DOCUMENT TITLE:

CRITICAL FACTOR SME DIAGNOSIS REPORT FOR SLOVAKIA

Project: Improving RD and business policy conditions for transnational cooperation in the manufacturing industry

Acronym: Smart Factory Hub

Work package	WP3: Benchmark and RIS3 based SFH model definition
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RE	Restricted to a group specified by the consortium	
CO	Confidential, only for members of the consortium	

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TARGET GROUP ASSESSMENT

Has this deliverable addressed any of the target group indicated in the application form?

Yes / No

If yes, please describe the involvement of each individual target group in the table below.

Target group	Number reached by the deliverable	Description of target group involvement
SME	*32*	SMEs from Slovakia fill out the questionnaire with the relevant answers
Regional public authority		
National public authority		
Higher education and research		
Business support organisation		

CONTENT

1 Introduction

The survey for Slovakia had been taking place from 6th April till the end of May 2017. We had addressed the production oriented SMEs from all over the Slovakia. The total number of the companies that were chosen and subsequently approached to engage in the survey from our side was 312. From this amount 125 the company representatives entered the questionnaire and 32 SMEs provided us complete answers which means 26% (from 125) and 10,25% from the total amount of the approached companies (312). However, the binding number of the completed responses was 25 in the project plan, i.e. the Slovak companies' answers to the questionnaire fulfil the goal on 125%. The overview statistics see the table below:

Response rate (?) Base: Entered intro

Status	Frequency	State
Entered intro	125	100%
Entered first page	63	50%
Started responding	44	35%
Partially completed	44	35%
Completed	32	26%
Unit usability (50%/80%)		
Usable units	34	77%
Partially usable units	1	2%
Unusable units	9	20%
Breakoffs		
Introductory breakoffs	81	65%
Questionnaire breakoffs	12	10% (neto 27%)
Total breakoffs	93	74%

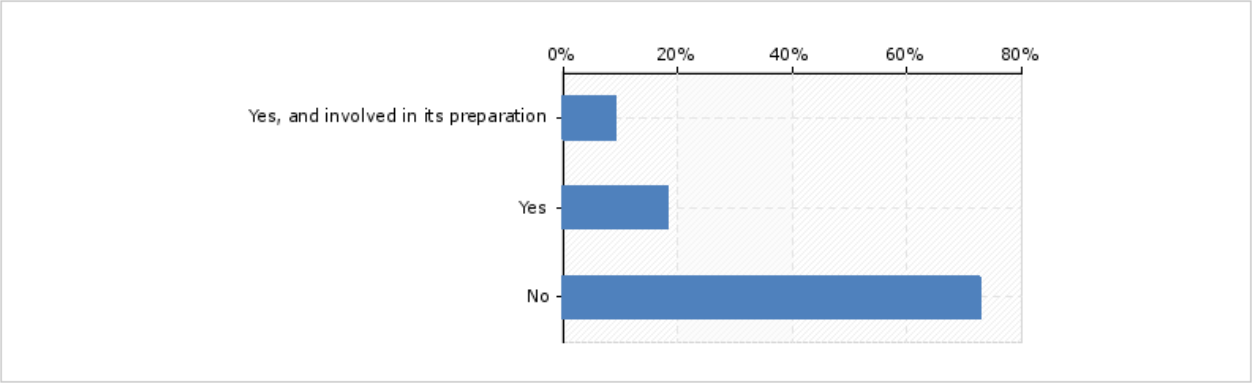
Below we are providing the analysis of the results based on the key questions set out in the questionnaire development.

2 Survey results for Slovakia

2.1 KEY QUESTION 1: How well are SMEs familiar with the Smart Specialization strategy or related policy and what was their involvement in creating it?

With this measure, the share of SMEs, who are familiar with the Smart Specialization strategy is provided, alongside with the share of SMEs involved in preparing it. Moreover, by summarizing the answers, we are able to determine the share of SMEs involved in preparation of Smart Specialization strategy.

Q3 - Are you familiar with the national Smart Specialization strategy* or related policy initiative defining Smart Manufacturing? *Also known as Smart manufacturing policy, RIS3 strategy, Industry 4.0 policy, Regional Innovation Strategy for Intelligent specialization, Smart Factory.



From the answers to this question is very obvious that more than 70% Slovak SMEs are not acquainted with the National Smart Specialization Strategy and only almost 20% of them are familiar with this strategy and less than 10% SMEs companies were involved in its preparation, too.

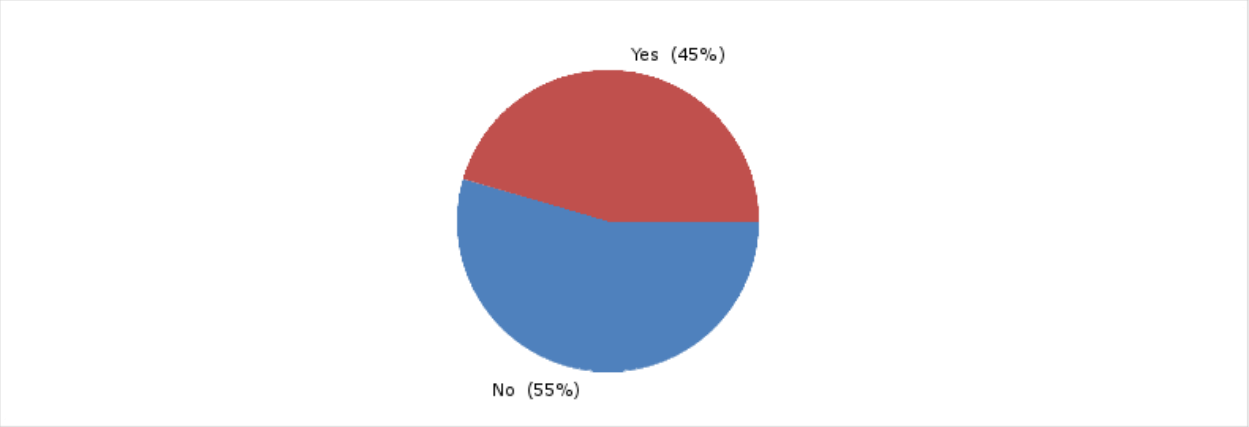
KEY MESSAGE to Q3:

Slovak SMEs predominantly have not been involved in development of the National Smart Specialization Strategy, which consequences is that the Strategy is not well recognised (answer Yes = ca 20%) by the Slovak SMEs.

