype of the system demonstrated in operative environment) ;8 (system complete and qualified); 9 (system tested in operative environment).To this scale we have added value 10 to indicate technologies already in production.

As Figure 17 illustrates, the majority of the Hungarian supplier companies are in a relatively low level (between 1-3 level) at simulation, cybersecurity, cloud technologies, augmented reality and big data services. However, as Figure 17 depicts the majority of the Hungarian supplier companies claimed that they are on at least Level 4 or above at autonomous robots and additive manufacturing services.

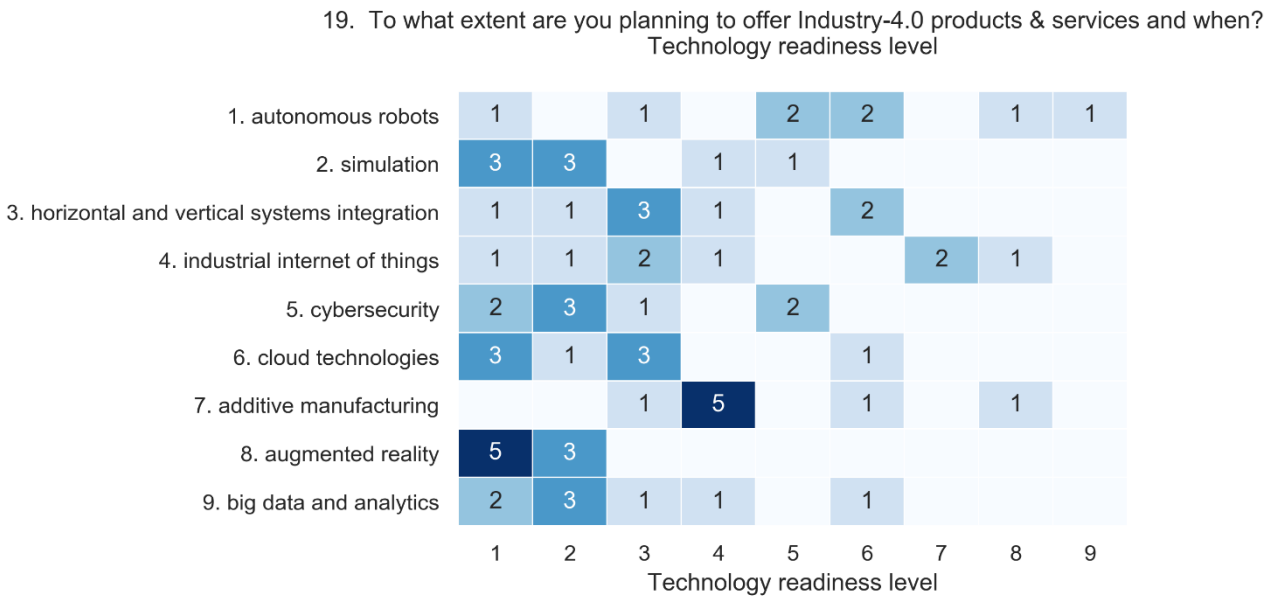

Figure 17: Technology Readiness Levels of Hungarian supplier companies

5.Other enabling factors

Question 5: Development of products and services

Apart from the above mentioned specific technology oriented results, further enabling factors may be taken into consideration when we scrutinise the innovation readiness factors.

In the analysis some questions were also asked which should be also known when a company is classified in terms of innovation and digitisation readiness. Among others, at the 5th question of the analysis, companies were asked how their most important products and services have been developed. SMEs in all regions were allowed to choose multiple answers. Regarding the Hungarian results, as Figure 18 depicts, the support of the technical office is crucial (30.5 % of the companies have chosen this answer). Apart from this, an improvement of technologies existing on market have been implemented internally in 22% of the companies. According to the Hungarian companies, the support of suppliers/customers is also remarkable (17%). Besides, Hungarian companies (13.6 %) have implemented a technology which had been already used by one of the competitors.

