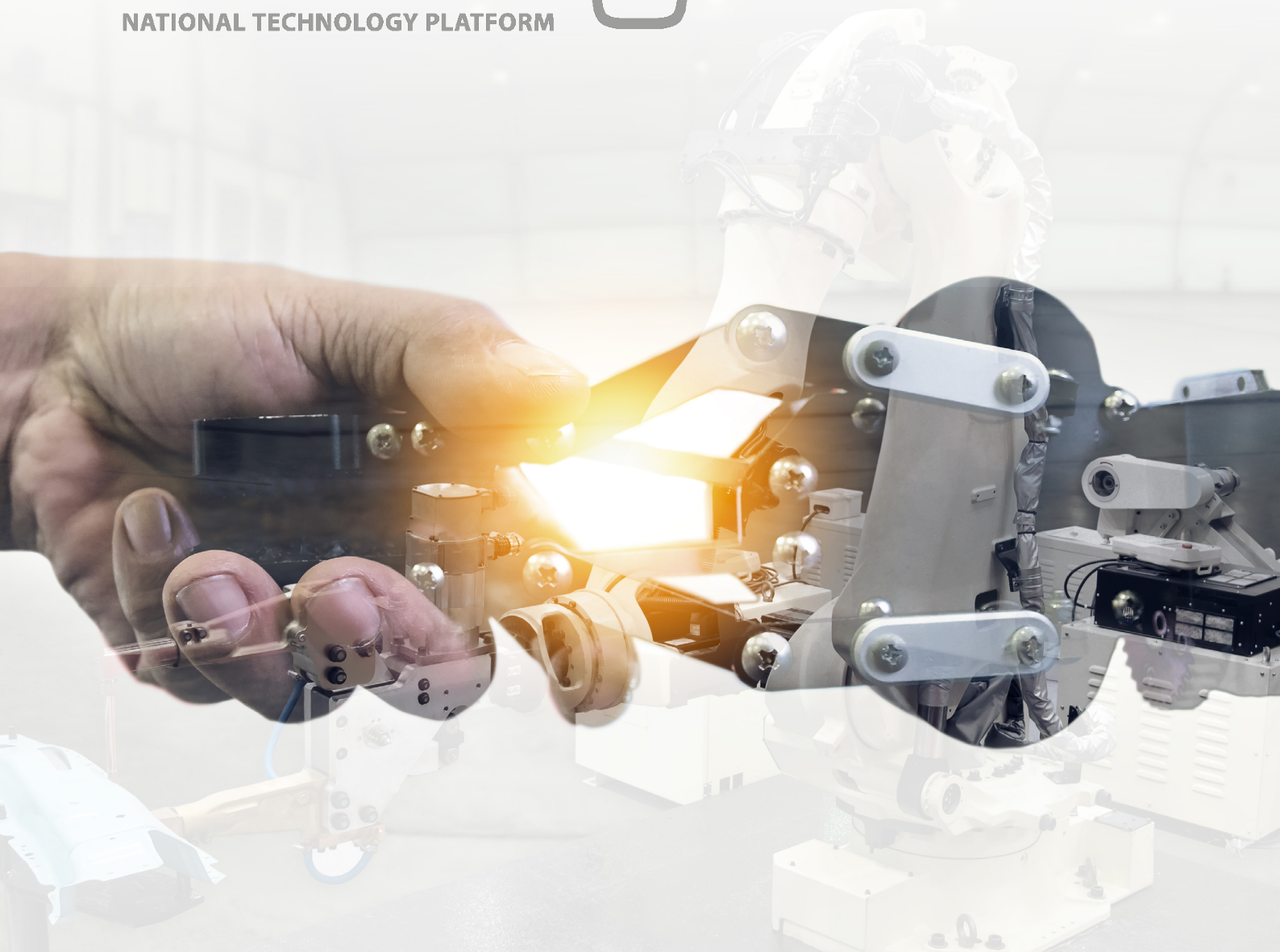


IPAR 4.0

NATIONAL TECHNOLOGY PLATFORM



INDUSTRY 4.0 NATIONAL TECHNOLOGY PLATFORM ASSOCIATION

The Questionnaire based Survey Project 2017



MTA SZTAKI

Hungarian Academy of Sciences
Institute for Computer Science and Control

www.sztaki.mta.hu | www.i40platform.hu

„Fostering knowledge sharing on the basis of exchange of information and the developments in the digitalisation and production.“

THE INDUSTRY 4.0 NATIONAL TECHNOLOGY PLATFORM ASSOCIATION (NTP)



1.

INTRODUCTION

The Industry 4.0 National Technology Platform was established in May 2016 under the coordination of the Institute for Computer Science and Control, Hungarian Academy of Sciences (MTA SZTAKI) and with the support of the Ministry for National Economy (NGM) comprising about 40 research institutions, high-education institutions, professional organisations and companies having premises in Hungary.

The overall goal of the Platform is to foster knowledge sharing on the basis of exchange of information and the developments – being the key issues of Industry 4.0 – in the digitalisation and production, as well as to offer professional consulting services and formulate recommendations to the government but also to all stakeholders of the Industry 4.0 ecosystem.

The importance of its existence and the attention arisen around it is clearly shown by the fact that the Platform that has in the meantime been transformed into the legal form of an Association has today about 100 members and membership figures increase continuously. The platform members perform their tasks and pursue cooperation in 7 Work Groups.

These are:

- Strategic Planning
- Employment, Education and Training
- Production and Logistics
- ICT Technologies (safety, reference architectures, standards)
- Industry 4.0 Cyber-physical Pilot Systems
- Innovation and Business Model
- Legal Framework

In 2017, working on an assignment received from the NGM, the Platform created a **strategic concept material for an Industry 4.0 based industry development in Hungary**, together with a background document to support and justify the statements therein. The main goal of the strategy is to boost the digital transformation of the industry that harnesses the smart tools, and thus conforms to the international trends of the Fourth Industrial Revolution's achievements (Industry 4.0). This can contribute heavily to Hungary's innovative reindustrialization, its industrial renewal, improvement of its competitiveness and the successful inclusion of Hungarian companies into the international production networks.

Accordingly, early in 2017 the Platform initiated its Survey Project which was intended to explore in a never known-before depth the technological and business readiness of the Hungarian companies from the perspective of digitalisation as well as to give an insight into the current directions of the relevant macroeconomic developments.

This report shortly presents the initial considerations of the project, analyses its most significant results and formulates some conclusions. For the sake of transparency and better understanding we will:

- first define the term Industry 4.0 and its relevant aspects;

- then describe the structure of our Questionnaire, its sources, the methodology used and also present the pillar structure of the strategy;
- finally, we summarise the major conclusions drawn from processing the survey responses.

2.

THE BACKGROUND OF THE FOURTH INDUSTRIAL REVOLUTION

When speaking about the 4th Industrial Revolution one has to realise that it is the digital transformation of the industry that is in the background, which can only be properly understood in conjunction within its societal, economic and technological environment, i.e. the entire ecosystem. The revolution manifests itself in the cyber-physical production systems through the whole lifecycle of the products by a new organisational and control approach to the value chain.

This cycle follows the ever more individualising customer demands and covers all stages of the process from the conceptual design of the product, through the order book management, product development and actual production, up to the delivery to the client, provision of product related services and recycling planning at the end.

The real-time availability of all relevant information forms the basis for this where it is assumed that the elements of the value-chain are connected into a network and are capable to provide anytime the data required to determine the optimal value stream. The connection of people, objects and systems enables to create dynamic and self-organising networks, optimised in real-time and producing added value across different companies. These networks can be optimised according to different criteria like cost, availability and resource use.

3. THE PILLAR STRUCTURE OF THE I4.0 INDUSTRY DEVELOPMENT STRATEGY

In the global trend of Industry 4.0, four major dimensions of the evolution process can be identified. **Technological changes** are driven by digitalisation and their impact on the process is basically through the integration of the value chains (by the vertical and horizontal value chains, the product and service systems, the digital business models and new access channels opened for the clients). But the contribution of the materials technology and energetics is also significant.

Societal changes are predominated by the influence of Industry 4.0 on its stakeholders, whether considered directly or in a broader sense, among them professional organisations which unite the companies who are the forerunners of implementing the new technology as well as public policy institutions who may efficiently assist the strategy implementation, especially in the various human resource areas like vocational training, renewal of labour market conditions, reforming the entire education system, etc. We pay special attention to the social and ecological effects of the changes that may affect the sensitivity and reaction of the society.

THE VISION OF INDUSTRY 4.0¹



HORIZONTAL INTEGRATION: The smart factory constantly adapts to new circumstances (such as the order volume or availability of materials) and automatically optimises its production processes. It does this through integration with suppliers and customers in the value chain.



VERTICAL INTEGRATION: People, machinery, and resources are digitally modelled in the smart factory, communicating with one another through cyber-physical systems (CPS).



SMART PRODUCTS have information about their own production process and can gather and transmit data during the manufacturing and usage phase. This makes it possible to obtain a digital model of the smart factory and offer data-driven services to customers during the usage phase.



HUMAN BEINGS are the drivers of added value. They are in the focal point.

¹ Based on the report of VDMA's IMPULS-Stiftung: Industrie 4.0 Readiness – October 2015

The changes in the **business paradigm and models** have a complex effect on the SME sector that, as the main actor on the offer side of the value chain has to face new cost types, risks, flexibility requirements as well as new, never experienced-before supplier roles, positions and strategies. Consequently, it has to introduce new, innovative business and operational models.

| Business | Society | Technology | Dimension Pillar |
|--|--|---|--|
| Renewal of SMS business models | Analysis and attitude shaping | Dedicated digitalisation investment programmes | Digitalisation and business development |
| Enterprise development and cluster formation | Concentrated strategic projects, supplier programmes | Improved efficiency and increased capacities | Production and logistics |
| In-house company trainings | Practice and theory orientation in I4.0 labour market training from vocational training to graduate and postgraduate education | Infrastructure for I4.0 oriented training and education | I.4.0 labour market development |
| New business models, RDI incubation | Reinforcing science, I4.0 RDI programmes | Production and related RDI services | Research, development and innovation |
| Digital I4.0 networks | Legislation, standardisation, control | Technology and infrastructure development | I4.0 ecosystem |

Figure 1. The pillar structure of the strategy

This pillar structure is pervaded by the State with its motivational, regulatory and controlling functions as well as the operation of its institutions where all initiatives have to exert a driving force towards the materialisation of the strategic goals, once accepted.

Notwithstanding, although being a constituent of the ecosystem, we do not consider it as a separate pillar in this approach.

THE PILLARS OF THE STRATEGY

In addition to the 3 dimensions, altogether 5 pillars have been defined.



DIGITALISATION AND BUSINESS DEVELOPMENT: This pillar is meant to reinforce basically from the SME perspective the endogenous and exogenous factors (comprising inter alia company digitalisation, internal organisation, new business and operational models) the synergy of which affects directly the operation of the production and logistic entities as well as their partners closely linked to them.



PRODUCTION AND LOGISTICS: This pillar accentuates the concrete, individual factors of the microeconomic environment mainly of the LNE and MNC actors of the industry sector that are necessary to implement the strategy.



INDUSTRY 4.0 LABOUR MARKET DEVELOPMENT: The pillar addresses as a preliminary condition of the success of any Industry 4.0 strategy, the human resource and labour market factors, especially in the area of training and education, and how they are to be integrated with the technological advance.



RESEARCH, DEVELOPMENT AND INNOVATION: This pillar is to harness in the optimal way the multiplying effects of the Industry 4.0 R&D&I activity. This justifies treating this area as a separate priority.



I4.0 ECOSYSTEM: The deep embeddedness of the Industry 4.0 paradigm in society and national economy requires the holistic treatment of the first four pillars as an integrated unit through inclusion of the relevant disciplines like sociology, environment management, legislation, etc. as well as the focussed adaptation of the executive institutional system of the State.

4.

THE NTP SURVEY PROJECT

THE SURVEY PROJECT AND ITS OBJECTIVES

The project should be considered as a primary input to the strategy development work. The main goals may be summarised as:

- To learn what the demands and expectations of the manufacturing industry in general and, those of the strategic management of the national economy in particular, are.
- To explore the familiarity with, and the acceptance of the Industry 4.0 concept as well as the current status of the Industry 4.0 implementation both at company and national economy level.
- To determine the Industry 4.0 specific R&D&I potential in Hungary; and finally
- To unfold the economic growth potential and conditions thereof.

Additionally, a SWOT analysis from the Industry 4.0 perspective had to be presented with respect to the specific comparative advantages Hungary may show up. Our secondary goals were:

- To justify the recommendations formulated in the industry development strategy, looking at a 3-5-year horizon, however, with an outlook to the 2025-2030 period, too.
- To support the elaboration of the drivers' structure as well as the measurement and evaluation methodology (i.e. a system of Key Success Factors (KSF) / Key Performance Indicators (KPI), both with a general validity for Hungary. The aim is to enable the monitoring of the progress being made in the strategy implementation.

THE STRUCTURE OF THE QUESTIONNAIRE

The Questionnaire was developed by SZTAKI with regularly consulting the most active members of the Platform's Strategic Planning Work Group and the leaders of the other Work Groups as well who in turn involved their own members, too. Thus, it is justified to state that the Questionnaire, though in its final form as it was sent out to the potential respondents reflects basically SZTAKI's concept, still represents the professional view and standpoint of the entire Platform.

The Questionnaire comprises three main parts as it can be derived from the goals defined above:

- The Section 1 (Questions 1-15) is related to the respondent's profile data like some operational and relevant statistical information.
- In the Section 2 (Questions 16-61) micro level information are gathered, i.e. those directly related to the individual companies, enabling to assess their Industry 4.0 capabilities. These questions are not only to assist qualifying their Industry 4.0 readiness but in a broader

context to highlight the strengths and weaknesses of their current consolidated situation and also to support the first level validation of the strategy.

- The Section 3 (Questions 62-98) aims to provide a comprehensive overview of the general current status in Hungary.

In this section the direct and indirect actors of the industry are asked to share their view on the prospects of the short term development of the country. Opportunities for, and impacts of the direct intervention of the State are also investigated. Moreover, parallel infrastructural investments, preferences to leverage competitiveness, possible financing and regulatory decisions are in the focus.

THE SOURCES OF THE QUESTIONNAIRE

We relied on various sources when composing the Questionnaire. Here we refer to five of them.

The Fraunhofer Institute for Production Systems and Design Technology (IPK) in cooperation with the then National Innovation Office conducted a market survey in 2014 with the aim to find out the requirements the industrial R&D activity in Hungary faces and has to meet.

SZTAKI executed for its 2nd Phase EPIC Proposal² a survey of limited scope about the expectations towards Industry 4.0 and the prevailing status of its implementation.

The research project sponsored by VDMA's IMPULS-Stiftung³ with its questionnaire and study⁴ constituted the 3rd and major source.

- This latter provides in its structure an outstanding pattern to build upon in Section 2 of the NTP Questionnaire.
- This offers the opportunity to directly compare the results of the Hungarian survey with those of the German samples.
- Thus, a fairly accurate picture may be drawn on the existing differences between the manufacturing companies in the two countries with respect to their Industry 4.0 readiness.

Both SZTAKI and the cooperating Work Groups – after having studied the former surveys – formulated additional questions reflecting the demands of their specific professional areas.

Last but not least, the inclusion of the key aspects of the Government's Irinyi Plan and the key points of interest defined by the mandating Ministry into the macroeconomic Section 3 led to the final version of the Questionnaire⁵ accessible even today to potential new respondents.