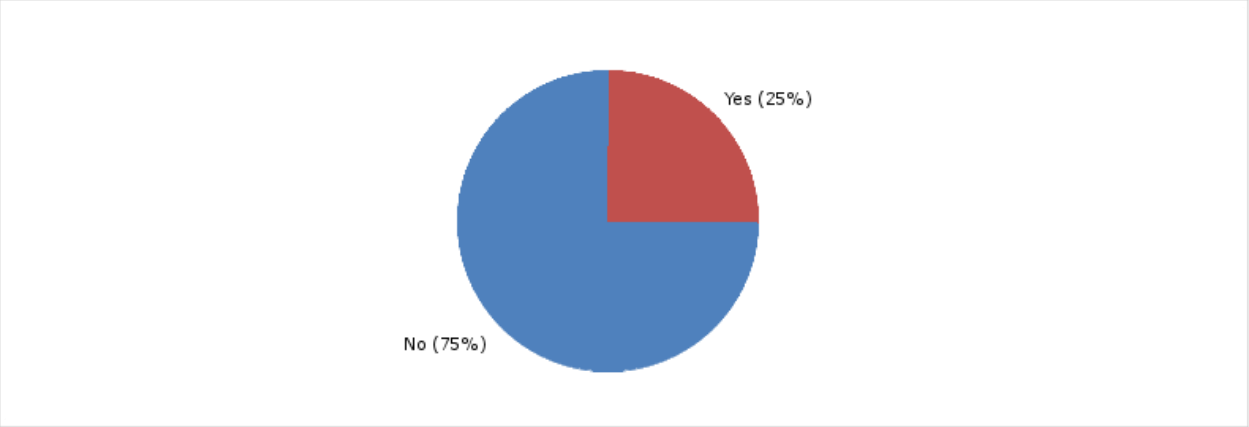
2.2 KEY QUESTION 2: How well is Smart Manufacturing perceived at strategic and spread at operational level (maturity of Smart Manufacturing in the SMEs)?

This measure will give us the answer to the question about how well is Smart Manufacturing understood at strategic level, by giving us the share of SMEs that understand the impact of Smart Manufacturing for their organisation. The second measure is used for determining how well the Smart Manufacturing is implemented in targeted region, by giving us the share of SMEs that currently use Smart Manufacturing systems/solutions in their organisations.

Q4 - Do you understand what are benefits/impacts of ''Smart manufacturing'' for your organization?



Q6 - Do you currently use Smart Manufacturing systems/solutions in your organisation?



The conclusion which follows from the answers to the question Q4 and Q6 is that the SMEs in Slovakia have the difficulties to understand the benefits of the Smart manufacturing, however the balance between informed and uninformed is 45 to 55% (the difference in absolute figure is only 3 companies).

It is very surprising fact that 25% of the SMEs are already using the Smart manufacturing systems/solutions in their organization (it represents over 50% of the informed SMEs).

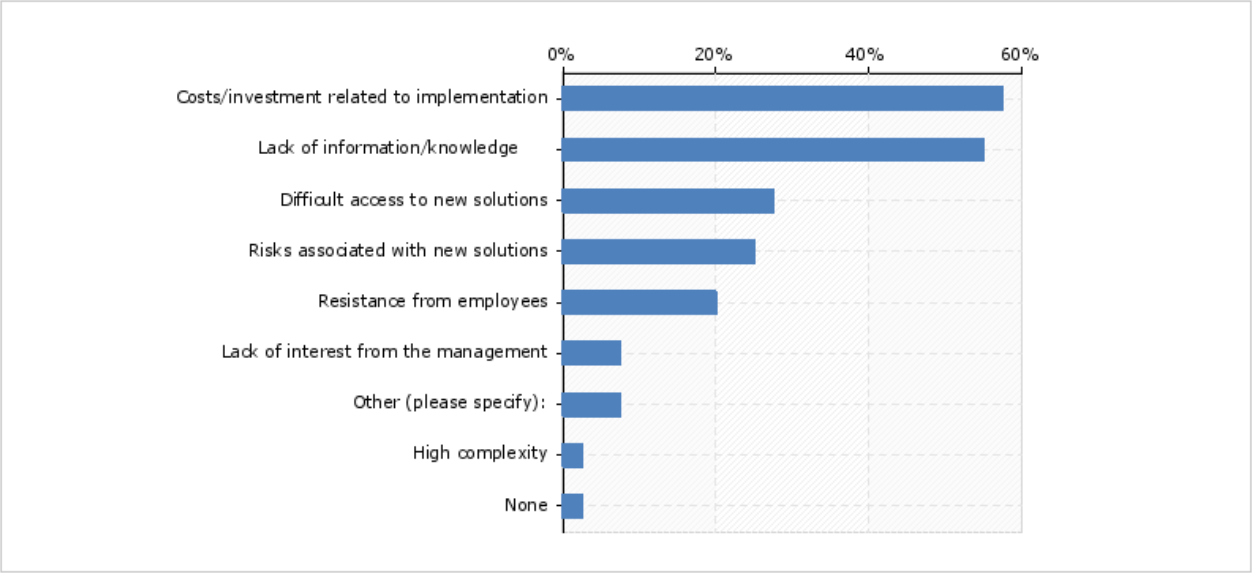
KEY MESSAGE to Q4 and Q6:

From the technical view (systems and solutions) the knowledge of the Smart manufacturing is spread among the Slovak SMEs in balance (45%-yes and 55%-no), with more than 25% of them are already using the Smart manufacturing systems/solutions at the operational level.

2.3 KEY QUESTION 3: What kind of challenges are SMEs facing in implementing Smart Manufacturing technologies and solutions?

This measure is one of the most important ones and will provide information on different challenges and obstacles SMEs are facing in implementing Smart Manufacturing technologies and solutions.

Q7 - What challenges are you facing in implementing Smart Manufacturing technologies?



The most SMEs are persuaded that the main challenge in implementing the Smart Manufacturing technologies (SM) and solutions are the Costs/investments related to implementation (58%), the next is the Lack of information/knowledge (55%). Also the problems comprise the Difficult access to the new solutions (27%) and the Risks associated with the new solutions (25%). On the other hand, the Lack of the interest from the management (7%) and High complexity (3-4%) represent just small barrier to the implementation of the Smart manufactory.

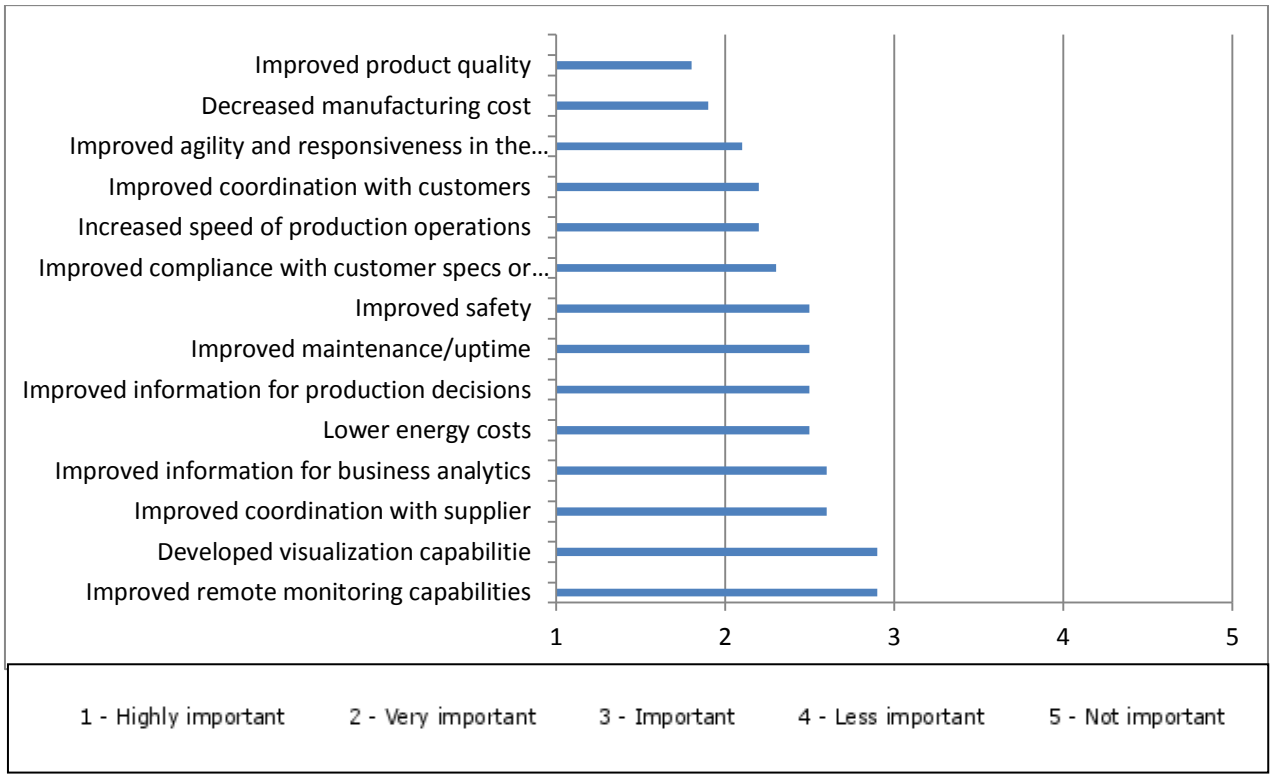
KEY MESSAGE to Q7:

SMEs are facing variety of challenges when it comes to the implementation of Smart manufacturing technologies. The most important are the objective barriers related to the Costs/investments and Lack of information/knowledge (over 55%, res. 58%). Surprisingly, the Resistance of the employees and High complexity of SM technologies have been representing by less than 10% (7%, res. 3%). These two low ranking challenges reflect only subjective barriers to the implementation of SM technologies.

2.4 KEY QUESTION 4: Which areas influenced by the Smart Manufacturing are most important for increasing the competitiveness of SMEs.

*This measure is providing the overview of areas, influenced by the Smart Manufacturing (further only **SM**), for which SMEs believe, will be essential for their competitiveness in the next three to five years.*

Q8 - How much do you think the following areas of improvement will be essential for your company's competitiveness in the next three to five years?



From the surveyed result of this question (Q8), which has been structured to the 14 predetermined answers, emerges that all responses have been ranking on the scale between Highly important (1) and Important (3):

- The First group (Highly important) represents the Improved product quality, Decreased manufacturing costs. These two improvements make the most important aspects of SMEs competitiveness.
- Second group (Very important) represents the Improved agility and responsiveness in the production process, Improved coordination with customers, Speed of production, Improved compliance with customer specs.
- Third group (Very important–important) represents others improvements like the improved: - Safety, - Maintenance/uptime, - Information for production decisions, -

Information for business analytics - Coordination with suppliers and Lower energy costs. This third group represent the improvement not only the management of production but also recognition of the customer specs.

- Fourth group (Important) represents the Remote monitoring capabilities and Developed visualization capabilities. The lowest values for SMEs competitiveness have the visualization and monitoring capabilities of production.
- There was none answer ranking as Less important (4) and Not Important (5).

KEY MESSAGE to Q8:

The most influential areas for increasing SME's competitiveness in the future are:

- **Highly important-Product quality, Manufacturing costs;**
- **Very important-Improvements of the production as well as the Satisfying of the customer specs.**

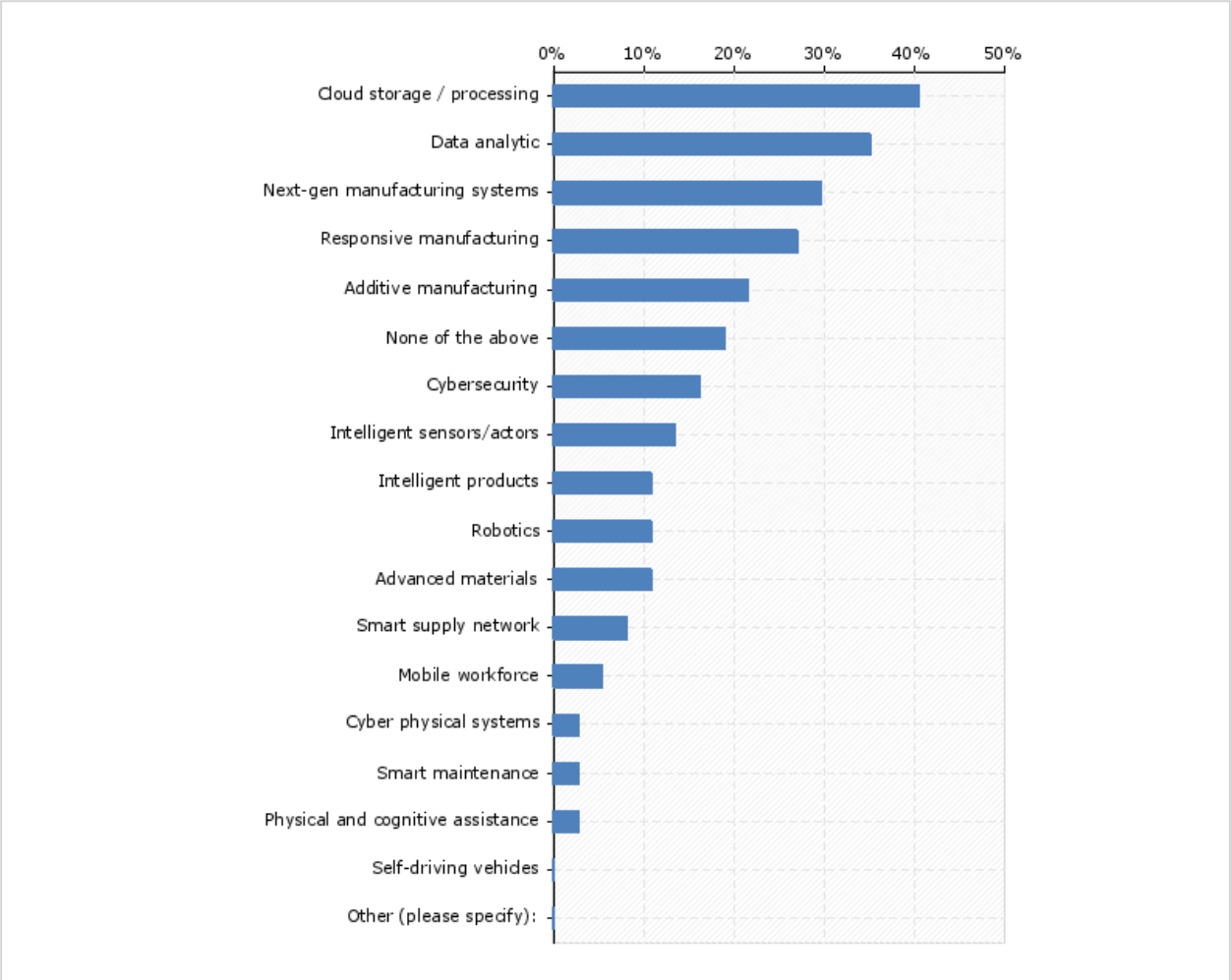
2.5 KEY QUESTION 5: What are the current state-of-art and future plans/strategic orientation for implementation of SMEs in relation to all three areas of intervention?