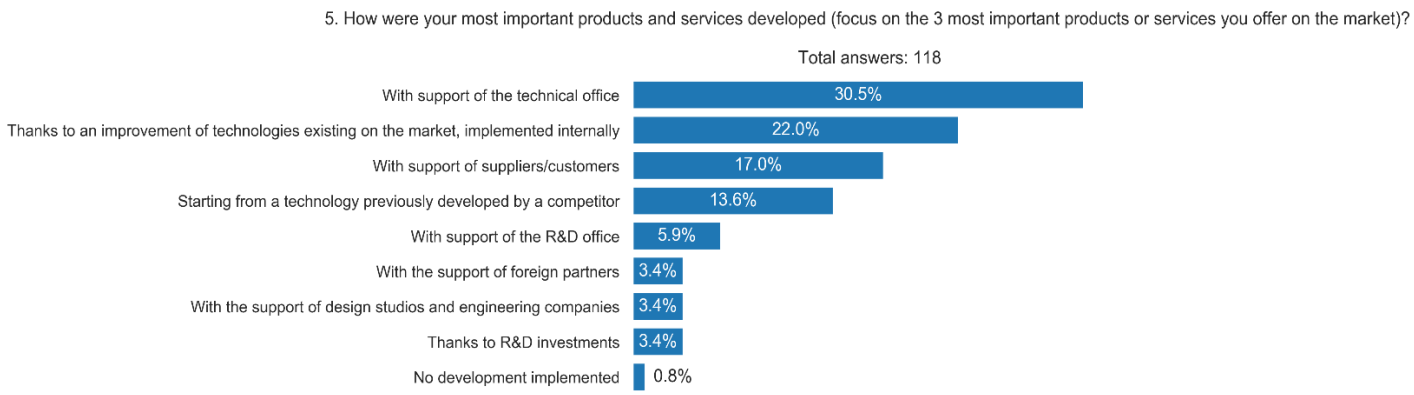

Figure 18: The different types of development pf products and services among all Hungarian companies

Question 7: R&D and technical offices of the companies

A further significant enabling factor in connection with innovation development might be the availability of an R&D office and a technical office in the company.

The following figures shall illustrate the ratio of the total staff in the R&D office as well as the proportion of the staff in the technical office are also depicted on a different figure.

In order to know that, the exact total staff of the companies had to be determined, so an additional search was needed, since this question was not exactly included in the analyses, only the interval groups have been asked concerning the size of the companies in Question 3.