We believe that as a result of harmonising the different sources and extending them substantially by new questions the basis for a high-quality, genuinely representative survey has been produced.

2 The Proposal prepared by SZTAKI and its consortium partners in 2016 that has won the support of the EU H2020 programme to establish the Centre of Excellence in Production Informatics and Control (EPIC)

3 VDMA Verband Deutscher Maschinen- und Anlagebau / German Machinery and Plant Manufacturers' Association

4 <http://industrie40.vdma.org/documents/4214230/5356229/Industrie%204.0%20Readiness%20Study%20English.pdf/>

5 <https://survey.sztaki.hu/index.php/178863?lang=hu>

| Section 2 Micro | Parallelism and analogy | Section 3 Macro |
|---|--|---|
| Strategy and organisation | A) General framework, definition of rules | Resolving geographical inequalities, Involvement of the State. |
| Smart factory, Intelligent processes, Smart products, Data-driven services | B) Internal processes, operation | Energy and material efficient tools and production methods, Using digital technologies, More efficient utilization of resources |
| Employees | C) Human resources | Employment policy, Creation of new jobs |

Figure 2. Internal structural relationships within the NTP Questionnaire



5.

THE RESPONDENTS IN FIGURES

Among the respondents all stakeholder groups relevant from the Industry 4.0 perspective were represented. Considering the evaluable responses, we find the following figures:

- The (general) Section 1 was filled in by 191 respondents.
- The (microeconomic) Section 2 was filled in by 133 respondents.
- The (macroeconomic) Section 3 was filled in by 141 respondents.

The differences between the sections may definitely be explained by the differing characteristics of the responding organisations. Responses of non-profit entities as well as non-productional or educational institutions in Section 2 were not included in the evaluation.

In spite of our expectations and regrettably, the macroeconomics focussed Section 3 was not filled in by a relatively large number of respondents.

As for the geographical distribution of the 191 respondents in Section 1 the analysis shows the following: in terms of the number of respondents Budapest is ahead, followed by the counties of Bács-Kiskun and Győr-Moson-Sopron then comes the county of Pest. The picture suggests a virtual division of the country into a Northern part and a Southern part with respect to the acceptance and actual reception of the Industry 4.0 paradigm.

This seems to be especially true if the town and suburbs of Kecskemét are excluded from the otherwise large county of Bács-Kiskun.

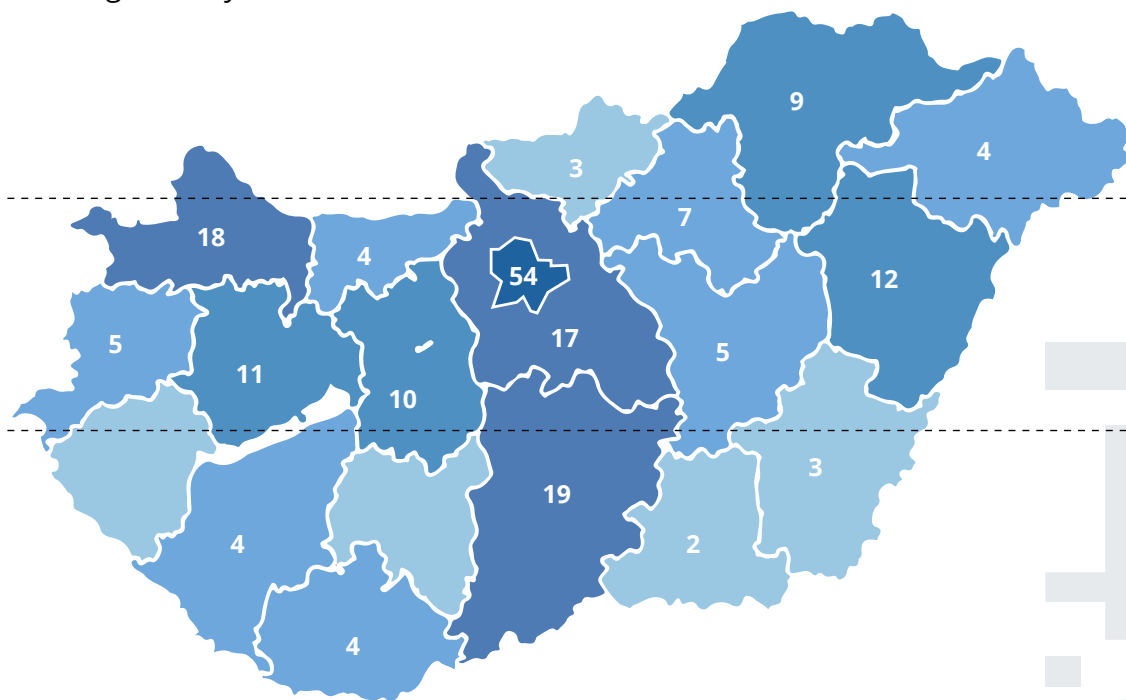


Figure 3. The geographical distribution of the respondents

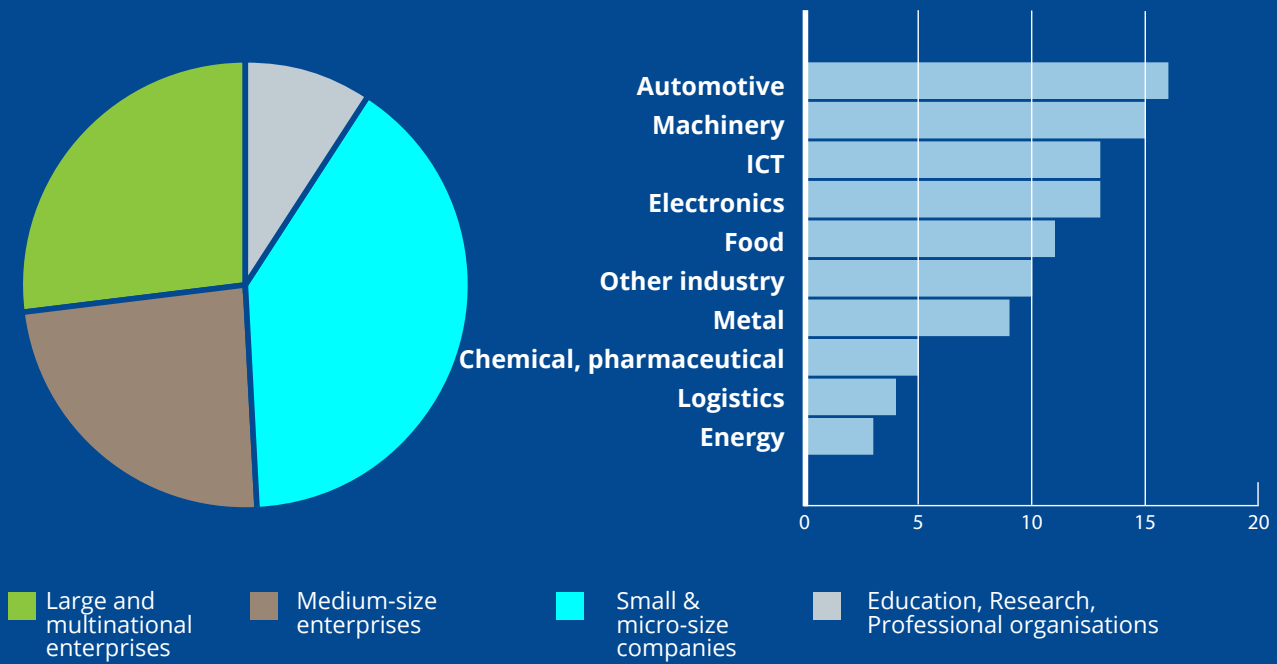


Figure 4. The distribution of the respondents by size/type and industrial sector

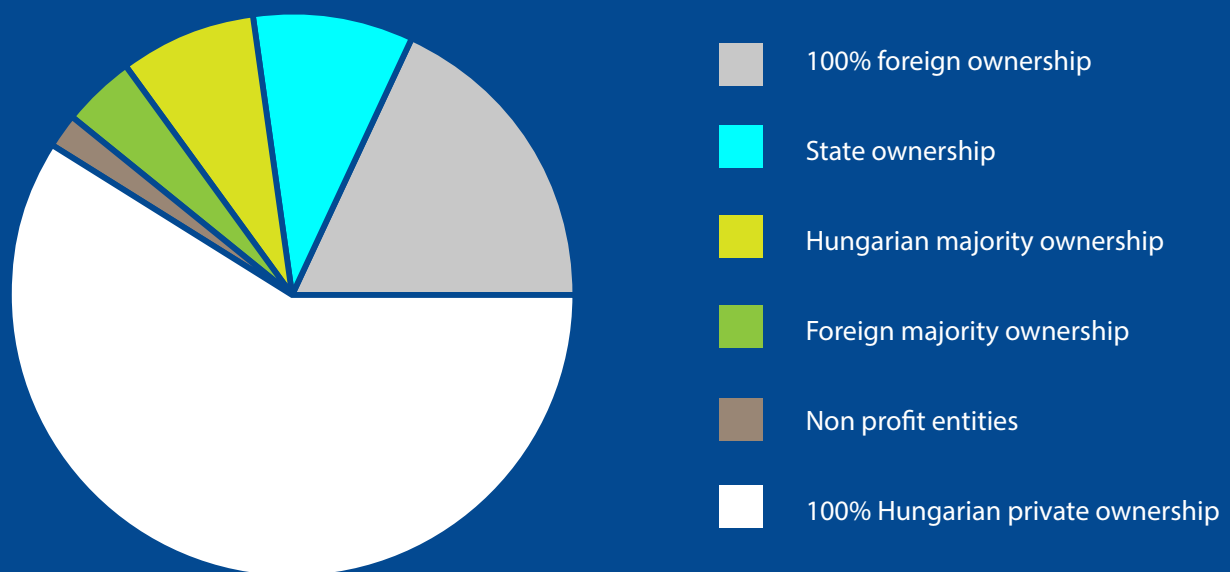


Figure 5. The distribution of the respondents by ownership type

It is evident from the responses that the manufacturing enterprises usually have not only one single industry profile, some of them indicated more than one industrial sector or additionally, even activity in consulting, training, logistics or the info-communication technology (ICT).

6.

THE GENERAL CHARACTER OF THE RESPONDENTS AND THEIR VISION ON THE FUTURE

Industry 4.0 is viewed important or indispensable from the competitiveness perspective by 71% of the industrial companies. This proportion is very favourable even if it is only 66% in case of the Hungarian companies whereas it is more than 85% for the international ones.

These figures demonstrate that the past 1-1.5 years have brought a breakthrough concerning the knowledge on Industry 4.0. This progress is also due to the fact that new solutions are mostly imported, first of all through the intermediation of the multinationals. However, they are followed gradually by the local SMEs in their supplier chain.

This view is underpinned by the result of the further analysis that shows that the same figures are 73% and 69% for the large companies and the SMEs, respectively.

This picture turns to unfavourable indeed if we look at the responses to the next question (Figure 6): despite the 71% voting for being 'Important' and 'Indispensable', 47% of the same respondents have no related corporate strategy and consequently, no system of indicators to measure progress.

There are only two SME type companies declaring that their strategy has been implemented.

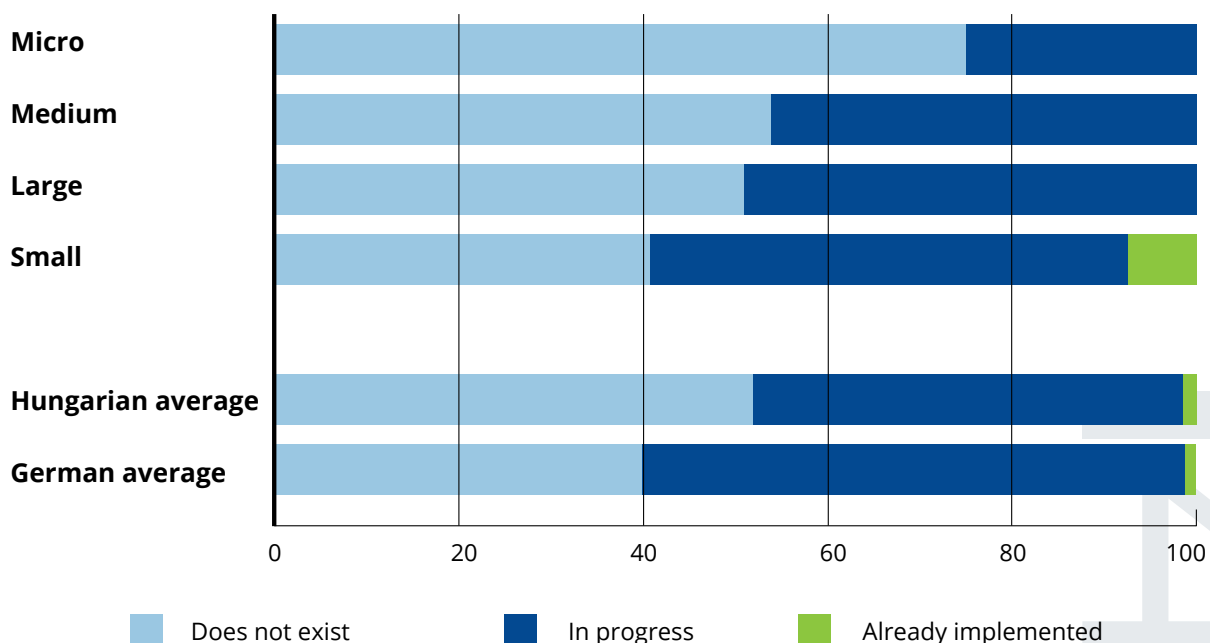


Figure 6. Share of accepted Industry 4.0 strategy at the companies and its implementation status

ASSESSMENT OF THE DIFFERENT INDUSTRY 4.0 TECHNOLOGIES

Digitalisation implies the appearance and active application of a handful of new technologies. Their ranking of relevance as viewed by the respondents is shown in Figure 7.

It is evident from the graph that the rating is fairly balanced, only artificial intelligence and virtual reality are less valued than would be desirable. Sensors, integrated enterprise management systems (ERP), production planning and scheduling systems (PPS) and real-time production control systems (MES) are on the top of this list.