This measure gives in-depth overview of SMEs current state-of-art and future plans/strategic orientation for implementation in relation to:

- *Novel technologies*
- *Production processes*
- *Human resource management*

This will provide insight and mapping possibility between the existing technologies solutions and good practices and future areas of interest.

Q10 - What kinds of novel technologies are currently implemented in your company?



From the surveyed result of the Q10 related to using and applying of the novel technologies, which has been structured to the 18 predetermined answers, shows following distribution of these technologies among the Slovak SMEs:

- First group (30% - 40% incidence) represents three new technologies (Cloud storage and processing; Data analytics; Next-gen manufacturing systems).
- Second group (16% - 26% incidence) represents new manufacturing (Responsive manufacturing; Additive manufacturing) and the security of manufacturing (Cybersecurity).
- Third group (11% - 14% incidence) represents the using of the intelligent sensors and robotics in the man manufacturing (Application of the intelligent sensors/actors; Intelligent products; Robotics; Advanced materials).
- Fourth group (3% - 8%) represents five new technologies (Smart supply network; Mobile workforce; Cyber physical systems; Smart maintenance; Physical and cognitive assistance). 3% incidence represents application of each of these technologies (Cyber physical systems; Smart maintenance and Physical and cognitive assistance) only in one approached SME.
- 19% SMEs have not implemented any listed novel technologies.
- None of the approached SMEs are using the Self-driving vehicles.

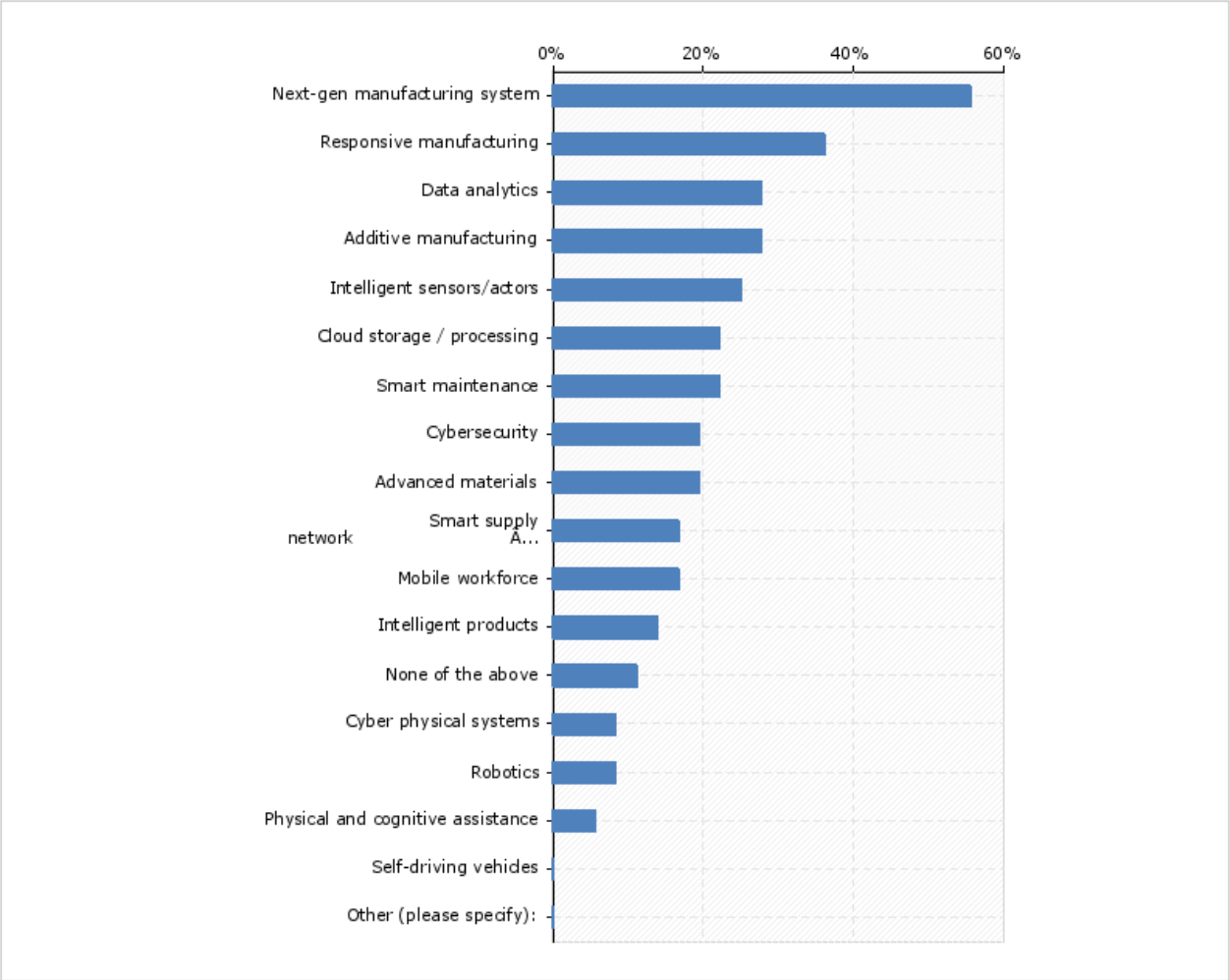
KEY MESSAGE to Q6:

The Slovak SMEs declare that currently implemented and planned SM technologies are ranking in four groups by importance:

- **Highest importance has the Cloud storage and processing; Data analytics; Next-gen manufacturing systems.**
- **19% SMEs have not implemented any listed novel technologies yet.**

From these results it is evident that vast majority (80%) of the SMEs have implemented even one SM technology.

Q11 - What kinds of novel technologies are relevant and/or planned to be implemented in the future?



From the surveyed result of the Q11 related to planning of the novel technologies, which has been structured to the 18 predetermined answers, shows following distribution of these technologies among the Slovak SMEs:

- First group (56%-36% incidence) with the highest interest for future implementation represents 2 technologies (Next-gen manufacturing system – over 55%; Responsive manufacturing-over 35%).
- Second group (28%-20% incidence) represents 7 novel technologies (Data analytics; Additive manufacturing; Intelligent sensors; Cloud storage/process and Smart maintenance; Cybersecurity and Advance materials – both have 20%).
- Third group (17%-5% incidence) represents 6 novel technologies (Smart supply network and Mobile workforce – both have 17%; Intelligent products; Cyber physical systems and Robotics; Physical and cognitive assistance).
- 11% of the SMEs are not planning to implement any of these listed novel technologies.