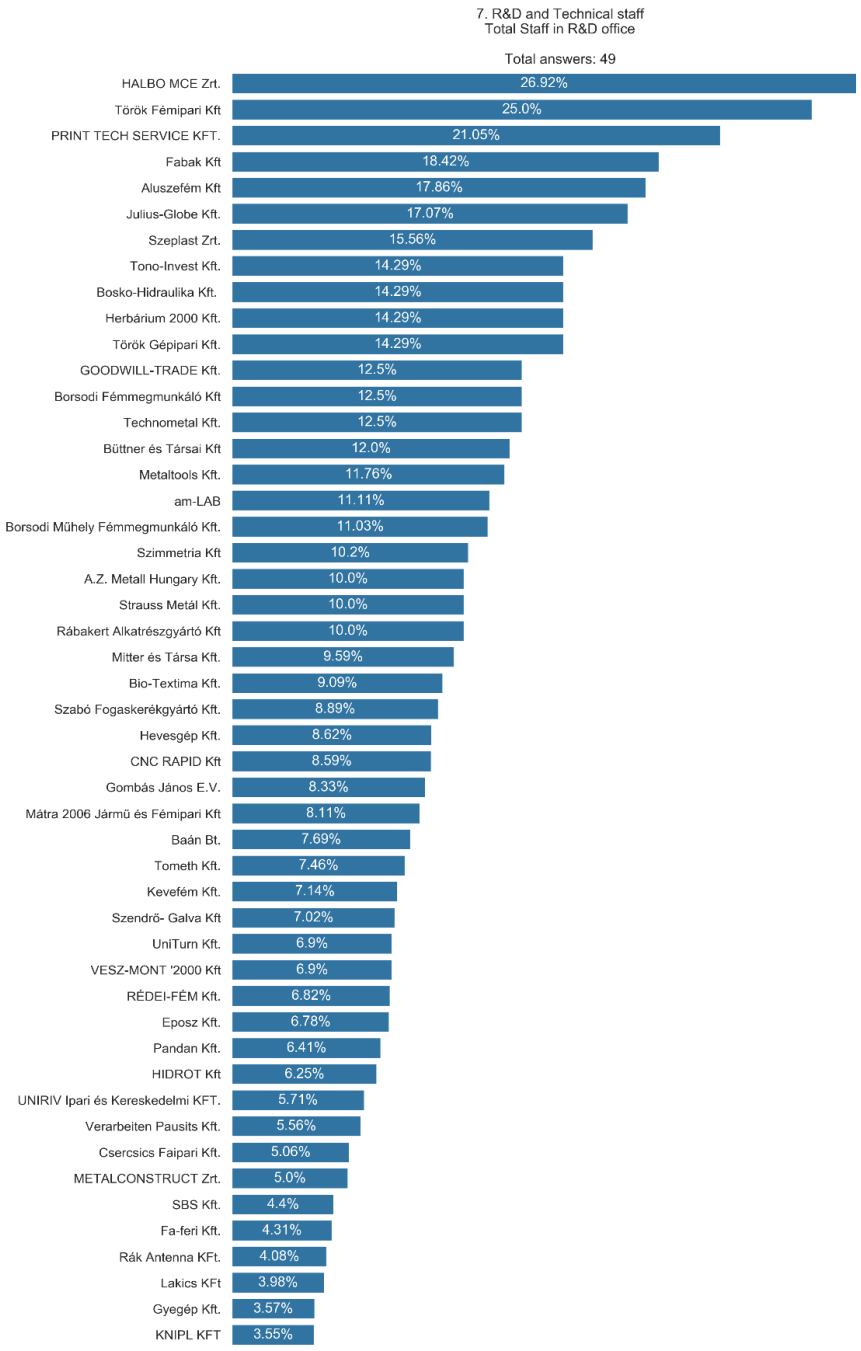

Figure 19: Distribution of R&D employees compared to total staff

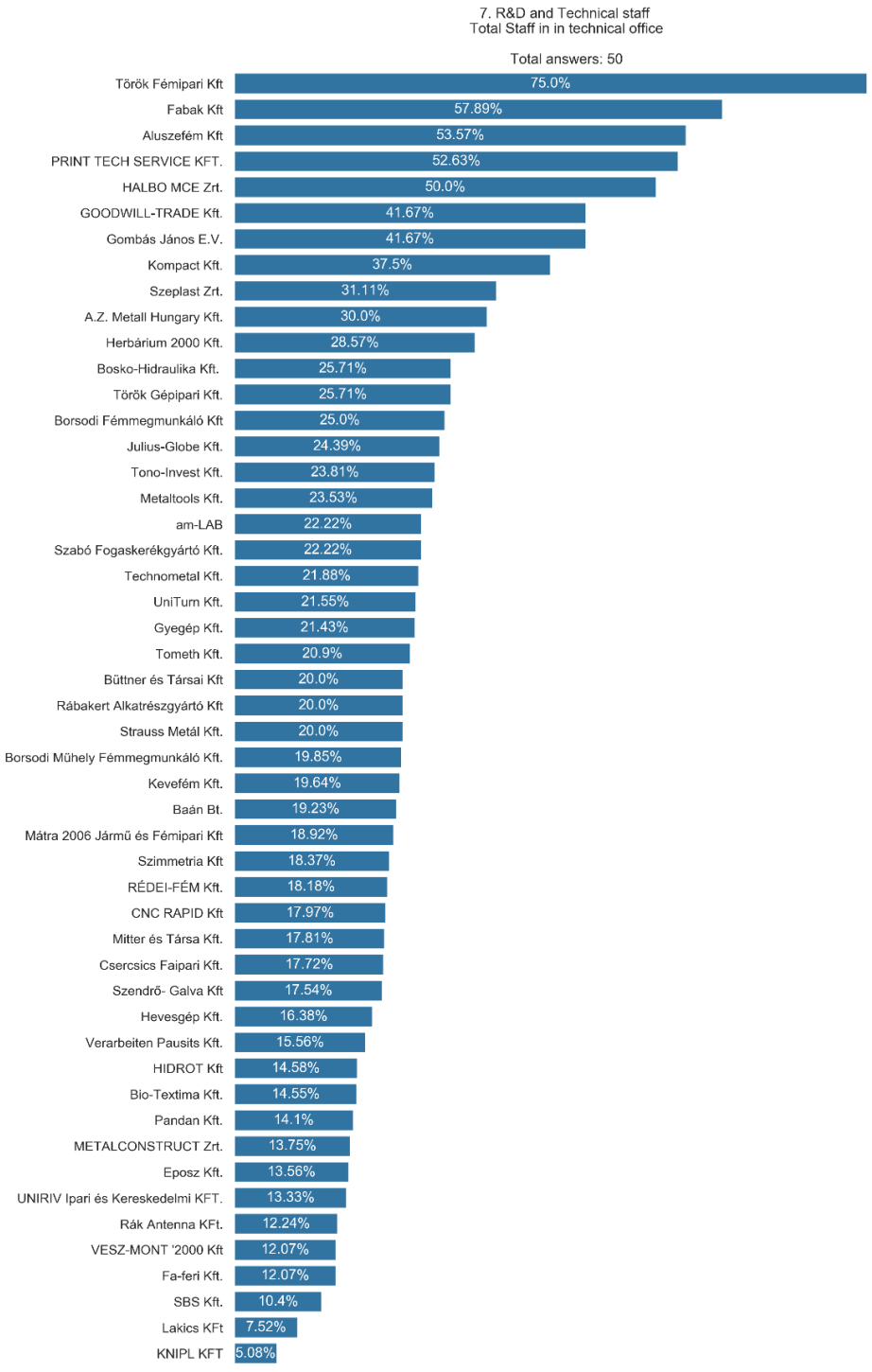

Figure 20: Distribution of the technical office employees compared to total staff

Besides the composition of the R&D and technical staff, the companies' involvements in national and EU projects in relation with innovation topic are also relevant and can be considered as an enabling factor when the innovation and digitization readiness level are scrutinised. At Question 8 of the questionnaire, companies were requested to share whether they had participated in funded projects on national or EU level in research and innovation field in the past or not. Companies were allowed to choose more than one answer at this question, this is the reason why the number of the total answers exceeded 50.

As Figure 21 demonstrates, approximately 2/3 of the Hungarian companies have already been a beneficiary of a research and innovation project on EU level. Furthermore, according to the