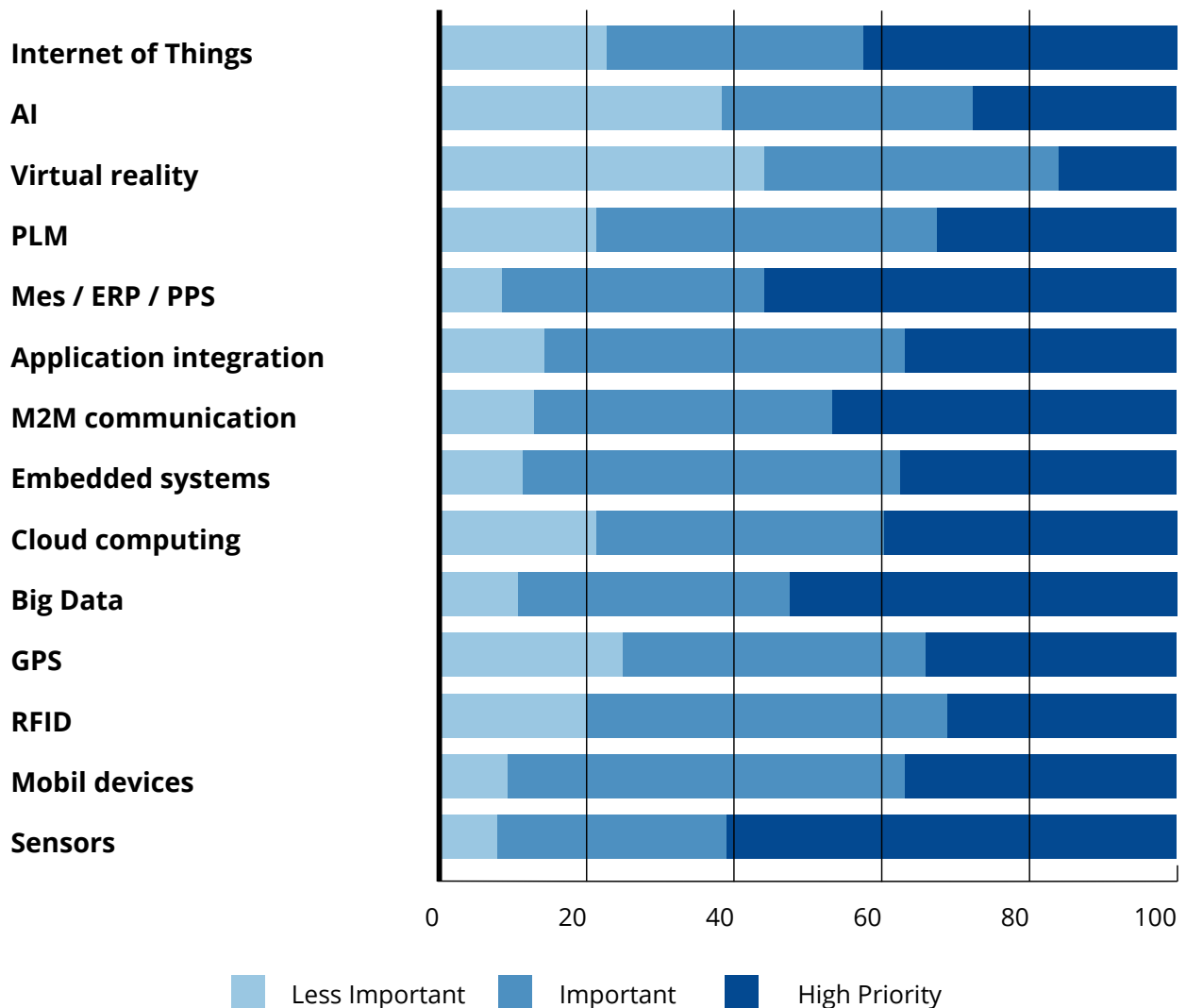


Figure 7. Future relevance of Industry 4.0 technologies

The next graph (Figure 8) is very illustrative concerning the companies' openness to the new technologies. It seems that cloud based services are well spread: approximately one-third of the respondents are using them, for the rest, however, this technology is still not present, although a minority of them have some plans to introduce it. The evolution of cloud usage is apparent.

First of all, it is utilised for data backup and storage, eventually for running specific software tools, but the essential breakthrough, i.e. processing cloud data for control purposes is still not imminent for most of them, albeit this is the field that offers great opportunities to the SMEs for cost savings or to introduce new generation tools for production planning, scheduling and simulation.

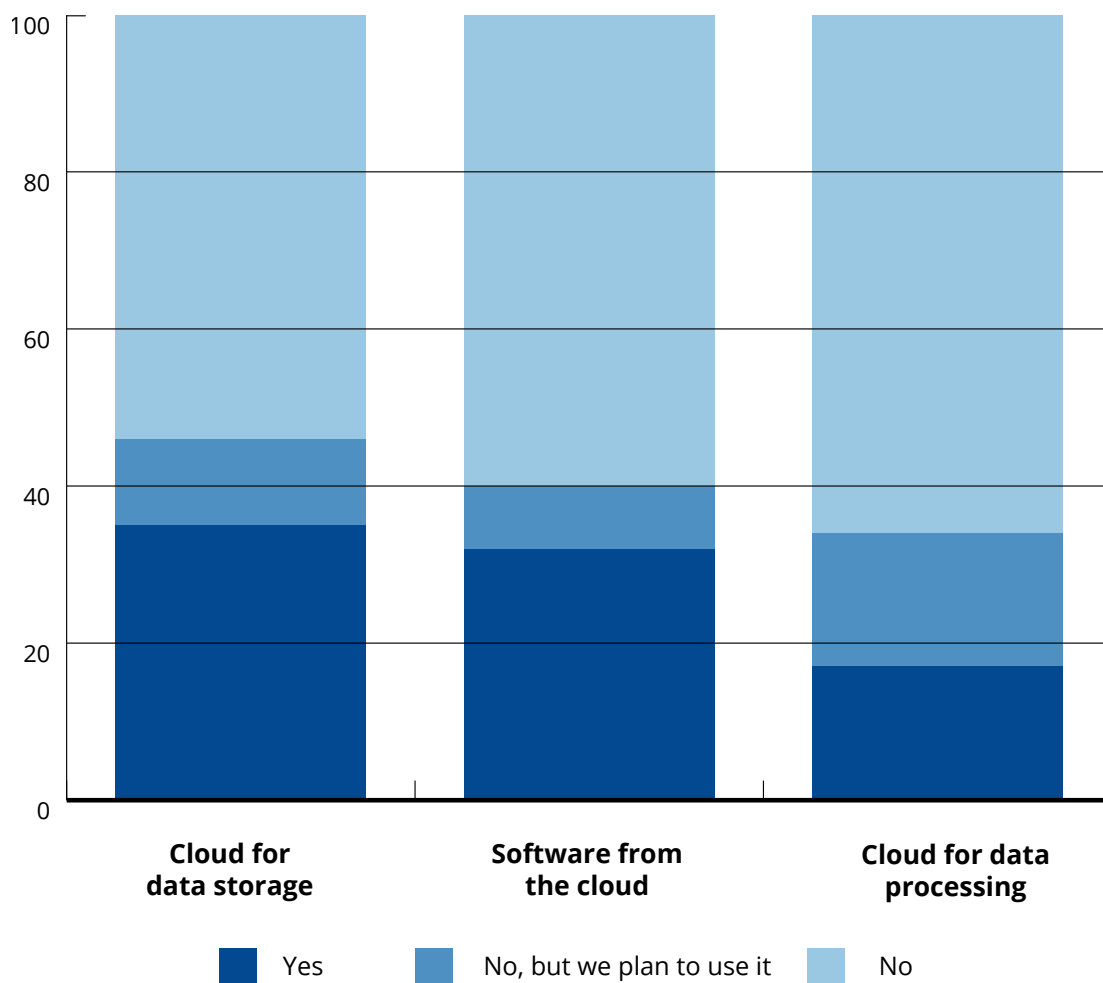


Figure 8. Penetration of the cloud technologies

Industry 4.0 based manufacturing and logistics require significant investments. This is why some questions were related to the areas and the extent of Industry 4.0 targeted investment made by the companies.

Moreover, of the same importance is the question where they are planning such investments in the period 2018-2020? It is not only the areas that count but also the volume of the investments in terms of percentage of their total annual income (Figure 9).

Today, the companies' investments for developing purposes predominate in the *Production, Manufacturing, IT and Quality management*, followed by *Employee training, Logistics and Research and Development*.

These areas are going to remain priority areas in the future, too, although their share is expected to decrease to a slight extent in favour of some other, currently disproportionately neglected areas like *Procurement, Value chain management and Finance / Accounting*. This planned movement positively supports horizontal integration and may contribute to make the business aspect of the ecosystem a reality.

Based on the findings shown in Figure 9, the conclusion may be drawn that in the future a healthier distribution moving towards a more balanced investment policy will prevail among the investment target areas.

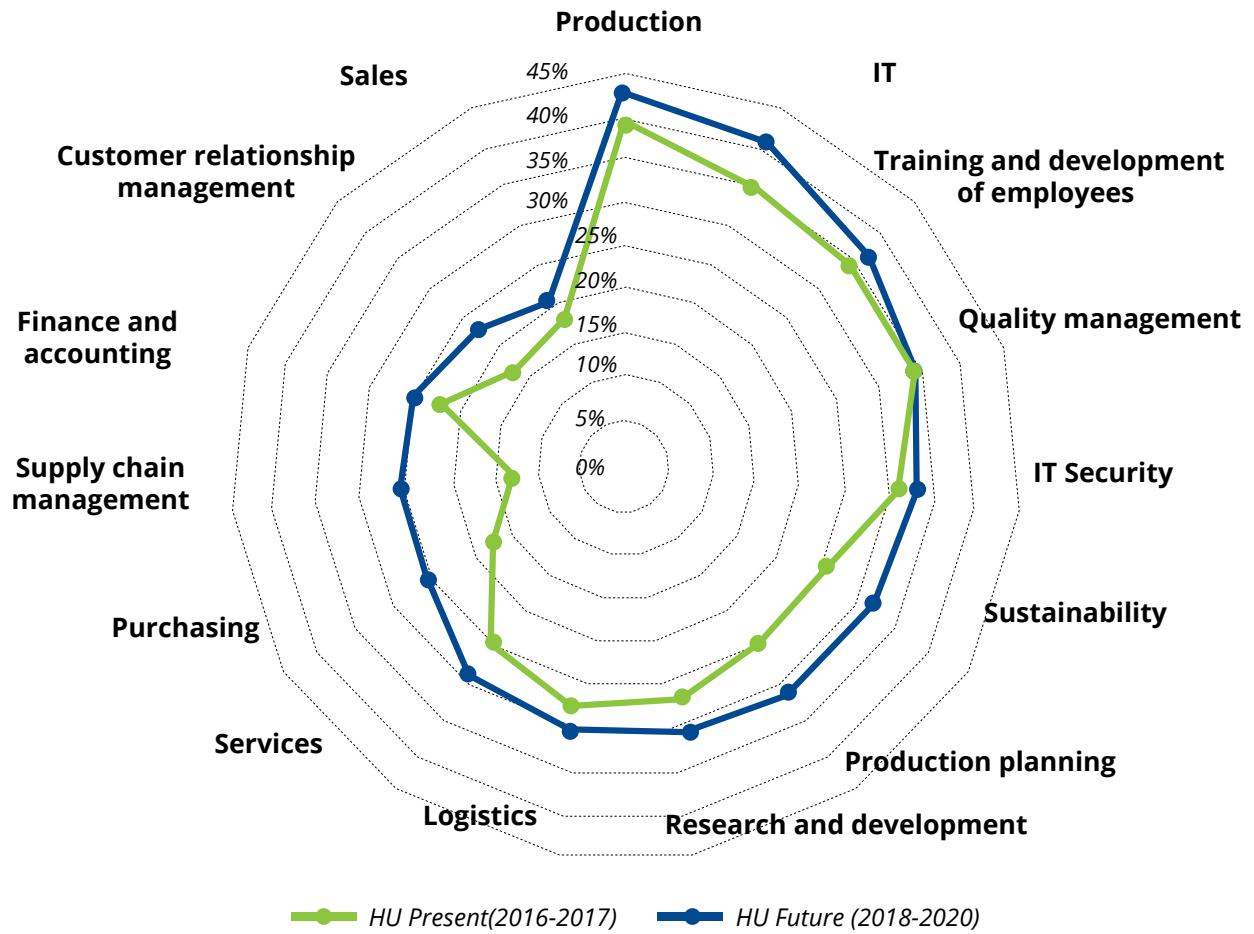
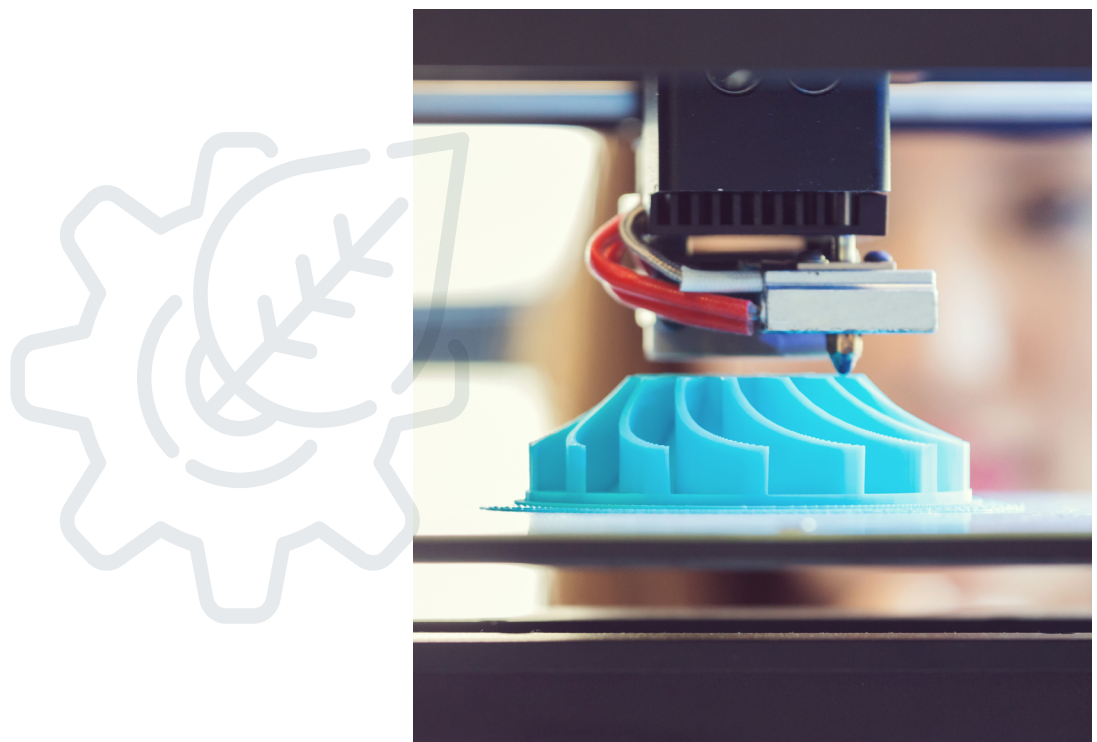


Figure 9. Current and near-future areas of Industry 4.0 related investments



7.

COOPERATION IN RESEARCH AND DEVELOPMENT TO FOSTER INNOVATION

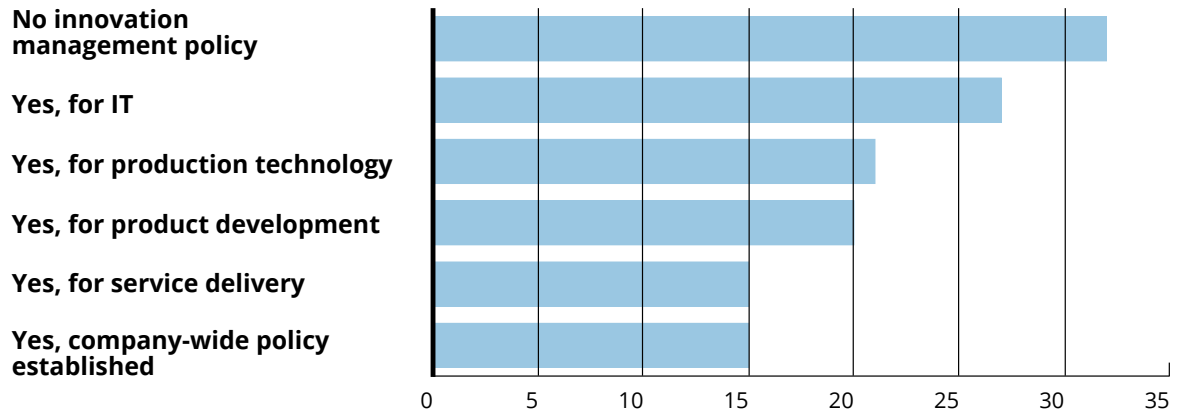


Figure 10. Innovation management in the practice

It is a key issue whether an industrial company has a control process to support innovation management (Figure 10). According to the responses, Hungarian companies fall substantially behind the best practice that may perhaps be explained by the assumption of not realising the importance of this question.

