DOCUMENT TITLE:

HANDBOOK TOOL REPORT

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

Acronym: Smart Factory Hub

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Dissemination level		
PU	Public	
PP	Restricted to other Programme participants	
RE	Restricted to a group specified by the consortium	x
CO	Confidential, only for members of the consortium	

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	*58*	SME which provide data for good practice
Regional public authority		
National public authority		
Higher education and research		
Business support organisation		

CONTENT

1. ABOUT SMART MANUFACTURING

The National Institute of Standards and Technology (NIST) defines Smart Manufacturing as systems that are “fully-integrated, collaborative manufacturing systems that respond in real time to meet changing demands and conditions in the factory, in the supply network, and in customer needs.”

The Smart Manufacturing Leadership Coalition definition states, "Smart Manufacturing is the ability to solve existing and future problems via an open infrastructure that allows solutions to be implemented at the speed of business while creating advantaged value."

Smart manufacturing (SM) represents an approach driven by technological advances and makes use of machineries connected to the Internet to monitor the production process. Smart manufacturing makes use of data analyses to identify the opportunities of automated operations to improve the manufacturing performance. As more and more machines are networked through the Internet of Things, the automation level of the manufacturing process will increase.
Embedding sensors within the manufacturing process will enable data collection within the entire manufacturing area and data analysts can use these information to output preventive maintenance operation to improve the overall performance of the manufacturing workflow.
The biggest challenges that are currently holding smart manufacturing adoption on a larger scale represents the lack of standards and interoperability. This in an ongoing process and currently there are various industry stakeholders are investigating the opportunities to develop and promote technical standards of the sensors and machineries capable of communicating with each other effectively.

The SFH project will strategically focus in following three areas of interest when dealing with Smart Manufacturing good practice:

- Novel technologies
- Effective production process
- Effective human resources

Novel technologies:

1. Smart supply network
2. Next-gen manufacturing systems
3. Cloud storage / processing
4. Data analytics
5. Cybersecurity
6. Intelligent sensors/actors
7. Cyber physical systems
8. Smart maintenance
9. Mobile workforce
10. Self-driving vehicles
11. Intelligent products
12. Additive manufacturing
13. Robotics

14. Advanced materials
15. Responsive manufacturing
16. Physical and cognitive assistance
17. None of the above
18. Other (please specify)

Solutions/methods related to production processes:

1. Design for X
2. FMEA
3. 6 SIGMA
4. SPC
5. TPM
6. SMED
7. KANBAN
8. KAIZEN or other continuous process improvement method
9. Jidoka (Poka-Yoke or Andon)
10. VSM (Value Stream Mapping)
11. TOC (Theory of Constrains)
12. Lean manufacturing
13. None of the above
14. Other (please specify)

Solutions/methods related to human resource:

1. Ergonomics interventions on workplaces
2. Digital working instruction via mobile devices
3. Employee motivation systems
4. Online labour performance evaluation
5. Flexible working hours /working time model
6. Employee self-service and smart scheduling
7. Optimal HR allocation and balancing
8. Knowledge sharing and transfer (Knowledge management)
9. On-line learning management system
10. Life-long learning – learning on demand
11. Talent management software
12. Skill management – skill tree
13. Strategic personnel development
14. None of the above
15. Other (please specify)

In Industryweek.com ("Are You an Authority on Dumb Manufacturing?" December 1, 2016), Charles Horth (CEO, Factora) refers to it as the difference between smart and dumb manufacturing:

> *"Many industry segments in manufacturing still operate in a similar manner as they did in the last century. But moving to smart manufacturing is not an incremental change–it's a quantum leap. So the players that decide to move ahead have a quantum competitive*

advantage. Not only that, they have an advantage that continues to grow in breadth, year by year."

In smart manufacturing, all parties involved in the production process can track in real-time the parameters of the production process and interact with them locally or remotely using IoT tools. Unlike the functioning of a classic process, in smart manufacturing, the product can be evaluated at each stage and can be corrected if needed.
IoT instruments (Figure 1) can be integrated at this point in almost all product manufacturing stages.

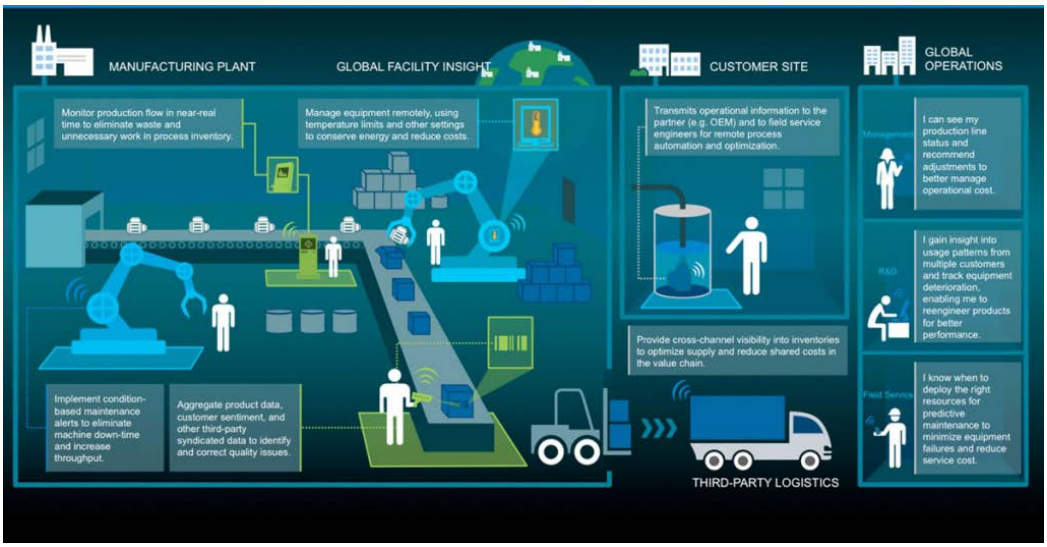

Fig. 1 IoT in Manufacturing[1]

According to Louis Colombus (Director, Global Cloud Product Management at Ingram Cloud), writing for Forbes.com ("Making Internet of Things (IoT) Pay In Manufacturing[2]," January 31, 2016):

- 76% of manufacturers will increase their use of smart devices or embedded intelligence in manufacturing processes in the next two years.
- 63% of manufacturers have either implemented or are planning to integrate IoT technologies into their products.
- 58% of manufacturers say that improving product quality is the most important objective they are pursuing by incorporating smart devices or embedding intelligence.
- 44% of manufacturers say that their biggest obstacle in leveraging the IoT is their company's limited knowledge of how the IoT can improve operations and products.

The Good Practice Handbook is a collection of solutions implemented in SMEs from 10 countries that can help increase the speed of adoption of specific smart manufacturing solutions and tools in the region.

[1] Source: http://iiot-world.com/smart-manufacturing/moving-to-smart-manufacturing-is-not-an-incremental-change-its-a-quantum-leap/

[2] Source https://www.forbes.com/sites/louiscolumbus/2016/01/31/making-internet-of-things-iot-pay-in-manufacturing/#55f553523cdd

2. GOOD PRACTICE IN SMART MANUFACTURING

Examples of good practices gathered within the project were classified using the schematic diagram detailed in Figure 2, starting from the suppliers and ending with the customers.

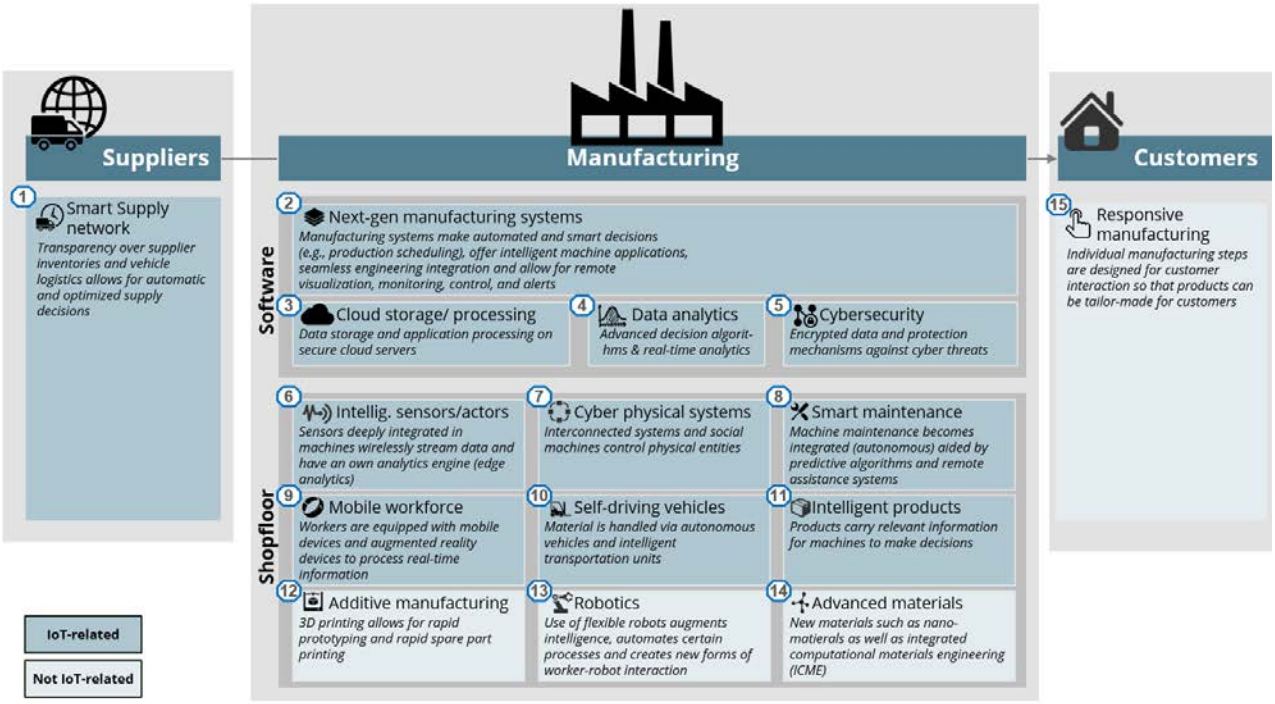

Fig. 2 15 components of the smart factory of the future[3]

Smart Supply network - Transparency over supplier inventories and vehicle logistics allows for automatic and optimized supply decisions

Next-gen manufacturing systems - Manufacturing systems make automated and smart decisions (e.g., production scheduling), offer intelligent machine applications, seamless engineering integration and allow for remote visualization, monitoring, control, and alerts

Cloud storage/ processing - Data storage and application processing on secure cloud servers

Data analytics - Advanced decision algorithms & real-time analytics

Cybersecurity - Encrypted data and protection mechanisms against cyber threats

Intelligent sensors/actors - Sensors deeply integrated in machines wirelessly stream data and have an own analytics engine (edge analytics)

Cyber physical systems - Interconnected systems and social machines control physical entities

[3] Source https://iot-analytics.com/industrial-internet-disrupt-smart-factory/

Smart maintenance - Machine maintenance becomes integrated (autonomous) aided by predictive algorithms and remote assistance systems

Mobile workforce - Workers are equipped with mobile devices and augmented reality devices to process real-time information

Self-driving vehicles - Material is handled via autonomous vehicles and intelligent transportation units

Intelligent products - Products carry relevant information for machines to make decisions

Additive manufacturing – 3D printing allows for rapid prototyping and rapid spare part printing

Robotics Use of flexible robots augments intelligence, automates certain processes and creates new forms of worker-robot interaction

Advanced materials - New materials such as nanomaterials as well as integrated computational materials engineering (ICME)

Responsive manufacturing - Individual manufacturing steps are designed for customer interaction so that products can be tailor-made for customers

3. GOOD PRACTICE SUMMARY

The good practice collection and processing is an activity from the WP4: Improving Knowledge Base (Figure 3) and has begun with the development of a Good Practical Guideline. Their collection and processing is completed in such a way that the identified solutions can be found by the potential beneficiaries as easily and quickly as possible.

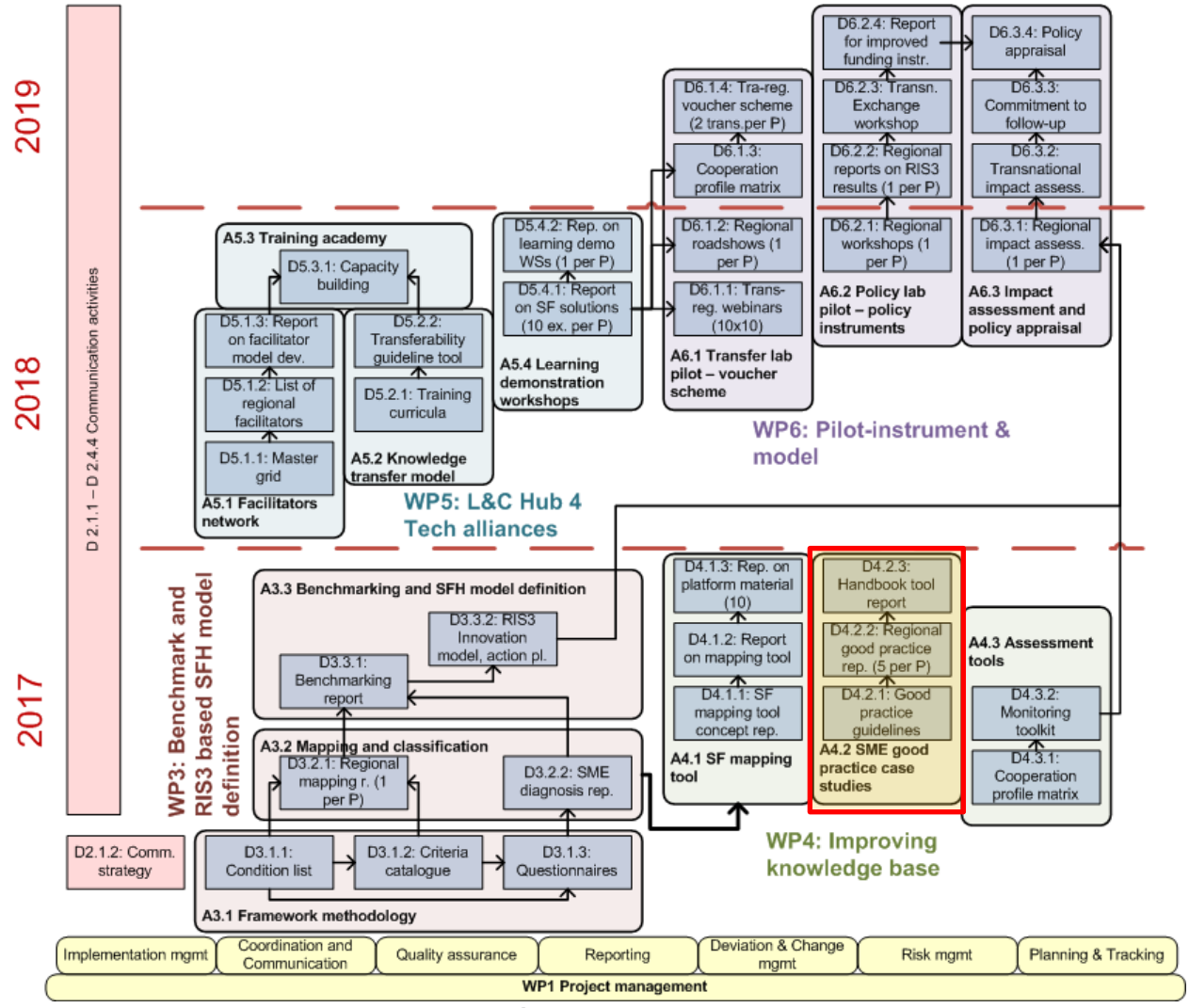

Fig. 3 SFH WBS

In total, 58 good practices were collected, more than the 50 initially planned, their distribution across countries can be seen in Fig. 4. Fig. 5 contains the number of good practices that each category has, all of which are presented in Figure 2.

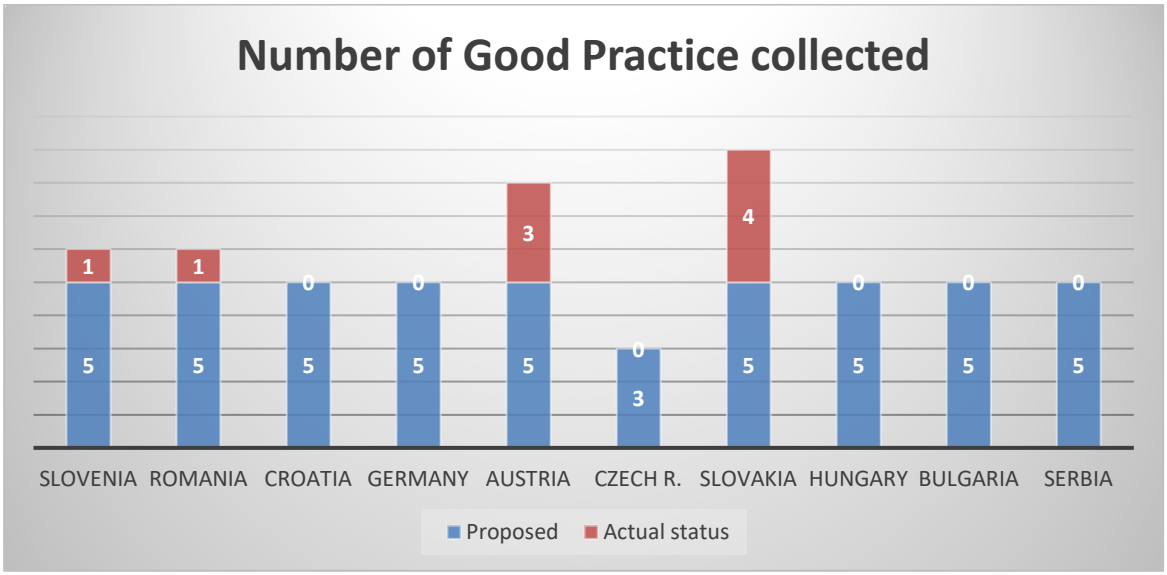

Fig. 4 Number of GP collected

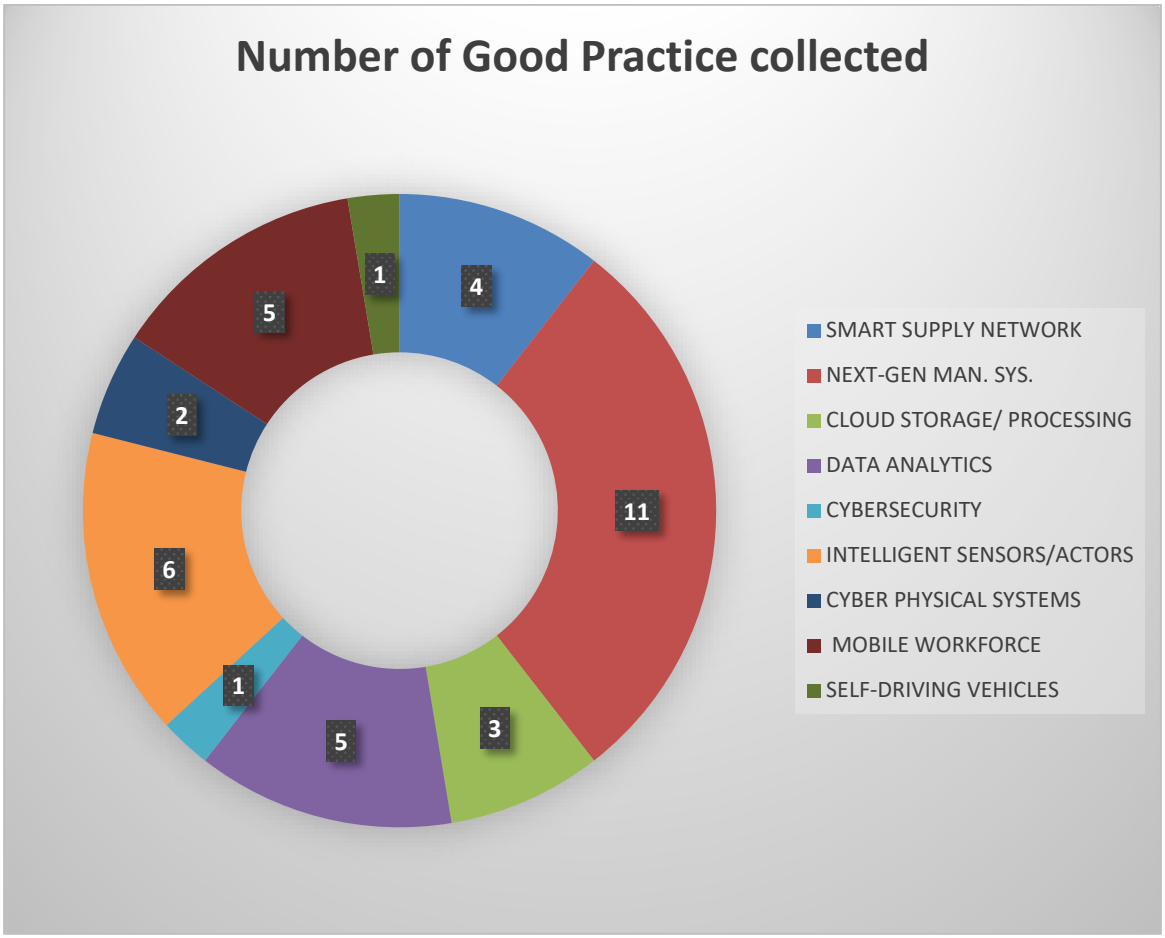

Fig. 5 Number of GP on each category

3.1 SMART SUPPLY NETWORK

3.1.1 Bin picking

Photoneo's Bin picking solution works with our family of industrial grade 3D scanners PhoXi Scan. Using advanced 3D algorithms, it runs at high speed and with a high precision. It allows the user to scan object or input a CAD model, select grip points and alternative grip points. The container is scanned and objects are picked one by one. Such solution was implemented in ROMI Industrial Systems s.r.o., company from Slovakia. Similar solutions are already implemented in companies ZF, Hydac, and Boge. The demanding needs on automation require nowadays complex systems which very often can be achieved only with the help of industrial robots. Therefore we cooperate with different robot producers and integrate their robots in to our production solutions. Bin picking by Photoneo is a new technology, which leads to autonomous bin picking workplace. Such workplace is an essential part of Smart Factory. Increasing the efficiency of robotic work cells is directly connected to autonomous robot problem. Such solutions are requested in Smart Factory. The robotic vision and 3D scanning systems become more and more important for automation solutions since the need to automate even smaller production quantities and therefore create flexible automation solutions is growing. Our solution brings new approach (technology) to bin picking by robot. We are capable to analyse 3D data in bins and compare it with CAD model of the picked part. Analysis then decides which part is seizable for the robot. By the application of such procedure the robot is able to pick all the parts in bin without any help of human. This brings very effective solutions in industries, where assemblies or similar process are needed. Our solution is completely different to those providing by competitors. Bin picking is well known problem and robots are capable to solve this problem when the parts are placed in known positions. Our solution does need to know the precise position of the part and this is great comparative advantage in compare with our competitors. Solution was validated in, and the reliability of solution is usually over 90% (i.e. from 1000 parts 900 is autonomously picked). However, this depends on the shape of part and bin. Some more complicated parts can fit into each other and this will decrease the reliability. Another interesting parameter is the time of unloading. This also depends on part and bin. However, full 3D scanning and data processing of our solution does not last longer than 1 s. Impact of this solution is positive in the manner of more efficient autonomous production. However, there is also negative impact in taking part of people's work. System is limited as a standard robotic workplace, especially from the safety point of view. Some limitations are also defined by parts which the robotic grippers are able to pick. And other limitations are based on the kinematics of the robot. This depends on the used robot and the shape of the bin.

3.1.2 Digital internal logistics verification throughout the plant

In Honeywell Turbo s. r. o., Sova Digital focusing on the continuous optimization of production processes, proactive maintenance, and continuous processing of process data. Basic goal is to support the existing production structures within the industry and the most efficient use of

resources by augmented production and planning strategies, such as the digital twin. Honeywell Turbo s. r. o., started cooperation with the company Sova Digital a.s. in late 2016. Sova Digital offered integration of the digital internal logistics verification throughout the plant this is essentially for a functional system of continuous process optimization, which is formed by the cooperation of physical production lines with a digital "copy. It creates the digital factory environment, in which the company can optimize the operation directly through the production chain, manipulate parameters and production processes; adapting the product to market requirements. This solution is strongly tied with the "Smart Factory" concept, as a novel technology. Digital internal logistics verification throughout the plant collects and evaluates the information continuously, allowing, among other things, to shorten and streamline the production cycle, reduce the rise time of introducing new products, detecting inefficient settings of the underlying processes. The concept of the digital twin, therefore, is built on the principle known today as Industry 4.0. The Digital internal logistics verification throughout the plant is formed by the physical production line and its digital "copy". The major feature of this arrangement is the interface, through which data exchange takes place. The digital part is based on the simulation tool called Plant Simulation (PS) made by SIEMENS. The digital simulation model of the production line was created in this environment. This model was a detailed virtual copy of the physical process. The impact of the solution was highly positive, as the scrap rates were reduced and the assembly time was reduced with an average too. These led to an increase in productivity and customer satisfaction. The quality of Digital internal logistics verification throughout the plant is strongly based on the quality of the data provided. Based on this, we can build a high quality simulation model for software needs (Siemens Technomatix PS)
This solution was the first of its kind, as not any other company made use of this type of practice, especially in its assembly process. As mentioned previously, as direct results of the implementation significantly increased productivity and customer satisfaction were obtained.

3.1.3 Palletized warehouse inventory scanning using drones

Aptus has implemented an airborne data collection system to provide stock take (inventory). The system uses self-driving drones capable of navigating through the warehouse. Drones represent a lightweight, manoeuvrable flying device equipped with multiple propellers that have a building in barcode scanner used to obtain an accurate inventory report. The SME created the product based on the needs of customers that wanted to be able to have a warehouse inventory system that would allow them to track the inventory in real time. The system makes use of self-driving drones equipped with custom barcode scanners. For this system to work it is really important to have the barcodes positioned properly and have them horizontally aligned and without creases.
This solution is strongly tied with the Smart Factory concept, and it represents a novel technology that makes use of the advances drones capable of self-driving through palletizing warehouses in order to scan the barcodes of each pallet regardless their height position on large industrial shelves. The innovative nature of this solution is that the drones use a navigation system that makes use vision processing system and proximity sensors in order to navigate the drones within the warehouse. Traditional drones are used outdoors and they are managed using GPS positioning, but indoors drones don't have reliable access to GPS. Also the GPS positioning has

an accuracy of 1 meter. The impact of the solution was positive at it reduced the time required to do the inventory using forklifts and personal. The company now knows exactly how many items are stored within their warehouse. The proposed system main limitation is in regards to various obstacles that might be present within the storage area in different areas at different given points. Another limitation is closely tied to the barcodes, they need to be properly aligned horizontally and be creased free in order to ensure the proper reading of those by the self-flying drones.
The storage area should not have loose wrap elements from the wrapped pallets to ensure that the drones won't get entangled. The possibility to manage the warehouse inventory with less personal and have a real time report on "the fly" by using self-driving autonomous drones. Reliable software that can be customized to each warehouse specific needs.