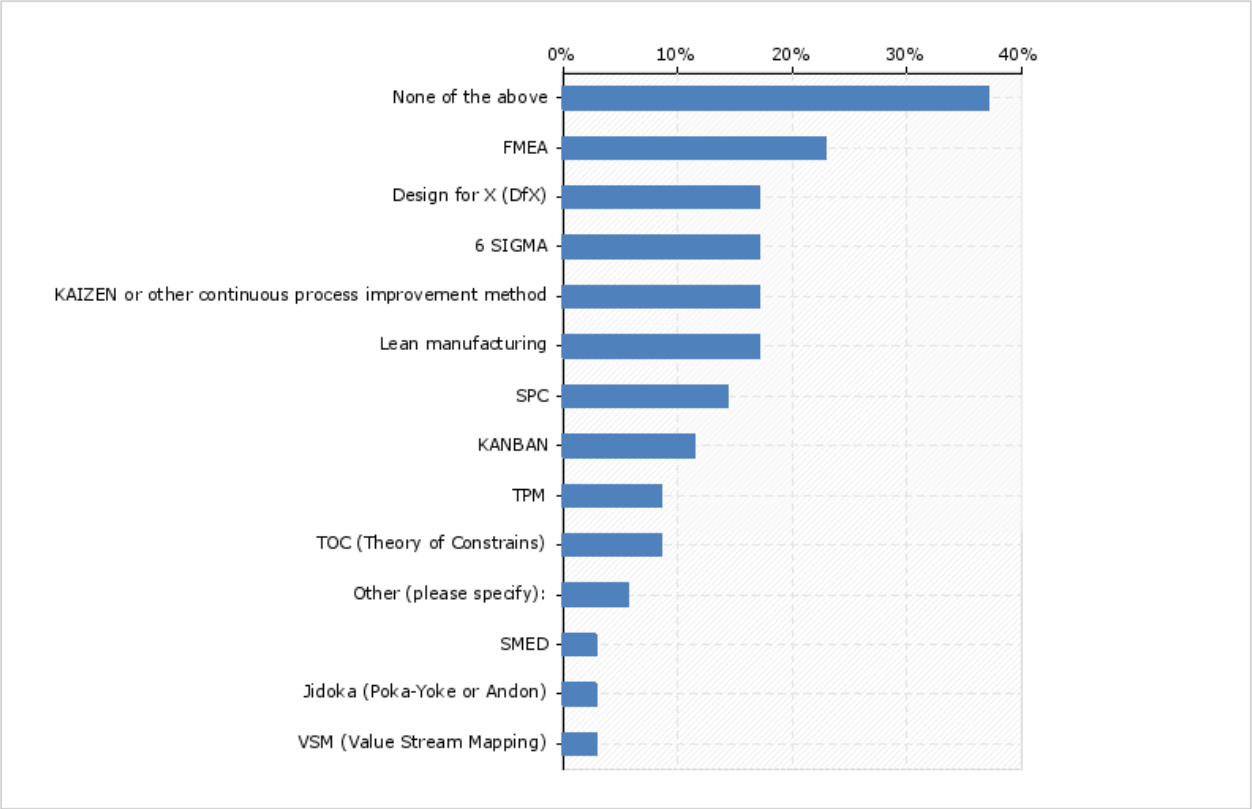
KEY MESSAGE to Q11:

The Slovak SMEs are planning to implement SM technologies by importance:

- **Highest importance has the Next-gen manufacturing system and the Responsive manufacturing.**
- **11% SMEs (i.e. 3 SMEs) are not planning to implement any of these listed novel technologies.**

According to the responses it is evident that vast majority (89%) SMEs are planning to implement even two SM technologies.

Q13 - What kinds of solutions/methods related to production processes are currently implemented in your company?



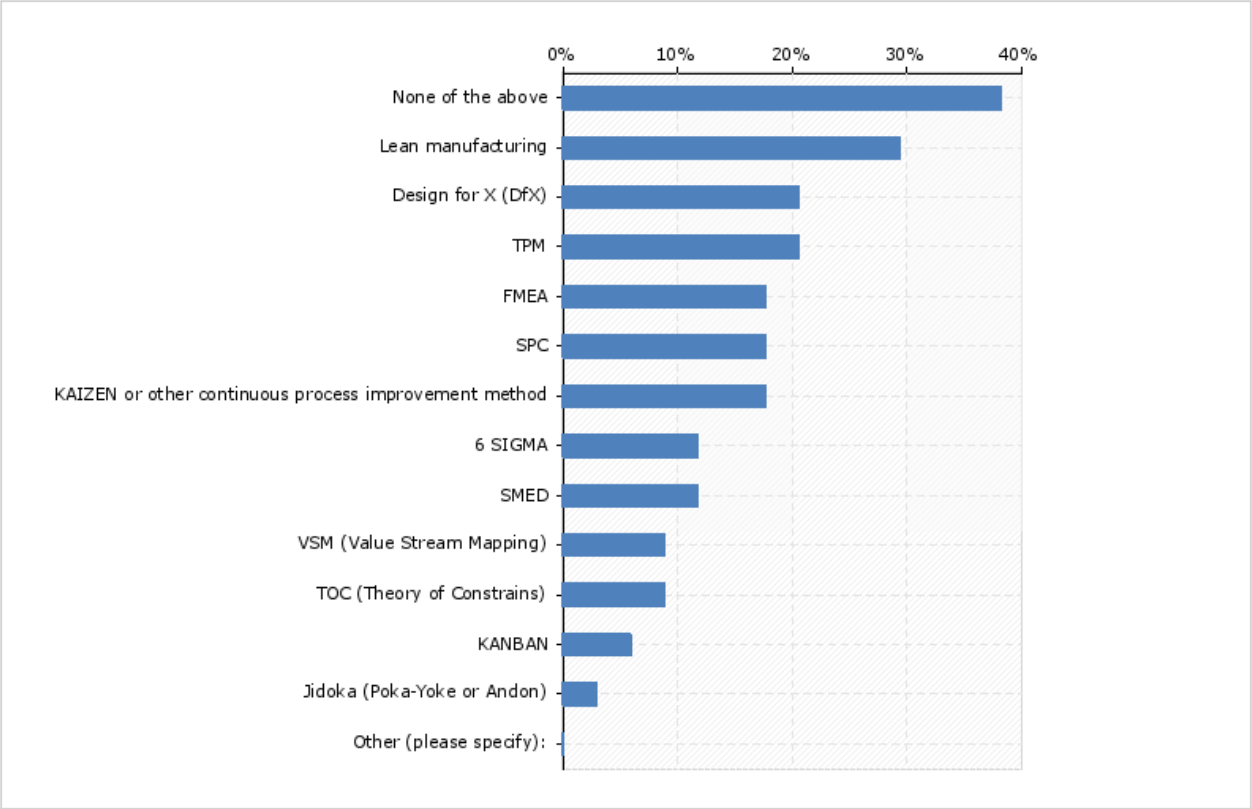
From the surveyed result of the Q13 related to the currently implemented production process solutions/methods, which has been structured to the 14 predetermined answers, shows following distribution of these methods among the Slovak SMEs:

- Almost 38% (i.e. 12 SMEs) approached companies are not currently applying these solutions/methods in their production processes.
- Highest ranking between these solutions/methods has the Failure Mode and Effects Analysis (FMEA - 23%).
- Second group (17%-13% incidence) represents 4 solutions/methods (Design for X; 6 SIGMA; KAIZEN and LEAN Manufacturing), which has been implemented by 22 SMEs. The 2 other methods (Statistical process control (SPC) and KANBAN) has been implemented by 5 SMEs.
- Third group (9%-3% incidence) represents 6 solutions/methods; from this amount 2 of them (Total Productive Maintenance (TPM) and Theory of constrains (TOC) were implemented by 3 SMEs and 3 methods/solutions (SMED, JIDOKA and VSM) were implemented by 1 SME. Two SMEs have applied other than listed methods/solutions.

KEY MESSAGE to Q13:

The survey of using of the solutions/methods related to production processes shows that approximately 60% of the approached SMEs has already implemented even one of the 13 (12+1xOthers) listed methods/solutions. Almost 38% of the SMEs (i.e. 12 SMEs) have implemented none of these listed methods/solutions.