Research and development is financed first of all from internal sources (Figure 11.a). The fact that 23% of the respondents applied sources for this purpose in the amount exceeding 5% of their total yearly income is to be welcomed (Figure 11.b).

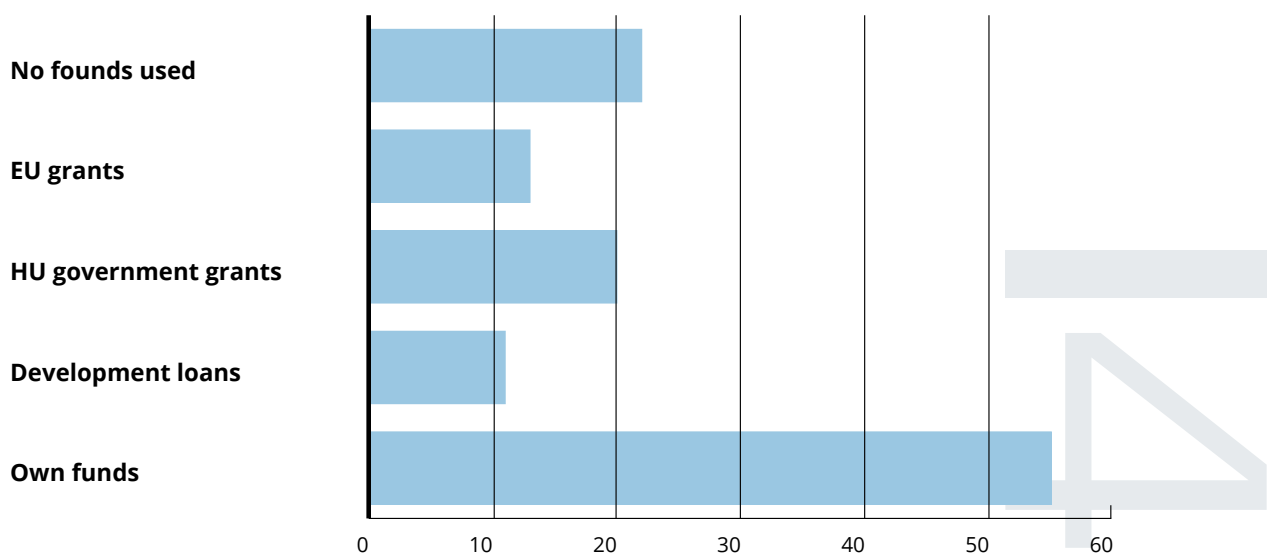


Figure 11.a. Financing R&D activity: a) the sources of funds

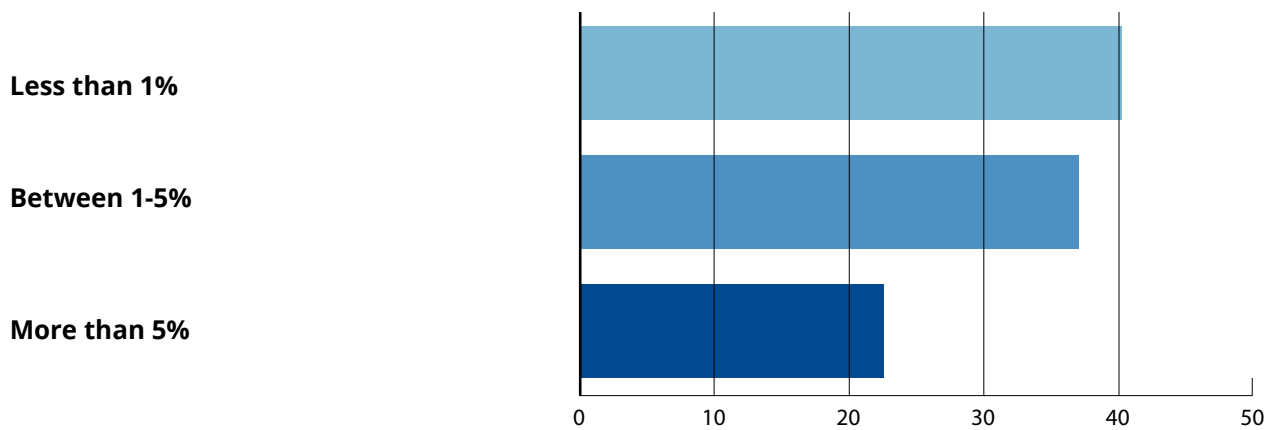


Figure 11.b. Financing R&D activity: b) the volume of funds applied

This result is to be appreciated in the light of the fact that their general opinion on the local R&D suppliers is not unanimously positive (Figure 12).

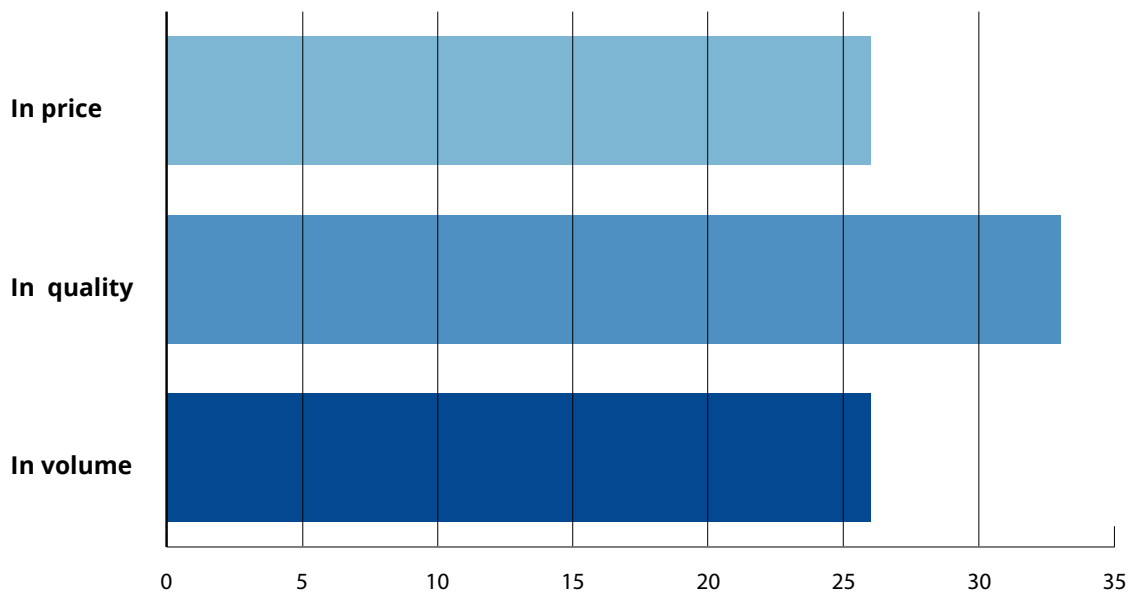


Figure 12. Level of satisfaction with the quality of local R&D services available on the local market

The **cooperation between academia and industry** has a special role in implementing Industry 4.0 because these activities have a strong multiplicative effect on the internal capacities of the companies. Unfortunately, only 47% of them made use of this opportunity.

The fact, i.e. that “only” 53% of industrial companies had no R&D&I cooperation at all with any academic or university partners whereas 47% had some, may be seen as a situation that can raise some hopes for the future. However, we think that the figures of further analysis, i.e. 8% of the latter category had 10+ joint projects, while 38% had only 1 or 2 projects annually, are very low. The conclusion is clear: this type of cooperation has to be strengthened in the future.

The **task of research-development and innovation** – apart from its actual form (company’s own R&D or academia-industry cooperation) – is to produce new production processes, methods and create new competitive products and services on the basis of the renewed technologies. In this respect the picture is rather negative: **38% of the companies did not introduce any innovation in the past 5 years.**

There are evidently some who perform better: **12%** of them implemented 10+ new processes or methods, while **25%** have now 10+ new products or services (Figures 13.a and 13.b).

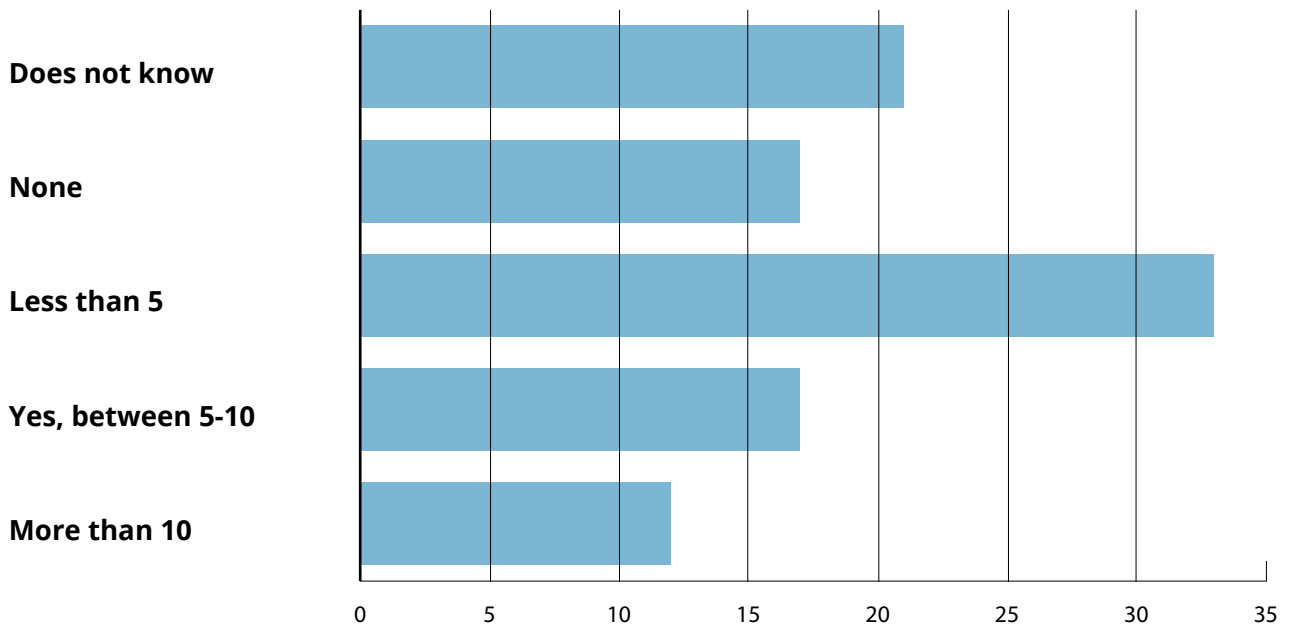


Figure 13.a. Results of innovation: new processes, methods introduced in the past 5 years

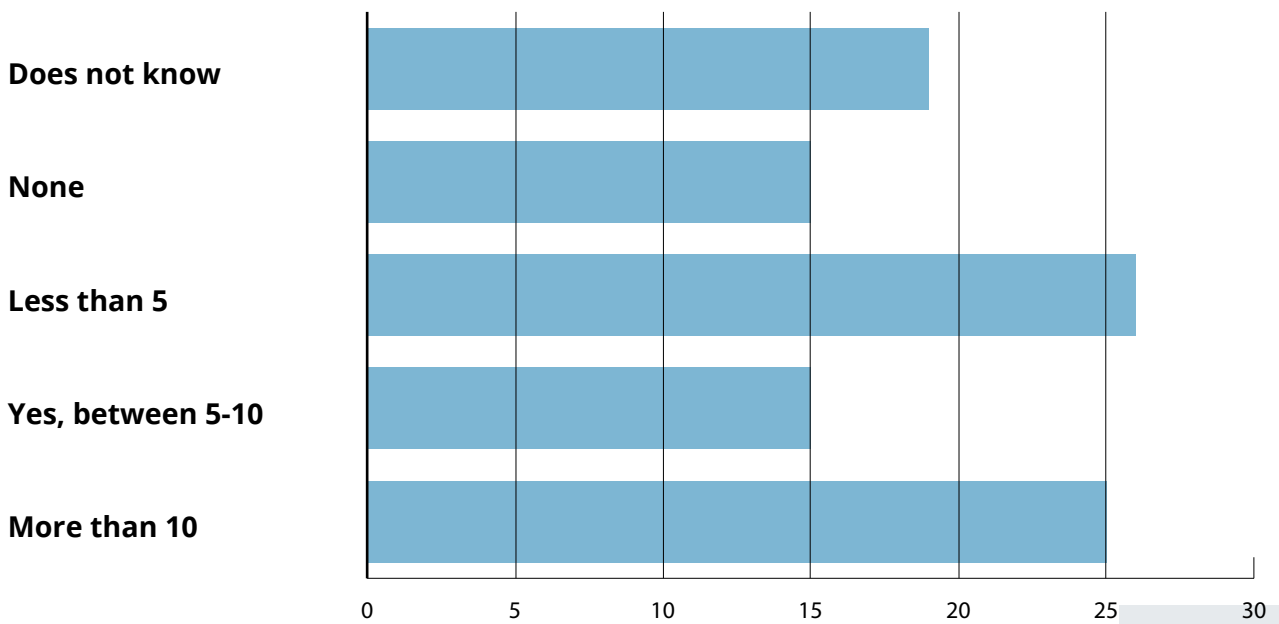


Figure 13.a. Results of innovation: new products, services in the offering introduced the past 5 years

8.

HORIZONTAL AND VERTICAL INTEGRATION

Another crucial issue of Industry 4.0 are the horizontal and vertical integration. 70% of the respondents believe that being a member of a cluster is beneficial from the horizontal integration point of view. Notwithstanding, 56% of the companies are not members in any cluster, 34% are members in one, while only 11% are members of more than one cluster.

Another question revealed the widely spread opinion that information sharing is necessary for the horizontal integration of the companies' external relations which enables to optimise the value creation chain. 44% of them on a regular basis, 43% on a case-by-case basis share their data automatically with their suppliers and/or clients. Regarding the inter-company integration, the IT is ahead and the high rates in *Procurement, Production and Manufacturing, Logistics* are obviously in correlation with each other (Figures 14.a and 14.b). Concerning the integration of companies with their partners, the variance is already higher, although here too, *Procurement* and *Logistics* are on the top. *Finance* is lagging behind despite the fact that this would be a straightforward solution.