3.1.4 Integrated logistic system

Galambos Trans Ltd focuses on unique storage solutions. The integrated logistic systems are built into the multinational manufacturing customer's ERP system – M2M communication. The Galambos Trans Ltd developed integrated logistics systems which allows the machine to machine communication. This is in line with the industry 4.0 goals and promote innovative solutions in the storage systems. Storage system digitalisation and adaptation for requirements of Industry 4.0 – HRM or cost efficiency The solution combines the multinational customer's ERP systems with the logistic system, so it can minimize the failure risk and also spare time compared to the manual storage systems. Main audience are the multinational companies and middle-sized companies, as the solution combines the Enterprise resource planning systems with the storage system. Special innovative creative solutions and value-added processes provide to partners with the services to meet their needs. The solution is software based and all relevant data are stored in databases which guarantees the sustainability. Especially among Hungarian SMEs, the digitalization of processes and the installation of ERP systems is even more available. Based on this trend, more and more SMEs will be able to implement this good practice, if they are handling significant stock. Integration of storage system will be possible with other existing internal systems.

3.2 NEXT-GEN MANUFACTURING SYSTEMS

3.2.1 OneBase – MFT

This industry independent intralogistics solution integrates a high-performance warehouse management system with continual material tracking for the in-plant logistics processes.
With a multitude of modules, this flexible, total solution forms the basis for modern logistics. The material movements are posted automatically and the products get continuously tracked through the warehouse. Hereby the operator has an exact and complete overview where each and every piece of material is in the logistics chain at any time.
Optimization algorithms and a dynamic, adaptive set of rules automatically ensure the ongoing calculation of the necessary transport orders for quick processing of all the required in-plant

material transports. This optimized real-time procedure leads to efficient usage of the available warehousing and transport capacities and assures the efficient material flow.
Longstanding proven intralogistics methods and the extensive know-how as integrator of Real Time Locating Systems (RTLS) formed the basis for OneBase – MFT.
The results of the GP are: more transparency in intralogistics and enablement for automatic warehouse management by continuous material tracking and situation adaptive material flow control.
OneBase – MFT and its automated intralogistics environment introduces a high grade of innovation and significant improvement in quality and efficiency of logistics and production supply processes, because:

- The warehouse management will no longer be done in the minds of the operators
- You know where the material precisely is at any time
- Intralogistics availability around the clock
- No more barcode scanning and manual mistakes, because the automatic load detection avoids manual actions for identification (hands-free)
- Situation adaptive transport management with route optimized transport orders under consideration of the current transporter position (forklift, cranes, AGVs …)
- Fleet management and optimization
- Digitalization of the intralogistics processes
- Performance optimization for manually operated vehicles (automated load detection, guidance systems for better orientation within the warehouse by a state-of-the-art 3D environment, transport orders)

Improvement of human and machine safety by providing location related safety function like collision avoidance and speed control

3.2.2 Product Lifecycle Management (PLM) System

The good practice is a system for manufacturing management aiming to optimize and digitalize the manufacturing process in the factory through:

- Automate the preparation of accompanying technological documentation in accordance with ISO 9001: 2000 (order documents, complete maps, route cards, etc).;
- Automated transmission of tasks from one workplace/machine to another via computer terminals;
- Permanent monitoring of the condition of the parts and the nodes;
- Timing reports for each product at every operation;
- References for workers working on each operation for each detail according to ISO 9001: 2000;
- Remote access to production data with the ability to change the priority for order execution;

The system consists of network of computer terminals, cloud based server, and computers, smartphones, tablets etc. KOMANDIR.NET system operates using Google Apps. The good practice is strongly linked to the SFH approach by implementing a smart system for optimizing the ensuring production process and cost efficiency and quality assurance. The implementation of the system has positive impact on company production process related to time optimization and order prioritizing.

3.2.3 Milkrun 4.0

WITTENSTEIN | alpha

The challenge for WITTENSTEIN bastian GmbH was to avoid a media discontinuity between the paper-based planning board for controlling order processing and IT-supported production planning. The media discontinuity resulted in long and inflexible production planning cycles. This meant that workers could not call up the information directly at the machine and digitally transfer it back to the production planning system. This has changed with the introduction of Industry 4.0 technology: In addition to increased flexibility in production planning and improved information transfer, a transparent and consistent database for extended approaches to production. WITTENSTEIN bastian GmbH has further developed existing IT back-end production systems and networked them with each other. LED screens are now showing the planning status electronically. In addition, all machines and order papers were provided with a DataMatrix code, which means that identification is also carried out digitally. Tablet PCs enable mobile access to the production planning system. Problems and causes of problems that endanger the execution of the order are fully recorded in an escalation database. Problem causes can thus be methodically and analytically eliminated. The database also provides the basis for applying Big Data algorithms. In the future, it will be possible to analyze fundamental interrelationships with regard to materials, tools, setup parts, production machines and suppliers. This improves the processing of orders. The results are very positive, for workers and for the companies. The employees will therefore have more time for their real work as they can control everything from a central point and see directly where there is a lack of material. For the companies it is easy, to see where potentials are and where problems. This solution is also helpful for other SMEs, as they also have logistics problems. By implementing such a system, a lot of time and money can be saved.

3.2.4 Computer vision using deep neural networks NEURONIT in industrial production

ANEXT

VW Bratislava in its production of specially glued body parts to check their quality experimentally deploys deep neural networks from Anext. The intention is to limit the impact of the human factor in the automotive industry in the spirit of the concept Industry 4.0. VW Bratislava started cooperation with the company Anext in late 2017. This year was successful finished development deep neural network NEURONIT for different application industrial outputs. One of them is deployment in the area advanced industrial computer vision with elements of AI.
This solution is strongly tied with the “Smart Factory” concept, as a novel technology, advanced industrial computer vision with elements of AI were incorporated directly and contributed to the production of a specific product. The innovative nature of this solution is that it provides fully automatic quality control of the robotically applied layer of adhesive glues. The proposed workstation is completely unattended and guarantees the quality of the finished parts in production.

The application of the current technology extended over to other industry branches, but its use differed in nature from this type of application . When this solution was implemented, it was the first of its kind that made use of deep neural network advanced industrial computer vision with elements of AI. Currently used for the purpose computer vision system without elements of AI (for example Cognex). Just adding elements of AI makes the system fully autonomous in the spirit of the concept Industry 4.0. The impact of the solution was highly positive, as the scrap rates were reduced to almost 0% and the assembly time was reduced with an average too. These led to an increase in productivity and customer satisfaction. This solution was the first of its kind, as not any other company made use of this type of practice, especially in its assembly process.
As mentioned previously, as direct results of the implementation significantly increased productivity and customer satisfaction were obtained.

3.2.5 Using deep neural networks NEURONIT with advanced Computer vision in industrial production

Plastic Omnium in its production of automotive bumpers to check their quality experimentally deploys deep neural networks from Anext. The intention is to limit the impact of the human factor in the automotive industry in the spirit of the concept Industry 4.0. Plastic Omnium started cooperation with the company Anext in late 2017. This year was successful finished development deep neural network NEURONIT for different application industrial outputs. One of them is deployment in the area advanced industrial computer vision with elements of AI.
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This solution was the first of its kind, as not any other company made use of this type of practice, especially in its assembly process. As mentioned previously, as direct results of the implementation significantly increased productivity and customer satisfaction were obtained.
The system performs better if the component devices have better technical specifications (e.g. computing servers, high-precision cameras) and the quality of the data provided to deep neural network must be as good as possible

3.2.6 The digital twin of an industrial production line within the industry 4.0 concept

In Embraco Slovakia s.r.o., Sova Digital focusing on the continuous optimization of production processes, proactive maintenance, and continuous processing of process data. Basic goal is to support the existing production structures within the automotive industry and the most efficient use of resources by augmented production and planning strategies, such as the digital twin. Embraco Slovakia s.r.o started cooperation with the company Sova Digital a.s. in late 2016. Sova Digital offered integration of the digital twin (DT). A DT is essentially a functional system of continuous process optimization, which is formed by the cooperation of physical production lines with a digital "copy. It creates the digital factory environment, in which the company can optimize the operation directly through the production chain, manipulate parameters and production processes; adapting the product to market requirements. This solution is strongly tied with the "Smart Factory" concept, as a novel technology. Digital twin collects and evaluates the information continuously, allowing, among other things, to shorten and streamline the production cycle, reduce the rise time of introducing new products, detecting inefficient settings of the underlying processes. The concept of the digital twin, therefore, is built on the principle known today as Industry 4.0. The digital twin is formed by the physical production line and its digital "copy". The major feature of this arrangement is the interface, through which data exchange takes place. The digital part is based on the simulation tool called Plant Simulation (PS) made by SIEMENS. The digital simulation model of the production line was created in this environment. This model was a detailed virtual copy of the physical process. The impact of the solution was highly positive, as the scrap rates were reduced and the assembly time was reduced with an average too. These led to an increase in productivity and customer satisfaction. The quality of DT of the plant is strongly based on the quality of the data provided. Based on this, we can build a high quality simulation model for software needs (Siemens Technomatix PS). This solution was the first of its kind, as not any other company made use of this type of practice, especially in its assembly process. As mentioned previously, as direct results of the implementation significantly increased productivity and customer satisfaction were obtained.

3.2.7 Automatization and digitalization of production and business processes

Medicop and ININ started the collaboration when ININ implemented ERP solution for managing financial and material flows IPSPlus. In the beginning of 2017 they started new project: Optimization and digitalization of production processes. Consulting services for optimized production processes and implementation of IPSPlus manufacture, provided by ININ, helped Medicop achiev significant improvements. By implementing new solution, Medicop gained significant improvements on production process, purchasing process and inventory management.

The solution helped company gain significant cost efficiency and higher product quality customized and automatized production and other processes. Additionally, the integration with other solution and central ERP visibly increased time efficiency and reduced administration tasks. Innovative nature of this solution is that it provides fully digitalized information and documentation flow across company. Additionally, it provides needed information and instruction directly on work station. Moreover, for each work order and task the system tracks time, which enables company to determine required resources for specific order and forecast delivery date. The advantage of the solution is that it is adjusted for the specific of company's production process and that it is integrated with other software solution. Flexibility enables company to keep its competitive advantage, while integration provides fully digitalized documentation and information flow. The impact was highly positive since company significantly reduced time for administration, decreased number of complaints by 20% and optimized material purchasing that led to lower inventory costs. Additionally, it increased on-time deliveries by determining delivery time.

3.2.8 Solopex solo – personalized industrial intelligence tool

IoT solution for production company operating in high-dynamic supply chain (automotive industry or similar high-demanding and fast-paced industry). It is especially applicable for those from steel, plastic and tooling industry. SOLO is the ultimate tuning add-on for industrial IT systems. It enables manufacturers to take the best planning decisions for organizing complex tasks on and off the shop floor. SOLO plans tasks like material preparation, production scheduling, workforce allocation, and warehousing optimally at the push of a button. SOLO combines the power of the cloud with a high-end decision optimization engine. SOLO is accessible as a SaaS product via REST API, integrating easily with any system infrastructure. It does not disrupt existing processes and adjusts to the current data situation. Our solution is already taking into consideration next step of Industrial revolution (Industrial AI). It is also noted that our solution can be ready in less than a month, while it is not disrupting the manufacturing process. Another plus is also subscription based fee, which is not presenting too high investment related issue for the company. No specific limitations were noted while implementing the solution. Specific attention should be given to the persons involved in the process of implementation, since IT knowledge is of a special importance, whereas usually processes are run by experienced experts, who lack knowledge of computer science.

3.2.9 Digitalisation of HRM in IMPOL GROUP

In line with the guidelines of Industry 4.0, the transition to business brings a number of challenges also in the field of human resources management, where the increasing needs for knowledge management, competence development and the management of the complexity of changes are emerging. For this purpose, the human resources development field also needs agile solutions that effectively support strategic management functions with human resources. With the help of the new information system HRM 4.0, the Impol Group has the appropriate platform for managing the complexity of human resource management. The new information system enables the

development of personnel through targeted management, monitoring of activities, competence development, knowledge management, performance measurement (360-degree appraisal), monitoring of company dynamics (measurement of organizational climate, questionnaires, forums), promotion of innovation reporting of useful proposals, innovations), mastering the field of occupational safety (records, medical examinations, work accidents, incidents) and giving feedback. The IT solution also enables every employee access to the application with the help of a smartphone, thus promoting personal development, two-way communication, building affiliation and simplifying data management.

The application itself will bring the following benefits:

- saving time for data processing,
- saving time for data entry,
- reduction in the number of transmission errors,
- increasing transparency of data,
- improved control of events in organizations.

Career management tools will enable employees to:

- raising the commitment of employees,
- raising the membership of employees,
- raising the productivity of employees,
- reduction of work incidents.

3.2.10 Optimizing all business processes by implementing a customized erp solutions – ASiS ERP

ALFASOFTWARE

Fibrex Co has implemented ASiS ERP solution for its factory of bath tubs and swimming pools manufacturing, with the main purpose of implementing barcode traceability regarding operations made to products in the manufacturing process. Using mobile phones in the production hall, working operators can record operations in real time, for each product, by scanning barcode labels for each operation. This way, operations completed can be seen in ASiS database. At the end, after quality tests, a barcode is attached to the warranty certificate and if there are any flaws, by scanning this barcode, in ASiS can be seen the entire production history (operations made, people who made them, time). Fibrex Co is one of the main manufacturers of baths tubs and swimming pools in Romania. If there is a quality problem with some of these baths tubs and swimming pools, the product and problem can be traced back to the completed operations, in no time, due to barcodes attached for each product (that confer traceability down the production chain, in ASiS ERP system). At Fibrex Co, ASiS ERP solution for production comes up with a few innovative features for an integrated system: mobile application for entering production achievements that can immediately be seen in the database, barcodes scanning for completing production operations, seen directly in the ERP system, viewing stock in real-time. The impact of the ERP solution implemented was highly positive as the general turnover of the company increased by 20%. Scrap rates reduced from 10% to 2%. The productivity increased by 14% in the production line. The main customer of this company increased orders to the company. The limitations may appear from integrating certain devices with ASiS system. For example, ASiS has no problem working with

certain scales, but for others, development for integration is needed. The frame of the ERP system allows updates without affecting specific configuration. Errors and minor complaints are solved throughout the online support system, in no more than maximum two days.

3.2.11 Quality assurance solutions for automated production processes and additive manufacturing applications

Plasmo offers quality assurance solutions that enable our customers to implement a secure, efficient and cost-optimized production mainly in automated metal working industry. Plasmo has a large clientele of top global companies established in different industries (automotive, steel, mobility, aerospace industry, suppliers etc.).
Plasmo systems inspect the quality of components of i.e. vehicles, aircraft, ships, turbines, furnaces, household appliances, windows or steel structures to make these and many other products safer and more efficient. Our solutions capture all relevant data for process optimization (errors, defects, process deviations, tracking of component data) and visualisation adopted to the relevant user level.
Customers have told us that plasmo quality assurance solutions make their production process significantly more efficient (by optimization of the production process and further reducing costs created by new insights due to the implementation of monitoring systems – “customers know their production processes better” and use the existing information for defined measures).
Selling points
The company`s solution are independent from the integrator or laser manufacturer wich give more flexibility. Also is a customized solutions, the plasmo quality platform offers solutions adoptable to individual requirements of production processes.
Plasmo aggregates all necessary disciplines for the implementation of quality assurance systems in house, in the headquarter in Vienna. Plasmo works cooperates with research institutes and industrial partners to focus all expertise optimally on plasmo’s core topic: quality assurance and monitoring of production processes. All plasmo systems are industrialised and accepted in automotive, steel and aerospace industry as well as in electro mobility.

3.3 CLOUD STORAGE/ PROCESSING

3.3.1 Televend Smart Vending

Televend Smart Vending platform is a unique combination of Hardware and Software products which organize and optimize daily business in vending operator company. It is the most important and most useful technical improvement in the last ten years in vending industry. There is no need for investment in huge software modules and there is no need for internal IT specialists: powerful platform is in the Cloud. It is real proof that 4th Industrial revolution has started.
Platform consists of:

1. Televend Box which is inserted in the vending machine and communicates via GSM with the Cloud
2. Televend Cloud which supports vending operator's daily business using real time data
3. Televend Mobil App which supports fillers and technicians on their daily tasks
4. Televend Virtual bank which allows consumers to close loop payment and marketing actions
5. T- Wallet Mobil App – consumers application for cashless payment via Smartphone

The company's goal is to have complete centralization of production and development since their IoT product Televend consists of complex hardware and software components that are closely related. In the schematics of their system it is visible that every development on a hardware installed into the vending machine is connected to the cloud solutions.
They have combined many different technologies to be able to deliver a versatile and useful solution for a very challenging market.
TELEVEND CLOUD is central point of modern Smart Vending Company. It is a powerful platform which could completely change vending operator business model, guiding company in the most optimal way. Benefits of TELEVEND Smart Vending concept are unbelievable. It will suggest exactly what is the most optimal way how to organize tomorrow's actions, saving time and money. All is based on real time data and historical based predictions, using advanced mathematical algorithms and methods. Connected machines are all controlled from one centre which allowes them to make optimal decisions. This allows them to react immediately in case of an error on any machine. It allows them to provide top precise cash collection up to last cent. Reports are on daily bases showing Key Performance Indicators of any machine in real time. Dynamic planogram management will adjust every machine to best performing product choice. Expiry date management will take care of product usability proposing to move short lasting product to "faster" machines.
Experienced engineers, who have been working on the complex projects in industrial automation, were assigned to design a robust hardware with GSM Internet connection which connects to a vending machine along with an efficient assembly line. It was crucial to find reliable suppliers flexible to support highly growing demands of a new product and to keep the development in house in order to quickly react to new requirements from various customers as there are many vending machine types and many different requests to tackle in the industry. Case studies show massive improvement in cost efficiency of vending operators in many areas. Compatibility is one

of the main challenges on the market with almost thousand different machine types. Different communication protocols are required: EXECUTIVE, MDB, BDV, EVA DTS, CSI etc. Low cost and industrial design are needed as much as an easy installation. There are also a lot of requirements for small electronic devices. Other biggest challenge is a slow speed of implementation with most important customers and a lot of need for employees education.

3.3.2 OSICE - Optimization as a Service in Cloud environment

OSICE is a Cloud service intended for solving complex optimization problems in the distributed computing environment. It provides all interested third parties, especially low resources stakeholders like SMEs, with the effective tool for the problem solving and decision making. This goal is achieved through the implementation of the optimization procedures based on evolutionary algorithms (EA) in Cloud computing environment and through the development of simple and intuitive application programming interface (API). Vodena is an innovative ICT company established as a research spin-off from the Faculty of Science, University of Kragujevac, Serbia. Our enterprise offers university-strength research, modeling, simulation and data analysis, all integrated through flexible and efficient software applications. After years of experience in solving various optimization problems we have developed a web service for solving optimization problems on supercomputers using evolutionary algorithms. Finally, we have decided to offer the service to the market as a Cloud service. OSICE is an innovative ICT concept which will disrupt existing markets of optimization software and create new ones by enabling SMEs to utilize immense computational power of the Cloud for optimization problem solving and decision making, regardless their financial, technological and knowledge level. OSICE provides a comprehensive solution comparable to in-house optimization solutions without need for investment in HPC infrastructure and reducing the costs of expert stuff by 80%. In addition, it provides ease-of-use of available commercial solutions, but with possibility to optimize large real-world problems in Cloud-based environment.

3.3.3 Virtual environments to create sustainable innovations

Operational excellence requires harmony across design, production, distribution, people and processes. In MAGIC ENGINEERING organization, the innovation is driven by current technological needs coming from various industries: Aerospace & Defence, Transportation & Mobility, Engineering & Construction, Consumer Goods & Retail, Industrial Equipment, High-Tech. Our software products portfolio, from Dassault Systemes, enables our technical team to transform operations, designing and testing in a simulated production environment. Once completed, our customers that are using our technology can efficiently plan, produce, and manage all resources from staff to production and later to customer delivery. Our solution is strongly tied with the “Smart Factory” concept, as a collaborative platform technology. With our software solutions the engineers can evaluate the simulation results in the early phase of product creation - shorten and streamline

the production cycle, reducing the time-to-market, detecting inefficient settings of the underlying processes. Therefore, the concept of Digital Manufacturing is built on the principle known today as Industry 4.0. Digital Manufacturing drives manufacturing innovation and efficiency by planning, simulating, and modelling global production processes. DELMIA allows manufacturers to virtually experience their entire factory production from the impact of design to determining how to meet global demand. These simulation activities allow manufacturers to better address and shift processes so as to quickly respond to competition, or to take advantage of new market opportunities. The solution being highly scalable, practically we have no limitation on the deployment size.
This solution was the first of its kind in Romania, as no any other company made use of this type of practice, especially in its CNC machining and assembly processes with robots. As mentioned previously, direct results of the implementation significantly increased productivity and customer satisfaction was obtained. The platform returns better results if the input data accuracy is higher and the Robots & CNCs are better documented with technical specifications. The success of the implementation depends on the capability of overcoming the resistance of employees regarding the technological change. The reliability and performance of the system is directly related to the initial investment in mid-level hardware (ENOVIA servers)

3.4 DATA ANALYTICS

3.4.1 FIT (Factory Incident Tracker)

Small and Medium Enterprises are lacking of ERP / MES Software that is in fact too big for their scale. Furthermore producing companies focus on fast solution of any incidents that may occur and then pass the further analysis. The good practise of said solution is to track, analysis and avoid often occurring failures in the long run. This might as well shorten the expenditures of maintenance, could lead to easily keep delivery goals and in long run give SME the possibility to do efficiency and effectiveness planning with a low level technique.

3.4.2 Industry Cockpit CHARM

The industrial cockpit RQM. CHARM is an easy-to-use tool for individual and dynamic cockpits to monitor production, reaction and alerting in real time as well as for decision support. The technical solution is that the data, which are important during production, can be clearly displayed with CHARM. The innovation is that all data is displayed in a bundled form, thus saving unnecessary searching. CHARME was tested at the Pickert & Partner GmbH and at the Industrial Automation Show 2017, too. From the costs perspective, the solution proved to be highly efficient, as it requires minimum intervention (only for initial commissioning, maintenance and software updates) and further investments after implementation are not needed, except in the case of training newly employed operators. The employee receives information for the process and thus reduces the

susceptibility to errors. The solution led to a significant decrease in the number of faulty and defective products reported by customers, which in turn increased customer satisfaction. Employees save valuable time by seeing all important information instantly without having to search for it. Unimportant information is also hidden. A technical limitation is that the plug-ins must be updated regularly. The hardware must also be kept up to date. As already mentioned, CHARME supports the worker with exactly the information that is important for him. These vary from person to person and from order to order. This ability to provide the right information to the right person at the right time is one of CHARME's most important tasks. This solution can be implemented for a wide range of companies without any industry-specific ties. It should be noted, however, that it requires a financial commitment and that the organisational culture should be open to the use of new technologies.

3.4.3 InFrame Synapse MES: Effective entry into IT-based manufacturing

Digitization and computerization of business processes through the implementation of dedicated information systems and automated data acquisition and processes is today key to maintaining and increasing competitiveness. The project gave the experience of the 4th industrial revolution of first hand and a tangible experience of how digitalization has a direct impact on production. wn development together with partner companies. In the first step functional specification of software solution based on client's expectations, requests and analysis of the situation is written. Functional specification includes listing all functionalities and defining data model of the new software solution. We offer support of our experts' wide range of knowledge and experience in fields of business, industry and energetics when designing content of the solution. In the second step code planning and development is executed. We use modern and up-to-date business application software architecture and Microsoft (.NET and MS SQL) environment. Outcome of code development is web-based application that can be hosted in the cloud which guarantees high level of reliability and data security or hosting can be set up on client's server. In the last step of information systems' development cycle, software implementation at the customer is done. To ease the transition to new information system, educational workshops are organised. While the system is up and running clients are provided constant maintenance and application support. Succesfully finished project follows phase of maintenance and possible upgrades where we offer content and technical assistance. Complete data collection at a surprisingly low price. The solution is modular, scalable, and tailored. It scales with needs of production. The InFrame Synapse MES mini can grow with customer requirements. It can be scaled to a mature InFrame Synapse MES if needed. As an easily embedded solution for Tracking and Tracing needs, the InFrame Synapse MES mini certainly is a worthwhile investment. Through control and greater transparency of production, bottlenecks, deviations from the predicted quality levels (through monitoring of parameters) can be identified, error types and analysis are monitored, real-time alarms are sent to the responsible person on smart devices (also the possibility of analyzing alarms, frequency ranges, depending on a particular machine or operator, etc.), through various industrial indicators (most often, indicators

such as the total efficiency of devices or OEE for monitoring the performance of devices are exposed). It is possible to obtain an additional dimension of production, to control material consumption and consequent reduction in waste, which helps to reduce costs directly. It is also possible to control the operators in production. Added value is flexibility, control and visualization of events in production.

3.4.4 Applied FMEA for manufacturing plastic components in the automotive industry

The FMEA method was applied within Thomas Romania Plastic, a mold injection manufacturing company, which produces plastic components for the automotive industry. In this particular case, the method was used for identifying risks related to the functioning of the manufacturing process, before starting the serial production, in the product validation stage. This risk analysis was adjusted to the main stages of the process, in accordance with its flow chart, among which, worth mentioning are: material reception, components incoming check, mold injection (initial setup, startup confirmation, serial production), packaging, storage, delivery. The company implemented the IATF certification in 2017 and one requirement of the standard (IATF 16949:2016) is the inclusion of risk analysis activities for all manufacturing processes. The FMEA method is a proper tool for conducting such analyses because it helps in the detection and prevention of diverse potential failures and in containing their negative effects. PFMEA respects the guidelines from the AIAG manual. When the company starts the manufacturing of a new product, all related processes must be planned before committing any resources. By deploying FMEA and including it in the planning stage, potential process failures are identified here, which leads to minimum failures that need to be corrected after they appeared in the manufacturing cycle. This means that failures are prevented before they psychically appear, or at least the risk of their occurrence is lowered, all of which translates to exponentially lowered quality costs. The impact of the FMEA method is that it reduces non-conforming workpieces, it significantly reduces costs of poor quality and it is also useful for making process forecasts. The method is well documented and established, it is simple to use and doesn't require significant financial commitment for its implementation. To improve the impact of process FMEA is always recommended to use a multidisciplinary team with competence in different fields: engineering, production, quality, logistics, human resources.