Q14 - What kinds of solutions/methods related to production processes are planned to be implemented in the future?



From the surveyed result of this question (Q14) related to the planned production process solutions/methods to be implemented by the SMEs, which has been structured to the 14 predetermined answers, shows following distribution of these technologies among the Slovak SMEs:

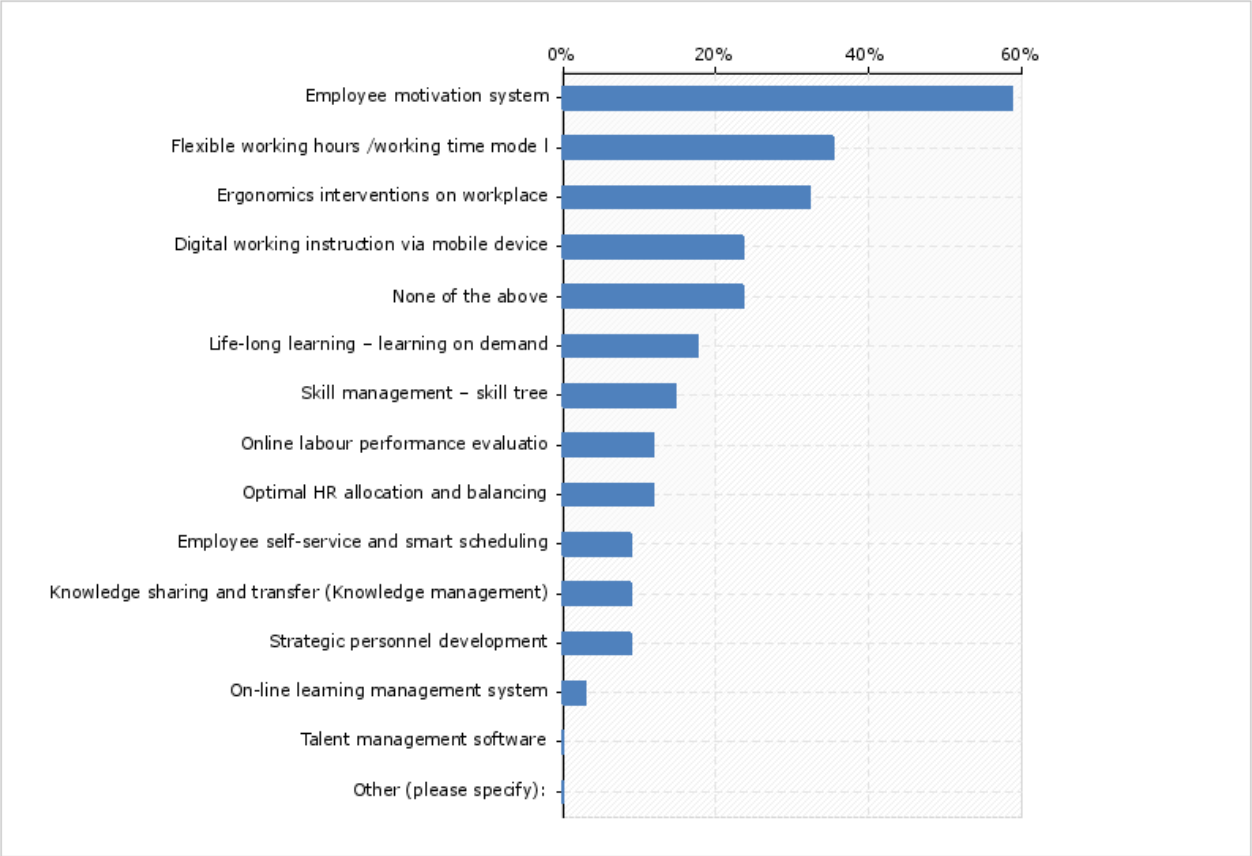
- Almost 38% (i.e. 12 SMEs) approached companies are not currently planning to implement these solutions/methods in their production processes.
- Highest ranking between these solutions/methods has the Lean manufacturing (30%). That means 10 approached SMEs are planning to implement this method/solution in the future.
- Second group (20%-17% incidence) represents 5 solutions/methods. Two solutions/methods are 20% (Design for X and Total Productive Maintenance - TPM) and the 3 other methods (the Failure Mode and Effects Analysis – FMEA, 17%; Statistical process control - SPC and KAIZEN) with 17% incidence. That means 5 to 6 approached SMEs are planning to implement these 5 methods/solutions in the future.
- Third group (11%-3% incidence) represents 5 solutions/methods; SMED (11%) and 2 methods/solutions (VSM and Theory of constrains – TOC) have 9%; and the methods/solutions KANBAN has 6% and Jidoka has 3%. Methods of third group are planned to be implemented by 1-3 of the SMEs.
- No SMEs are planning other than listed methods/solutions.

KEY MESSAGE to Q14:

The survey of planning the implementation of the solutions/methods related to production processes shows that approximately 60% of the approached SMEs are planning to implement even one of the 12 listed methods/solutions.

- **Highest ranking between these solutions/methods has the Lean manufacturing.**
- **Second group (20%-17% incidence) represents 5 solutions/methods: the Design for X and Total Productive Maintenance (TPM), the Failure Mode and Effects Analysis (FMEA), Statistical process control (SPC) and KAIZEN.**
- **More than 1/3 SMEs have not planning to implement any new solutions/methods related to production process.**

Q16 - What kinds of solutions/methods related to human resource management are currently implemented in your company?



From the surveyed result of this question (Q16) related to the human resource management (HRM) methods/solutions currently implemented by the SMEs, which has been structured to the 15 predetermined answers, shows following distribution of these technologies among the Slovak SMEs:

- Almost 23% (i.e. 7 SMEs) approached companies not yet implemented any of the listed HRM solutions/methods in their production processes.
- Highest ranking among these HRM solutions/methods has the Employee motivation system (59%). This only proves the reality that stimulation system for employee is crucial also for implementation smart manufacturing processes. (19 SMEs companies implement this HRM method).
- Second group (36%-23% incidence) represents 3 HRM solutions/methods. From this number two methods have more than 30% incidence (Flexible working hours/working time model and Ergonomics intervention on workplace) and one method has 23% incidence (Digital working instruction via mobile devices).
- Third group (17%-10%) represents 7 HRM solutions/methods (Lifelong learning – learning on demand – 17%; Skill management-skill tree – 15%; Online labour performance evaluation and Optimal HR allocation and balancing have 12% incidence; and three methods with the incidence 10%: Employee self-service and smart scheduling, Knowledge sharing and transfer and Strategic personnel development.
- Online learning management system (with 3% incidence) has been implemented only by one SME.