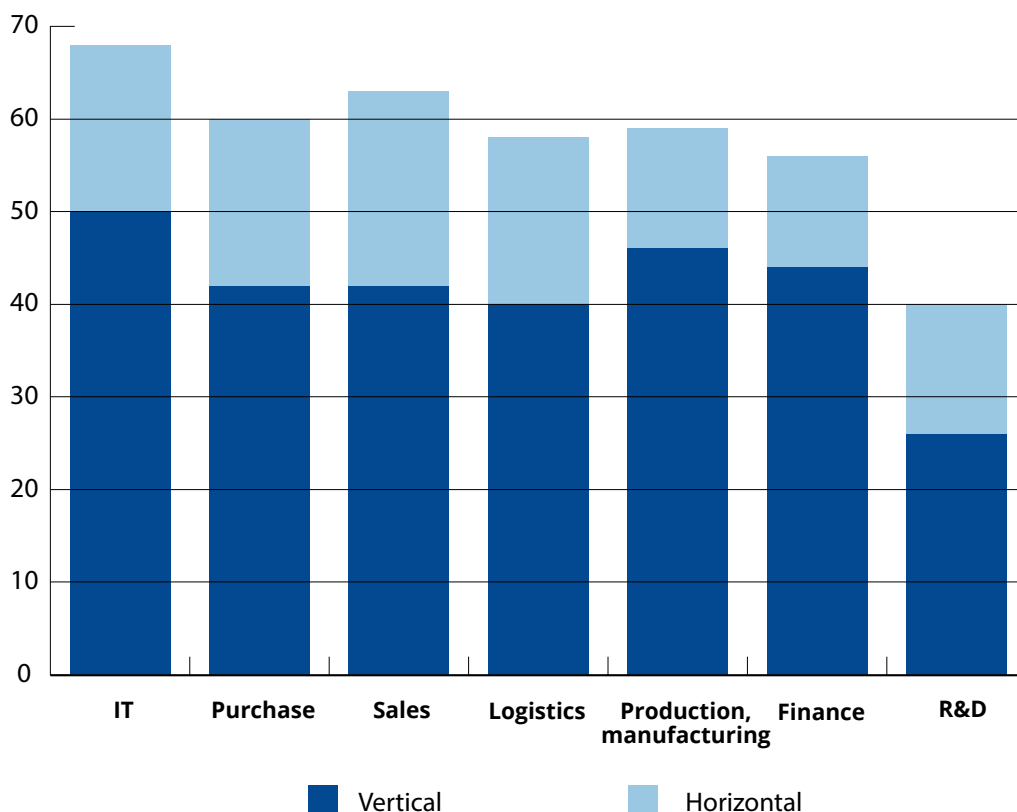


Figure 14.a. Areas of horizontal and vertical integration: SMEs

There seems to exist a considerable difference between the SMEs and the large companies⁶ in favour of the latter when considering the extent of implementing the integration. This provides the evidence that in Hungary, too, integrated supplier chains are about to appear in practice.

⁶ In spite of the chosen graphical representation method the two values cannot be mechanically added up.

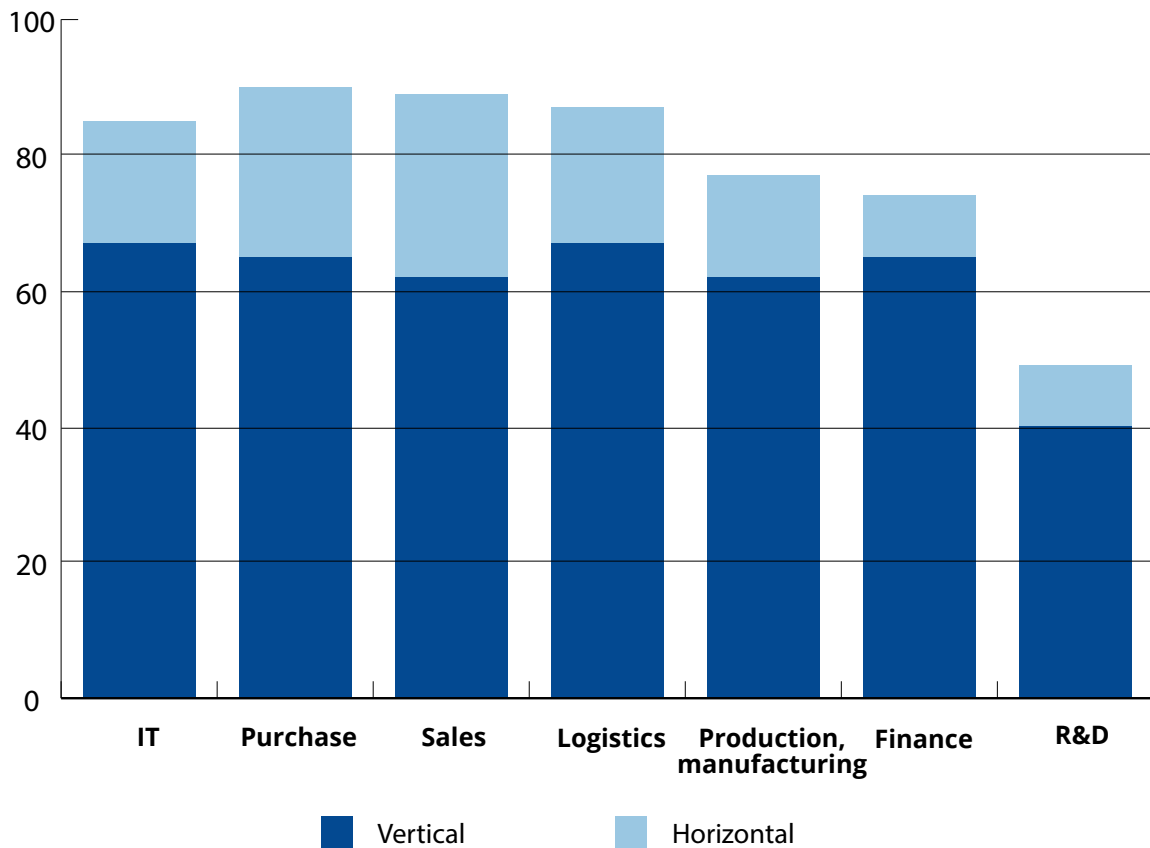


Figure 14.b. Areas of horizontal and vertical integration: Large companies

As to the general opinion of the respondents, 62% of them fully recognise the importance of these integrated supplier chains from the competitiveness perspective. 34% of them only with some limitations. It is fortunate to see that only 4% of them do not understand its added value.

Integration implies in both dimensions collecting, storing and processing an immense amount of data. For this, it is indispensable that the data be stored in databases in a structured format. This is why it is interesting what Figure 15 demonstrates: the rapid evolution of the Big Data technology in the near future versus its rather modest position today.

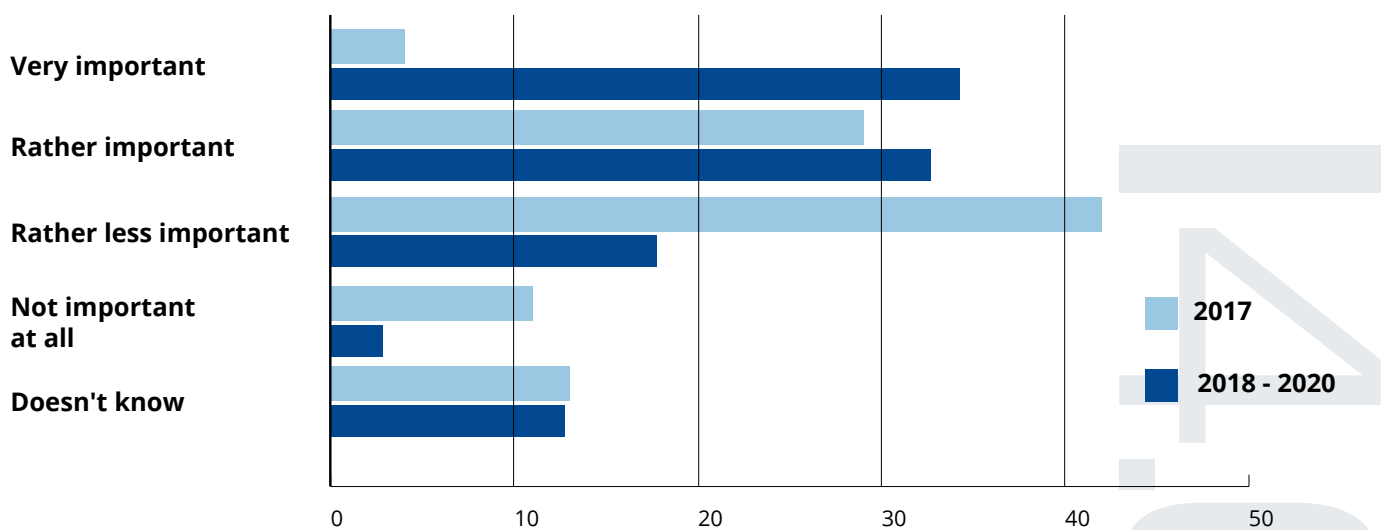


Figure 15. Results of innovation: prospects of Big Data applications

The benefits of Big Data can be utilised only if the virtual model reflecting the physical world of the production is intensively and continuously fed with data. The virtual modelling phase comes first and the virtual production design phase afterwards (Figures 16.a and 16.b).

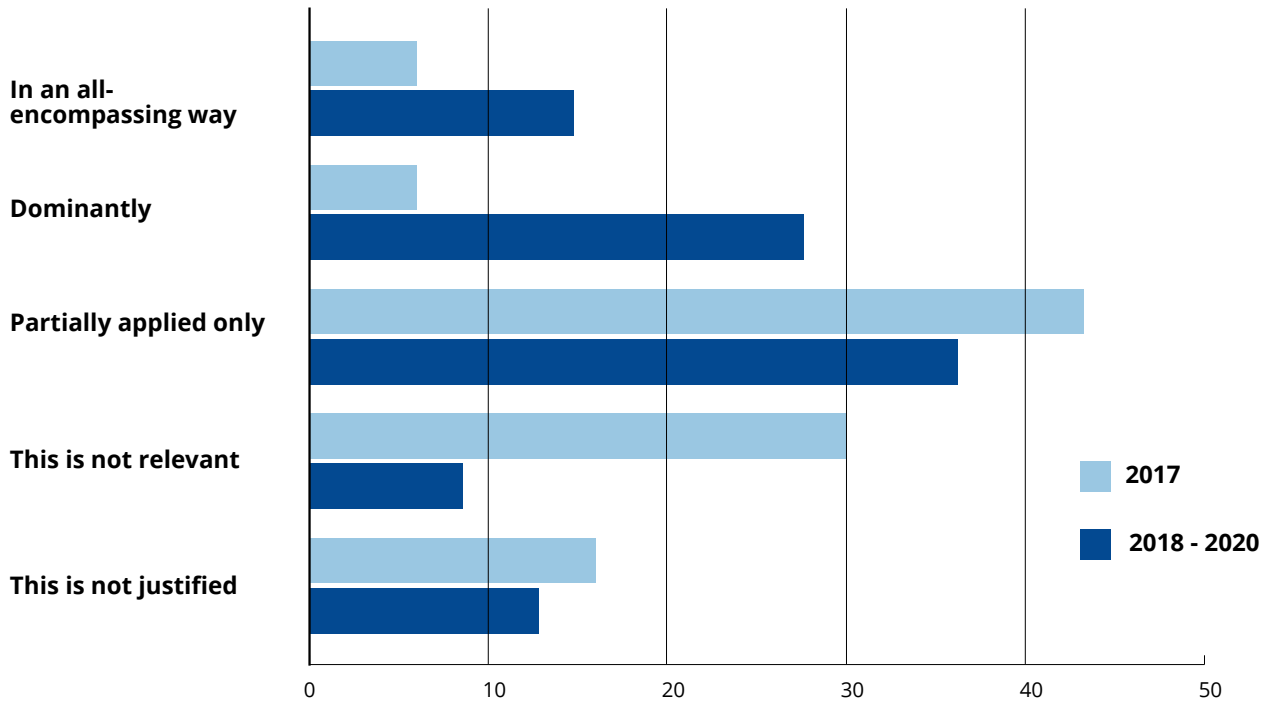


Figure 16.a. The present and future of virtualisation in the modelling

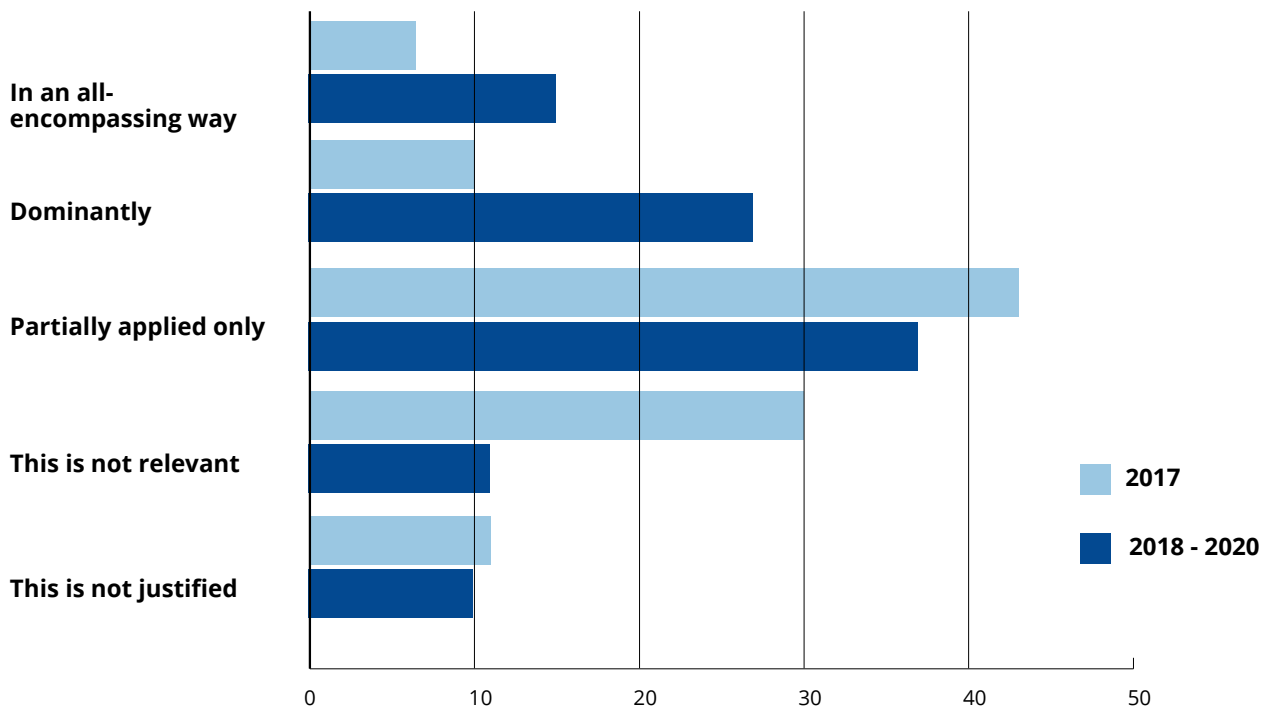


Figure 16.b. The present and future of virtualisation in the design phase

9.

SMART PRODUCTS

Smart products collect data on the production and usage phases of their life cycle and forward them for processing.

This data collection on the entirety of the manufacturing process and the product usage is and will be one of the crucial issues of Industry 4.0. The collected data can be and should be utilised in numerous areas.

Therefore, a key question of the Questionnaire – considering the fact that smart factories enable the digital modelling of the whole plant – asked from the respondents whether production specific data are collected on the production processes in the shop floor.

The survey shows that a great part of the industrial companies have understood its importance: 35% of them collect at least partially data (Figure 17).