3.4.5 Process improvements using simulation software

This good practice demonstrates the usefulness of simulation software, through which manufacturing processes are recreated in the virtual environment, for the purpose of better understanding their functioning and contributing to their optimization by reducing redundancies, eliminating unproductive times and avoiding blockages in the overall manufacturing flow. S.C. Turbocam Romania, a division of Turbocam International (with 10 locations in 8 countries and 3 continents), "is a global turbomachinery development and manufacturing company that specializes in 5-axis machining of flowpath components" (Turbocam International, 2017). As a concern for

continuously improving their fabrication processes, Turbocam Romania searched for innovative ways for addressing this issue. The Technical University of Cluj-Napoca offered a potential solution in this sense and proposed to simulate their existing processes with the purpose of conducting an in-depth analysis for identifying potential improvement possibilities. The solution offers detailed tracking of the manufacturing flow and in-depth study with robust tools at the level of each process, which facilitates advanced scientific corrective intervention, leading to greater performance, if the company implements measures according to the results thus obtained. The simulations increased the overall manufacturing flow's fluidity, the personnel workloads were reduced between 10-15%, certain redundant activities were identified and eliminated from the fabrication process and most importantly the scrap rate was reduced significantly. As a direct result of these measures the company received positive feedback from clients for shorter execution and delivery times and for the increase of the quality of products. Special attention must be given to the data collection process and when inputting them into the simulation program. If the data is entered incorrectly, the identified improvement measures (obtained based on knowledge from the simulations) can affect real-life processes in a negative way. T he advantage of such a solution is that each manufacturing process can be observed palpably, and after simulations, the additional quality instruments provided by the Sigma Flow Modeler program offer the possibility of intervening on areas where bottlenecks and/or problems are identified, which can be improved by reallocation of resources; or by other means. Moreover, infinite scenarios can be tested without committing any resources for setting up and starting rea-life processes, which translates to minimum risks and reduced costs for managing and maintaining this solution.

3.5 CYBERSECURITY

3.5.1 Secure QR-Code (sQR)

The sQR features another level of security and offers new possibilities regarding the use of QR codes with respect to authentication. Basically, the sQR contains information such as the ID, name of a person or machine, respectively. This information is electronically signed to ensure data integrity. An APP which is able to check the validity of this signature has been developed. Additionally, it is also possible to encrypt the information of the QR Code and to decrypt it with the corresponding public key within the APP. After the information is decrypted and the signature is validated, the APP provides a possibility to verify the real identity of a person or a machine. In case of a person, there is the additional possibility to compare a photo and in case of a machine, additional information regarding the location of the machine can be provided. The innovation of this solution is the fact that the information within the QR code can be signed and/or encrypted represents a novel approach regarding authentication. When it comes to signing and encryption of QR codes, there is no comparable solution on the market to the best of the author's knowledge. Proof of identity of the person/machine can be ensured by easy means. Only a limited amount of data can be stored within a QR code. In case of machines, the QR code itself has to be applied in

a way that malpractice is prevented. Furthermore, it has to be ensured that the camera of the device where the APP is installed (e.g., mobile phone, virtual reality glasses) is capable of scanning the QR code properly. The use of QR codes which contain signed and/or encrypted information features a fast and easy solution for strong authentication of a person/machine.

3.6 INTELLIGENT SENSORS/ACTORS

3.6.1 Monarco HAT

Monarco HAT is an add-on board which provides input-output interfaces following industrial automation standards for the Raspberry Pi (B+ and newer) minicomputer. It is designed according to the HAT (Hardware Attached on Top) specification. It enables collection of data from machines for its visualisation or evaluation.

This product was created in response to the demand of SMEs for upgrading or retrofitting existing control systems of machines. Monarco HAT is based around ARM Cortex-M3 microcontroller (MCU) which provides a wide set of embedded peripherals missing on the Raspberry Pi itself. It offers PWMs for all digital outputs, versatile counters including quadrature encoder signal decoders, digital-to-analog and analog-to-digital converters, and RS-485 communication etc. ARM MCU can also provide very deterministic IO timing compared to Raspberry Pi with Linux.

Below are the applications we had in mind when we designed the add-on board which we call the Monarco HAT.

- Reading and archiving data from standard industrial sensors.
- Monitoring of machines.
- Providing communication gateway between various devices.
- Feedback control in non-critical applications.

The good practise was validated with industrial clients worldwide. (USA, Australia, Taiwan, Republic of South Africa, Germany, Austria, Belgium, Norway, etc.)

The impact of the solution was highly positive, the new collected data and interconnection between individual machines led to an increase in productivity and lowering failure rates in final quality tests on production lines.

Monarco HAT was developed by control engineers for control engineers. So far it is the only board aimed at industrial automation and following the HAT standard. Years of experience in automation domain and electronics design were put into the product design. Although Monarco HAT is a very young product, our records indicate very low failure rates. Hundreds of satisfied customers are enjoying the benefits of using the solution. The device is universal and can be used for all tasks in automation and cybernetics. Low entry costs make it attractive also for SMEs and even end customers.

3.6.2 VESKI d.o.o.

Veski d.o.o. was established in 1990 in Zagreb. Their field of expertise is vibration and on-line advanced machine condition monitoring. Their specialty is also measurement and signal

processing. Their services include advanced signal analysis, design, manufacturing and installation of in-house solutions for on-line machine condition monitoring and protection systems on hydro power plants. This also implies better asset management by the end user.
CoDiS On-line monitoring is a product that is developed and suited for future usage within “smart power plants” and is ready for Industry 4.0. Data collection, smart sensors, IoT, and consequently Big Data Analysis is what will be the base of future industry. Their solution is based on National Instruments PAC (CompactRIO) technology. It is an open platform that allows them to implement smart and advanced algorithms in pour CoDiS platform, which they use for machine condition prediction. Algorithms include mathematical models of generators that can be used to predict different faults and create failure mode signatures. Their solution is mostly different as their final product is a hardware (measurement device) that is completely software reconfigurable, meaning it can accommodate any type of signal from any type of sensors installed on hydro generator or in the plant, whereas their competitors have dedicated hardware modules that can’t be used for different measurements. That gives them a flexibility to completely custom tailor the solution and implement algorithms dedicated for each machine. Using their products, their customers have managed to reduce their maintenance and plan the activities. Also they have helped in preventing the malfunctions by predicting the critical situations and alerting the customer. This has been done automatically from their device. Their product is very specific and it requires specific skills to be able to implement and use it. Limitations would be inadequate knowledge of end users and consequently their reluctance to implement and embrace new technologies in their day to day activities.

3.6.3 Smart Sense – Smart City AirQ Environmental Monitoring System

Station for air quality monitoring (Smart Sense AirQ) is based on flexible Smart Sense platform, making it suitable for deployment in various measurement applications. This platform can be upgraded with different sensor technologies and it can implement different communication protocols. System enables remote control, monitoring and configuration of AirQ system and OTA software upgrades managed by Smart Sense server. Monitoring station uses very sensitive electrochemical gas sensors. Each gas sensor is factory calibrated and lasts for up to 24 months, depending on air pollution. Gas sensors can be easily exchanged on the field without a need for deinstallation of monitoring station. For monitoring particles, the laser optical sensing modules is used. Smart Sense is a Croatian IT company consisting of both tech magicians and business savants, on a mission of closing the gap between physical and cyber world with innovative state-of-the-art IoT solutions. Their strong suit is Smart sensor development with a main interests in a Smart Home and Smart City solutions, infrastructure and human body monitoring. Their ultimate goal is to enable a more delightful everyday life for the end users so they can relax and enjoy the Smart sense complete home/life solutions. Their focus of interest is Internet of Things, the idea of techtopia where all things around us are connected, communicating and working in perfect harmony. This task is distant, expensive and not easily achievable so for this purpose only, they

write their own software, create their own hardware and tread bravely towards the interconnected reality and the Holy Grail of networking: The Internet of Everything.
Smart Sense core team has successfully implemented numerous projects in cooperation with industry and Faculty of electrical engineering and computing within EU framework program.

3.6.4 Orange BOX

There are existing production enterprises, which are equipped with machines and lines, which are not capable to communicate with superior systems. Orange Box creates a gate to ERP, MES, Edge, Fog and Cloud solutions for these older machines. It provides technologies from Industry 4.0 without the need of programming. It interprets OEE and states of machine in real time. Extension to this is an Edge system, which provide all tools for data analysis and reporting, trends tracking, etc. OrangeBox was implemented in company Nestlé. Robust control systems B&R provided HW platform for data acquiring (productivity, quality, energy consumption, operating state,) from machine in real time. These control systems perform data acquisition, their evaluation and display, and in consequence their transfer through communication standards as OPC UA, MQTT, into superior control system, where analysis and reports are created. OrangeBox allows upgrade to Smart factory of almost any production factory. It provides new communication technology OPC UA, MQTT, even for machines without own control system. Results of consequent data analysis have immediate impact on arrangements for increasing the productivity, effectivity, quality and energetic effectivity of machines and lines. At the same time it allows to follow the effects of changes on individual parameters, watching the trends and compering them with historical data. OrangeBox is IIoT device, which creates the gate between the machine and analytical tool (server, cloud, edge controller). Innovation of this solution lies in its configurability without the need of programming or IT knowledge about OPC UA or MQTT. Moreover, the knowledge of PLC programming is also not needed. After implementation of minimal configuration at a customer and after 2 days of measuring, this system was able to organizational actions, which increased overall utility of machine over 20%. Analysis brought surprising relations. Investment returns were defined on level of 3 weeks. System is dependent on analytical abilities of the customer and possibilities of accepting necessary actions.

3.6.5 Smallest passive contactless sensors of physical quantities in the world

European Defence Agency used RVmagnetics´s sensors to measure the structural health of carbon fibres composites. Czech construction company used RVmagnetics´s sensors to measure the forces during the construction of a train bridge. With Singapore partner RVmagnetics are creating the smart composites based on microwire technology. With partner RVmagnetics creates new generation, effective, more robust and simple railroad sensor to monitor the traffic and other parameters. EDA needed to know what the quality of composites material is used in European

defence program. Goal of the project was to compare the technologies of structural health monitoring and improve the manufacture process, effectivity, etc. RVmagnetics´s microwire technology was compared with standard invasive and non-invasive techniques with excellent results. Czech construction company need to measure the forces during the construction of new innovative train bridge. RVmagnetics developed new non-destructive measuring system, with zero error, which shows what kind of forces are inside of concrete. With RVmagnetics´s technology could be goods of our partners smarter, more effective, self-diagnosed and much more. The innovative nature of this solution is that it provides non-invasive testing, monitoring and measuring method for composites materials, which monitors the production process, application process and values from real use. With this technology partners can save the material costs, produce smarter goods and bring new added value for their partners. From the costs perspective, the solution can save upto 30% of material costs for selected sectors (composites materials), or provide new and high added value with minimum initial costs.

3.6.6 E-VINEYARD – Vineyard management software

Evineyard helps you with paperwork and crucial decisions – to save time, improve sustainability and performance. Evineyard matches the latest technology and science with the real needs of the winegrowers. Elmitel is software based company, which is employing young engineers who are interested in new technologies and innovations. While working with some new ideas the team started to “play” with sensor technology and their application into real life. After initial testing and development, the idea of Evineyard was born and also other possible applications of software based solution into real life scenarios. The solution is introducing new technology in form of sensor technology, while it is also helping to improve the production processes of companies. Built with winegrowers, eVineyard is designed with simplicity of use in mind from the ground up.
eVineyard is the only fully integrated, complete vineyard management system, on the market. It combines sensor data with data about your activities and vineyard parameters, to give you punctual decision support about when to spray. The impact is very good as all the customers are very satisfied with our solution, as it has saved their crop and by that also their expenses many times.
eVineyard is the only fully integrated, complete vineyard management system, on the market. It combines sensor data with data about your activities and vineyard parameters, to give you punctual decision support about when to spray.
The application itself will bring the following benefits:

- saving time for data processing,
- saving time for data entry,
- reduction in the number of transmission errors,
- increasing transparency of data,
- improved control of events in organizations.

Career management tools will enable employees to:

- raising the commitment of employees,
- raising the membership of employees,
- raising the productivity of employees,

- reduction of work incidents.

Larger companies are aware of HRM processes and are searching for IT supported systems to automate data collection from employees related to satisfaction on working place, productiveness, education, trainings and other HRM related relevant data.

3.7 CYBER PHYSICAL SYSTEMS

3.7.1 Production Cell 4.0

Production Cell 4.0 is being developed as a base unit of future smart factories. The cell is formed by interconnected devices that are involved in the partial steps of the production of metal workpieces. The motivation is to prepare a cell for easy adaptation of production for SMEs. The cell is used to test principles and develop new industry-related technologies in connection with Industry 4.0. Several subjects participated on the development of production cell 4.0. The machine was provided by TAJMAC-ZPS, measuring station by Renishaw, B + R Automation developed an open platform, a robot for the demonstration of integrated robotics was borrowed by COMAU, SMC delivered clamping elements, and thanks to Sewio Networks the movement of people around the cell can be tracked. The cell forms a functional production unit linking a CNC machine, a robot and a measuring station. The uniform system solves proprietary communication with each device and communicates externally with open protocols. Thanks to modular architecture the device can be easily modified and the system can be supplemented by other software applications.
The so-called production control process remains the basis of the production cell - the measuring station in the cell checks the quality of each workpiece after finishing. When a deviation is detected, the workpiece, including the necessary corrections, is sent back to the machine for repair. This greatly reduces the need of the operator to interfere with machine settings during the manufacturing process. Key capabilities include horizontal and vertical connectivity of the cell with other manufacturing systems. For the cell, the so-called edge node connection into the cloud platform was prepared where the data mining is being conducted to search for deeper connections. The cell is controlled by a system opened for user applications and the third-party applications. The data are displayed in augmented reality, monitoring of people movement is being done, condition monitoring of CNC machine and, last but not least, quality control of production process. The impact of the good practise is highly positive, as the scrap rates are reduced to almost 0% and the process of self-adjustment is fully automatic. Data about the machining process are displayed virtually and in time so the customer has all the necessary information for decision making. The benefit of Production Cell 4.0 is based on the interconnection of new technologies into a functional unit and in the same time openness to the technologies of other industrial partners. Those interested can even engage their devices (such as the material transport system or 3D printer), use it to test their own technologies or develop features that they would like to prefer in their business.

3.7.2 SEW-EURODRIVEs

A production line of the future, the Smart Factory, is presented in the smallest possible space. In order to make them functional, various systems are used: autonomous transport and assembly vehicles (AGVs) are combined and the most advanced industrial robots are coupled with state-of-the-art user interfaces. These support the user with gesture control, 3D real-time visualization and augmented reality. The control panel brings together all the information necessary for a quick decision by the user. He thus has an intelligent, permanently up-to-date schedule in front of him. He hardly has to modify it any more - but if he wants to, he only needs a single, fingers-fast tap.
Cameras on the ceiling track the movement of the storage containers with the product. Thanks to Augmented Reality, users can see where their goods are located at any time on the control panel of the intralogistics station - 3D models and additional information are rendered live into the video stream of the cameras on the ceiling. Users can easily drag live data to their smartphones or tablets via Touch Live. Maintenance workers in the factory no longer have to run to every device for simple maintenance steps. It is one of the first technologies that enables the digital monitoring and modification of the production process from start to finish. Every manufacturing company is a potential user, since the production process has several work steps that can be digitally monitored and controlled by SEW-EURODRIVEs. From a cost perspective, it is initially a very large effort, since all parts of the production process have to be connected, and tablets have to be purchased to control the processes. The results are very positive, for workers and for the companies. The employees will therefore have less work, as they can control everything from a central point and see directly where there may be problems. For the companies it is easy, to see where potentials are and where problems.

3.8 MOBILE WORKFORCE

3.8.1 Impact of a live-video-assistance-system on the problem-solving-competence of service and maintenance employees

By using the EVOLARIS Live-Video-Assistance-System named EVOCALL, the problem-solving process can be influenced positively. EVOCALL is able to replace non-effective communication channels. Besides, in combination with a “work-shadowing” approach, the on-site presence of experts as well as the repair times can be reduced.
The solution reduce the response time. Before between 24h – 36h worldwide, in combination with EVOCALL round about 30 Minutes. Limitations are network shares and network (WLAN) infrastructure constraints (e.g. firewall ports needed to be opened) placed in data centre, high secured communication, in combination with smart glass hands free. Selling points : minimize on-site presence of experts, minimize travelling cost, reduce repair time, and increase plant availability

3.8.2 WorkHeldVoiceAssistant

WorkHeld seamlessly connects field technicians with their project coordinators in the head office. Construction plans, checklists and work orders are continuously updated and defects can be reported immediately. WorkHeld enables all involved parties to always be up to date on the project progress. We developed a new form of interaction for workers and technicians with low IT skills similar to Amazon Alexa or Apple Siri build with NLP (natural language processing) and Speech to Text Technologies. Voice Assistant that runs on smartphones and tablets and can be connected to headsets. They are more motivated to document their work and have access to data an information even though they are not highly skilled in IT. Voice Assistants open up completely new forms of interaction with IT systems and can be applied to all sorts of Use-cases.

3.8.3 Virtual reality work instructions

FACULTY OF MECHANICAL ENGINEERING
UNIVERSITY OF WEST BOHEMIA
REGIONAL TECHNOLOGICAL INSTITUTE

The goal was to create a virtual work instructions that will shorten the time needed to train new employees to improve work performance, reduce mistakes, and ease work by eliminating inappropriate assembly and further disassembly of parts. The shorter the training of new employees is, the sooner they will be able to perform their work and produce flawless products. These instructions are also useful if the operator gets into an unfamiliar situation and if he have to do some work for the first time. A first prototype was created in the course of a master thesis. The system was further developed within the research work conducted in the RoRTI project from National Sustainability Programme funded by the Ministry of education and then validated and improved with lead customers. The innovative nature of this solution is that it provides animated instructions for the operators training and work which makes their activities more efficient. The instruction can be performed as fully virtual or in mixed reality (augmenter reality). The visualisation with smart glasses (Vuzix) was tested however the satisfaction was very low. Thus the simple visualisation on LCD display – tablet, smartphone was provided. The system was developed with aid of Unity 3D software package. The impact of the solution was highly positive, as the assembly time was reduced by 40% in the first trial round, by 22% in the second trial round, by 23% in the third trial round and by 20% in the fourth trial round. From these results can be seen that the virtual work instructions enables around 20% faster assemblies.

Moreover as the printed documentation is reduced significantly the reduction is also in the printing costs. The technology is universal however the software is programed directly for specific products. If the product is updated or modified the same goes also for the software which needs to be updated as well. The quality of company's internal databases and also the speed of connection is essential.

The augmented reality work instructions has still many limitations. Marker technology is sensitive for the distance from marker and vison angle. The object fitting technology is limited by the size of the product which can maximally be around 30x30 cm.

3.8.4 “der schlaue Klaus” – “the smart Klaus”

The intelligent database supported image processing software "Smart Klaus" was developed as an assistance system that offers a perfect solution to these challenges. Where RFID and barcodes reach their limits, industrial image recognition plays to its strengths along the entire supply chain - sometimes in combination with existing systems - or can even replace them with intelligent feature recognition. One or more cameras record the passing products. The software checks the image for certain characteristics. Intelligent algorithms then recognize distinctive points and compare them with the database. On the basis of the stored characteristics, the "Clever Klaus" now identifies and checks the products. If the system detects an error, the "Clever Klaus" outputs a signal in the form of a tone or screen hint. The employee receives a note. From the costs perspective, the solution proved to be highly efficient, as it requires minimum intervention (only for maintenance and software updates) and further investments after implementation are not needed, except in the case of training newly employed operators. The employee receives information for the process and thus reduces the susceptibility to errors. The solution led to a significant decrease in the number of faulty and defective products reported by customers, which in turn increased customer satisfaction. The solution has a positive effect for employees and the companies. The employees can fix their mistakes immediately as soon as they made it. It also makes their work easier by giving them instructions on what to do and this saves them time, what results in less cost for the companies. The system must have a certain technical state of art, otherwise the implementation is only possible with great effort or not at all.

3.8.5 cubu:S

cubu:S is an intelligent and networkable infrastructure for manual workstations, primarily for assembly, packaging and order picking. The system was developed to support the employees at the assembly station to minimize possible user errors. In a joint project with Esslingen University of Applied Sciences and the Protective Workshop in Heilbronn, an assistance system was developed that guides employees step by step through assembly and commissioning processes on the basis of movement recognition. The technical solution is that a motion sensor from consumer electronics was integrated into the system. By combining it with a commercially available beamer and a PC, it was possible to design a flexible system with minimal hardware requirements. From the costs perspective, the solution proved to be highly efficient, as it requires minimum intervention (only for maintenance and software updates) and further investments after implementation are not needed, except in the case of training newly employed operators. The employee receives information for the process and thus reduces the susceptibility to errors. The solution led to a significant decrease in the number of faulty and defective products reported by customers, which in turn increased customer satisfaction. It has a positive effect because employees can fix it immediately as soon as they make a mistake. It also makes their work easier by giving them instructions on what to do and this saves them time.

3.9 SELF-DRIVING VEHICLES

3.9.1 Volumetric measurements by UAV

UAVONIC
unmanned aircraft services

Volumetric measurement by UAV devices is a modern method allowing for example inspection of outdoor storage with high capacity. This method can replace employees with standard measuring devices, which have higher inaccuracies and their usage is time consuming or there is a risk of potential injury. Volumetric measurements by UAV are composed of aerial pictures created by calibrated cameras or laser scanners. This data are consequently processed in software, which creates digital 3D model of measured material. Accuracy of this process is higher than the other standard measuring methods. Such volumetric measurements were proposed and implemented in Mondi SCP a.s. Company created this solution due to intensive work of experienced and technically competent employees and also due to cooperation of segment specialist from Mondi SCP a.s. Our approach is characterized by novel technologies as precise cameras or laser scanners and by intelligent software solutions. It is clear that smart factory needs smart control and smart control is characterized by smart and precise measuring. Our approach brings novel approach to volumetric measurements in any segment of the industry. It is hard to validate volumetric measurements of high capacity storage. Validation can be done only by standard measuring devices, which are usually much more inaccurate than laser scanners or cameras. However, the measurement can be validated in industrial process, e.g. amount of consumed wood. Validation in Mondi SCP a.s. was performed this way. Impact of this solution is positive in the manner of control of whole producing process. Partner exactly knows, what amount of material he has available for production and consequently he can optimize whole logistic and save the costs. System is limited by environment around the storage. If the storage is outside, our system is not able to measure when the weather is not suitable for the flight of UAV. Moreover, it is also limited in some dusty or in other ways disadvantageous for UAV technology.

3.10 INTELLIGENT PRODUCTS

3.10.1 HSTec, High Speed Technique

HSTec
HIGH SPEED TECHNIQUE

HSTec is specialized in the development, design and manufacture of high speed motorized spindles, direct drives and other high speed technologies, as well as engineering, design and automation of special machine tools and systems. Since it's founding, HSTEC has developed a wide range of motorized spindles and electric drives for direct application in machining centres and machine tools. A flexible team of highly skilled mechanical and electrical engineers with great working experience in development, design and production of special machine tools and implementation of industrial robots offers creative solutions in industrial automation. HSTec's R&D team is focused on individualized production offering development, design, calculations and optimization, production and assembly of machine tool components according to customer

requests. The high standard of product quality control continues after the implementation of the product at the customer, thus managing the product's lifecycle. Technical solutions and innovations arise from the continuous involvement in novel technologies, creating products that are not only innovative, but are also the solution to the unsolved problems in production processes, such as energy efficiency, digital machine networking, implementing solutions in hazardous environment and thus eliminating possible personal injuries in the production process. Satisfied customers, product improvement, taking part in development of future smart factories by improving their product according to guidelines of Industry 4.0 strategy. Their employees are continuously improving their skills and knowledge, the company's employment rate is continuously rising which is being positively affected on the development of the Zadar County. Limitations are mainly in the ability to find skilled professionals who are willing to work in small towns. The educational system needs to be up-grated so the company continuously invests time and money to improve the level of knowledge of its employees. Limitations are found in the local area, where there is a minor percentage of suppliers, almost all suppliers are located at least 300 km from the company location (which negatively affects the time management and transportation costs).

3.10.2 TITERA heating under glove.

Heating under glove can be used as a simple working glove (cool environment), combined with the additional outer layer (cold environment) or with strong insulated outer layer (extreme cold environment). Into textile are integrated temperature sensors, embroider isolative Braids on upper side and heating places over fingertips and electronic control unit, which can regulate different temperature range. A heating element are heated wires. These are sewn on textiles using embroidery technology. TITERA bridges the gap between small sized companies and large-scale industry. It explores the everyday needs of people related with the textiles and its use. To every project we bring industry knowledge and of the best technical solution for the first batch production. We work large scale companies to produce innovative content, solutions and demonstrators by means of combining materials and technologies. A lot of innovative products developed in the research organization are usually not developed to the stage of commercialization. This often happens because of the necessary investments in the development of usable prototype, due to poorly conducted market analysis or because of the necessary knowledge needed for the positioning of the product on the market. There are also usually ill-prepared maintenance protocols, the evaluation by end-users is not designed or the knowledge to commercialize is highly inadequate. TITERA has tight collaboration with their end users, for who it develops the smart wearable products and smart composites. The big advantage for people who work or play outdoors is that heated clothing keeps them warm during breaks in activity, when body temperature can decrease quickly. They will feel comfortable.

3.10.3 Complete production of machines with built in smart applications

Julius-Globe Ltd. is supplying energy sector, oil rigs and automotive industries. During workshop level production procedure i4.0 applications are utilized – machinary equipped with RFID and built-in routers for distance optimization. Julius-Globe Ltd. is one of the leading SMEs in Wes-Hungarian region who are using novel technologies on the field of advanced manufacturing.: Realised research and development; Development of Engine Block (oil of body water) contamination testing equipment; Digital display, surface roughness measuring device-specific improvement; Support the development of production technology, glass roof blind; Raw material feed roller surface material non-stick and wear-resistant experiment; Research and introduction of raw material-dependent optimal coating experiments; Integration of advanced technologies and measurement equipment manufacturing technology changes into customers' production; Manufacturing production of medical device testing - knee replacement - Medical University of Szeged; Development of new heat treatment units; Development and construction of propeller; The aim was to develop new production technologies - development of only from one material screw blade propellers, the longer the blade size and the larger the number of blades; Ideal blade design, development of edge geometries; Mounted propeller design manufacturing; Manufacturing of a greater number of propeller blades; Straight and twisted blade propellers airflow engineering study. Implementing innovative solutions open new door in customer relationship. New segment of market can be targeted, so it is an absolutely long-term investment. Also, the same situation with employing highly qualified workforce.

3.10.4 Special purpose machinery

With respect to Industry4.0 applications the main focuses of Vesz-Mont 2000 Ltd are: Integrated sensor technology into robotics and Laser-engraving applications into mobile devices.
In 2010 they realized that they need to provide wider service portfolio to our customers. They targeted technologies they were not proficient at the time. Focus was on laser technologies. They were looking for companies with this competency and they were able to keep moving on this path. Nowadays Vesz-Mont 2000 Ltd - one of the largest S.P.M. builder in Hungary. Using of Advanced manufacturing technologies can develop the production of the beneficiaries. They developed a readable code connecting workers, machines and parts involved in the production, enabling them recognizing each other. The IIoT (Industrial Internet of Things) device will provide instant information about the production.