statistics, 22.4% of the Hungarian companies have already participated on such projects on national level. In one word, Figure 21 points out that the majority of the Hungarian companies have been/are active in the participation of research and innovation projects both on national and EU level.

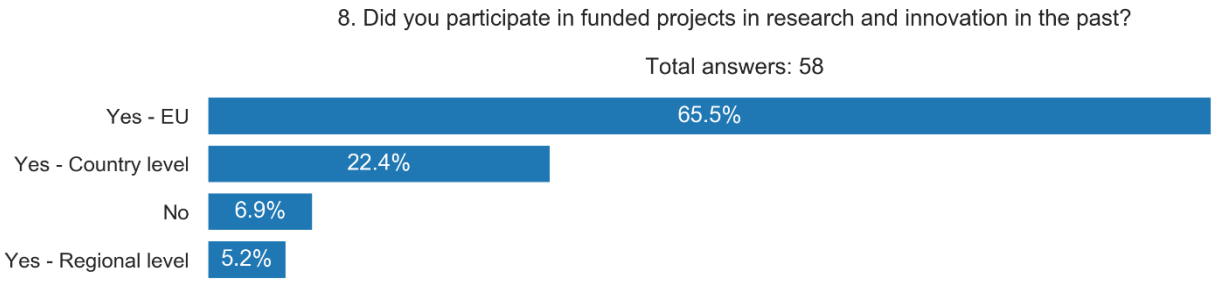

Figure 21: Distribution of project involvement

Question 9 accurately asked the number of involvements in public funded projects, as well as the ongoing number of cooperations with research labs and other associations. According to the results, the majority of the Hungarian companies (76%) have been involved between 1-5 public funded projects in the last five years taking into account EU, national and regional level as well. Regarding the ongoing cooperations with research institutions, 80% of the Hungarian companies have at least one, but max. ten cooperations with such associations as Figure 22 illustrates.

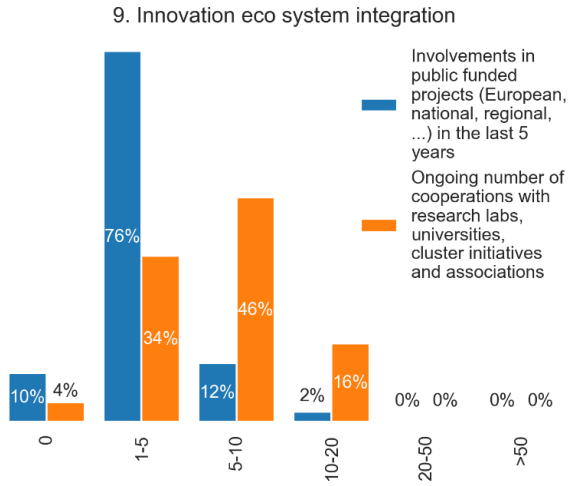

Figure 22: Innovation eco system integration