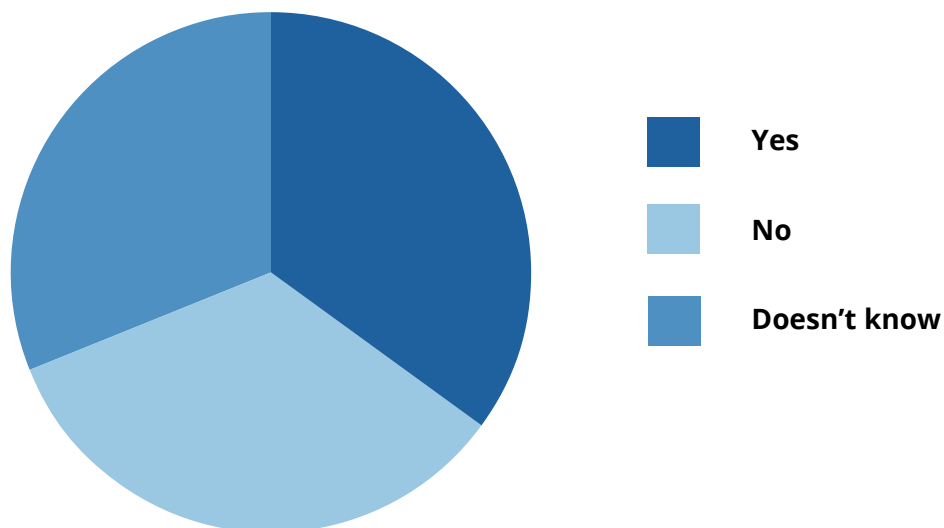


Figure 17. The penetration of data collection

UTILISATION OF COLLECTED DATA

Regarding the utilisation of the data collected in the manufacturing process at the smart factories, the situation far less positive (Figures 18 and 19). 65% of the respondents do not make use of this facility.

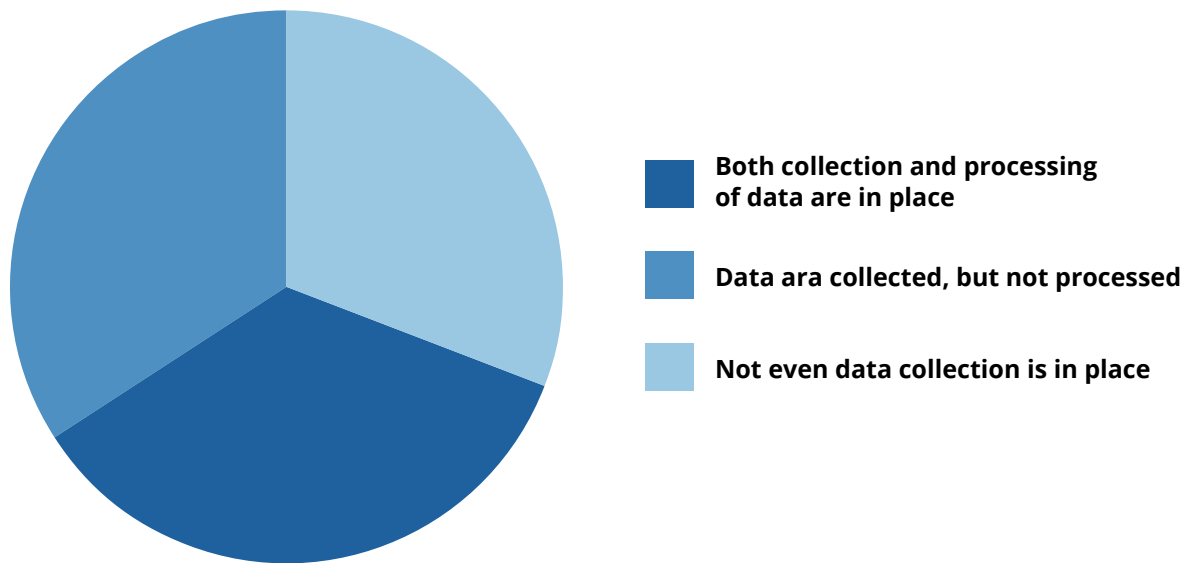


Figure 18. Results of innovation: evaluation of the data collected during product usage

Those who do utilise the data, mostly make it for *Quality management*, *Production optimisation* and *Technology development* purposes. (It was possible to select more than just one response from the options offered.)

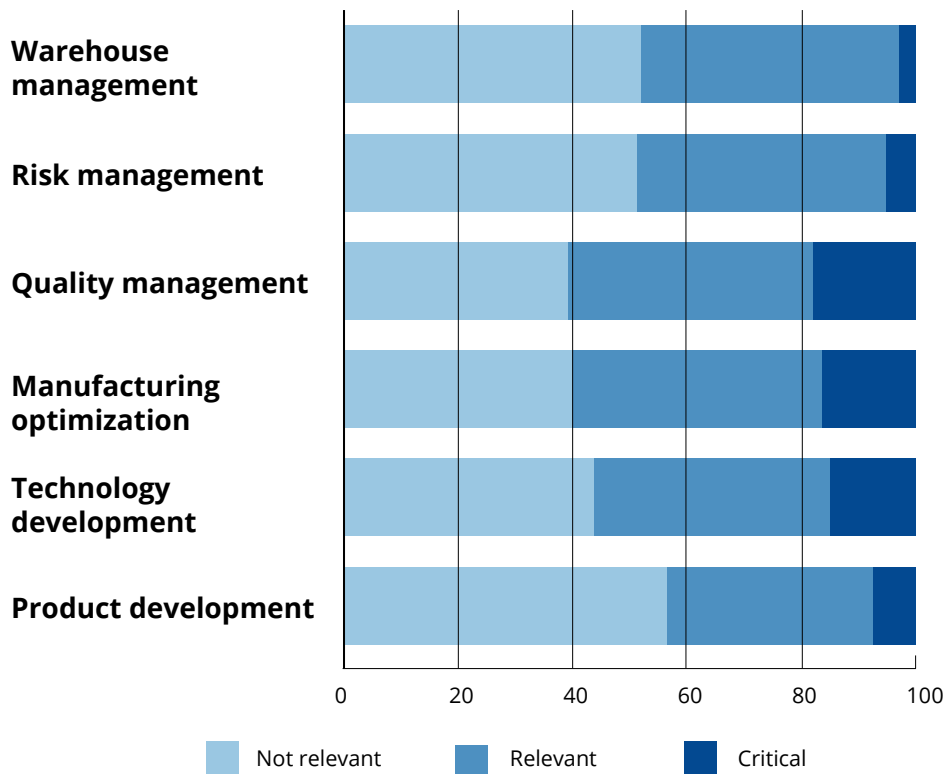


Figure 19. Results of innovation: evaluation of the data collected by purpose type

The conclusion drawn from the next questions is unequivocal: due to the high proportion of the 'No' responses smart production in Hungary can successfully gain place only by a radical upgrade of the existing infrastructure (Figures 20.a, 20.b and 20.c).

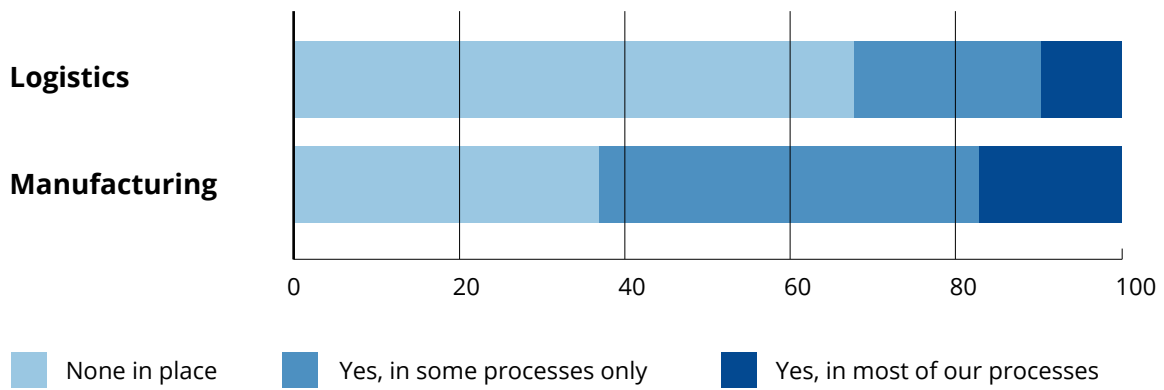


Figure 20.a. Automated machinery and tools in the manufacturing process and logistics: the present

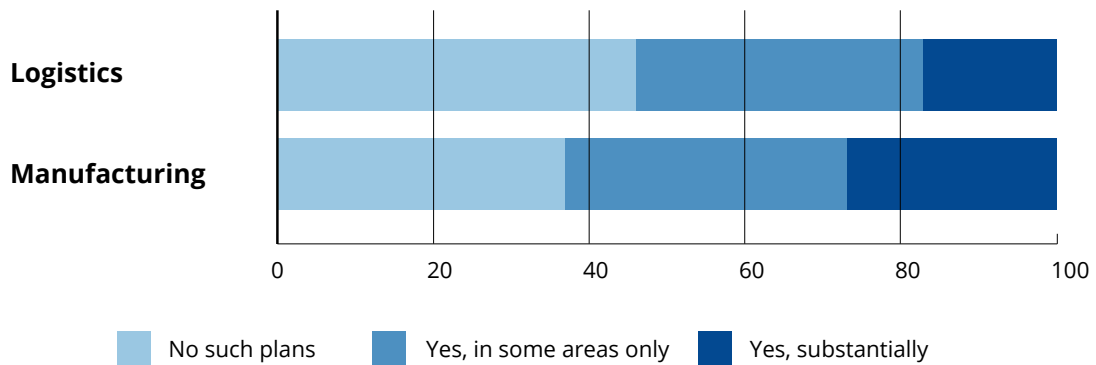


Figure 20.b. Automated machinery and tools in the manufacturing processes and logistics: plans for enhancements

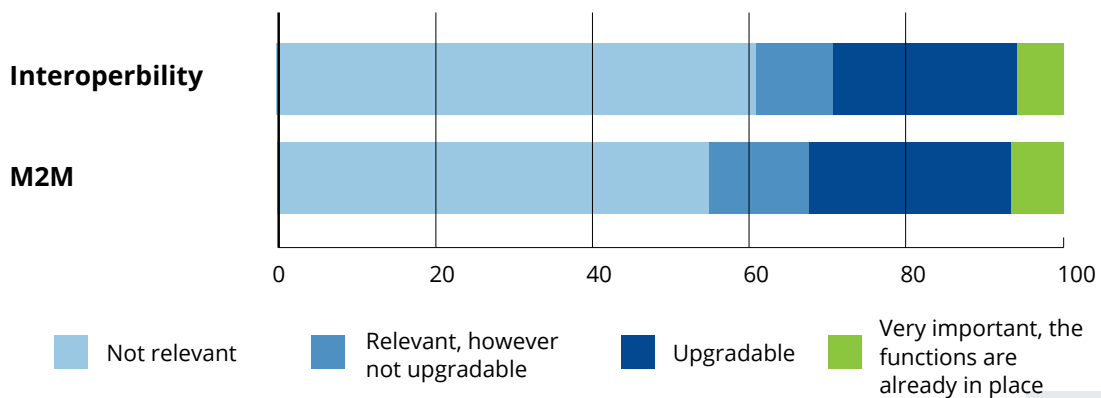


Figure 20.c. Assessment of upgradeability of the existing infrastructure in the manufacturing processes and logistics

In the light of these results the outcome of the next question is not surprising. This indicates a significant lag: altogether 17% of the industrial companies are able to run self-reacting production processes that adapt themselves automatically to the changes in the environment.

An analogous question was linked to the next development phase where individual workpieces themselves control their own production process. It is therefore, important to assess to what extent exist in Hungary solutions for products controlling their own production?

In accordance with the previous results, it is not surprising that only 14% of the respondents

reported on their first experiments with this technology. Some of them successfully introduced it as pilot or partially operational solutions.

The comprehensive data collection on product usage and its processing affects the corporate business model since, based on these high-value data additional services may be offered together with a product possessing some sort of intelligence.

The last place of service development in the ranking of the different utilisation options of the usage data (Figure 21) demonstrates that there is a great potential still to be realised in this area.

Product optimization

Lessons to be learned from improper usage of the products

Data are not collected on usage

Observation and analysis of the usage patterns

Development of new services to be offered with the product

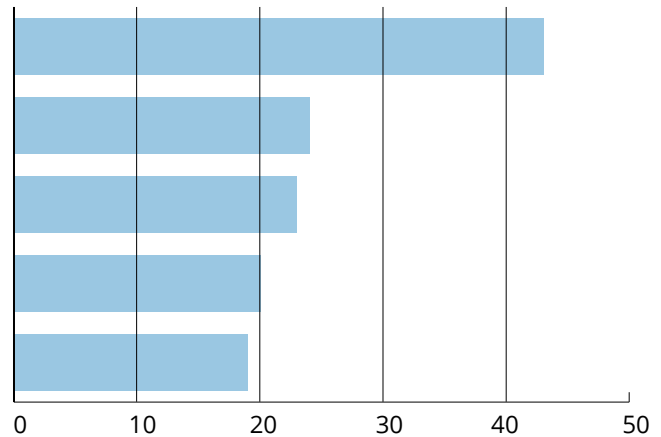


Figure 21. The potential of usage data utilisation



10.

THE HUMAN BEING IN CONTROL OF THE VALUE CREATION

It is the employee himself who takes the first place in the ranking of Industry 4.0 challenges and the tasks to be resolved by the State. (This topic is addressed also in Chapter 11.)

When assessing the Industry 4.0 competencies of their own employees it is apparent that whatever specific skill areas are concerned – with the exception of one – the *‘Doesn’t exist’* and *‘Does exist but insufficiently’* types of responses predominate with their combined rate over 60%. The proportion of *‘It exists at satisfactory level’* type of responses is conspicuously low.

Even having this in mind the areas of automation techniques are in the most unfavourable situation. Another conclusion of the analysis: the large companies seem to be in a slightly better position in this respect than the SMEs.

The results underline the opinion of those who urge a complete reshaping of the educational system putting Industry 4.0 orientation and digital competency development into the focus. This view is represented by both the Ministry NGM and the whole professional community, and was manifested in concrete recommendations in the strategy.

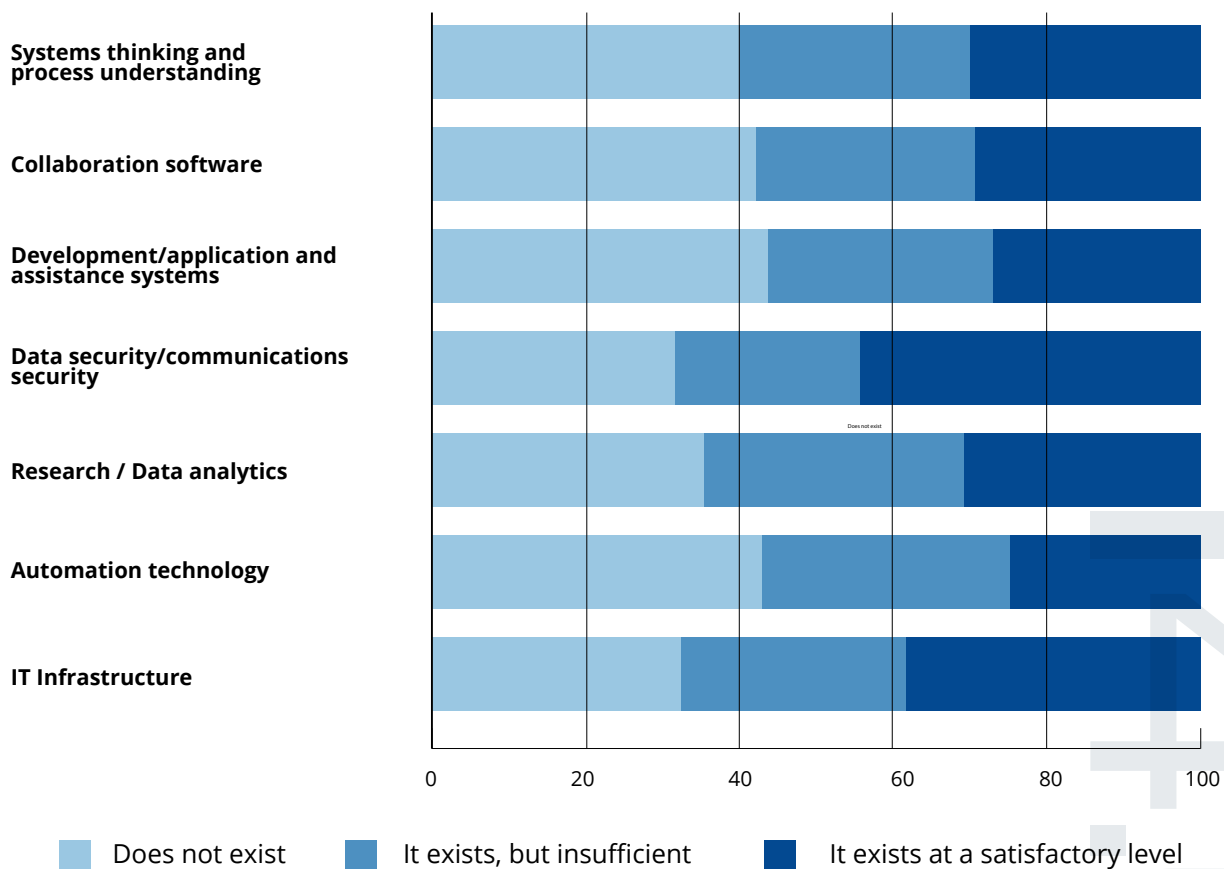


Figure 22. The assessment of employees' current Industry 4.0 related competencies with respect to the future demands

The perception of both the companies' management and the employees about the impact of Industry 4.0 on work conditions is of foremost importance (Figure 23).