3.10.5 Machinery manufacturing with industry 4.0 applications

Borsodi Műhely Ltd. focuses on integrating robotics and sensor technology into mounting of the single-purpose assembly lines – both design and production included. The main aim of the Borsodi Műhely Ltd. is to satisfy the procurer's needs. Borsodi Műhely Ltd. has professional experiences in the production of unique and precision accessories and gauges. Thanks for the continuous technological developments, the company has the most modern technologies and machines, and this guarantees a high level of quality. In a unique way

the company provide training for students to ensure labour development in all areas. The company has a good relationship with the University of Győr. The company supports the dual training in the university. During the Practicing-training the company provides 3 months for the students. Within this 3 months the students spend 4-5 days in the company. The company has trainees in the field of engineering, finance and human resource too. Typically, students coming to the company during their last semester, and the company offers them an employment contract if they get their thesis.

3.11 ADDITIVE MANUFACTURING

3.11.1 Additive manufactory research center

Basically AM-Lab is meant to be working in the additive manufacturing sector, 3D printing is the main direction. The main point is to develop new technical solutions with the use of this modern technology in an environmentally friendly way and to organize training sessions to university students and to other interested possible end-users like local citizens, representatives of companies and so. As in the case of a lot of European regions, the population of Vas County is decreasing and getting older and older. The small towns grow older as the younger generation moving to bigger cities to get more qualitative education and better positions to work in. This tendency forces the organization of new services and brings up questions about the availability of adequate workforce. The labour force must be available not only in space and time, but also in the appropriate competence, which is not possible in a lot of cases in the county. With establishing AM-Lab, the aims to ensure that the project provides the employees with marketable, new knowledge and experience based on the labour market. By doing so, participants can fill in jobs locally, oriented, more profitably with professionally challenging jobs, providing a better quality of life and provide them with professional development opportunities. For the sake of sustainability, credibility and entrepreneurship, the AM-Lab Centre also provides services to local businesses, as a test centre and as an educational venue.

3.12 ROBOTICS

3.12.1 XROB Makes robot usage simple

With XRob users with minimal training experiences are able to create robotic processes in a new and effective way. The system is designed to be cost effective also for small companies.
The benefits are

- Easy & fast configuration – no programming skills required
- Fast retooling for a high number of variants
- Intuitive process setup within few minutes
- Easy integration into existing environment and processes
- Versatile and expandable

- Supports all popular robot brands

It is a novel technology, which can be used also for small lot sizes. It is more cost efficiency as it shorten ramp up time and no expert is need to configurate the robot for new tasks.
The software system XRob allows the creation of complex robot applications within a few minutes. With unique and easy-to-use features significant speed up will be accomplished during ramp up. This makes the operation more efficient and flexible than common programming methods. The novel software architecture allows easy and intuitive creation of processes and configuration of the components of a robot system by only one single user interface.
On-board key technologies are:

- On-board 3D modeling of work spaces for automatic collision model
- Process simulator with automatic path planning
- Inline 2D/3D position recognition
- Object recognition in real-time
- Mobile user interface

3.12.2 ALES – Automatic Laser Engraving System

The system is a good practice for implementing automatic technologies in a hand process in order to optimize the process and increase the productivity of the company. The good practice consist of a laser, a metal disc with slots for placing the metal plates, which is rotated by a stepper motor, controlled by an Arduino computer. The idea and the creation of the good practice came with the need of the factory to be competitive on the market. The automation of the process increase the productivity and reduce the production cost. Implementing computer in the manufacturing and automation of the production process is the base of the SFH approach. Self-operating system improves the production process, cost efficiency as well as the risk management. The technical solution if the good practice is simple, but effective. Arduino computer controls the stepper motor rotating the metal disc allowing the laser to brand higher number of products in smaller amount of time. With the implementation of the good practice the increase of the production is nearly 200% as well the automation process saves the personnel time. The limitations from technical point are the size of the metal product and placing it in horizontal position for engraving. No limitation in implementation.

3.12.3 Automated production line with industrial robots for manufacturing cardboard pallets

Our solution regarding the manufacture of cardboard pallets is fully automated and flexible and can be used to manufacture standard pallets or custom special size. Our solution supports Romanian exporters to implement and comply with the International Standards for Phytosanitary Measures

No.15 (ISPM 15). The automatic cardboard production line has been designed to meet the needs of products exporters and carriers such that they can implement and comply with ISPM 15.
The solution is fully reconfigurable and adaptable to the needs of any company and to any existing budget. The line has been fully developed within Inno Robotics and it was implemented at a supplier for a multinational corporation operating in the furniture industry. The solution is a completely automated and fits within the smart manufacturing concept. Its integration into any manual and automated manufacturing system is simple and easy, offering flexibility in terms of speed and types of customized assembled pallets. The automation of the manufacturing process for the cardboard pallets has proved to be a complex project in which various equipment has been introduced: different types of conveyor belts, different robot models, linear axes, grippers adapted to each operation in the process, presses. The first operation for the production of cardboard pallets is completed by a linear axis system provided with a vacuum gripper that picks up the cardboard base to which the pallet's feet are attached and places it on a conveyor. At the same time, a Fanuc serial robot feeds another conveyor belt with cardboard feet frames which, after applying the adhesive paste, are moved by the Delta robots and positioned on the base plate according to a particular pattern. The pallets thus fabricated are transported to a press, and then they are picked up by another Fanuc robot, which palletizes them. The line is much more compact than other solutions for making classic and cardboard pallets. The beneficiary is a manufacturer of wooden furniture and by installing the line, they have internalized the production process of the cardboard pallets. This internalization has led to customer`s independence from suppliers and offer a lot of flexibility to their packing systems. By being able to produce any type of pallet size, it can save the raw material used in the manufacturing process and it can optimize the way the goods are arranged in trucks by producing pallets that are the right size for their products. Another positive aspect was the elimination of the pallet storage space, the storage space for the raw material needed to create the pallets is three times smaller than the space in which the pallets were stored.

3.12.4 Computer Numerical Control (CNC) Machine –M550/M450

The CNC – mchine RAIS model M550 and M450 are computer operated drilling and cutting machines designed for manufacturing metal parts for the foundry industry.
The Computer Numerical Control Machines are controlled by a computer. Coordinates are uploaded into the machine controller from a separate CAD program. Being controlled form a computer the machines produce consistent and high-quality work. Implementing the CNC machines in the manufacturing allows faster production and quality assurance.
CNC Machine M550 has more than 50 nozzles allows wide spectre of metal processing. M550 also has automatic rotator for 3D processing. CNC Machine M450 don't has such a high precession as M550, but has drilling with integrated cooling which reduces the time for deep drilling and increase the productivity.

3.12.5 Sigma – modular system

The system Sigma is a modular printing system which consists of flexible conveyor belt and collaborative robots (co-bots). The Sigma system was developed in evolutionary way with the need of the company to increase the productivity. The developing of a system like Sigma and integrating robots in the work process increase the production process, assure quality as well as cost efficiency. Collaborative robots (co-bots) integrated in the production increases speed and the precision of manufacturing which is critical in microelectronics components Microelectronics, Co-bots, Modular, Automation. The modular character of the system allows easier modification and customization of the system, which makes faster development and production of new products. The impact on the company has been positive. Reducing the needed personnel for the same task from 9 to 2 and at the same time increasing the production. The modular characteristic of the good practice is the biggest advantage which allows the quick modification of the system and quick development of new products.

3.12.6 Klimaoprema production method for fire dampers is industry 4.0.

In the production of fire dampers Klimaoprema is using smart specialization. Production process is divided into phases. Product has a QR code which is read by the camera and gives information on how much time the product has spent in which production phase and which employee was working on it. In this way they detect if and where the error occurred, they analyse the time necessary for production, control the quality, the product and the whole production process in advance. Klimaoprema developed new and innovative smart production of fire dampers by using new technologies which created cost effective production processes. Production lines are developed in cooperation between Klimaoprema's engineers and renowned European machinery manufacturers. Technical solutions and innovations in fire dampers production are: light, strong one peace casing, easy installation, unique fire performance on the market, low pressure drop, damper blade smaller than nominal size – no possible collision with air duct, EI 120S fire resistance at 500 Pa. The impact is positive and reads in exporting fire dampers into new markets, new customers, achieving profit and new employments.

3.12.7 Collaborative robot integrated in industrial environment of Smart Factory

Integration of collaborative robot into an industrial environment with the aim of removal non-ergonomic and not effective human labour. Integration and implementation of application, which requires high precision and accuracy, and high safety in terms of sharing the workplace between

robot and humans. This solution was integrated in Škoda Vrchlabí (Czech republic). In 2014 company started to focus its activities on higher degree of robotics. Trends in this field showed that one of the most important integrations will be robots capable of cooperation with humans. Our company has own development and research capacities, that is why we created this solution. Solution is fully compatible with Smart Factory and it follows the trends in Smart Factory. It is fully integrated with other systems and it can communicate with its environment in IoT meaning, but also in communication with humans. Design of safe workplace with multi-axis robot, which can help the human operator, eventually it can replace him within difficult operations. Repeatability and full integrity between operators without the necessity of safety barriers usage. Solution was integrated in ŠKODA Auto, Vrchlabí (Czech republic) as an assembly cell used for servo mechanics of automated gear. It was first integration of collaborative robotics in group Volkswage, and it was awarded as the most innovative act in 2015 in Slovak republic. Other integration was in ŠKODA Auto Mladá Boleslav (Czech republic) for tracking and inspecting the quality of products from suppliers. Our solution is specified by implementation of collaborative robots, which can be implemented near the human workers or they can directly cooperate their actions with humans in production process. Integration of such solution will increase the quality of production operations and repeatability of production itself.

3.12.8 CNC robotic packing, palletizing and welding

We made a robotic welding system that is programmed through the PC and software for 3D modeling of parts. The traditional way of programming robots is with the help of a cone with which the robot learns how to move. Robot programming software reduced the programming time of the robot from several hours to a few minutes and made a robot suitable for companies that produce small series. Through conversation with customers, we realized that robotics does not pay off to many domestic companies because no one has a big series. While the robot is programmed, a person can wipe half of the parts manually. For this reason, we started developing an application that will enable the robot to be profitable and to companies that do not have a series.
This is a new technology that improves production processes in small-scale companies that can not provide welders or have problems with them. In the computer software, the 3D model of the work to be welded is inserted. With a few clicks, the positions are marked where they need to be protected. The software automatically generates a robot program. The operator should just insert a piece on the table and load the program of robots that generated the software. The solution is quite different because it accelerates and facilitates the robot programming process and makes the product more applicable to many customers.

3.13 ADVANCED MATERIALS

3.13.1 IT Photovoltaic System - IT PS

Photovoltaic System installed on the roof and the parking lot of the factory providing electricity and lowering the company's expenses. The system is custom made from metal frames, photovoltaic panels, voltage invertors and switch, serving as both shelter and electricity provider. The high electricity expenses of the factory, made it necessary to find an alternative solution for power supply using new technologies. The good practice is tied to the Smart factory hub's approach in relation to the cost efficiency of the production process. The innovation is that the construction of the system is used also as a parking shelter and at the same time is a power supply provider reducing the electricity cost for the production by 50%.The implementation of the system has positive impact on company production process related to decrease of production costs. The technical and implementation limitations depends on the open area that the company has. Also the use of the good practice could be limited by national legal issues.

3.13.2 EcoTherm - a set of coatings for thermal insulation of wood hive

EcoTherm is a coating with a very low thermal conductivity coefficient (λ = 0.0016 W / (mk) making it an exceptional isolator in very thin coatings of 0.7-1.0 mm. When applied on a hive, it very favorably affects the microclimate within the hive , prevents the decline of societies due to great cold or heat, bees consume less energy, they are healthier (no crop formation) and bring more honey. All of our products are ecological - water based. We have done health tests. The mechanism is based on the most modern raw materials in the form of microspheres with exceptional thermal insulation characteristics. The main thing is to keep the wood as a natural habitat of bees and to insulate from the outside significantly the thermal insulation properties of the hive. The coating is applied in a thickness of 1 mm and does not affect the dimensions and weight of the hives. This is very important because hives are transported and must be manipulated often with them. Coatings of other manufacturers do not have thermal insulation properties and can not be compared with our coatings. There are beehives made of styrofoam and plastic that have insulation, but it is not a natural habitat of bees and as such is not widely accepted. The product must be applied at a temperature of 14-30 C. The product must not freeze and should not be in direct sunlight. Our product is unique on the market. There are no similar products for this purpose. A large number of positive factors and no negative. The product is environmentally friendly, health-minded, easy to apply. We enable the bee's society to maintain the necessary microclimate in a wooden hive as a natural habitat.

3.13.3 Production of disinfectant at the place of consumption (in situ)

Production of disinfectant (1% sodium hypochlorite solution; and a mixed disifectant - a mixture of sodium hypochlorite and chlorine dioxide) users expel hazardous chemicals from use in the process of disinfection of drinking and process water. First plant for the production of 1% solution of sodium hypochlorite at the place of consumption (in situ) HLOROGEN® was manufactured and instaled in 1996.Since then,over 120 HLOROGEN and OksiHLOROGEN plants have been installed on the territory of Serbia and Montenegro. HLOROGEN and OksiHLOROGEN tehnologies are smart solutions for automatic disifectant production at the place of consumption that fully disclose the possibility of human error in the proces of water disinfection and completely replace the use hazardous chemicals (primarily gas chlorine that is hazardous to human health and life) in water disinfection. Application of technological equipment HLOROGEN an OksiHLOROGEN reduces the costs of water disinfection increases the independence of user. Use of easily available raw materials for the production of disifectant at the place of consumption - kitchen salt,water and elctiricity.this eliminates the use of hazardous substances and chemicals from the proces of water disinfection and ensures greater enviropmental safety of the water treatment plant.Using this technology users' independance from chemical suppliers for disinfectants is achieved.

3.14 RESPONSIVE MANUFACTURING

3.14.1 Industry 4.0 Maturity Model

The Maturity Model is a structured methodology to evaluate the Industry 4.0 status quo of a company, create a tailor-made vision and derive an individual road map to get from status quo to the vision. This model is a new approach to structure the technological change process through Industry 4.0 in a company and realized as a software cloud application on license. Production processes, organizational processes, machines, software applications can be investigated with the model and the outcome will lead to cost efficiency and process optimization. Enclosed to the software tool is a benchmark database where all investigations are saved anonymous.
The maturity model is the first known approach to describe the Industry 4.0 status of an entity with 24 criteria including a derivation of a road map for implementation. The Model is not a tool for assessing a whole company and make general improvement suggestions. It is a specialized tool going in depth a providing an action plan.

3.14.2 Individual orthopedic cartridges, CAD / CAM technology.

ottobock.

Based on good years of experience in the development of individual orthopedic cartridges and modernizing technology, CAD / CAM technology has been used in the production of our orthopedic cartridges. CAD / CAM technology speeds up the production process and improves the quality of fabrication of products, with the help of high-quality materials. A faster production process, high-quality materials, Ottobock orthopaedic cartridges reduce the effects of micro trauma and save the locomotors system. Positive experiences of the users who come to create more pairs of individual orthopaedic cartridges.

4. LESSON LEARNED

This section contains the learned lessons related to the good practice collection activity from the perspective of the partner and who provided the data for each good practice.

4.1 Lessons learned from the perspective of the companies who provided the good practice information

Slovenia

Overall, the SMEs responding to the questionnaire found the initiative good and added value for them from the perspective of business opportunity and promotion. They were motivated to participate since the information provided will be used in the promotion material.

Furthermore, some SMEs (at the common workshop during the presentation of possible cooperation) explained that they would be willing to participate in several promotions oriented activities, such as conferences, workshops, presentations at events. This information shall be taken into consideration when planning further activities.

On the other hand, the SMEs found it difficult to fill out the questionnaire due to complexity of requested information. This was not considered as a show stopper, however some SMEs needed editorial and explanatory support in filling the information.

Romania

The responders were questioned about the learned lessons from their point of view and asked to provide information about the most important aspects. These are summarized as follow:

- **Aptus Software** – The questionnaire can be improved and the data collection method would be more efficient if it took place online.
- **Turbo Cam** – the project idea is excellent, we intend to use the mapping tool, which will help us to make ourselves better known in the region in which the project is implemented. The questionnaire is, perhaps too long and the provided example was of great help.
- **Alfa Software** – Our product can be successfully used in smart manufacturing, which was the reason why we participated in this study. We are also looking forward to other results of this interesting project.
- **Inno robotics** – one of our goals by 2020 is the expansion of the company at an international level by providing solutions, products and services in the field of industrial automation. We believe that by participating in this study and by accessing the platform developed in the project we have laid out the foundation of our objective. The questionnaire was too long and we are waiting for the online version of the material.
- **Thomas Tontec** - The assistance provided from the UTC-N in completing the questionnaire was very welcomed.
- **Magic Engineering** – we have no observations, we manage to fill in the questionnaire ourselves

Croatia

The responders were questioned about the learned lessons from their point of view and asked to provide information about the most important aspects. These are summarized as follow:

- **HSTec** – They weren't quite clear what we wanted from them. They didn't know the answers to a lot of questions, so they needed our help in filling the questionnaire.
- **Intis** – They complained that the form was too long and too general.
- **Klimaoprema** – They wanted an online version of the questionnaire and they complained that a lot of the questions were similar.
- **Veski** – They asked what they would gain by filling the questionnaire because they didn't see the value in it, until we explained that the good practice handbook is an international promotional material.

Germany

The responders were questioned about the learned lessons from their point of view and asked to provide information about the most important aspects. These are summarized as follow:

- **Schnaithmann:** Cubu:S was initially developed as an assisted assembly system for elderly and handicapped people. However, it turned out that also shop floor operators greatly benefit of digital working instructions. Cubu:S also reflects, what can be achieved by having clever students working at a project which aims at solving real world problems.
- **OPTIMUM:** Most SMEs require simple and cost-effective solutions. This is why we as a company developed "Schlauer Klaus". It demonstrably provides support for a variety of assembly tasks but is also easy to configure and requires only low implementation costs.
- **Pickert & Partner:** Often, the problem of shop floor workers in SMEs is that different data is captured in different places. CHARME industry cockpit solves this issue by integrating various operational parameters into one comprehensive cockpit. This allows its user to quickly gain an understanding into potential bottlenecks and underperforming processes.
- **Centigrade:** In order to minimize organisational waste, for SMEs it is crucial to introduce smart assistance systems that provide decision support for workers. E.g. through digital planning and monitoring it is possible to reduce media breaks.
- **WITTENSTEIN:** Industry 4.0 is successfully implemented when companies learn from the practical implementation of concrete projects. The real value of usecases is within well thought-out applications and not within the technologies per se. Also, constant feedback from later users/ employees is very important during the development of potential solutions.

Austria

The responders were questioned about the learned lessons from their point of view and asked to provide information about the most important aspects. These are summarized as follow:

- ***EVOLARIS:*** Customizing is an important requirement for user acceptance. .Different processes need to be reflected and supported by the solution
- ***ABF:*** reduction of travelled distances and to possible reduction of needed vehicles
- ***Tablet Solution:*** Good conversation design is essential
- ***CDI:*** SME (below 150 Employees) that have rather none or few IT Systems yet implemented and SME are not using data for long term problem analysis.
- ***XiTrust:*** User acceptance strongly correlates with the level of experience concerning the technologies involved.

- ***Plasmo:*** Adequate trainings adopted to the know-how level of the trained organization and remote & hotline services are necessary to increase the awareness for the new technology, provide demonstration facilities.
- ***PROFACTOR:*** an intuitive user interface is essential, as workers have now programming skills. Acceptance of the half-automated tasks for the works
- ***FH OÖ:*** Due to the complexity of industry 4.0, SMEs are struggling with implementing technology, as they cannot know determine at which stage of implementation and which technology will be useful for them.

Czech Republic

The responders were questioned about the learned lessons from their point of view and asked to provide information about the most important aspects. These are summarized as follow:

- **Intemac** – We have a brand new solution which was developed just recently. The SFH project could help to promote our solution and popularize the Industry 4.0 topic between the Czech companies, thus it is interesting for us. The project idea is very good. We want to stay in touch for the rest of the project. As we are also partially funded by the public finances we also would like to take place at the Stuttgart academy for facilitators.
- **REX Controls** – Our company has already a good experience in international trade. The Monarco HAT was already sold worldwide but we are still looking for different communication channels. The mapping tool platform could serve us as another communication channel and spread the information about our solution via Europe.
- **Regional Technological Institute** – The idea of mapping tool platform is very good. We see the potential in it and we can imagine how it can helps us in communication with potential customers.

Slovakia

All the companies were enthusiastic about the overall idea of the Smart Factory HUB project. However, when they saw the questionnaire, they feel a little embarrassed. They were not willing to fill out so much data. Moreover, some data can be filled only by CEO, some by managers, some by technicians, etc. Most of these companies (Photoneo, Matador, UAVONIC) recommended electronic questionnaire, with simpler questions. At least some groups of answers should be prepared in advance.

The most discussed problems related to implementation of innovative solutions were financial difficulty of initial investments and misunderstanding of the need to innovate.

Bulgaria

Every SME that have implemented smart technologies in their companies experience direct benefits in the field of energy efficiency, cost reduction, increase production, quality assurance, which increase their competitiveness.

The companies are open for implementing smart technologies and automation of the production process but the main obstacle, that the companies have with implementing smart technologies are financial, however a good technologies have very high investment return.

Serbia
The companies that responded to the questionnaires recognized the significance of our activities and their benefit from the perspective of further business opportunities through promotion. They are also on disposal for future activities. It is significant to mention that there are companies that could not fill in the questionnaires due to the lack of time or personnel, given the period of the year and lot of obligations they had, but are willing to cooperate in future.

Nevertheless, some companies encountered difficulties with understanding of some questions that are, at first glance, the same. Some asked for assistance and clarification, but some companies left the fields they didn't understand blank.

4.2 Lesson learned from the perspective of the partners involved in SFH project

Slovenia
The PTP has been using two approaches in reaching for interested SMEs: (i) direct communication and (ii) social network invitation for cooperation. The invitation sent through the social networks was tested for the first time, resulting in 8 organisations responding and finally with 3 good practices collected. The most of drop-offs were based on the fact that the solution could not be considered as a good practice.

Although we have decided for rather flexible approach in classifying if solution can be considered a good practice, one of the most important lessons learned is that Slovenian companies have rather low perception of the term Smart manufacturing and consequently also recognising what a good practice in the field of Smart manufacturing would be.

The second most important lesson learned is that the Smart manufacturing good practices are difficult to identify, document and present. Most of the solutions for the manufacturing oriented SMEs cannot be purchased and implemented easily (off-the-shelf or plug-and-play solutions), but need initial assessment, careful planning and a lot of customisation. Most of the time, these solutions are rather complex, tackling several fields of implementation at the same time in order to make the solution practical in beneficial.

Romania
Collecting the five GPs was not an easy task, many of the firms that could have provided data and which were identified and contacted refused to complete the questionnaire. The invoked reasons were varied, but most often the reasons behind the refusal were the approvals that are needed in multi-national companies regarding sensible (confidential) information and the lack of human and time resources in the case of SMEs.
There were many cases in which, at first glance, it seemed that a company could provide an example of good practice, but after filling out the questionnaire we have come to the conclusion that the provided case is not a good practice example in the SFH philosophy.

One of the successful strategies for Romania was to promote data collection as a marketing activity, which, through the Mapping tool, increased the visibility of the products and services offered by the respondents as well as the possibility of finding new clients through the platform.
In Romania smart manufacturing is still at its incipient stage regarding SMEs, many companies are starting to implement specific smart manufacturing elements, however they don't do it integratively, but rather to solve punctual problems in the classic production process.
In the case of multi-national companies, the situation is quite different, robots and intelligent systems are present in most production units and technologies such as NFC, AR or mobile applications are used.
One of the problems we faced was obtaining the right to publish the collected materials: pictures, movies or simulations.

Croatia
Collecting the five GPs was not easy because many of the SMEs refused to fill a very long questionnaire, and they didn't see the value in participating. Many companies that could have participated, refused because they needed approval regarding confidential information and they didn't have the time and human resources to do it. We had a case where after reviewing the good practice with the lead partner, we had come to the conclusion that it is not a good practice example. We had success by highlighting the fact that the good practice story could serve as a marketing activity. In Croatia, Smart manufacturing is in its early stage so companies implement specific smart manufacturing elements mostly to solve costly production issues. One of the problems we faced was obtaining pictures and movies because they were either confidential or they didn't have them.

Germany
SMEs often face the issue that integration of new, sophisticated technology demands high levels of expertise and investment costs. In addition, many SMEs shy away from real implementations because they lack the right contact person to consult. Furthermore, SMEs often lack resources that are committed to actually guide the digital transformation process of their company. Another big problem is within the acceptance of new technology. Especially older employees often have reservations regarding changes of their work tasks.

Austria
PROFACTOR has a well-established network with SMEs and LE, additionally PROFACTOR provides itself solution to SMEs. We faced difficulties with the comprehensive questionnaire, SMEs tend to be overwhelmed by the quantity of questions. Helping the SMEs in filling out the questionnaire a lot of useful input was delivered. The possibility of providing results and their products to a broader auditorium audience was seen as a chance by all SMEs.

Czech Republic
Collecting all the good practices was not an easy task, that's also why the goal was not met in desired time. Not many companies who have been addressed with cooperation refused but this wasn't contributing to the success anyway. The biggest problem was the aspect of time. Especially bigger companies has their inner process of confirmation if they can provide the data and participate but this process was sometimes so time consuming and confusing for the outsider that

sometimes we even didn't know where the confirmation process stopped. Some companies who wanted to participate during the first meeting declined later due to time reason when they were asked to fill in the datasheet. Even the good practices presented in this document haven't been filled directly by the companies. We asked them for different information material regarding theirs solutions. We harvested the necessary information and filled the datasheets for good practices and the companies was then asked to check the info, correct it a fill in the missing fields. Some of the companies was not able to cooperate of god practices due to lack of personal. We were told that many of the skilled workers are assigned with more important tasks (projects, reports) that needs to be done before end of the year, however they said that after the New Year they want to participate on the project.
Presentation of mapping tool platform validated as interesting tool. During the meetings all the companies were presented with the mapping tool platform. Everybody likes it and seems a potential in it. In many cases it was the decision reason for cooperation.

Slovakia
We think that the chosen form of questionnaire is very inappropriate. Such questionnaire should be more digital and intuitive, e.g. electronic questionnaire as web page. Moreover, some answers should be prepared beforehand. Filling out questionnaire with such long texts is not comfortable for anybody. And we also think that the evaluation of the questionnaires was not so pleasant. It is a good practice to provide a simple questionnaire with the much more intuitive system and there must be an opportunity for companies to create a product presentation in standard form, e.g. 4 slides pptx file. This is a standard way of presenting companies in EU.