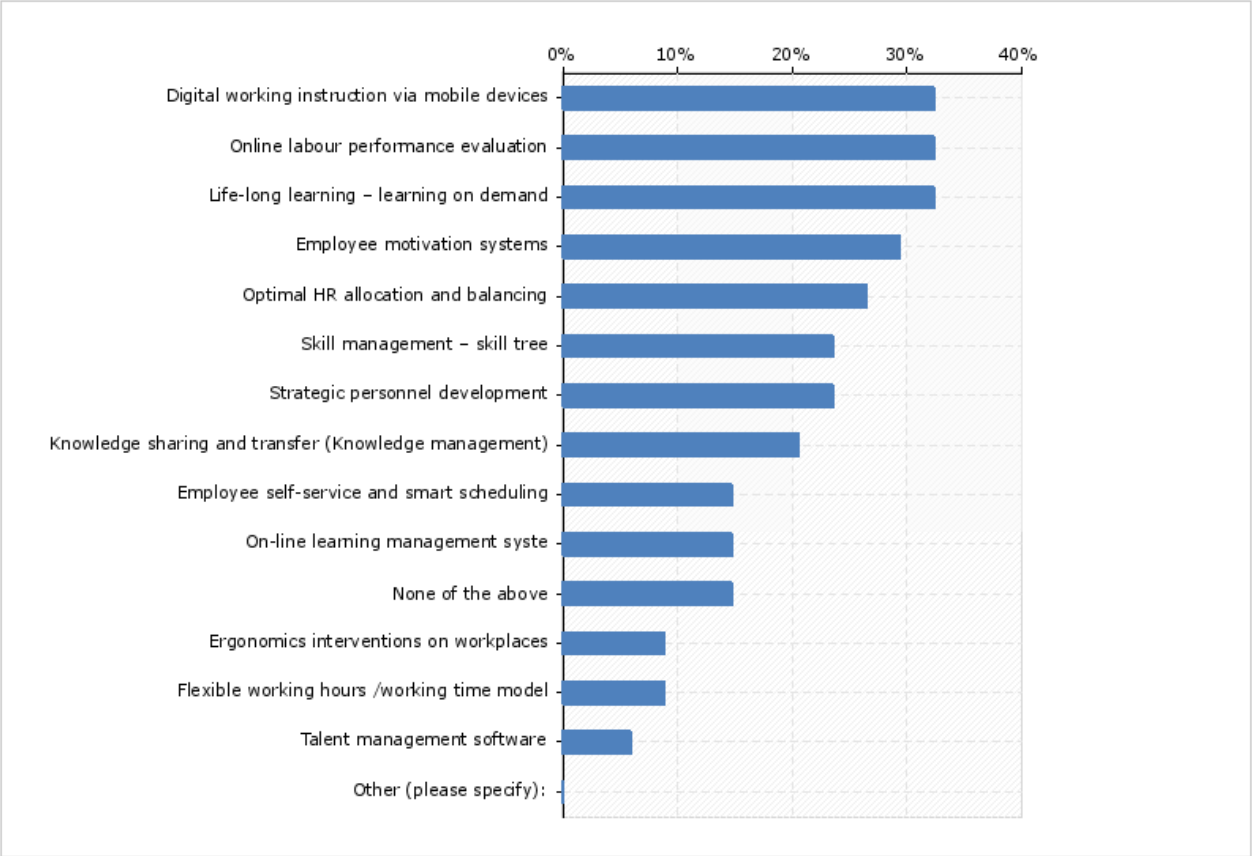
- No SMEs implemented other than listed HRM methods/solutions.

KEY MESSAGE to Q16:

From the surveyed result of the question Q16 related to the human resource management (HRM) methods/solutions which are currently implemented by more than three quarter (77%) of the SMEs.

- **Highest ranking between these HRM solutions/methods has the Employee motivation system (59%, it means 19 SMEs).**
- **Second group (36%-23% incidence) represents 3 HRM solutions/methods: the Flexible working hours/working time model, Ergonomics intervention on workplace, Digital working instruction via mobile devices.**
- **One quarter of the SMEs not yet implemented any of the listed HRM solutions/methods in their production processes.**

Q17 - What kinds of solutions/methods related to human resource management are planned to be implemented in the future?



From the surveyed result of this question (Q17) related to the planned HRM process solutions/methods to be implemented by the SMEs, which has been structured to the 15 predetermined answers, shows following distribution of these methods among the Slovak SMEs:

- Almost 15% (i.e. 5 SMEs) of the approached companies are not planning to implement any of the listed HRM solutions/methods in their production processes.
- First group (32%-27% incidence) has the 5 highest ranking HRM methods/solutions, from which three methods have the 32% incidence (Digital working instruction via mobile devices, Online labour performance evaluation and Lifelong learning – learning on demand) and one method has 30% (Employee motivation system) 59%) and the last has 27% incidence (Optimal HR allocation and balancing).
- Second group (24%-20% incidence) represents 3 HRM solutions/methods. From this number two has the 24% incidence (Skill management-skill tree and Strategic personnel development) and one method has the 20% incidence has Knowledge sharing and transfer.
- Third group (15%-7%) represents 5 HRM solutions/methods from which two of them with the 15% incidence (Employee self-service and smart scheduling and Online learning management system) and two methods with the 9% incidence (Ergonomics intervention on workplace and Flexible working hours/working time model) and one method with the 7% incidence (Talent management software).
- None SMEs are planning to implement other than listed HRM methods/solutions.

KEY MESSAGE to Q17:

It is very positive fact that 85% of the approached Slovak SMEs are planning to implement several HRM solutions/methods:

- **Highest ranking with one third of the approached SMEs have these 4 methods: the Digital working instruction via mobile devices, Online labour performance evaluation, Life-long learning-learning on demand, and the Employee motivation systems. The last HRM method- the Employee motivation systems (with the 59% incidence as the implemented method and 30% incidence as the planning to be implemented HRM method) seems to be a top critical method for the 29 approached SMEs in the human resource management.**

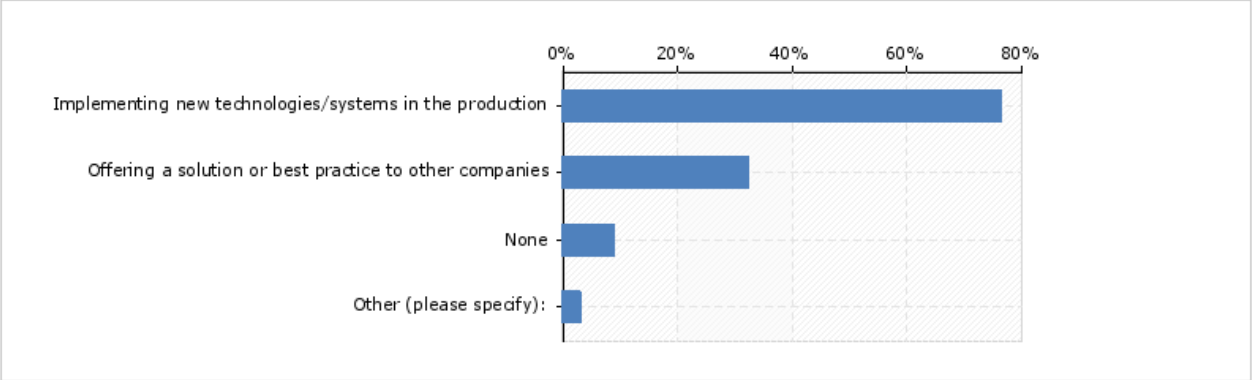
- **Second group comprising of the 3 HRM methods/solutions (Knowledge sharing and transfer, Skill management-skill tree and Strategic personnel development – with average ranking 34% incidence for the implemented and planning to be implemented) represents optimal using of the listed HRM methods for 11 SMEs.**

- **Still there are 15% of the Slovak SMEs that are not planning to implement the HRM methods.**