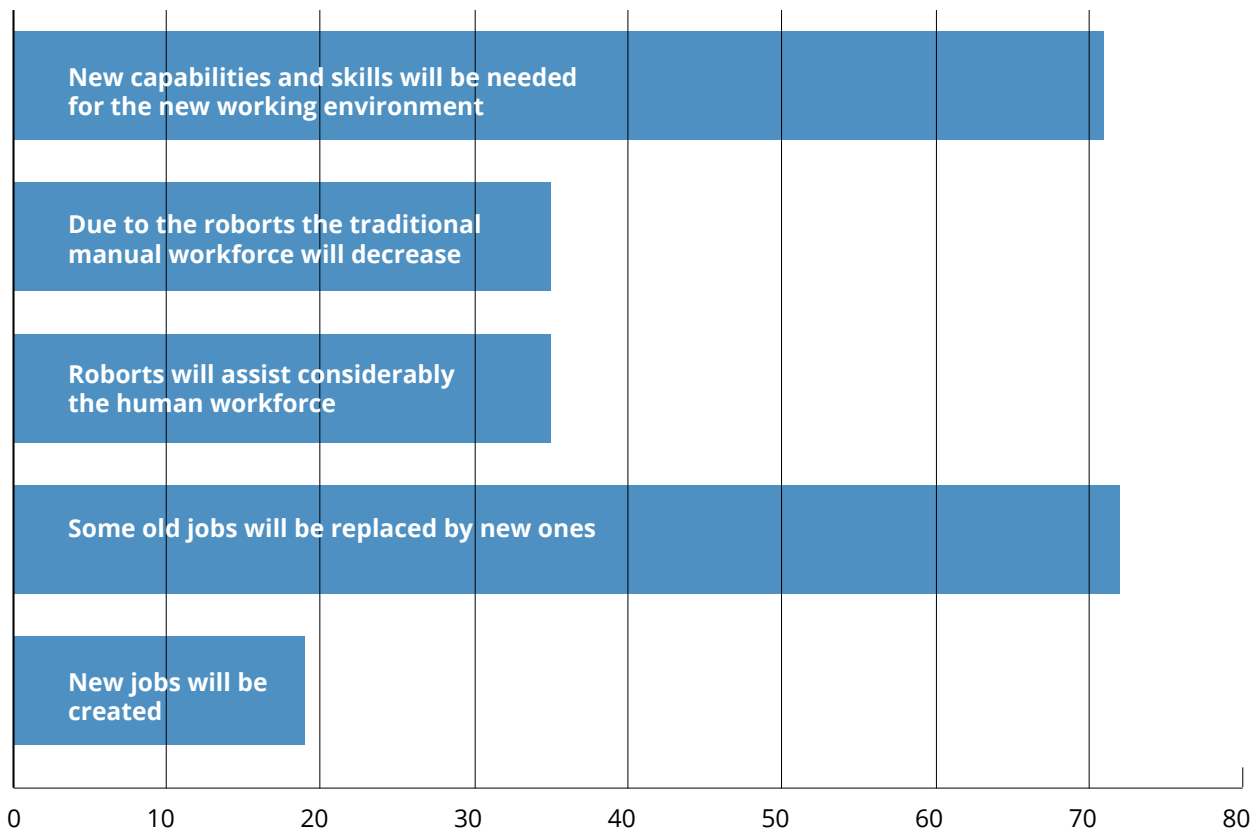


Figure 23. The assessment of expected changes in the work conditions generated by Industry 4.0



11.

THE ROLE OF THE STATE IN SHAPING THE INDUSTRY 4.0 ECOSYSTEM

There are two different approaches to address the contribution of the State and its possible roles.

First, the responses dealing with the direct state interventions are presented. Among the most promising areas of efficient intervention, education and infrastructure development received over 90% rating of *Very important* and *Important* (Figure 24). Though it is true that all other areas (like financing programmes, employment policy, regional development, etc.) have also received over 70% of the voting, the final ranking is still very instructive.

The responses can be interpreted as the expression of the respondents' expectations.

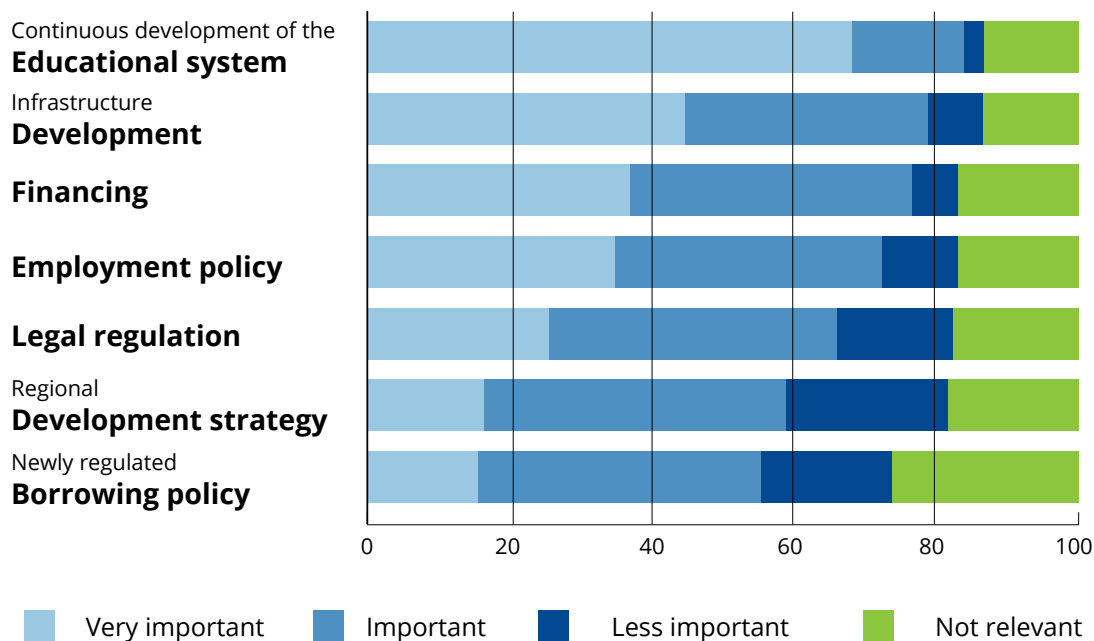


Figure 24. The assessment of the areas and efficiency of the direct state intervention

How can the State meet these expectations? What developmental and regulatory measures do the actors like to see on the market? What tools are thought to be the most straightforward?

The assessment of the tools at the State's disposal is the following:

FINANCING

What is more desirable: tax reduction, special basic funding schemes or both? The last option preponderates from the perspectives of both the digitalisation and enhancement of the competitiveness (Figures 25.a. and 25.b). It is obvious that the majority of the respondents votes for

the combination of the two tools. What makes it interesting is the homogeneity of the responses.

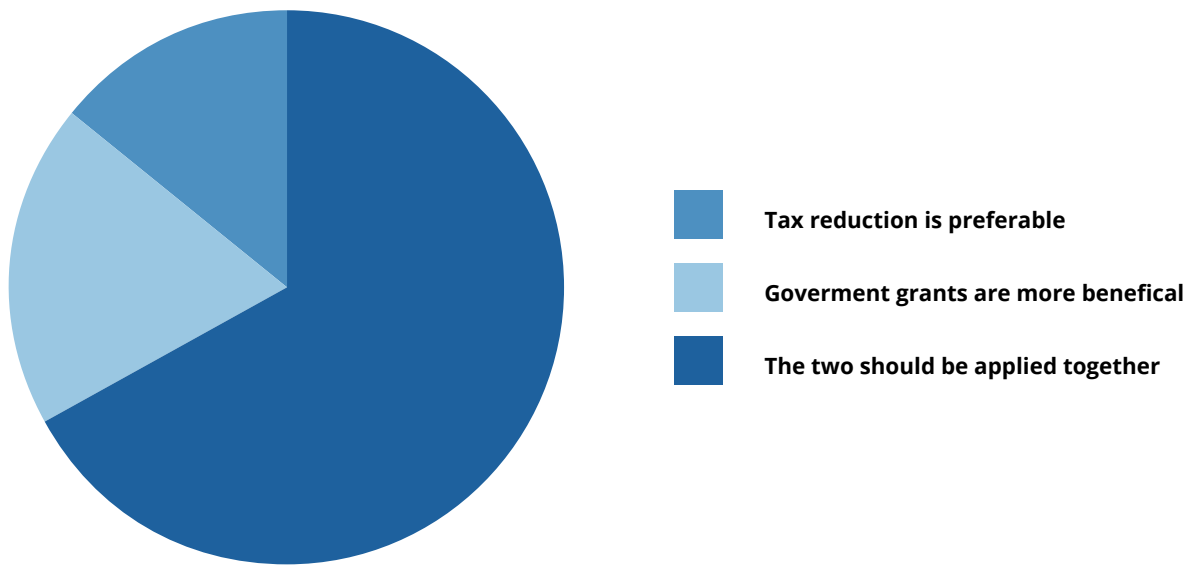


Figure 25.a. The motivating effect of tax reduction and basic funding on digitalisation

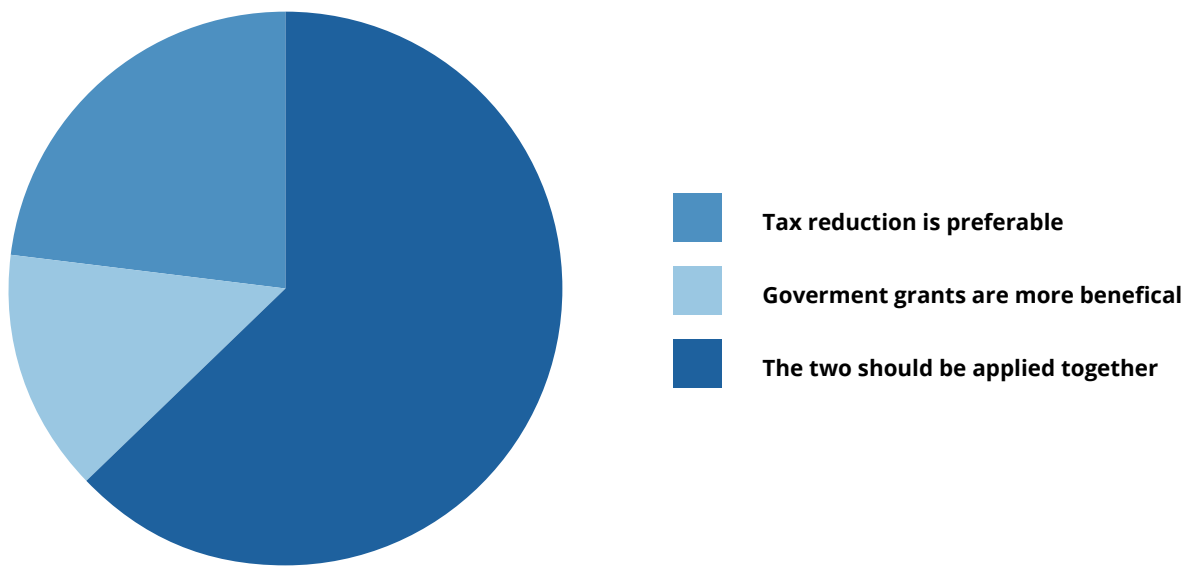


Figure 25.b. The multiplicative effect of tax reduction and government funds on competitiveness

The majority agrees with **treating the less developed regions as preference** of high priority, although some thoughts could be made on the high rate of 'No' responses, i.e. 40 and 20%, respectively. Does it show lack of solidarity?

Infrastructural development is generally supported (Figure 27) since this fosters logistic facilities for the suppliers and makes the target markets physically more accessible. Moreover, it could alleviate problems of travelling for the employees as well.

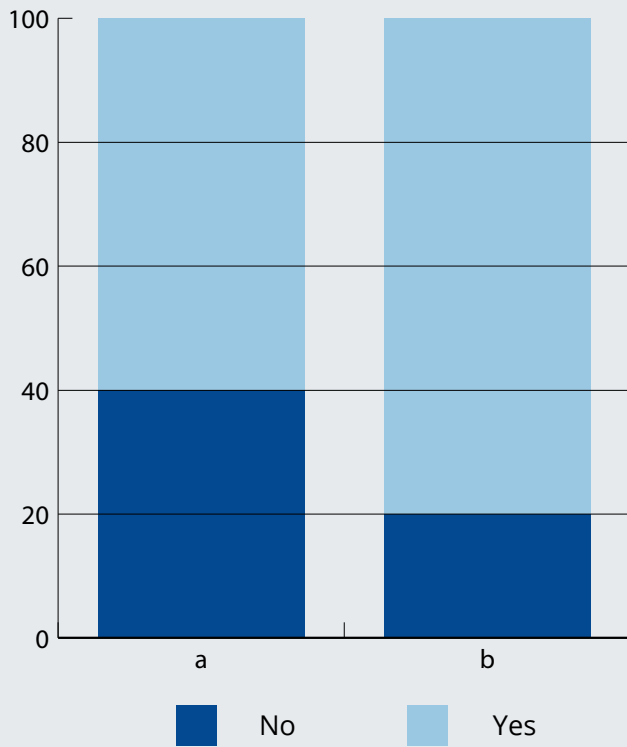
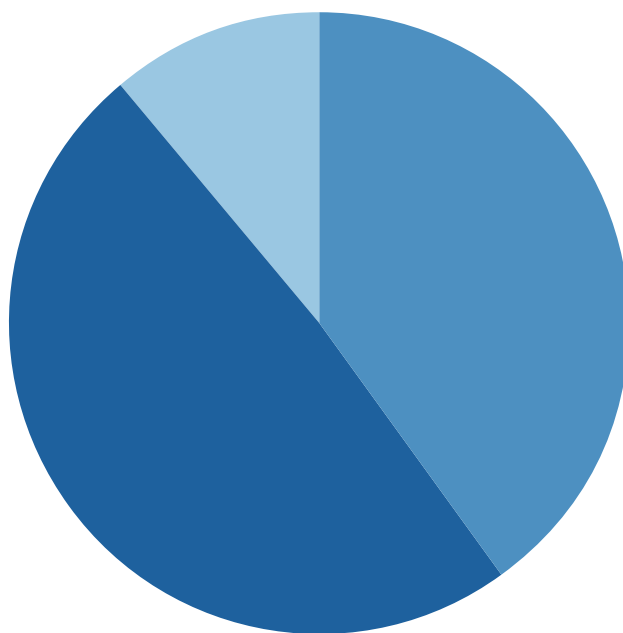


Figure 26.a. The negative effects regional inequalities

Figure 26.b. The high priority treatment of the less developed regions by the state policy



- No, it is not so important
- Yes, utmost important
- Yes, it is generally true

Figure 27. The demand for transport infrastructure (highways, railway, aerial) development in support of horizontal integration

The other, indirect approach to assess the tasks of State interventions is to listen to the actors concerned: where do they see the major hindrances to the implementation of Industry 4.0? And then the State actively can help them to overcome them.