Generally, the involved companies were inclined to the cooperation and willingly provided us their experiences and solutions. They are looking forward to the next collaboration regarding this project and also smart solutions. Especially from the reason that many SMEs in Slovakia are conscious about the importance of the smart solutions for increasing their competitiveness on the European Internal Market but they are still not using and applying these solutions in their production process.

Bulgaria
The SME's in Bulgaria mainly develop their own technologies, leaded by the need of staying relevant and competitive on the market. Because of this most of the technologies are custom and flexible in order to fit the specific need of the company. The automation of the production process does not lead to reduction of personnel, but they are redirected to new tasks leading to development of new products and services as well as growth and expansion of the company.

Serbia
Gathering questionnaires was not that easy task as it may look, especially because Serbia is only partner country that doesn't have Smart Specialization Strategy and companies had problems to understand, for them new, "*Smart manufacturing"* term. It took us more than one month of work, from targeting adequate companies, through explanation, motivation and assistance to final result.

This time we decided to select about ten companies through Chamber's network that meet our needs and focus on them, instead of sending hundreds of invitations. From 9 selected companies,

5 of them finally responded, although with some difficulties in understanding the questions and, in some cases, with our assistance. There were companies that have promised to fill in the questionnaire, but they failed due to some justified reasons, but this is something that we have to count on.

At the bottom line, we can say that some Serbian companies had a lot of difficulties to understand the "*Smart manufacturing*" term and to recognise what a good practice in that field would be.

5. CONCLUSION

A total of 58 good practices have been collected, covering nearly all the smart manufactured domains presented and illustrated in figure2.

With only one exception, all partners managed to document the five required examples of good practice, the fewest were collected by the Czech Republic (3) and most were collected by Slovakia (9) followed by Austria (8), Slovenia and Romania (6).

The documentation process was not an easy task, the good practice documentation is difficult, the difficulties encountered by the partners vary, starting with the data collection questionnaire that was considered to complicate for some companies while other companies had problems understanding the good practice concept in smart manufacturing.

The responses collected using the questionnaire will also be used for an ex-ante evaluation. The questionnaire was the result of a collective consultation between the partners, and the information gathered with it helped to generate an average of 4 pages / good practice. Which can not be considered as a great effort from the one designed to fill in such a questionnaire. Probably the type of questions may not have been familiar to those who answered the questionnaire and hence the difficulties encountered. The average page number of a filled in good practice questionnaire is 4, while the shortest has 2 pages and the longest has 6.

The partners used different strategies to collect the good practice data, either direct communication, social media networks, or promoted the idea as a marketing action using the Mapping Tool platform as an attraction for companies.

It is noteworthy that without a planning of the good practice collection process the results is varied and covers 14 areas of interest for smart manufacturing. Any company that needs help can find a good solution among the 58 good practices collected. The gathered good practices data is complementary, their variety and the industrial specificity of the 10 countries that participated in the study have led to this unexpected result.

6. APPENDIX

1. Logo of the companies which contribute to Good Practice
2. 58 questionnaire used for document god practices collected

7. LOGO OF THE COMPANIES WHICH CONTRIBUTE TO GOOD PRACTICE


ANEXT


Matador
GROUP


Photoneo
focused on 3D


ALFASOFTWARE


APTUS


SOVA DIGITAL
Product Lifecycle Management


UAVONIC
unmanned aircraft services


impol
190 YEARS
Aluminium Industry


ELMITEL


Inden


Medicop
EQUIPMENT SPECIALIST


inin


litera


solopex


MAGIC
ENGINEERING


Vodéna


EkoLak
ICM


Sigma


GALAMBOS
TRANS Kft.
INTERNATIONALER TRANSPORT


JULIUS GLOBE
KERESKEDELMI ÉS TERMÉKGYÁRTÓ KFT.


ottobock.


am-LAB
additive manufacturing


MAGIC
ENGINEERING


THOMAS
TONTEC


VESZ-MONT 2000
SZERELÉSTECHNIKAI ÉS GÉPIPARI KFT.


INNO
Innovation Has No Limit
ROBOTICS


BORSODI


TURBOCAM
INTERNATIONAL

8. 58 QUESTIONNAIRE USED FOR DOCUMENT GOD PRACTICES COLLECTED

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	Company: Elmitel d.o.o.  Contact person: Matic Šerc – R&D manager Orehovci 1a, 9250 Gornja Radgona Phone: +386 40 811 465 E-mail: info@evineyardapp.com Website: www.evineyardapp.com
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	E-VINEYARD – Vineyard management software 
	Provide a concise description of the good practice being addressed	Evineyard helps you with paperwork and crucial decisions – to save time, improve sustainability and performance. Evineyard matches the latest technology and science with the real needs of the winegrowers.

Element	Guiding questions	Answers
		
GOOD PRACTICE DESCRIPTION		
Detailed description	How did the SME create good practice / new product?	Elmitel is software based company, which is employing young engineers who are interested in new technologies and innovations. While working with some new ideas the team started to “play” with sensor technology and their application into real life. After initial testing and development, the idea of Evineyard was born and also other possible applications of software based solution into real life scenarios.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management? Describe what are the technical solutions and innovations: of the good practice	The solution is introducing new technology in form of sensor technology, while it is also helping to improve the production processes of companies. There are following features available within the solution: - Turn regulative records into value: Fill your work evidences from the tractor, in the vineyard, from any device - phone, tablet or computer - Regulate irrigation. Achieve superior quality - Avoid disease outbreaks. Spray with confidence - Reduce vineyard manager's administration.

Element	Guiding questions	Answers
		- Integration = power, simplicity and safety. - No installation. No training. All yours.
		
	Highlights (or keywords) of the Best Practice	Vineyard management, Internet of Things, Production management, SaaS
	Good practice applied in : (NACE code)	A1.2.1 - Growing of grapes
Benchmarking	How does your solution related to others provided by competitors	Built with winegrowers, eVineyard is designed with simplicity of use in mind from the ground up. eVineyard is the only fully integrated, complete vineyard management system, on the market. It combines sensor data with data about your activities and vineyard parameters, to give you punctual decision support about when to spray.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media,	https://vimeo.com/164903966 http://www.elmitel.si/

Element	Guiding questions	Answers
	pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	https://www.youtube.com/channel/UCOEKL8Lea5qTPQUemTLO9fw  
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	The solution has been implemented in various regions in the world, starting in Europe and Australia, while last

Element	Guiding questions	Answers
		applications were done also in North and South America. 
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	The target customers are vine growers, typically those are the ones who have at lease 20 Ha of vineyards. But also smaller ones are the target since solution has two options for implementation.
Targeted customers and scale of use	Select the target group of customers: 1. SMEs (<250 employees) 2. Large companies 3. Public institutions 4. End customer (Business to Customer) Other, please specify	Mainly they are SMEs, while also Large companies are the target. We want to develop smaller systems which would be also attractive to end customers which have smaller vineyards.
	METHODOLOGICAL APPROACH	
Managerial aspects	Cost efficiency of the good practice, if applicable	Cost efficiency is important aspect of the solution, and is applicable due to following reasons:

Element	Guiding questions	Answers
		- irrigation management saves water and by this also money - Spraying just in time and when needed saves investment - Save up to 80% of time on administration All in all saves money related to investment into OPEX which can be used differently or transferred into direct income of the company.
	Quality assurance aspects, if applicable	By implementing the solution company is increasing the quality of products and increase the production.
	Risk management aspects, if applicable	The solution is taking away the risk of loosing all the crop due to disease outbreak or climate changes and also the risk of loosing any data, since they are always stored on the safe in the cloud.
Implementation guidelines	How can the Good practice be implemented?	The good practice can be implemented in two ways: 1. Small scale: Implementation of software solution into daily operation of vine grower. Showcase and training for the customer. 2. Large scale: Implementation of sensors in the vineyard, testing their work, implementation of software solution into daily operation of vine grower and connection with field sensors, showcase and training for the customer
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	In most cases one person is needed who will work with the software with addition to the computer and smartphone, which are currently not presenting too much of a burden as this is present in everyday life

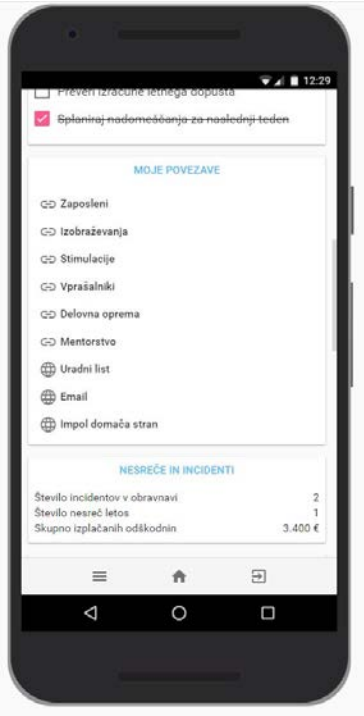
Element	Guiding questions	Answers
		already. In case of large scale there is also a need for investment into sensors on the field.
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	The validation is still an ongoing process as we are validating almost each implementation separately. The first validation took part with our local wine grower, which has its vineyards next to our offices. With his help we were also developing the solution and its functionalities.
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The impact is very good as all the customers are very satisfied with our solution, as it has saved their crop and by that also their expenses many times.
	SUCCESS FACTORS AND CONSTRAINTS	
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	The limitation is usually connected to the specific limitations of the wine grower, as there are different obstacles when implementing the solution. Either the terrain is difficult and there are difficulties with implementation or on other hand person working with the solution does not have basic skills in computer science.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	eVineyard is the only fully integrated, complete vineyard management system, on the market. It combines sensor data with data about your activities and vineyard

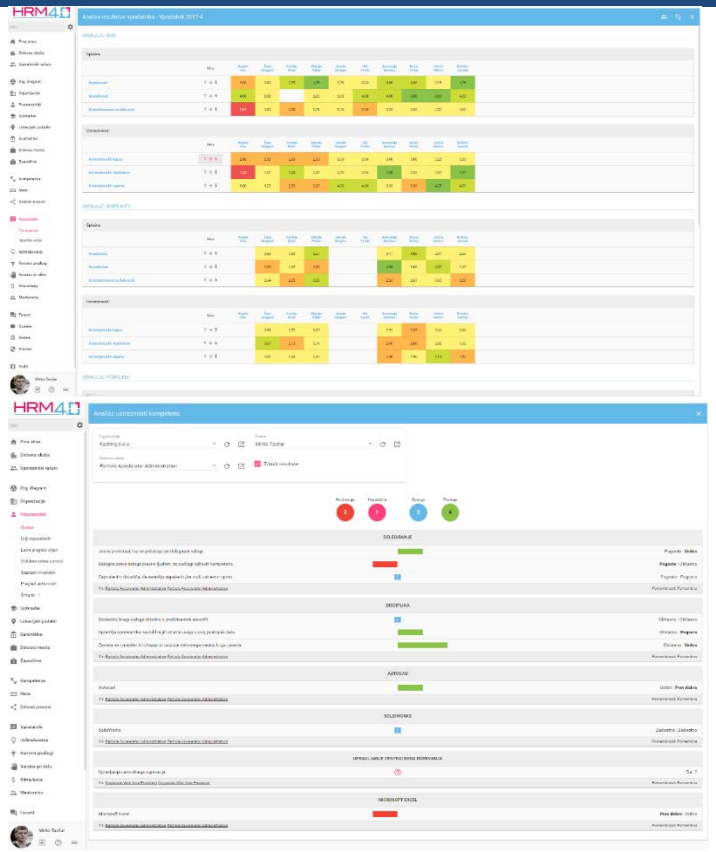
Element	Guiding questions	Answers
		parameters, to give you punctual decision support about when to spray. By that wine growers get full solution from one supplier, not needing to go to one supplier for software and to other for hardware.
Need assessment	What else would be needed in order to improve the impact of the Good practice	There are some specifics in each of the markets. While we are familiar with environment and limits in Europe, we are lacking this knowledge in other continents like Australia and North-South America. This is why we are often looking for partnership in these new markets in order to get more familiar with specialties there.
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	It is important to be opened for new things, as this solution was developed in a process of open thinking and “playing” with sensors. Other thing is that every economic area could be transformed into digital. We were acting as pioneers in the area of Agriculture and want to move forward also to other areas.
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	Since there is an upcoming trend of “smart” applications in Agriculture, we are more than sure that the solution will be sustainable throughout next years. As we are in continuous process of simplification of our solution we

Element	Guiding questions	Answers
		are making sure that it will be available and understandable for all the wine growers in the region.
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs? What are the possibilities of extending the good practice more widely?	NA The possibility to extend the good practice is huge, as sensors together with developed software can be implemented in different areas of Agriculture, but on other hand not only Agriculture but also economic areas, such as manufacturing and other. So far we are focusing only into Agriculture, where we are already developing solution also for vegetable growing.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The impact of the good practice is very important, as the solution is directly influencing the production of food, which will be an important aspect in future years. On other hand digitalization is happening in each step of our lives, this is why it is important to implement solutions like ours as this will help the humanity and all the actors included.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	No limitations for dissemination.

Element	Guiding questions	Answers
	INTRODUCTION	
	Data identification, logo, contact person, possible representative image(s).	
Company information		Skupina Impol Edvard Slaček, CEO Partizanska 38, 2310 Slovenska Bistrica, Slovenija Tel. +386 2 8453 100 E-mail: info@impol.si
	Name or acronym: what is the name that captures the essence of the good practice	Digitalisation of HRM in IMPOL GROUP
Name and brief description.	Provide a concise description of the good practice being addressed	In line with the guidelines of Industry 4.0, the transition to business brings a number of challenges also in the field of human resources management, where the increasing needs for knowledge management, competence development and the management of the complexity of changes are emerging. For this purpose, the human resources development field also needs agile solutions that effectively support strategic management functions with human resources.
	GOOD PRACTICE DESCRIPTION	

Element	Guiding questions	Answers
Detailed description	How did the SME create good practice / new product?	The Impol Group decided to develop the personnel information system, following the following goals: to ensure the corporate management of a complex business group, to follow the requirements of the corporate strategy of Industry 4.0 and to provide strategic management of employees.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	HRM system digitalisation and adaptation for requirements of Industry 4.0
	Describe what are the technical solutions and innovations: of the good practice	With the help of the new information system HRM 4.0, the Impol Group has the appropriate platform for managing the complexity of human resource management. The new information system enables the development of personnel through targeted management, monitoring of activities, competence development, knowledge management, performance measurement (360-degree appraisal), monitoring of company dynamics (measurement of organizational climate, questionnaires, forums), promotion of innovation reporting of useful proposals, innovations), mastering the field of occupational safety (records, medical examinations, work accidents, incidents) and giving feedback. The IT solution also enables every employee access to the application with the help of a smartphone, thus promoting personal development,

Element	Guiding questions	Answers
		two-way communication, building affiliation and simplifying data management.
	Highlights (or keywords) of the Best Practice	HRM digitalisation, Industry 4.0
	Good practice applied in : (NACE code)	J63 - Information service activities; J62 - Computer programming, consultancy and related activities
Benchmarking	How does your solution related to others provided by competitors	The solution was developed for dedicated requirements in IMPOL group and therefore it is not possible to directly compare the solution with competitors.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	

Element	Guiding questions	Answers
		
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Slovenija, EU

Element	Guiding questions	Answers
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Advanced analytics enables the up-to-date monitoring of key personnel development indicators while at the same time the system through its interconnectivity with key institutions (Employment Service, Health Insurance Institute) greatly simplifies administrative processes and reporting processes.
Targeted customers and scale of use	Select the target group of customers: **5. SMEs (<250 employees)** **6. Large companies** **7. Public institutions** 8. End customer (Business to Customer) Other, please specify	
	METHODOLOGICAL APPROACH	
Managerial aspects	Cost efficiency of the good practice, if applicable	The solution is software based and as such very cost effective.
	Quality assurance aspects, if applicable	The solution is providing data that can be incorporated to existing quality assurance systems.
	Risk management aspects, if applicable	The solution is providing data that can be incorporated to existing risk management systems.
Implementation guidelines	How can the Good practice be implemented?	To implement the solution in a company it is required to outline the functionalities to be used. The implementation itself is technically not very challenging but focus to internal training of personnel using the system in organisation is important.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	Implementation of IT solution does not require much resources.

Element	Guiding questions	Answers
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	The validation was done by HRM responsible persons in IMPOL GROUP. The process was performed while development of the product and several people have been involved.
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The application itself will bring the following benefits: - saving time for data processing, - saving time for data entry, - reduction in the number of transmission errors, - increasing transparency of data, - improved control of events in organizations. Career management tools will enable employees to: - raising the commitment of employees, - raising the membership of employees, - raising the productivity of employees, - reduction of work incidents. HRM 4.0 offers the following benefits as a smart service: - Improves the state of knowledge and the possibility of more efficient and successful management of employees and their rewards, motivation etc..., - supports the lean business of organizations, since it makes it easier to manage data and knowledge of employees, - Provides added value for users with reminders, predictions and skills for future planning.

Element	Guiding questions	Answers
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	No major limitations identified.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	Larger companies are aware of HRM processes and are searching for IT supported systems to automate data collection from employees related to satisfaction on working place, productiveness, education, trainings and other HRM related relevant data.
Need assessment	What else would be needed in order to improve the impact of the Good practice	NA
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	With the development of the HRM 4.0 application, the following knowledge was acquired at three levels: a) Implementation level: Process knowledge, how to approach application development, b) content level: The application comprehensively lists the basic processes in the personnel function, with emphasis on the specifics required by the manufacturing companies, c) Structural level: The application provides a framework within which organizations can store their knowledge.
SUSTAINABILITY		
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	The solution is software based and all relevant data are stored in databases. The data is collected regularly and

Element	Guiding questions	Answers
		the database will grow with time. Sustainability as such is given by the use of relevant data collected.
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	The process openness of the application also enables the use in other organizations, and therefore a marketing application distribution strategy was created, which will cover the costs of development and will provide the basis for further upgrading of the functionality. In this context, we can, for example, with the application; they helped primarily small and medium-sized enterprises in the management of human resources, based on the use of smart solutions.
	What are the possibilities of extending the good practice more widely?	The solution can be further integrated to other existing systems in the company to provide more insights and better information's for taking HRM related decisions that can influence the total productivity in the company.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The solution described can only support the company strategy if integrated properly to existing HRM and management decision processes. The solution cannot be a substitute for required professionals that will take decisions but can support them to collect relevant information faster and take decisions based on such information in a more exact way.

Element		Guiding questions	Answers
Disclaimer Acknowledgements	/	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	INDEN D.O.O. Cesta v Mestni log 88a, 1000 Ljubljana, Slovenija T: +386 31 556 721 W: www.inden.si Klemen Lisec KAM, klemen.lisec@inden.si Dušan Božič DIREKTOR, dusan.bozic@inden.si
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	InFrame Synapse MES: Effective entry into IT-based manufacturing
	Provide a concise description of the good practice being addressed	Digitization and computerization of business processes through the implementation of dedicated information systems and automated data acquisition and processes is today key to maintaining and increasing competitiveness. The project gave the experience of the 4th industrial revolution of first hand and a tangible experience of how digitalization has a direct impact on production.
	GOOD PRACTICE DESCRIPTION	
Detailed description	How did the SME create good practice / new product?	Own development together with partner companies. In the first step functional specification of software solution based on client's expectations, requests and analysis of the situation is written. Functional specification includes listing all functionalities and defining data model of the new software solution. We offer support of our experts' wide range of knowledge

Element	Guiding questions	Answers
		and experience in fields of business, industry and energetics when designing content of the solution. In the second step code planning and development is executed. We use modern and up-to-date business application software architecture and Microsoft (.NET and MS SQL) environment. Outcome of code development is web-based application that can be hosted in the cloud which guarantees high level of reliability and data security or hosting can be set up on client's server. In the last step of information systems' development cycle, software implementation at the customer is done. To ease the transition to new information system, educational workshops are organised. While the system is up and running clients are provided constant maintenance and application support. Succesfully finished project follows phase of maintenance and possible upgrades where we offer content and technical assistance.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	Production process control system.
	Describe what are the technical solutions and innovations: of the good practice	Complete data collection at a surprisingly low price. The solution is modular, scalable, and tailored.

Element	Guiding questions	Answers
		It scales with needs of production. The InFrame Synapse MES mini can grow with customer requirements. It can be scaled to a mature InFrame Synapse MES if needed. As an easily embedded solution for Tracking and Tracing needs, the InFrame Synapse MES mini certainly is a worthwhile investment.
	Highlights (or keywords) of the Best Practice	• Unbox, collect data, and optimize • Production and process data acquisition, direct entry in tracking & tracing • Simple analysis via reporting • Simple add further equipment and work plans • Modular functional concept – simple add further functions • Cost-effective solution, rapid integration • Create your own reports
	Good practice applied in : (NACE code)	J63 - Information service activities

Element	Guiding questions	Answers
Benchmarking	How does your solution related to others provided by competitors	 The solution is better than competition because it developed in the giant semiconductor industry, the white goods industry and the automotive industry, which had clear demands and a vision for the future. These are today completely digital factories and part of their solution is also our solution. The solution is designed to be updated every 14 days - as a result, the solution always complies with the latest guidelines. https://youtu.be/8CxCWIx3kLA
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or	http://inden.si/en/pdf/Datasheet%20InFrame%20Synapse%20MES%20mini%20Release%205.0%20EN%20v03.pdf

Element	Guiding questions	Answers
	other material about the Good practice implementation (if existing).	
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Slovenia (EU)
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	The target group of good practice are all companies that have discrete production in their establishments. The size of companies that are suitable for the implementation of good practice or solution starts with 30 to 50 employees in production.
Targeted customers and scale of use	Select the target group of customers: **9. SMEs (<250 employees)** 10. Large companies 11. Public institutions 12. End customer (Business to Customer) Other, please specify	Target group are mainly SMEs.
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	Small and medium-sized manufacturers benefit from a production, which is consistently IT-based to be controllable and schedulable. In the past, the introduction and maintenance of such Manufacturing Execution Systems (MES) have been associated with great effort. With InFrame Synapse MES mini, the SMEs can get the transparent and process-oriented view onto their production. Production data are

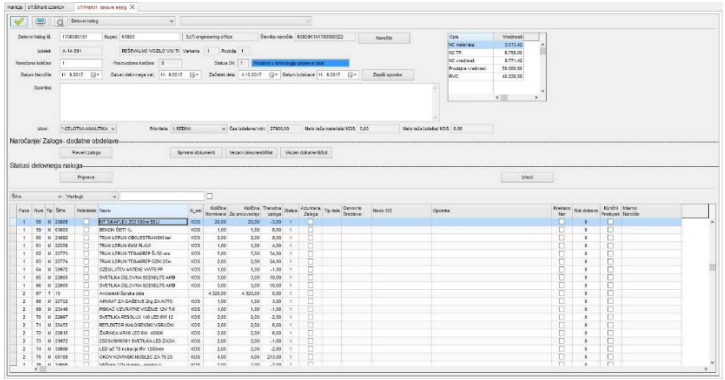
Element	Guiding questions	Answers
		processed and available for further process optimization.
	Quality assurance aspects, if applicable	Better overview of production process and available data are supporting existing quality management systems and quality assurance by providing relevant information for further decisions and actions.
	Risk management aspects, if applicable	Better overview of production process and available data are reducing the potential risk and in general supporting the risk management process.
Implementation guidelines	How can the Good practice be implemented?	If a business considers data collection and analysis to be most important, a mature high-volume MES would be too complex and expensive. InFrame had these thoughts in mind and came out with InFrame Synapse MES mini which is a “stripped down” MES for SMEs and their entry into the IT-based process optimization. This version is simply a Manufacturing Execution System without the “Execution”. Nevertheless, the InFrame Synapse MES mini offers complete production and process data collection, plus a cost-effective entry into productive tracking and tracing.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	The implementation requires a person from customer who is capable of describing all production process and is actively involved in scaling up the solution. The whole process is usually done within a month, while the finances are not of a big scale as we are usually preparing the solution for specific customer needs, so

Element	Guiding questions	Answers
		also the finances are being discussed with customers from case to case.
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	Validation of implemented solution is done by existing team in the company that was responsible for production already before implementation. More sophisticated information and details provided are critically evaluated and validated to get an approval from customer top management.
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	Through control and greater transparency of production, bottlenecks, deviations from the predicted quality levels (through monitoring of parameters) can be identified, error types and analysis are monitored, real-time alarms are sent to the responsible person on smart devices (also the possibility of analyzing alarms, frequency ranges, depending on a particular machine or operator, etc.), through various industrial indicators (most often, indicators such as the total efficiency of devices or OEE for monitoring the performance of devices are exposed). It is possible to obtain an additional dimension of production, to control material consumption and consequent reduction in waste, which helps to reduce costs directly. It is also possible to control the operators in production. Added value is

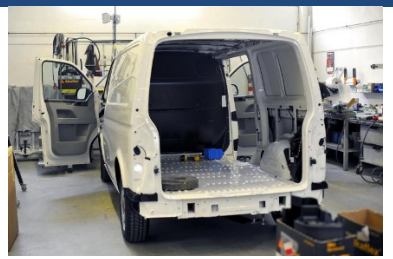
Element	Guiding questions	Answers
		flexibility, control and visualization of events in production.
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	There are no major limitations. The implementation of the system is possible in all productions but the collection of data is based on used and available sensors and data collection systems that are the input for production optimisation.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	With InFrame Synapse MES mini, camLine presents a lean, cost-effective, and easy to install solution. This allows SMEs the transparent and process-oriented view onto their production. Production data are processed and available for further process optimization.
Need assessment	What else would be needed in order to improve the impact of the Good practice	The more data can be collected, more optimisations can be performed.
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	It is possible to improve every production process and in every production it is possible to produce faster, more efficient and with better quality.
SUSTAINABILITY		
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	Good control and overview of production system is a prerequisite for the future and will be even more important in the future. Described solution will be even improved in the future therefore sustainability is assured.
REPLICABILITY AND UP SCALING		

Element	Guiding questions	Answers
Replicability and further application	How can the solution / good practice be useful for other SMEs?	The application solution can be transferred to all sectors of the manufacturing industry. In the implementation of such complex systems, there are always special requirements that must be fulfilled.
	What are the possibilities of extending the good practice more widely?	All the positive effects of the implementation can be transferred or repeated, but the approach and the way in which they are carried out due to the different organization of production, age of equipment, employees, management (which may be unprepared for changes), the prepared infrastructure are different. The list of requirements to be fulfilled is individual on a case-by-case basis.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The good practice is useful for production oriented SMEs in order to allow them to digitize their production processes and increase their efficiency. In todays worlds, the digitalization is playing an important part, and if SMEs will not jump on this train of so called Industry 4.0, they will face a big gap between the leaders of this new industry era, which will cause them to not be competitive enough. By implementing solution as this one, they will make the first and concrete steps into digitalization.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	No limitations.