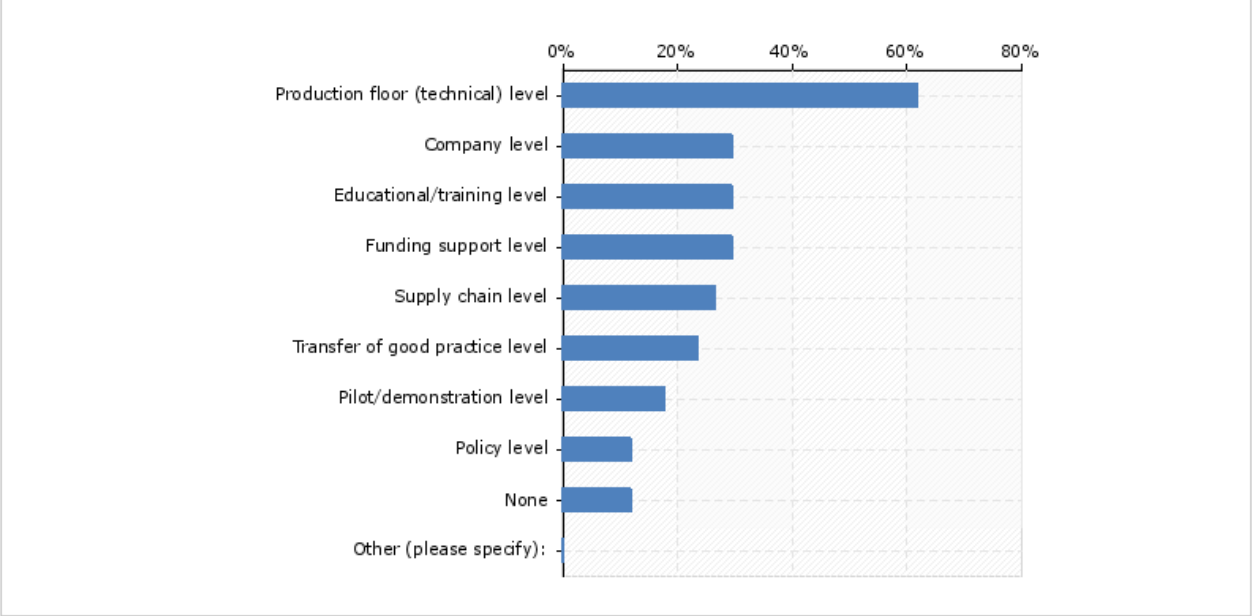
2.6 KEY QUESTION 6: Would SMEs be willing to cooperate, in which areas and at what levels?

This measure will give a share of SMEs that would be willing to cooperate in implementation of Smart Manufacturing technologies and solutions. Moreover, the measure will provide in-depth view on which are the most favourable areas and levels of cooperation.

Q19 - In which cooperation area would you be interested?



Q20 - At what level would you be interested in cooperation?



Ad Q19: The vast majority of the surveyed Slovak companies are willing to cooperate in the implementation of the new technologies/systems (77%). 31% of the approached SMEs are interested in offering a solution or best practice to other companies. Only the 4 approached SMEs declared none interest and one SME shows other form of cooperation. It is evident that there is a huge interest of the Slovak SMEs to participate and cooperate in the implementation of the new technologies, solutions/methods and HRM methods in their business.

Ad Q20: The SMEs presented an interest in various levels. The high interest is in the cooperation at the Production floor (technical) level (62%). The company declared the very interest (30%) in the group of cooperation levels: The Company level, Education/training level and Funding support level. Low interest of the SMEs (12%) has the Policy level cooperation and the same 12 % incidence of the SMEs declared interest for none cooperation.

KEY MESSAGES to Q19 and Q20:

Ad Q19: More than three quarter of the approached Slovak SMEs are willing to cooperate in the future, predominantly acting as "receivers" of new technologies and systems. The one third approached SMEs are interested in offering a solution or best practice to other companies.

Ad Q20: The highest interest was declared in the funding support or concrete technical cooperation at the production floor. The SMEs are very interesting in the Education/training level and Funding support level.

12% approached SMEs have no interest in cooperation.

3 Conclusion

Slovak SMEs have not been predominantly involved in development of the National Smart Specialization Strategy, which consequences is that the Strategy is not well recognised by the Slovak SMEs. However, around 30% of them are aware of the existence of such strategy at the policy level.

From the technical view (systems and solutions) the knowledge of the Smart manufacturing is spread among the Slovak SMEs in balance (45%-yes and 55%-no), how Smart manufacturing (in general) can or can't be beneficial for their company. Thus, more than 25% of them are already using the Smart manufacturing systems/solutions at the operational level.

SMEs are facing variety of challenges when it comes to the implementation of Smart manufacturing technologies. The most important are the objective barriers related to the Costs/investments and Lack of information/knowledge (over 55%, res. 58%). Surprisingly, the Resistance of the employees and High complexity of SM technologies have been representing by less than 10% (7%, res. 3%). These two low ranking challenges reflect only subjective barriers to the implementation of SM technologies.

Slovak SMEs declare the most influential areas for increasing SME's competitiveness in the future are:

- **Highly important - Product quality, Manufacturing costs;**
- **Very important - Improvements of the production as well as the Satisfying of the customer specs.**

Therefore, it is important to focus on relevant technologies and solutions.

The Slovak SMEs declare that currently implemented and planned SM technologies are ranking in four groups by importance; Highest importance has the Cloud storage and processing; Data analytics and Next-gen manufacturing systems. In the opposite: 19% SMEs have not implemented any listed SM technologies.

Current state-of-art shows that around 60% of SMEs has already implemented novel technologies related to smart manufacturing. Almost 38% of the SMEs have implemented none of the listed methods/solutions. The same positive trend is in the human resource management, where the more than three quarters (77%) of the SMEs implemented one of the modern HRM methods. However, one quarter (23%) of the SMEs are not yet implemented any of the listed HRM solutions/methods in their production processes.

The survey of planning the implementation of the solutions/methods related to production processes shows that approximately 60% of the approached SMEs are planning to implement even one of the 12 listed methods/solutions, though more than 1/3 SMEs have not planning to implement any new solutions/methods related to production process.
The better trend can be seen in the planning to implement HRM methods: 85% of the approached Slovak SMEs are planning to implement and only 15% of the SMEs are not planning to implement HRM methods in Slovakia.

All this shows that among the Slovak SMEs is very positive trend to current or future implementation of smart manufacturing technologies or solutions.

More than three quarters (77%) of the approached Slovak SMEs are willing to cooperate in the future, predominantly acting as "receivers'' of new technologies and systems. The one third (31%) approached SMEs are interested in offering a solution or best practice to other companies.

The highest interest was declared in the funding support or concrete technical cooperation at the production floor. On the other hand, the SMEs are very interesting in the Education/training and Funding support levels. Also the very high interest of the SMEs is in the Supply chain level support, 24% of the SMEs have interest in the Transfer of good practice level and 18% of the SMEs are ready for the cooperation in the Pilot/demonstration level in Slovakia.

The Survey shows that the implementation of the SM technologies/solutions/methods is very actual and vital also for the SMEs. These SMEs are conscious about the importance of the Smart Manufacturing technologies and HRM methods for increasing their competitiveness on the European Internal Market.

Bratislava, 14.07.2017
elaborated by Paulíček, Knopp
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