As seen before (in Chapter 10), the major problems for the respondents are the non-availability of skilled staff and their training (Figures 28.a and 28.b).

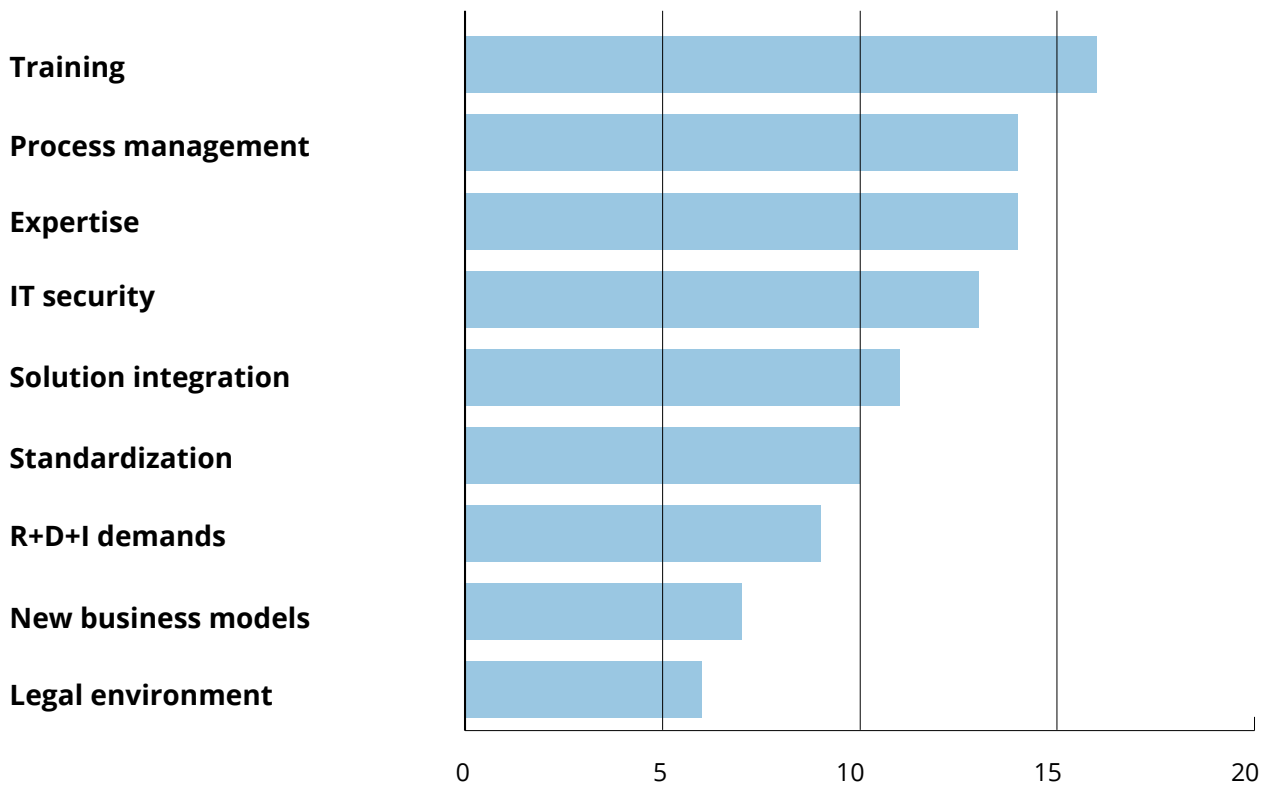


Figure 28.a. The major technological challenges of implementing new digital technologies

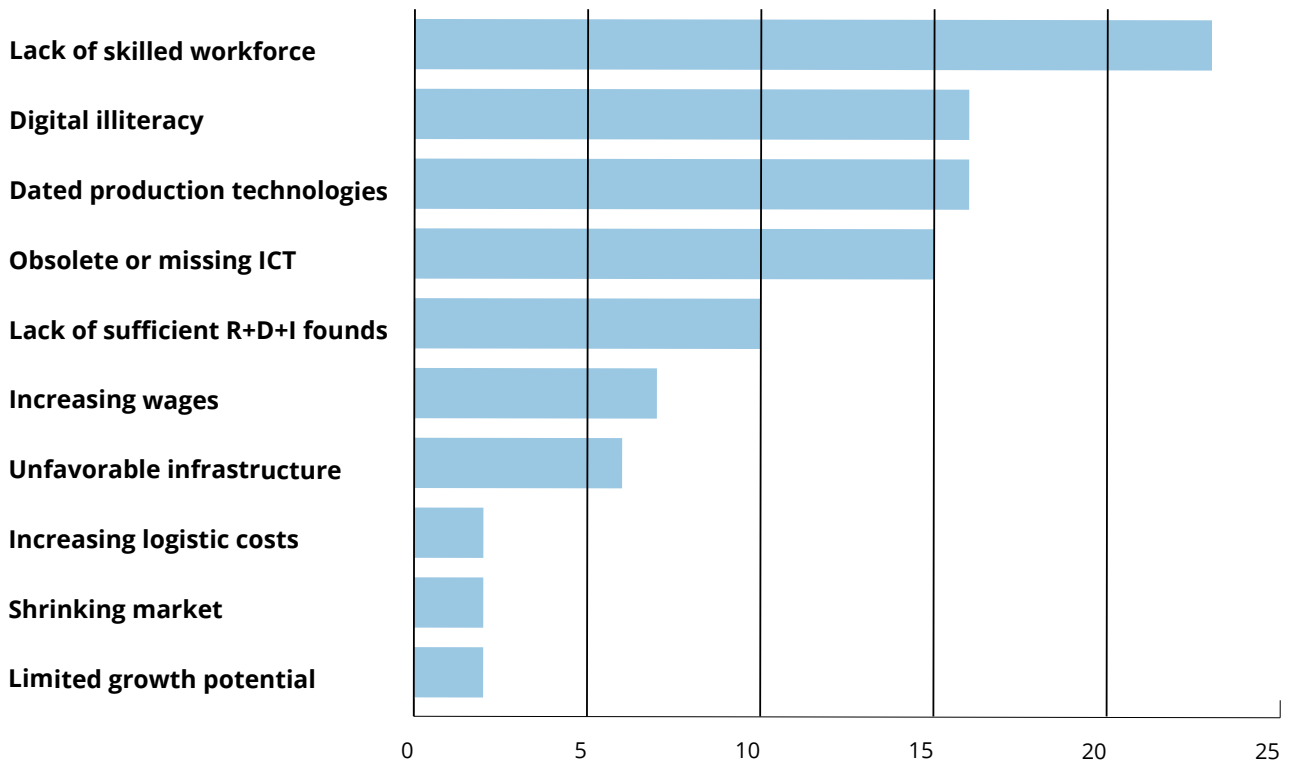


Figure 28.b. The major obstacles of improving competitiveness

The question inquiring about the challenges of competitiveness brought the result which is not surprising at all because of the preceding analyses.

For most of the respondents the relevant problems are the lack of skilled workforce, digital illiteracy, outdated production technologies and production / business processes as well as obsolete info-communication technologies.



12.

READINESS INDEX OF THE COMPANIES

We have evaluated the responses received in the Section 2 individually. Applying a set of pre-defined scores and allocated weightings yields the Industry 4.0 readiness index of a respondent industrial company.

The qualification has six levels:

- Level 0: **Outsiders**
- Level 1: **Beginners**
- Level 2: **Intermediates**
- Level 3: **Experienced**
- Level 4: **Experts**
- Level 5: **Top performers.**

These categories come from the VDMA study and have been kept for the sake of comparability. The scoring and weighting methodology, however, was set up by us, thus differences in the scaling will inevitably result in differences in the index values calculated for the companies in the two countries. Notwithstanding, when comparing the consolidated result of the Hungarian evaluation with that of the German study (Figure 29) one may come to the conclusion that the Hungarian companies addressed by the Questionnaire were more active in filling it in than their German counterparts who seemed less receptive of the topic.

However, it would be mistaken to think that German companies are at the same level of readiness only as the Hungarians, since the whole Industry 4.0 paradigm was initiated by Germany. The clear evidence for this is the existence and proportion of the top performers there.

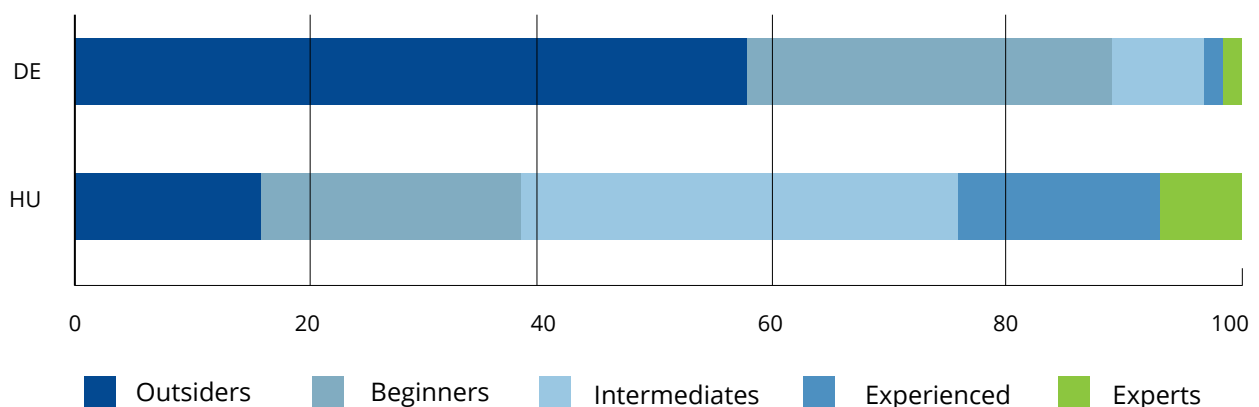
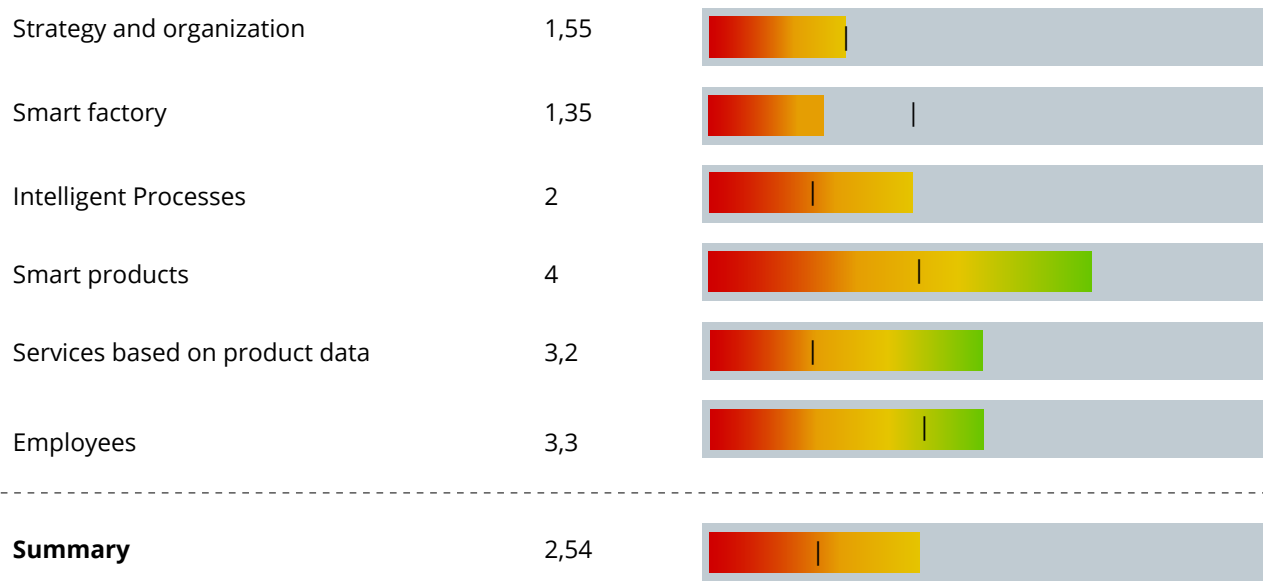


Figure 29. The Industry 4.0 Readiness Index in Germany and Hungary

The individual Readiness Index for a company is presented in the following format (Figure 30) for those who sent back the Questionnaire with indicating their names and asked for a feedback.



**Figure 30. The individual scoring result of a company (0-5)
The Hungarian average is indicated by the † bar**



SUMMARY

LESSONS FROM THE SURVEY

- A breakthrough took place in the last 1-1.5 years in Hungary with respect to the general knowledge about Industry 4.0 and the recognition of its utmost importance.
- The majority of the industrial companies, however, have no Industry 4.0 strategy in place.
- Although a great part of industrial companies have an understanding of the relevance of data collection, the rate of those actually doing it in a comprehensive way is negligible.
- The proportion of industrial companies currently operating a non-upgradable technical infrastructure is high.
- The capacity for innovation of numerous companies is insufficient.
- Most companies do not harness the income generating effect of the additional services introduced on the basis of product data collection.
- Considering the Industry 4.0 competencies of the companies' own employees the predominance of the 'Doesn't exist' and 'It exists but insufficiently' type of responses is striking.
- The biggest difficulty areas of the SMEs are process and work organisation, availability of required skill and continuous training.

RELEVANT CONCLUSIONS OF THE SURVEY

- A great deal is still to be done with respect to the Industry 4.0 oriented dissemination and cultural education.
- The majority of the Hungarian industrial companies have to renew their technical infrastructure to ensure evolutionary upgradeability.
- It is evident that strengthening the R&D&I potential is one of the crucial tasks in any Industry 4.0 based development strategy.
- The actors irrespective of their position in the value chain need new, product related smart services.
- A complete renewal of the entire education system with special respect to the vocational training, high education and lifetime learning is a must.
- Without the intervention of the State SMEs cannot cope with the challenges generated by Industry 4.0. The State has therefore, to support them by direct and indirect means.

IMPRESSUM

© *Industry 4.0 National Technology Platform Association, 2017*

Editor-in-Chief: Prof. Dr. László Monostori. President

Authors: Gábor Nick, József Váncza, Tamás Várgedő

Translation: Tamás Várgedő

Graphical design: Angéla Horváth

H-1111 Budapest Kende Street 13-17

Phone: +36 1 279 6110

www.i40platform.hu

All rights reserved