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	Company: ININ d.o.o. Logo: Contact person: Tara Rožman, Marketing Manager Phone: +386 2 534 14 10 E-mail: tara.rozman@inin.si Company: Medicop d.o.o. Logo: Contact person: Tadej Ružič, director Phone: +386 2 539 12 50 E-mail: tadej.ruzic@medicop.eu
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	Automatization and digitalization of production and business processes
	Provide a concise description of the good practice being addressed	Medicop and ININ started the collaboration when ININ implemented ERP solution for managing financial and material flows IPSPlus. In the beginning of 2017 they started new project: Optimization and digitalization of production processes. Consulting services for optimized production processes and implementation of

Element	Guiding questions	Answers
		IPSPlus manufacture, provided by ININ, helped Medicop achiev significant improvements.
		
GOOD PRACTICE DESCRIPTION		
Detailed description	How did the SME create good practice / new product?	By implementing new solution, Medicop gained significant improvements on production process, purchasing process and inventory management.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	The solution helped company gain significant cost efficiency and higher product quality customized and automatized production and other processes. Additionally, the integration with other solution and central ERP visibly increased time efficiency and reduced administration tasks.
	Describe what are the technical solutions and innovations: of the good practice	Innovative nature of this solution is that it provides fully digitalized information and documentation flow across company. Additionally, it provides needed information and instruction directly on work station. Moreover, for each work order and task the system tracks time, which

Element	Guiding questions	Answers
		enables company to determine required resources for specific order and forecast delivery date.
		
	Highlights (or keywords) of the Best Practice	Production process, Manufacturing software, Cost efficiency, Time tracking, Production stages, Integration
	Good practice applied in : (NACE code)	C32.500 - Manufacture of medical and dental instruments and supplies
Benchmarking	How does your solution related to others provided by competitors	The advantage of the solution is that it is adjusted for the specific of company's production process and that it is integrated with other software solution. Flexibility enables company to keep its competitive advantage, while integration provides fully digitalized documentation and information flow.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	

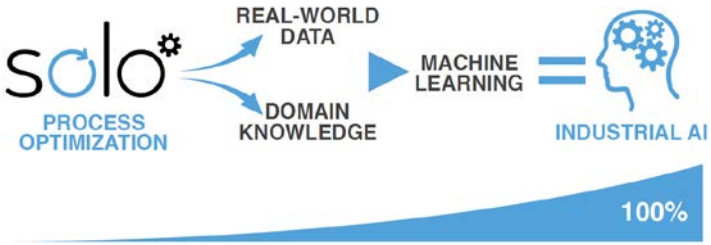
Element	Guiding questions	Answers
		
		
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	The solution described previously was implemented in Medicop factory situated in Murska Sobota, Slovenia.
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	The solution can be implemented in various manufacturing companies in need for flexible and adjustable software solution and full digitalization of production and other business processes.
Targeted customers and scale of use	Select the target group of customers: 13. SMEs (<250 employees) 14. Large companies 15. Public institutions	SMEs (<250 employees)

Element	Guiding questions	Answers
	16. End customer (Business to Customer)	
	Other, please specify	
	METHODOLOGICAL APPROACH	
Managerial aspects	Cost efficiency of the good practice, if applicable	- Reduced amount of packaging due to optimized material purchasing - Reduced surface needed for inventory due to more optimized purchasing
	Quality assurance aspects, if applicable	- Reduced number of complaints due to traceability of production process and consequently fast and easy problem identification
	Risk management aspects, if applicable	N/A
Implementation guidelines	How can the Good practice be implemented?	The methodology for implementing the solution comprised of following steps: 1. Agreed and signed collaboration 2. Blue print including detailed description of current business and production processes 3. Meetings with key employees for determining specifics and designing desired solution 4. Adjusting solution for specifics and establishing integrations with other solution 5. Implementing the solution and teaching employees 6. Maintenance, upgrades, new features and more…
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	Resources needed for implementation are: - key employees for each business process to define specifics and desired features and to describe current production process - other employees that will meet the solution at everyday operations

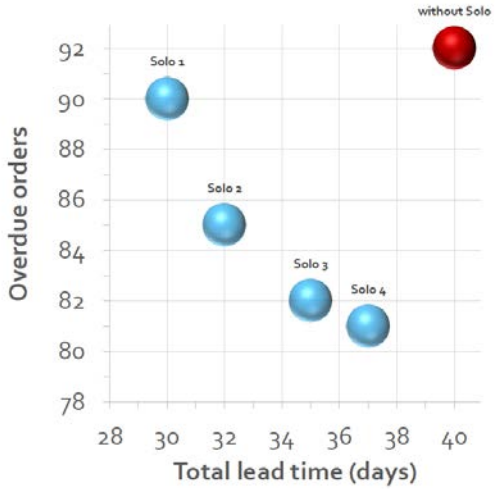
Element	Guiding questions	Answers
		- timespan is determined after blueprint, when scope of required adjustment is defined, and it also depends of company's commitment - required infrastructure includes monitors for production, identification key cards, server with Microsoft licences, barcode scanner and barcode printer - the financial aspect of implementing the solution depends on specifics required by the company, number of required integrations and implementation time, production process complexity
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	The validation process was completed by measuring time and costs used before and after implementation.
RESULTS / IMPACT		
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The impact was highly positive since company significantly reduced time for administration, decreased number of complaints by 20% and optimized material purchasing that led to lower inventory costs. Additionally, it increased on-time deliveries by determining delivery time.
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	The main limitation lies in employees, which are not ready for changes and are afraid of new technology. This can significantly increase implementation time. Key employees must be willing to cooperate and contribute to successful implementation.

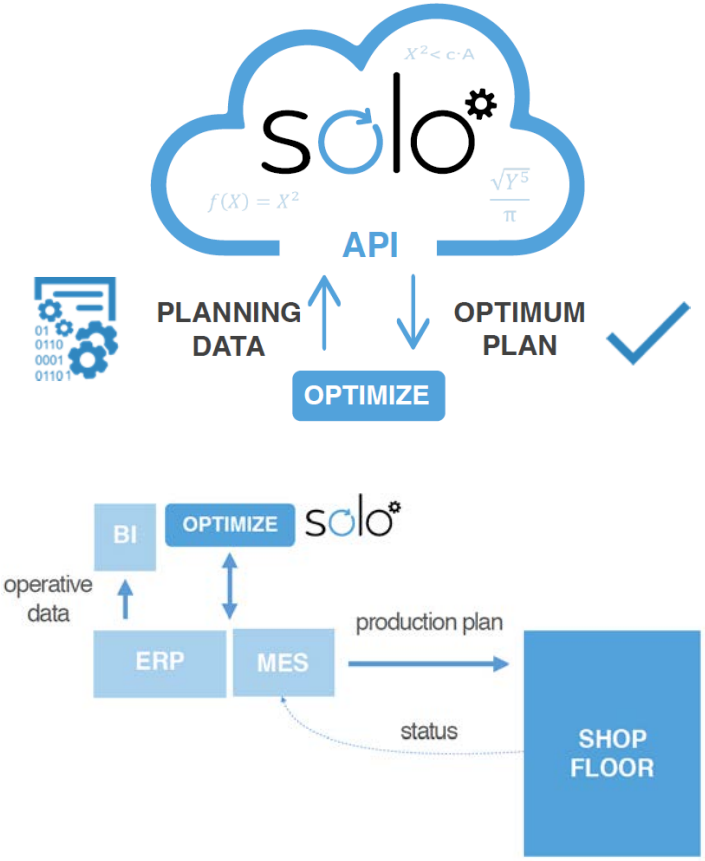
Element	Guiding questions	Answers
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	The solution provides flexibility and adjustability, which ensures keeping competitive advantage that lies in good production process. Additionally, every customer is for us individual project to which we allocate sufficient time and effort. Finally, the solution can be easily integrated with existing software, which reduces time needed for transferring data and documents and eliminated double entry.
Need assessment	What else would be needed in order to improve the impact of the Good practice	In next stages module for production planning and scheduling based on previously gathered data in existing solution, will be developed and implemented. In that way company will be able to organize sales team better and provide them with accurate information on possible delivery date and production occupancy. Additionally, the company will have information on required resources for specific time period.
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	The success of the implementation depends on the capability of overcoming the resistance of workers regarding the new technology and different work process. Additionally, the success highly depends on clearly defined and accurately described business process.
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	The amount of printed documentation is almost zero, while all information is in the system and provided to

Element	Guiding questions	Answers
		workers at their work station. Additionally, all documentation is transferred digitally across company.
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	The solution can be implemented to all kinds of manufacturing companies, either with series production, make to order production or combination of both. It must be noted that solution is designed for small and medium sized companies.
	What are the possibilities of extending the good practice more widely?	There is possibility of extending the solution widely, especially due to new technologies for remote support and maintenance, which reduces costs. For implementation physical presence at location is required.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The solution requires some financial investment; however it provides solution integrated with other software used by company and features adjusted for specifics of production process. All that provides company with significant time and cost savings.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	Data identification : Solopex d.o.o. Logo: Contact person: Alexander Engels – Managing director Pionirska cesta 9, 1360 Vrhnika, Slovenia Phone: +386 (0) 30 646 455 E-mail: info@solopex.com Website: www.solopex.com
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	Solopex solo – personalized industrial intelligence tool IoT solution for production company operating in high-dynamic supply chain (automotive industry or similar high-demanding and fast-paced industry). It is especially applicable for those from steel, plastic and tooling industry.
	Provide a concise description of the good practice being addressed	
	GOOD PRACTICE DESCRIPTION	

Element	Guiding questions	Answers
	How did the SME create good practice / new product?	The founders of the Solopex have ideal set of skills to create this product and ensure success in the market. The team have following members: - Industrial IT Specialist (Manufacturing, telecommunications,…) - Optimization Expert (Statistics, engineering,…) - Serial Entrepreneur (30 years of experience in tooling and founder of 9 companies)
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	The solution is tied to increasing the efficiency of production processes.
Detailed description	Describe what are the technical solutions and innovations: of the good practice	SOLO is the ultimate tuning add-on for industrial IT systems. It enables manufacturers to take the best planning decisions for organizing complex tasks on and off the shop floor. SOLO plans tasks like material preparation, production scheduling, workforce allocation, and warehousing optimally at the push of a button. SOLO combines the power of the cloud with a high-end decision optimization engine. SOLO is accessible as a SaaS product via REST API, integrating easily with any system infrastructure. It does not disrupt existing processes and adjusts to the current data situation.

Element	Guiding questions	Answers
		
Benchmarking	Highlights (or keywords) of the Best Practice	Specific keywords: Industrial AI, IoT solution, Supply chain
	Good practice applied in : (NACE code)	C22 - Manufacture of rubber and plastic products; C24 - Manufacture of basic metals; C25 - Manufacture of fabricated metal products, except machinery and equipment
	How does your solution related to others provided by competitors	Our solution is already taking into consideration next step of Industrial revolution (Industrial AI). It is also noted that our solution can be ready in less than a month, while it is not disrupting the manufacturing process. Another plus is also subscription based fee, which is not presenting too high investment related issue for the company.

Element	Guiding questions	Answers
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	

Element	Guiding questions	Answers

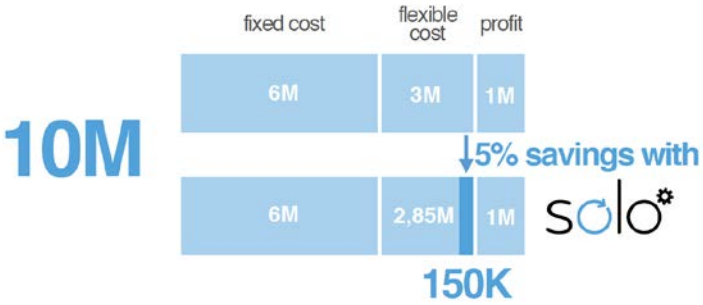
Results depend on Priorities

	Old solution	Solo 1	Solo 2	Solo 3	Solo 4
Priority	?	Minimize total lead time	Prioritize lead time reduction	Prioritize overdue reduction	Minimize overdues
Lead time in days	T+40	T+30	T+32	T+35	T+37
Overdue orders	92	90	85	82	81
Computation time	~15 min	~1 min	~1 min	~1 min	~1 min

	OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience		What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	The good practice is in early phase of adoption, where it was first tested with 4 pilot cases in Slovenia and Croatia. The further implications were done in Slovenian and Croatian companies, while solution is actively marketed in DACH regions, where future step would be to enter the market of USA.
		Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Ideal customer: Two sizes: - Company size 1: o >100 employees o >25M annual revenue o Growing, ideally more than 20% annual growth during last 3-5 years - Company size 2: o >500 employees o >100M annual revenue

Element	Guiding questions	Answers
		o Growing, ideally more than 5% annual growth during last 3-5 years
		
Targeted customers and scale of use	Select the target group of customers: 17. SMEs (<250 employees) 18. Large companies 19. Public institutions 20. End customer (Business to Customer) Other, please specify	Targeted customer are both SMEs and Large companies.
	METHODOLOGICAL APPROACH	
Managerial aspects	Cost efficiency of the good practice, if applicable	Solopex SOLO saves manufacturers time and money: Planners save time by planning production-related tasks at the push of a button. SOLO computes plans that minimize wastage, overall production time, and space use in warehouses. Compared to manual processing, savings of 15% and more can be achieved for dedicated planning tasks.

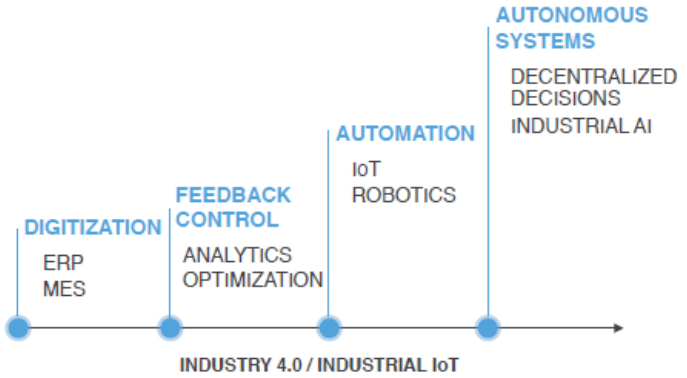
Element	Guiding questions	Answers
		With SOLO's monthly subscription model, this leads to an immediate return on investment and a lasting increase in profit margins.
	Quality assurance aspects, if applicable	Many industrial manufacturers organize production-related tasks in a manual or semi-automatic way. Human planners apply best-practice approaches or thumb rules and rely heavily on their experience. This works fine until the planning situation reaches a certain complexity, at which the human mind becomes unable to process all possible alternatives. Consequently, crucial performance indicators like material yield, machinery uptime, and system throughput drop and reduce business efficiency.
	Risk management aspects, if applicable	Taking the best planning decisions and being able to immediately react to changes and unexpected events in



Element	Guiding questions	Answers
		daily operations allows industrial clients to manufacture their products at the highest possible speed and to utilize their resources in the most efficient way.
Implementation guidelines	How can the Good practice be implemented?	Following procedure is used when implementing our solution: 1. Analysis: Analysis on how the production processes are planned (5 days) 2. Packaging into SOLO: design of algorithms which finds better planning decisions and package this algorithm into SOLO (10 days) 3. Interface: Finally, the integration to the client system is done. (3 days) By that whole process takes less than a month and it gets quicker with every new client. 
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	Resources involved: - 3 experts who are engineers, computer scientists, and mathematicians.

Element	Guiding questions	Answers
		- Solution can be ready to use in 3 weeks (1 week analytics, 2 weeks design and implementation) - Analysis is for free, while implementation is based on customer requirements
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	The validation process was completed within the customer factory where comparison between results before and after implementation was done.
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	- Solopex Solo is providing strictly better planning descisions in a fraction of the time (1min vs 15min) - With goal prioritization, Solo can be adapted to the client's most pressing needs - In the overload situation that the client is in, a good strategy is to minimize lead times (Solo 1) in order to get shop floor operations back to a normal state - In normal operations where sales are mostly within production capacity, the primary goal should be on-time delivery (Solo 3 or 4).
	SUCCESS FACTORS AND CONSTRAINTS	
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	No specific limitations were noted while implementing the solution. Specific attention should be given to the persons involved in the process of implementation, since IT knowledge is of a special importance, whereas

Element	Guiding questions	Answers
		usually processes are run by experienced experts, who lack knowledge of computer science.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	- Gain in process efficiency of 15% or more, while saving hundreds of Euros and hours of processing time - Rapid return on investment - Lasting increase in profit margins - Integrates easily with existing IT infrastructure - Does not disrupt existing processes - Adjusts to current data situation - Can manage unexpected events
Need assessment	What else would be needed in order to improve the impact of the Good practice	Nothing specific to be added.
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Solo can be adapted to the client's most pressing needs. There is always human factor involved in this process, whereas it is important that production managers are prepared for this step and are looking into same direction as management of the company.
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	The production all over Europe and world is moving into digitalization of processes into so called Industry 4.0, where Industrial AI, which is a basic of Solopex Solo represents the most advanced part of this transformation. This is why we see our product as a sustainable in the current market.

Element	Guiding questions	Answers
		
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	SOLO has been designed for manufacturing companies in steel, plastics, aluminum, tooling, chemical, and electronics industry. This is why it can be easily tranfered to any of these production oriented companies.
	What are the possibilities of extending the good practice more widely?	So far there are no special plans on widening the scope, as we first want to start with implementation on a big scale, after that we will focus on further development of our solution.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The Solopex SOLO offers customer tailor made solution to their specific production process needs, where it integrates easily with existing IT infrastructure of the customer. While implementing the solution the process is not disrupting the existing production processes so

Element		Guiding questions	Answers
			the costumer is not facing any production loss or loss of income. The start investment is easy to carry on, as it is based on subscription fee and is not representing too much of a burden for the customer.
Disclaimer Acknowledgements	/	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	No limitations and it can be used for dissemination.

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	Data identification : TITERA, technically innovative technologies, Ltd. Logo: Contact person: dr. Daniela Zavec, director Obrtna ulica 40, 9000 Murska Sobota, Slovenia E-mail: daniela@titerad.com Website: www.titerad.com
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	With company ITP GmbH we have developed the heating under glove.
	Provide a concise description of the good practice being addressed	 Heating under glove can be used as a simple working glove (cool environment), combined with the additional outer layer (cold environment) or with strong insulated outer layer (extreme cold environment).

Element	Guiding questions	Answers
		Into textile are integrated temperature sensors, embroider isolative Braids on upper side and heating places over fingertips and electronic control unit, which can regulate different temperature range. A heating element are heated wires. These are sewn on textiles using embroidery technology.
GOOD PRACTICE DESCRIPTION		
Detailed description	How did the SME create good practice / new product?	TITERA bridges the gap between small sized companies and large-scale industry. It explores the everyday needs of people related with the textiles and its use. To every project we bring industry knowledge and of the best technical solution for the first batch production. We work large scale companies to produce innovative content, solutions and demonstrators by means of combining materials and technologies. A lot of innovative products developed in the research organization are usually not developed to the stage of commercialization. This often happens because of the necessary investments in the development of usable prototype, due to poorly conducted market analysis or because of the necessary knowledge needed for the positioning of the product on the market. There are also usually ill-prepared maintenance protocols, the

Element	Guiding questions	Answers
		evaluation by end-users is not designed or the knowledge to commercialize is highly inadequate. TITERA has tight collaboration with their end users, for who it develops the smart wearable products and smart composites.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management? Describe what are the technical solutions and innovations: of the good practice	Novel technology is related to combining the wearable technology with the traditional textile technologies processes. Heating under glove can be used as a simple working glove (cool environment), combined with the additional outer layer (cold environment) or with strong insulated outer layer (extreme cold environment). This is specifically used in extreme environments where temperature is very low, for example cold store or regions where the winter is very harsh, with very low degrees. Production oriented companies faces the difficulties on how to equip workers in order to provide them decent workplace, which is why heating gloves together with heating clothes present perfect solution. Following specifications are known for low temperature heating materials: • Voltage range of 1.5 V to 230 V • Temperature range of 10°C to 100°C • Heat output can be adapted according to the customer's preferences

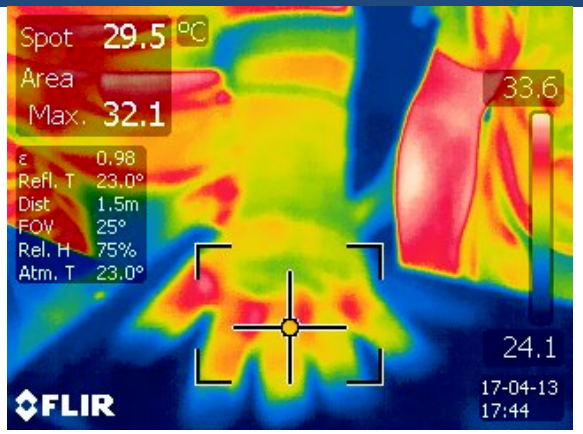
Element	Guiding questions	Answers

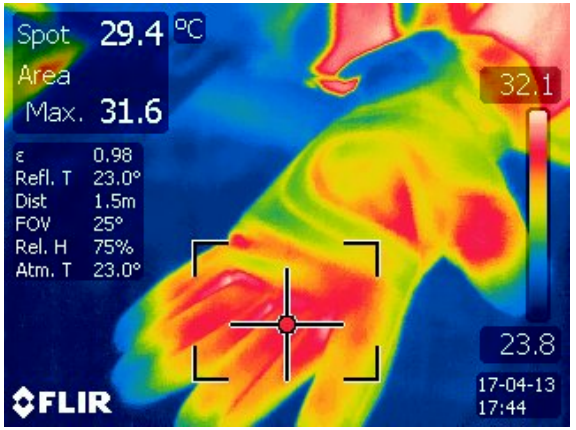
- Advantages: rapid surface heating and energy-efficient heating compared with conventional wire heating systems

Heating textiles can be manufactured with various textile manufacturing technologies.

Energy supplies two batteries with 7,4 V and power 15 W. Booth gloves can be charged at the same time.
Glove-electronic is made in two options:
- With integrated temperature sensors for control and regulation.
- Option ON/OFF – without integrated temperature sensors.

Element	Guiding questions	Answers





Element	Guiding questions	Answers
Benchmarking	Highlights (or keywords) of the Best Practice	Specific keywords: textile, temperature sensors, heated wires, embroidery technology
	Good practice applied in : (NACE code)	C13 - Manufacture of textiles
	How does your solution related to others provided by competitors	Existing products for heating elements are mostly integrated into the outer garment. Carbon fibres are replacing embedded heating wires, which are rigid and heavy, break easily, and require more energy. Making use of low voltages for safety, electrically heated clothing comes with a button on the outside which enables the regulation of the heating system. Heating is achieved through the integration of the heating pads based on metal wires weaved into the surface. At the moment such heating kits have to be taken out of the garment item while washing. Our heating elements can be washed.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	
OBJECTIVE AND TARGET AUDIENCE		

Element	Guiding questions	Answers
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Slovenia, Prekmurje Germany, Thüringen
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Workers in a cold environment
Targeted customers and scale of use	Select the target group of customers: 21. SMEs (<250 employees) 22. Large companies 23. Public institutions 24. End customer (Business to Customer) Other, please specify	1. SMEs (<250 employees) 2. Large companies 3. Public institutions 4. End customer (Business to Customer)
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	No special cost efficiency noted.
	Quality assurance aspects, if applicable	Product can positive impact the human health. Workers can work longer while exposed to cold environment. While feeling comfortable in cold environment, the work efficiency will be higher.
	Risk management aspects, if applicable	Battery.
Implementation guidelines	How can the Good practice be implemented?	There are no special implementation rules, as product is ready to use. So it is just a matter of reading the instructions on how to use it.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	There is a need for appropriate sewing equipment which needs to be implemented into traditional manufacturing facilities.
VALIDATION PROCESS		

Element	Guiding questions	Answers
Validation	Provide a brief description of the good practice validation process.	Validation in our case can be performed through quality check process in a final step of production. Positive feedback from end users.
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The big advantage for people who work or play outdoors is that heated clothing keeps them warm during breaks in activity, when body temperature can decrease quickly. They will feel comfortable.
	SUCCESS FACTORS AND CONSTRAINTS	
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	Today's technical limitations are related to the lack of appropriate sewing machines needed for placing a metal wires over textile layer. Automatization process is required, but not possible yet.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	The presented heating glove is the only one that kind of type. It consists of two layers. It can also be washed.
Need assessment	What else would be needed in order to improve the impact of the Good practice	The product is developed and ready for market, but there is lack of promotion about "smart" textiles. So there still needs to be some work done in order to present the benefits of such best practices.
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Being innovative on every step is needed in all industrial environments. The cooperation between research, business support organizations and end-users (production companies) is needed in order to develop

Element	Guiding questions	Answers
		the product which is ready for the market and acceptable by the market.
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	The market of "smart" textile is being developed rapidly and it is just a matter of time, when each of the production line will be using one or another implication of those kind of materials.
	REPLICABILITY AND UP SCALING	
Replicability and further application	How can the solution / good practice be useful for other SMEs?	Once the technology can be adopted in serial production of heating gloves, also other protective garment items can be produced by the same technology. Transfer the technology on other type of products is welcome.
	What are the possibilities of extending the good practice more widely?	Researching, developing, creating and demonstrating innovative solutions in the field of the smart textile and wearable electronics, personal protection equipment, thermoregulation and human thermal comfort will bring more and more possible applications. By spreading the technology on other products for personal protection.
	FINAL REMARKS	
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The heated gloves play an important role in the tough environments, where the temperature is very low. In order to ensure the healthy environment and workers

Element		Guiding questions	Answers
			satisfaction and by that also the production efficiency with added value it is important to implement such smart products, which are already on the market and are changing the everyday of workers.
Disclaimer Acknowledgements	/	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	No limitations.

Romania

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	ALFA SOFTWARE S.A. Producer of ASiS ERP  Logo: ALFASOFTWARE Contact person: Pavel Cristian Gabriel – CEO Patriciu Barbu Street, No 57, Cluj-Napoca Phone: 0730020203 Email: cristy@asw.ro Website: www.asw.ro
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	OPTIMIZING ALL BUSINESS PROCESSES BY IMPLEMENTING A CUSTOMIZED ERP SOLUTIONS – ASiS ERP
	Provide a concise description of the good practice being addressed	Fibrex Co has implemented ASiS ERP solution for its factory of bath tubs and swimming pools manufacturing, with the main purpose of implementing **barcode traceability regarding operations made to products in the manufacturing process**. Using mobile phones in the production hall, working operators can record operations in real time, for each product, by scanning barcode labels for each operation.

Element	Guiding questions	Answers
		This way, operations completed can be seen in ASiS database. At the end, after quality tests, a barcode is attached to the warranty certificate and if there are any flaws, by scanning this barcode, in ASiS can be seen the entire production history (operations made, people who made them, time).
GOOD PRACTICE DESCRIPTION		
Detailed description	How did the SME create good practice / new product?	Fibrex Co is one of the main manufacturers of baths tubs and swimming pools in Romania. If there is a quality problem with some of these baths tubs and swimming pools, the product and problem can be traced back to the completed operations, in no time, due to barcodes attached for each product (that confer traceability down the production chain, in ASiS ERP system).
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	ASiS ERP solution is strongly tied with the "Smart Factory" concept because it addresses all of the following: 1. **New technology**: it offers a personalized ERP solution, integrating barcode readers and other devices – Internet of Things (IoT) 2. **Production processes**: ASiS focuses on all economic (financial, accounting, cost calculation) and production processes (technology, operations/stages) within a manufacturing company.

Element	Guiding questions	Answers
		3. **Cost efficiency**: ASiS ERP assures cost efficiency because it helps implement standardized production processes, with information and correlation between stocks of raw materials, customer orders, human resources and machineries. 4. **Quality assurance**: ASiS ERP assures quality for products developed in manufacturing by using mobile devices that have ASiS mobile application installed. Quality processes are validated by traceability policies defined in ASiS ERP.
	Describe what are the technical solutions and innovations: of the good practice	At Fibrex Co, ASiS ERP solution for production comes up with a few innovative features for an integrated system: mobile application for entering production achievements that can immediately be seen in the database, barcodes scanning for completing production operations, seen directly in the ERP system, viewing stock in real-time.
	Highlights (or keywords) of the Best Practice	Traceability, stock optimisation, production achievements, ERP IoT, integrating production devices with ERP, data driven company
	Good practice applied in : (NACE code)	
Benchmarking	How does your solution related to others provided by competitors	ASiS ERP is a validated solution by 20 years of experience in the technology and business solutions sector, that can be used in different industries (retail, construction, distribution, utilities, HORECA), not only in production.

Element	Guiding questions	Answers
		Updated throughout the time according to technological requirements, ASiS ERP is one of the most modern and adaptable integrated IT solution, 100% online, the first of its kind in Romania! What makes a clear difference between ASiS ERP and other integrated solutions in Romania? The following: • **Increased flexibility and adaptability**: ASiS has a 90% ready-made structure, the remaining 10% allows for refined adaptations in a record time and in accordance to industry and customer needs. • **Availability from anywhere** ASiS does not require installation on working stations (installation is done exclusively on the server) and can securely be accessed from anywhere via an Internet connection. • **Accessibility for information from mobile devices** (IOS, Android) Any information from the ASiS database can be brought on mobile devices due to ASiSmobile (application of the ERP that works on Android or IOS) • **SaaS solution**: ASiS ERP is a Cloud-computing solution. • **Human Resources** in Alfa Software have more than 10 years of experience in the development and implementation of ERP solutions.

Element	Guiding questions	Answers
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	You can find case studies about ASiS ERP implementations and client testimonials on our website: www.asw.ro. https://www.asw.ro/english/clients/ https://www.asw.ro/english/blog-alfa-software/ https://www.asw.ro/english/erp-solutions/ Other materials: https://prezi.com/_vnjvkekq4xk/solutia-asis-erp-pentru-viticultura/ https://prezi.com/ei6bl8bh_obk/asis-erp/ https://www.youtube.com/watch?v=RjkKjw4iOMY&t=75s
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	The production solution described earlier was implemented in the company named Fibrex Co, from Crasna, Salaj county, Transylvania, Romania.
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	ASiS solutions can be applied to mid-sized and large companies (regardless of their field of activity) that want to optimize their processes and to become more competitive in the market.
Targeted customers and scale of use	Select the target group of customers: 25. SMEs (<250 employees) 26. Large companies	SMEs (<250 employees)

Element	Guiding questions	Answers
	27. Public institutions	Large companies
	28. End customer (Business to Customer)	Public institutions
	Other, please specify	
	METHODOLOGICAL APPROACH	
Managerial aspects	Cost efficiency of the good practice, if applicable	ASiS solution for production that was implemented at Fibrex Co (implementation completed in 2015) brought an increase by 20% in the company`s turnover in 2016. ASiS ERP came for the company as a package of licenses, implementation services, customization and development services and a monthly fee for technical assistance and support. The initial investment in production devices, server, licences and services was significant, but maintenance of the provided solution turned out to be a reasonable cost.
	Quality assurance aspects, if applicable	Traceability across the production chain assures quality in the production chain and especially for the final products. Validating operations in the system (production achievements) by operators in the manufacturing brings efficiency and reduces the mistake.
	Risk management aspects, if applicable	N/A
Implementation guidelines	How can the Good practice be implemented?	The starting point in the implementation process is the **business process analysis**. Then a plan and the implementation project are completed. Usually, the preparation of an implementation project takes place

Element	Guiding questions	Answers
		with the presence and participation of both parties: Alfa Software representatives - with experience in the business verticals of the company involved, the proposed implementation team and representatives/project manager from the beneficiary. A start date is set for the implementation and it begins with the setup and configuration of the server. Because ASiS is an online ERP, modules and standard applications are installed on the server. Application settings and user rights are also configured on the main server. When starting the implementation process, data initialization means entering data into the ERP from an existing database: suppliers, customers, balances, assets, employees, etc. If this data is available in electronic format, then it will be automatically imported in ASiS. **System configuration** is the adaptation stage and brings the system to parameters set by the client in the analysis phase by activating parameters that already exist or by programming them. **Training** involves teaching users to use the system according to their job description. This kind of training will be held throughout all the implementation process. At the end of the implementation, general trainings are organized for each department, detailing app features in use. Operational phase means that the all the

Element	Guiding questions	Answers
		departments use the ERP system on a daily basis. At this stage, data will be entered into the system: invoices, receipts, production reports, etc. Based on the data entered, reports will be extracted containing vital information for decision making. These reports are usually related to stocks, sales, production, costs, etc. At the end of a monthly financial exercise in ASiS ERP, the implementation is evaluated and a Protocol of delivery and acceptance is signed. What is evaluated at the end of the implementation process: • that all the client`s applications are installed and in use; • that the system works in the parameters set in the analysis phase; New features can be successfully developed beyond the period of implementation of the system, when new requirements arise or there is a reorganization, thus creating the basis of a long term partnership.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	Every ERP implementation demands a different amount of resources from the company that is preparing to make a change, depending on field of activity, size, etc. In order to follow the steps described above for an implementation project, a company must commit resources to:

Element	Guiding questions	Answers
		• providing project management (a person within the company familiar with all the internal processes, responsible for the implementation project) • offering information about the ERP change for all the employees in order for them to embrace the change and make the implementation a successful project. • participating actively in an analysis completed with an implementation plan (that has estimated implementation phases, estimated working hours, go live moments and training sessions) • providing equipment for hardware infrastructure, decided together with Alfa Software team (server, mobile devices – smartphones or tablets, barcode readers, scales) • purchasing software licenses. Their price is influenced by the number of system users and by the selected ERP modules. Also, an ERP system can be purchased on premise or can be rented based on a monthly subscription (SaaS). • accepting ERP customization services according to analysis made within the company • accepting implementation services according to the complexity of the project • organizing ERP training sessions for each department • making a subscription for technical assistance - legislative adaptations and maintenance

Element	Guiding questions	Answers
		Every implementation project takes between 3 months to 1 year, depending on the complexity of business processes.
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	After the operational phase, a validation process was completed at Fibrex Co. The company`s turnover increased by 20% the next year after the implementation was completed. There was an increase in the production productivity and a decrease in the error/scrap rates after the implementation. Integrating all processes significantly simplified company`s flows.
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The impact of the ERP solution implemented was highly positive as the general turnover of the company increased by 20%. Scrap rates reduced from 10% to 2%. The productivity increased by 14% in the production line. The main customer of this company increased orders to the company.
	SUCCESS FACTORS AND CONSTRAINTS	
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	The limitations may appear from integrating certain devices with ASiS system. For example, ASiS has no problem working with certain scales, but for others, development for integration is needed. The frame of the ERP system allows updates without affecting specific configuration. Errors and minor

Element	Guiding questions	Answers
		complaints are solved throughout the online support system, in no more than maximum two days.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	In over 20 years of existence on the Romanian market, ASiS ERP has always been an innovative system, adapting to new technologies and offering innovative solutions to its customers. ASiS is the first Romanian integrated system to work 100% online. ASiS is very flexible. It has a 90% ready structure, the rest (10%) allowing developments and customizations according to specific needs. Using a secured Internet connection (and not local installation), ASiS is also a Cloud Computing solution and it can be accessed from anywhere via a monthly subscription (SaaS). ASiS is one of the few ERP solutions that has a mobile component (ASiSmobile) that brings data from the system on smartphones and tablets. This data refers to KPIs, project management, production achievements, retail information, and others.
Need assessment	What else would be needed in order to improve the impact of the Good practice	There are a few technical minimum requirements for ASiS ERP system to work. The first one refers to working stations capabilities that need to have running on them at least Windows 7, but Windows 10 is recommended.

Element	Guiding questions	Answers
		The second requirement refers to the server on which ASiS needs to be installed. The recommended configuration is the following:

SISTEM EVISION Ci73.6G
Placa de baza MSI Socket LGA1151, B250 GAMING M3, Intel B250 Chipset, 4 *DDR4 2400/2133 MHz, DVI-D/HDMI/12*DirectX, 2*PCIEx16, 4*PCIEx1, 2*M.2, 6*SATAIII, GAMING LAN 10/100/1000*1, 8*USB3.1/6*USB2.0, Realtek ALC1220 Codec, ATX
Intel Core™ i7 Kaby Lake i7-7700 4C 65W 3.60G 8M LGA1151 VT-dx ITT TXT
Memorie RAM 32GB, 2133MHz, DDR4
2 x SSD Samsung, 250GB, 850 Evo, retail, SATA3, rata transfer r/w: 540/520 mb/s, 7mm
HDD intern WD, 3.5", 1TB, BLACK, SATA3, 7200rpm, 64MB
CARCASA Cooler Master fara sursa, K350, mid-tower, ATX, 1* 120mm fan (inclus), I/O panel, side window, black
Sursa FSP HEXA Plus Series HE-500+, 500W, 80 Plus White, Eff. 80%, Active PFC, ATX12V v2.4, 1x120mm fan, neagra, retail

		The third requirement deals with equipment capabilities and interconnecting devices (cash-points, barcode readers, scales) with the ERP system.
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	The system has better performances if the hardware infrastructure is of high quality. Moreover, there has to be an acceptance agreement from everybody that will be working with the system in

Element	Guiding questions	Answers
		the company in order to sustain the implementation process (change of paradigm) and its success. The ERP system is “alive” and needs readjustments according to new market conditions, extensions and other features in order to give the company a competitive edge.
SUSTAINABILITY		
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	Direct connection between equipment and ERP system encourages performance. The number of employees reduces due to automatization and Internet of things. Throughout time, the prices for equipment decrease whereas their capabilities increase.
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	Traceability in production is a must in many production fields, especially in the food and pharmaceutical industry. This production solution can be used and slightly adapted in other domains without great difficulties. Reporting production achievements from mobile devices is also a desired functionality for production companies and can be replicated to other production companies too.
	What are the possibilities of extending the good practice more widely?	ASiS solutions can be implemented to a wide range of companies: retail, distribution, construction, waste management, etc. Access to ASiS database from mobile devices can be used differently, depending on the action or the information that needs to be accessed

Element	Guiding questions	Answers
		quickly. For distribution companies, sales agents can access information about customers from their smartphones and can also place orders. For retail companies, cash-registers can be tied to a tablet and sales can be made using that tablet. For waste management companies, consumption can be registered on the spot and bills can be paid by subscribers on the spot (if the company`s representative uses a mobile device).
	FINAL REMARKS	
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	Adopting an integrated solution could be expensive at first, but all the costs can be supported by the advantages that this solution brings: at least the increase of the company`s turnover with 3% in the year following the implementation. Other advantages are: increased productivity, stock optimization, cost control, accounting document automation, process control, increased customer satisfaction, customer orders optimization, production management.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	The success of an ERP implementation depends both on the involvement of the client and the provider. Thus, Alfa Software cannot guarantee the success of the solution presented before and can`t be held liable for its failure. We agree with on-line and printed dissemination of the information from the questionnaire.

Element	Guiding questions	Answers
INTRODUCTION		
Company information	Data identification, logo, contact person, possible representative image(s).	Company logo:  Contact person: Ionuț Suciu Address: B-dul Muncii, Nr. 16, Cluj-Napoca, Cluj, 400641 Phone: +40 264 411 970 Fax: +40 264 411 971 E-mail: ionut.suciu@thomas-tontec.com Website: http://www.thomas-tontec.com/
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	Applied FMEA for manufacturing plastic components in the automotive industry
	Provide a concise description of the good practice being addressed	The FMEA method was applied within Thomas Romania Plastic, a mold injection manufacturing company, which produces plastic components for the automotive industry. In this particular case, the method was used for identifying risks related to the functioning of the manufacturing process, before starting the serial production, in the product validation stage. This risk analysis was adjusted to the main stages of the process, in accordance with its flow chart, among which, worth mentioning are: material reception, components incoming check, mold injection (initial setup, startup confirmation, serial production), packaging, storage, delivery.
GOOD PRACTICE DESCRIPTION		

Element	Guiding questions	Answers
Detailed description	How did the SME create good practice / new product?	The company implemented the IATF certification in 2017 and one requirement of the standard (IATF 16949:2016) is the inclusion of risk analysis activities for all manufacturing processes. The FMEA method is a proper tool for conducting such analyses because it helps in the detection and prevention of diverse potential failures and in containing their negative effects. PFMEA respects the guidelines from the AIAG manual.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	When the company starts the manufacturing of a new product, all related processes must be planned before committing any resources. By deploying FMEA and including it in the planning stage, potential process failures are identified here, which leads to minimum failures that need to be corrected after they appeared in the manufacturing cycle. This means that failures are prevented before they psychically appear, or at least the risk of their occurrence is lowered, all of which translates to exponentially lowered quality costs.
	Describe what are the technical solutions and innovations: of the good practice	In Thomas-Tontec process FMEA is used as a preventive tool and includes both product and manufacturing process risk analysis. The results are used to develop the work instructions for production operators and quality inspectors.
	Highlights (or keywords) of the Best Practice	Failure prevention; Risk analysis; PFMEA

Element	Guiding questions	Answers
	Good practice applied in : (NACE code)	Good practice applied in the field of: C2229 – Manufacture of other plastic products;
Benchmarking	How does your solution related to others provided by competitors	N/A
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	Checking methods include: appearance check, dimensional check (with measuring instruments – CMM caliper, micrometer, control gauges), verifying incoming documentation (quality certification, checklists)
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	The instrument is successfully used within the Thomas Romania Plastic manufacturing company, a division of the Thomas Tontec group, operating in Cluj-Napoca, Romania.
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Mass production, Production with limited series, Manufacturing of customizable products.
Targeted customers and scale of use	Select the target group of customers: 29. SMEs (<250 employees) 30. Large companies 31. Public institutions 32. End customer (Business to Customer) Other, please specify	Any type of organization, regardless of the field of activity.
METHODOLOGICAL APPROACH		

Element	Guiding questions	Answers
Managerial aspects	Cost efficiency of the good practice, if applicable	The costs associated with the implementation and use of this method are minimum, it only needs human resources trained in applying the method correctly and financial resources for conducting periodic trainings of the designated personnel.
	Quality assurance aspects, if applicable	The use of the FMEA method helps in identifying non-conforming parts, before reaching the customer. This way, the customer satisfaction is increased, the complaints are decreased, and by keeping the processes under control, from this perspective, the overall quality of the manufactured product is also increased.
	Risk management aspects, if applicable	The FMEA is a convenient and simple method for evaluating the risk of potential failures from the perspective of severity, occurrence and detection. The product of the three indicators provides the so-called Risk Priority Number (RPN). Acceptable risks failures are those that have a RPN value lower than 125. In case this value is superseded improvement actions have to be proposed and implemented to lower either the occurrence or detection of potential failures. Severity can be lowered only by change I product design.
Implementation guidelines	How can the Good practice be implemented?	The implementation of this method is done by creating the necessary functional instructions and training of operators. In case of this company it assures training

Element	Guiding questions	Answers
		for the following employees: operators for checking and package the workpiece, technician for mounting the mold and for starting the process – loading or setting process parameters. For each process and phase there are clearly described instructions for applying the method and the operators are trained to conduct their activities corresponding to their own job description.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	Corresponding to the stages of implementation, the resources needed here are comprised of appointing a multidepartment team, that will be responsible for the implementation and further correct use of the method. Moreover, a plan containing periodic training of involved personnel is also advised.
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	The validation is achieved by creating a working matrix that certifies the training of operators and that they are aware of all potential risks related to the manufacturing process.
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The impact of the FMEA method is that it reduces non-conforming workpieces, it significantly reduces costs of poor quality and it is also useful for making process forecasts.
	SUCCESS FACTORS AND CONSTRAINTS	
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	

Element	Guiding questions	Answers
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	The method is well documented and established, it is simple to use and doesn't require significant financial commitment for its implementation.
Need assessment	What else would be needed in order to improve the impact of the Good practice	To improve the impact of process FMEA is always recommended to use a multidisciplinary team with competence in different fields: engineering, production, quality, logistics, human resources.
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	The FMEA is a very useful tool if used properly, before the start of serial production, during the product and process development phase. A lot of inconveniences and costs could be eliminated/ avoided.
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	N/A
	REPLICABILITY AND UP SCALING	
Replicability and further application	How can the solution / good practice be useful for other SMEs?	Any SME, regardless of its field of activity, can implement this method for analyzing risks associated to potential failures and/or for containing their negative impact.
	What are the possibilities of extending the good practice more widely?	The FMEA is used 100% in all the manufacturing processes. The risk-based thinking could be introduced in all the processes, even in the non-manufacturing ones (quality management systems processes).
	FINAL REMARKS	

Element	Guiding questions	Answers
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The FMEA is a very useful tool if used properly, before the start of serial production, during the product and process development phase. A lot of inconveniences and costs could be eliminated/ avoided.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	The company describing this good practice doesn't guarantee the successfulness of the solution and can't be held liable for its failure in application. We are agreeing with on-line and printed dissemination of the information from this questionnaire.

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	Data identification : Aptus Software SRL, Logo: Contact person: Oskar Bara – Managing Partner Bd. Pipera nr 1/II, 077190-Voluntari, Ilfov, Romania, Phone: (+4 021) 527 33 99 Fax: (+4 021) 527 33 98 E-mail: office@aptus.ro Website: www.aptus.ro
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	PALLETIZED WAREHOUSE INVENTORY SCANNING USING DRONES
	Provide a concise description of the good practice being addressed	Aptus has implemented an airborne data collection system to provide stock take (inventory). The system uses self-driving drones capable of navigating through the warehouse. Drones represent a lightweight, manoeuvrable flying device equipped with multiple propellers that have a building in barcode scanner used to obtain an accurate inventory report.
	GOOD PRACTICE DESCRIPTION	
Detailed description	How did the SME create good practice / new product?	The SME created the product based on the needs of customers that wanted to be able to have a warehouse inventory system that would allow them to track the inventory in real time. The system makes use of self-driving drones equipped with custom barcode

Element	Guiding questions	Answers
		scanners. For this system to work it is really important to have the barcodes positioned properly and have them horizontally aligned and without creases.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	This solution is strongly tied with the Smart Factory concept, and it represents a novel technology that makes use of the advances drones capable of self-driving through palletizing warehouses in order to scan the barcodes of each pallet regardless their height position on large industrial shelves.
	Describe what are the technical solutions and innovations: of the good practice	The innovative nature of this solution is that the drones use a navigation system that makes use vision processing system and proximity sensors in order to navigate the drones within the warehouse. Traditional drones are used outdoors and they are managed using GPS positioning, but indoors drones don't have reliable access to GPS. Also the GPS positioning has an accuracy of 1 meter. 

Element	Guiding questions	Answers
		
	Highlights (or keywords) of the Best Practice	Software as service, drones, inventory, warehouse
	Good practice applied in : (NACE code)	Good practice applied in the field of: H - Transporting and storage, more specifically H52.1 - Warehousing and storage
Benchmarking	How does your solution related to others provided by competitors	The solution makes use of the custom software that enables the drones to navigate indoors. The system has been designed to make use of both vision processing system as well as proximity sensors located on the drones. The system does not rely on fixed infrastructure and can be applied to any time of warehouse, even those with a non-uniformly layout.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant	

Element	Guiding questions	Answers
	information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	
	OBJECTIVE AND TARGET AUDIENCE	
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	The solution described previously has been applied in the Pepsi Co warehouse from Bucharest.
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	The solution can be applied by any other company that requires a real time inventory report of the current inventory within their warehouses.
Targeted customers and scale of use	Select the target group of customers: 33. SMEs (<250 employees) 34. Large companies 35. Public institutions 36. End customer (Business to Customer) Other, please specify	Large companies with large warehouses.
	METHODOLOGICAL APPROACH	
Managerial aspects	Cost efficiency of the good practice, if applicable	The solution has proven to be highly efficient, the storage can be divided into different areas, and have the drones only investigate a specific region of interest reducing the total number of drones, therefore reducing the costs. The system requires minimum intervention

Element	Guiding questions	Answers
		from the end user and it is mostly maintenance for the drones.
	Quality assurance aspects, if applicable	The solution enables real time inventory tracking using an automated self-driving system. The solution has good advantages for companies that follow the FEFO (First Expire First Out) system such as the dairies products used in the cases study company.
	Risk management aspects, if applicable	N/A
Implementation guidelines	How can the Good practice be implemented?	The system can be implemented in any warehouse, but once the system is running there are some specific rules that need to be followed such as: - the shelves position will not be changed randomly without updating the software that drives the drones routes. - the barcodes will not be cluttered on shelves, it is important to note that the drone will scan each individual bar code and will output the data to the server before it moves to the next barcode. - the drones are controlled wireless on their own frequencies and that frequency should not be overlapped by other wireless transmissions within the storage warehouse.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	Based on the size of warehouse, the system can be implemented within 3 to 6 months. The main system costs around 20000 euros and each individual drone will cost around 7000 euros. The

Element	Guiding questions	Answers
		system can be scaled to a large number of drones. Each drone will be allocated to a specific area within the warehouse.
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	The validation was done within the customer warehouse and the system is working without having to do a lot of maintenance.
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The impact of the solution was positive at it reduced the time required to do the inventory using forklifts and personal. The company now knows exactly how many items are stored within their warehouse.
	SUCCESS FACTORS AND CONSTRAINTS	
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	The proposed system main limitation is in regards to various obstacles that might be present within the storage area in different areas at different given points. Another limitation is closely tied to the barcodes, they need to be properly aligned horizontally and be creased free in order to ensure the proper reading of those by the self-flying drones. The storage area should not have loose wrap elements from the wrapped pallets to ensure that the drones won't get entangled.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	The possibility to manage the warehouse inventory with less personal and have a real time report on "the fly" by using self-driving autonomous drones.

Element	Guiding questions	Answers
		Reliable software that can be customized to each warehouse specific needs.
Need assessment	What else would be needed in order to improve the impact of the Good practice	Since self-driving technologies and artificial intelligence still represent innovative technologies they will improve in time considering that the vision navigation system and the drones sensors will become better and will provide more accurate input data for the drones.
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	The key lessons learned from the use of drones to deal with warehouse inventory are the following: • The system can be implemented with ease to any warehouse. • The client can view have a real time inventory of all the palletized items. • The system is fully autonomous and it requires little maintenance. • The pallets barcodes should not be cluttered to ensure that they are properly registered also the barcodes should not have creases.
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	The case study system is sustainable and as the technology advances, it will be required only to upgrade the drones and the barcode scanners to ensure that even creased barcodes can be recorded without any problems. •The system can be scheduled according to the needs of the warehouse

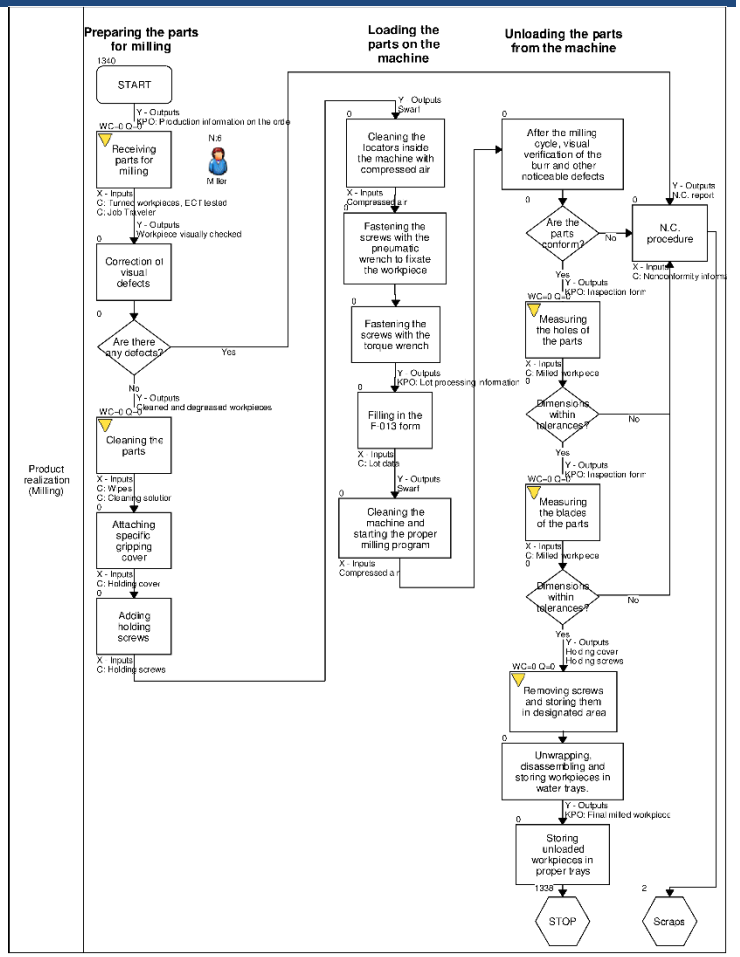
Element	Guiding questions	Answers
		•The maintenance costs are not high
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	This solution can be implemented to a wide range of companies from different industry branch in order to improve their inventory management. It must be noted that it requires a medium financial commitment since the system and the drones are quite expensive.
	What are the possibilities of extending the good practice more widely?	In the future it is possible to improve the functionality of the drones to do more complex tasks within the warehouse facility.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The solution is very flexible and it requires a medium financial investment. However the benefits of having the possibility to do a real time check the entire inventory within a warehouse represent a major selling point of the system. This type of system will most likely be adopted by most major warehouses within factories around the world.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	The company describing this good practice doesn't guarantee the successfulness of the solution and can't be held liable for its failure in application. We are agree with on-line and printed dissemination of the information from this questionnaire.

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	Company name: Turbocam Romania; Company logo: TURBOCAM INTERNATIONAL Contact person: Flavius Stroia; Address: Str. Voinicenilor Nr. 695A, Loc. Târgu-Mureș, Jud. Mureș, cod 540257, Romania; Phone: +40 740 284 630; Fax: +40 365 424 578; E-mail: flavius.stroia@turbocam.com Web: www.turbocam.com
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	Process improvements using simulation software
	Provide a concise description of the good practice being addressed	This good practice demonstrates the usefulness of simulation software, through which manufacturing processes are recreated in the virtual environment, for the purpose of better understanding their functioning and contributing to their optimization by reducing redundancies, eliminating unproductive times and avoiding blockages in the overall manufacturing flow.
	GOOD PRACTICE DESCRIPTION	
Detailed description	How did the SME create good practice / new product?	S.C. Turbocam Romania, a division of Turbocam International (with 10 locations in 8 countries and 3 continents), “is a global turbomachinery development and manufacturing company that specializes in 5-axis

Element	Guiding questions	Answers
		machining of flowpath components" (Turbocam International, 2017). As a concern for continuously improving their fabrication processes, Turbocam Romania searched for innovative ways for addressing this issue. The Technical University of Cluj-Napoca offered a potential solution in this sense and proposed to simulate their existing processes with the purpose of conducting an in-depth analysis for identifying potential improvement possibilities.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	The solution offers detailed tracking of the manufacturing flow and in-depth study with robust tools at the level of each process, which facilitates advanced scientific corrective intervention, leading to greater performance, if the company implements measures according to the results thus obtained.
	Describe what are the technical solutions and innovations: of the good practice	From a technical perspective the solution provides: • Balancing the component processes of the production system by sequentially correlating inputs and outputs throughout the product manufacturing flow; • Determining the optimal mechanisms for increasing labor productivity, considering at the same time a moderate workload level of the simulated operations; • Designing, testing and installing performance metrics based on available simulation information;

Element	Guiding questions	Answers
		• Implementing improvement tools and techniques and comparing the results achieved across the entire system; • Introducing intermediary buffer zones into the manufacturing stream, that allow self-regulation and avoid bottlenecks.
	Highlights (or keywords) of the Best Practice	Process simulation; improvement through simulation;
	Good practice applied in: (NACE code)	Good practice applied in the field of: 28.1.1. – Manufacture of engines and turbines, except aircraft, vehicle and cycle engines.
Benchmarking	How does your solution related to others provided by competitors	There are various
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	

Element	Guiding questions	Answers



The figures above represent the functioning of a real-life and its corresponding simulated process.

Element	Guiding questions	Answers
	OBJECTIVE AND TARGET AUDIENCE	
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	The solution was tested and implemented in Turbocam Romania, with headquarters in Târgu-Mureș, in Romania's Transylvania region.
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Mass production; Production with limited series; Manufacturing of customizable products.
Targeted customers and scale of use	Select the target group of customers: 37. SMEs (<250 employees) 38. Large companies 39. Public institutions 40. End customer (Business to Customer) Other, please specify	Any type of SME, which documented and structured its activities into processes, or large enterprise.
	METHODOLOGICAL APPROACH	
Managerial aspects	Cost efficiency of the good practice, if applicable	The simulations are completed using the Sigma Flow Modeler software, which includes process analysis instruments, statistical tools, Lean Six Sigma, and many more, which help in observing how existing processes work or what is the impact of the changes made to them, before they are put into practice. This way, resources (time, financial, human) are saved, because unexpected issues that are identified in simulations can be remedied before implementing changes in process operation.
	Quality assurance aspects, if applicable	This solution supports both the older version of ISO 9001:2008 Quality Management Standard approach, the process approach, and the philosophy promoted by

Element	Guiding questions	Answers
	Risk management aspects, if applicable	the newest ISO 9001:2015 standard, in which evidence of risk-based thinking is necessary. Applying this solution, management decisions can be taken in such a way that there is minimal risk, it is possible to analyze the manufacturing flow and process capacities, even before allocating the resources necessary for their operation, and the interventions are done only in those areas where it is need.
Implementation guidelines	How can the Good practice be implemented?	The implementation of this good practice begins with the observation and recording of how the existing processes function within the organization. In this case, the organization's quality manual was the first document that was consulted, in which the process map illustrates all processes within the company, as well as their interaction and material flow. Next, data collection about all activities must be completed with respect to the following important aspects: working times, allocated human and material resources as well as specific working instructions. Finally, all collected data is entered in the simulation program, which provides mathematical data about how the processes function and helps identify how they can be improved. Various scenarios can be tested, and the best solution can then be selected, which will be implemented into the manufacturing flow. As a safety measure, it is

Element	Guiding questions	Answers
		recommended to document and record how the changes affected real-life processes.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	The implementation of this solution can be completed with minimum resources: • appointing a multi-departmental team that will collect all the necessary data about the process; • acquiring Sigma Flow Modeler simulation program license (about 2000 $); • training the personnel for using the software (about 1000$ - 1 week); • running the simulations, identifying improvement measures and testing scenarios (about 1-2 weeks, depending on the process' complexity); • implementing best scenarios into real-life processes (1-2 weeks, depending on the process' complexity).
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	The validation of this good practice comprised in observing the effects that the improvement measures had on real-life processes, namely observing indicators such as scrap reduction rate, working times reduction rate, personnel workload rate, process bottlenecks, etc., over an established period of time (depending on the process complexity between 1 to 2 weeks) and if these indicators were improved the changes to real-life processes were adopted permanently. Otherwise, if the measures provided same or worse results the data

Element	Guiding questions	Answers
		entered into simulations was rechecked to determine what went wrong or why were these results obtained.
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The simulations increased the overall manufacturing flow's fluidity, the personnel workloads were reduced between 10-15%, certain redundant activities were identified and eliminated from the fabrication process and most importantly the scrap rate was reduced significantly. As a direct result of these measures the company received positive feedback from clients for shorter execution and delivery times and for the increase of the quality of products.
	SUCCESS FACTORS AND CONSTRAINTS	
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	Special attention must be given to the data collection process and when inputting them into the simulation program. If the data is entered incorrectly, the identified improvement measures (obtained based on knowledge from the simulations) can affect real-life processes in a negative way.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	The advantage of such a solution is that each manufacturing process can be observed palpably, and after simulations, the additional quality instruments provided by the Sigma Flow Modeler program offer the possibility of intervening on areas where bottlenecks and/or problems are identified, which can be improved by reallocation of resources; or by other means.

Element	Guiding questions	Answers
		Moreover, infinite scenarios can be tested without committing any resources for setting up and starting rea-life processes, which translates to minimum risks and reduced costs for managing and maintaining this solution.
Need assessment	What else would be needed in order to improve the impact of the Good practice	Currently, the simulation software offers clues about the areas where improvements can be made, and the end-user is the one that decides what are the conclusions that can be drawn from the simulations and which are the measures that have to be taken. If the solution could offer punctual measures on what to change/ eliminate or reduce from the manufacturing flow it would increase its impact.
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Turbocam Romania, after implementing the measures proposed by the simulation team, was very satisfied with the obtained results, as not only the functioning of processes was improved, but also the workload of personnel was reduced, leading to a positive impact both internally and externally.
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	N/A
	REPLICABILITY AND UP SCALING	
Replicability and further application	How can the solution / good practice be useful for other SMEs?	The solution is readily available to all SMEs, which are open for relying on the computational power of modern

Element	Guiding questions	Answers
		devices and the increased performance of innovative software programs for improving their processes
	What are the possibilities of extending the good practice more widely?	Raising the awareness between SMEs regarding the benefits of simulation software could result in the wide-scale adoption of this solution, as currently only a few companies understand its utility.
	FINAL REMARKS	
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The solution presented in this good practice, through the data obtained from simulations, demonstrated the utility and great benefits of specialized software programs for improving the functioning of processes and optimizing their time and other type of resources necessary for their operation. Turbocam Romania recommends this practice to other SMEs as well, which are preoccupied for objectively (based on empirical data) increasing the performance and functionality of their processes.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	The company describing this good practice doesn't guarantee the successfulness of the solution and can't be held liable for its failure in application. We agree with on-line and printed dissemination of the information from this questionnaire.

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	 Contact person: Eng. Cosmin Ioanes, Phd. Address: Str. Traian Vuia, nr. 212, Cluj-Napoca Phone: +40 364 805 073 E-mail: office@innorobotics.ro Website: www.innorobotics.ro
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	AUTOMATED PRODUCTION LINE WITH INDUSTRIAL ROBOTS FOR MANUFACTURING CARDBOARD PALLETS

Element	Guiding questions	Answers
	Provide a concise description of the good practice being addressed	Our solution regarding the manufacture of cardboard pallets is fully automated and flexible and can be used to manufacture standard pallets or custom special size. Our solution supports Romanian exporters to implement and comply with the International Standards for Phytosanitary Measures No.15 (ISPM 15)
	GOOD PRACTICE DESCRIPTION	
Detailed description	How did the SME create good practice / new product?	Inno Robotics provides to its customers fully automated solutions with industrial robots for various production processes: - loading / unloading parts from mold injection machines, CNCs or presses; - machining of non-metallic and metallic materials, as well as their engraving; - different manufacturing processes: grinding, deburring, gluing - assembling parts from the electronics industry - handling, sorting and transfer of raw materials and processed materials - painting or varnishing - electric arc welding The company has set out to meet the most varied and specific automation needs in the field of production by offering complete services as follows: - Defining the technical solution; - Mechanical and electrical design;

Element	Guiding questions	Answers
		- Software developments for robots and PLCs; - Robot cell assembly; - Validation and testing; - Training; - Warranty and post-warranty services. The automatic cardboard production line has been designed to meet the needs of products exporters and carriers such that they can implement and comply with ISPM 15. The solution is fully reconfigurable and adaptable to the needs of any company and to any existing budget. The line has been fully developed within Inno Robotics and it was implemented at a supplier for a multinational corporation operating in the furniture industry.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	The solution is ~~a~~ completely automated and fits within the smart manufacturing concept. Its integration into any manual and automated manufacturing system is simple and easy, offering flexibility in terms of speed and types of customized assembled pallets.
	Describe what are the technical solutions and innovations: of the good practice	The solution is fully automated and uses 6R robots for the line feed and final product palletizing and Fanuc Delta robots for the bottom feet-frame assembly of the main cardboard pallet. Using these robots, the speed of the pallet assembling is increased as well as the flexibility of the positioning of the cardboard bottom feet-frame.

Element	Guiding questions	Answers
		The automation of the manufacturing process for the cardboard pallets has proved to be a complex project in which various equipment has been introduced: different types of conveyor belts, different robot models, linear axes, grippers adapted to each operation in the process, presses. The first operation for the production of cardboard pallets is completed by a linear axis system provided with a vacuum gripper that picks up the cardboard base to which the pallet's feet are attached and places it on a conveyor. At the same time, a Fanuc serial robot feeds another conveyor belt with cardboard feet frames which, after applying the adhesive paste, are moved by the Delta robots and positioned on the base plate according to a particular pattern. The pallets thus fabricated are transported to a press, and then they are picked up by another Fanuc robot, which palletizes them. The line is much more compact than other solutions for making classic and cardboard pallets.
	Highlights (or keywords) of the Best Practice	Automated production line; Assembling and palletizing; Flexible system; Cardboard products.
	Good practice applied in: (NACE code)	Good practice applied in the field of: C17.2.1 - Manufacture of corrugated paper and paperboard and of containers of paper and paperboard
Benchmarking	How does your solution related to others provided by competitors	The production line combines robots (2x6R and 2x Fanuc Delta robots) with automatic raw material feeding systems. Therefore, in the case of the base cardboard,

Element	Guiding questions	Answers
		an automatic system was chosen, while a 6R robot was mounted for feeding the feet-frames to increase the flexibility of the system. The gluing system is automatic and the arrangement of the feet-frames on the pallet's base plate is completed by two Fanuc Delta robots that offer high work speed, precision and flexibility. The brazing process is completed with a mechanical press, after which the pallets are assembled in stacks according to the model requested by the customer. If the line is directly integrated into the packaging process of the final product, the last 6R robot can be removed. The system may be equipped with a vision system with option for counting for providing real-time data about the manufactured pallets.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	 https://www.youtube.com/watch?v=VOc5RQow86M
OBJECTIVE AND TARGET AUDIENCE		

Element	Guiding questions	Answers
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	The solution can be integrated into a manufacturing process where the products are packaged on cardboard pallets or it can be used as an independent system capable of creating cardboard pallets. The solution can be used in any company at any location. Being a new concept, recently launched on the market, the project was successfully tested and implemented in a Romanian factory.
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Potential customers can be furniture manufacturers, plastic component manufacturers, aluminum element manufacturers, etc.
Targeted customers and scale of use	Select the target group of customers: 41. SMEs (<250 employees) 42. Large companies 43. Public institutions 44. End customer (Business to Customer) Other, please specify: _____	Any type of SME or large enterprise
	METHODOLOGICAL APPROACH	
Managerial aspects	Cost efficiency of the good practice, if applicable	The line has been designed so that its production cost is as low as possible. Therefore, a limited number of robots have been used that have been placed at key points to offer accuracy and flexibility. For the other components, automated mechanical systems have been designed since they are a lot cheaper then robots.
	Quality assurance aspects, if applicable	The entire solution is automatic after the parameters are being defined. Also, the quality of the produced pallets

Element	Guiding questions	Answers
		is constant. Optionally, the gluing system can be equipped with sensors that indicate the lack of glue in the fuel tank and vision system for online inspection of the pallet quality. Considering that the whole process is automated, the quality of the pallets is better than in the case of a manual assembling line with human operators where the quality varies based on the human operators.
	Risk management aspects, if applicable	N/A
Implementation guidelines	How can the Good practice be implemented?	The implementation of the system begins with the establishment of the pallets type that will be created and the dimensions of the components that will be used for their manufacturing. Based on these data, the system, automated components and robots will be customized. Depending on the productivity and system customization, one or two Fanuc Delta robots and 1 or 2 6R robots will be used. After designing the mechanical systems, a layout of the solution is made, and the entire manufacturing process is simulated. The last step is the implementation of the line, this starts with the manufacture and assembling of the components, the mounting of the sensors and the automation of the component systems and the integration of the robots. At the programming and testing stage, the parameters for each pallet type are set, therefore changing the product is done in minutes without too many manual adjustments or attempts.

Element	Guiding questions	Answers
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	Depending on the complexity of the system, the cost may be between € 150,000 and € 300,000 depending if the vision system is integrated or not. Implementation can take between 2 and 4 months, the human resource needed by the beneficiary is about 200-man hours.
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	The validation of the product was carried out both by the manufacturer (Inno Robotics) and the final customer. Products made on the assembly line have been analyses and tested for their quality and strength.
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The beneficiary is a manufacturer of wooden furniture and by installing the line, they have internalized the production process of the cardboard pallets. This internalization has led to customer`s independence from suppliers and offer a lot of flexibility to their packing systems. By being able to produce any type of pallet size, it can save the raw material used in the manufacturing process and it can optimize the way the goods are arranged in trucks by producing pallets that are the right size for their products. Another positive aspect was the elimination of the pallet storage space, the storage space for the raw material needed to create the pallets is three times smaller than the space in which the pallets were stored.
	SUCCESS FACTORS AND CONSTRAINTS	

Element	Guiding questions	Answers
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	From a technical point of view, the limitations of the solution are given by the maximum width of the pallet, the conveyors used for the pallet base plates have a width determined in the design stage and it gives the maximum width of the pallet. Smaller pallets can be manufactured without any constraint. Pallet resistance is correlated with the quality of the cardboard and type of glue that was used. In terms of implementation, the line can be operated and supervised by a single operator. The line uses Fanuc robots but can also be configured with robots from other manufacturers. The line has a cardboard deburring system for the main frame and can produce pallets that are variable in length while the width remains constant.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	The automation, the increased productivity, the constant quality of products and the flexibility are the selling points of this production system.
Need assessment	What else would be needed in order to improve the impact of the Good practice	In the production flow of the cardboard pallets, a pallet base plate cutting system can be integrated and at the end of the process a system that can personalized the cardboard by either painting or applying stickers can be applied.
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	The most important lesson learned is that the most critical stage of implementation is the identification of all

Element	Guiding questions	Answers
		the initial customer requirements. So, if all the details and technical requirements are not set at this stage, the design of the line will be a painful process because every new customer requirements can lead to major changes of the technical design. The training process of the operators that will maintain the line is important and critical especially if they are not familiar with automated and robotic workflows.
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	The sustainability has two aspects in the case of the cardboard line: the replacement of wooden pallets with reclaimed cardboard pallets is an action that contributes to the protection of the environment and has other social and economic implications. From a financial point of view, the sustainability of the line is ensured by the fact that once this investment is made, it will ensure the long-term manufacture of cardboard pallets even if their design will suffer minor changes.
	REPLICABILITY AND UP SCALING	
Replicability and further application	How can the solution / good practice be useful for other SMEs?	The solution can be implemented both individually and jointly by 2-3 SMEs. The solution offers an alternative to the wooden pallets.
	What are the possibilities of extending the good practice more widely?	N/A
	FINAL REMARKS	

Element	Guiding questions	Answers
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The cardboard pallet manufacturing system is fully automated and it can be used in various fields. By implementing it, the costs of purchasing and using classical wooden pallets are reduced. If products are required to be exported in compliance with the ISPM 15, this solution represents a good choice.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	The company describing this good practice doesn't guarantee the successfulness of the solution and can't be held liable for its failure in application. We agree with on-line and printed dissemination of the information from this questionnaire.

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	Company: **MAGIC ENGINEERING S.R.L.** VAT no. RO18337980, reg. no. J08/226/2006 MAGIC ENGINEERING Contact person Attila PAPP – Sales Director **Mugurului, Nr. 4, Ap. 1, OP 2 CP 131** **500047 - Brasov, Romania** 2. Tel: +40 (0)268 337141 3. Fax: +40 (0)268 337149 4. Mobil: +40 (0)745 312868 5. Email: attila.papp@magic-engineering.ro Website: www.magic-engineering.ro
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	**VIRTUAL ENVIRONMENTS TO CREATE SUSTAINABLE INNOVATIONS**
	Provide a concise description of the good practice being addressed	**Operational excellence requires harmony across design, production, distribution, people and processes.** In MAGIC ENGINEERING organization, the innovation is driven by current technological needs coming from various industries: Aerospace & Defence, Transportation & Mobility, Engineering & Construction, Consumer Goods & Retail, Industrial Equipment, High-Tech.

Element	Guiding questions	Answers
		Our software products portfolio, from Dassault Systemes, enables our technical team to transform operations, designing and testing in a simulated production environment. Once completed, our customers that are using our technology can efficiently plan, produce, and manage all resources from staff to production and later to customer delivery.
GOOD PRACTICE DESCRIPTION		
Detailed description	How did the SME create good practice / new product?	In EMSIL SRL, we provide a platform embedding continuous process optimization algorithms, collecting real-time data from the physical production lines linked to the factory's virtual digital 3D model. The company can optimize direct operations through production chain, setting the parameters and production processes, adapting the product to the customer's requirements.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	Our solution is strongly tied with the "Smart Factory" concept, as a collaborative platform technology. With our software solutions the engineers can evaluate the simulation results in the early phase of product creation - shorten and streamline the production cycle, reducing the time-to-market, detecting inefficient settings of the underlying processes. Therefore, the concept of Digital Manufacturing is built on the principle known today as Industry 4.0.

Element	Guiding questions	Answers
	Describe what are the technical solutions and innovations: of the good practice	The digital simulation model of the production line was created in 3DEXPERIENCE platform modelling global production processes. This model was a detailed virtual copy of the physical processes.
	Highlights (or keywords) of the Best Practice	KoBP: digital manufacturing, production optimization, data collection, manufacturing capabilities simulation, material flow, customer feedback in the early stages of product development, delivery just in time
	Good practice applied in : (NACE code)	Manufacture of metal forming machinery (2841)
Benchmarking	How does your solution related to others provided by competitors	Digital Manufacturing drives manufacturing innovation and efficiency by planning, simulating, and modelling global production processes. DELMIA allows manufacturers to virtually experience their entire factory production from the impact of design to determining how to meet global demand. These simulation activities allow manufacturers to better address and shift processes so as to quickly respond to competition, or to take advantage of new market opportunities.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or	All additional information is available on request.

Element	Guiding questions	Answers
	other material about the Good practice implementation (if existing).	
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	The solution was tested in Transylvania region from Romania.
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	We will focus on the Automotive Industry, especially on small medium businesses (SMB).
Targeted customers and scale of use	Select the target group of customers: 45. SMEs (<250 employees) 46. Large companies 47. Public institutions 48. End customer (Business to Customer) Other, please specify	1. SMEs (<250 employees) 2. Large companies
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	From the costs perspective, the solution proved to be highly efficient with a good rate of return on investment (ROI), as it requires minimum intervention after installation/customization, further investments after implementation are not needed – good scalability.
	Quality assurance aspects, if applicable	The solution being developed for the automotive and aerospace industry led to a significant decrease in faulty and non-conforming products reported by customers, which in turn, increased customer satisfaction.

Element	Guiding questions	Answers
	Risk management aspects, if applicable	Managing traceability and impact analysis of requirements across different systems, our solution can manage the risks capturing data from any source (file, database) of any vendor in a wide variety of data and file formats.
Implementation guidelines	How can the Good practice be implemented?	The solution has a high degree of portability and can be adapted to companies operating in various industry branches (https://www.3ds.com/industries/).
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	Dedicated for mid-size SMEs (<250 employees) and big companies, the implementation needs 4 – 5 high skilled internal engineers and IT specialist to support our team during the implementation, the infrastructure costs around 30 KEUR, including databases.
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	The validation process was completed within customer's facility and comprised in the analysis and comparison of the error / scrap rates and the assembly time needed by operators before and after implementation.
RESULTS / IMPACT		
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The impact of the solution was positive, scrap rates were reduced and the assembly time was also reduced.
SUCCESS FACTORS AND CONSTRAINTS		

Element	Guiding questions	Answers
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	The solution being highly scalable, practically we have no limitation on the deployment size. This solution was the first of its kind in Romania, as no any other company made use of this type of practice, especially in its CNC machining and assembly processes with robots. As mentioned previously, direct results of the implementation significantly increased productivity and customer satisfaction was obtained.
Need assessment	What else would be needed in order to improve the impact of the Good practice	The platform returns better results if the input data accuracy is higher and the Robots & CNCs are better documented with technical specifications.
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	The success of the implementation depends on the capability of overcoming the resistance of employees regarding the technological change. The reliability and performance of the system is directly related to the initial investment in mid-level hardware (ENOVIA servers)
SUSTAINABILITY		
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	Currently the price of the solutions can be prohibitive mainly because of hardware infrastructure, however, due to future technological progress, their price will decrease and the cost of next implementations will be reduced.
REPLICABILITY AND UP SCALING		

Element	Guiding questions	Answers
Replicability and further application	How can the solution / good practice be useful for other SMEs?	3DEXPERIENCE software platform can be implemented to a wide range of companies from different industries, without being tied specifically to a certain industry branch. It must be noted, however, that it initially requires a medium financial commitment and the organizational culture should be open to the use of new technologies.
	What are the possibilities of extending the good practice more widely?	The on premise solution is costly because of IT infrastructure, but we can also deliver the cloud based solution, therefore avoiding any investment in servers.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The implementation of these types of solutions increases a company's readiness to adopt the new industrial revolution's principles, promoted in Europe under **Industrie 4.0 (Germany)**
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	The company describing this good practice doesn't guarantee the successfulness of the solution and can't be held liable for its failure in application. We agree with on-line and printed dissemination of the information from this questionnaire.

Croația

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	Company name: Klimaoprema d.d.  Address: Gradna 78a, 10430 Samobor, Croatia Web site: www.klimaoprema.hr E-mail: info@klimaoprema.hr OIB: 34383404032 Business activity: Design, production and service of Ventilation, Air-Conditioning and Cleanroom equipment Contact person: Helena Hrastnik, marketing manager, mobile no. +385913385410, hhrastnik@klimaoprema.hr CEO: Sergio Galošić, mobile no. +385996243860, sgalosic@klimaoprema.hr
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	Production of FIRE DAMPERS. In the production of fire dampers Klimaoprema is using industry 4.0.

Element	Guiding questions	Answers
	Provide a concise description of the good practice being addressed	In the production of fire dampers Klimaoprema is using smart specialization. Production process is divided into phases. Product has a QR code which is read by the camera and gives information on how much time the product has spent in which production phase and which employee was working on it. In this way they detect if and where the error occurred, they analyse the time necessary for production, control the quality, the product and the whole production process in advance.
GOOD PRACTICE DESCRIPTION		
Detailed description	How did the SME create good practice / new product?	Klimaoprema developed new smart production of fire dampers by following customer needs and demands on the new markets.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	Klimaoprema developed new and innovative smart production of fire dampers by using new technologies which created cost effective production processes. Production lines are developed in cooperation between Klimaoprema's engineers and renowned European machinery manufacturers.
	Describe what are the technical solutions and innovations: of the good practice	Technical solutions and innovations in fire dampers production are: light, strong one peace casing, easy

Element	Guiding questions	Answers
		installation, unique fire performance on the market, low pressure drop, damper blade smaller than nominal size – no possible collision with air duct, EI 120S fire resistance at 500 Pa. 
	Highlights (or keywords) of the Best Practice	One peace casing, aerodynamical design, easy installation, low weight.
	Good practice applied in : (NACE code)	C24.3 - Manufacture of other products of first processing of steel C28.2.5 – Manufacture of non-domestic cooling and ventilation equipment

Element	Guiding questions	Answers
Benchmarking	How does your solution related to others provided by competitors	Fire dampers produced in Klimaoprema have unique design, better performance and more efficient production compared to competitors.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	Klimaoprema video 
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Fire dampers are distributed all over the world, but mostly in France. Fire dampers are produced according to EN 15650, tested according to

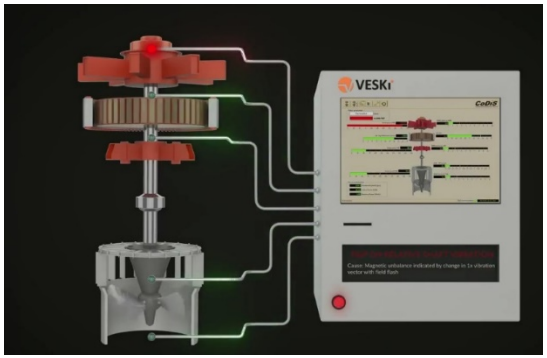
Element	Guiding questions	Answers
		EN 1366-2, classified according to EN 13501-3, have certificate of Constancy of performance and Declaration of constancy of performance according to Regulation (EU) No. 305/2011.
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	The target audience/potential customers are installers, engineering companies and wholesalers.
Targeted customers and scale of use	Select the target group of customers: 49. SMEs (<250 employees) 50. Large companies 51. Public institutions 52. End customer (Business to Customer) Other, please specify	1. SMEs (<250 employees) 2. Large companies 3. Business to Business customers (B2B) 4. Business to Customer customers (B2C)
	METHODOLOGICAL APPROACH	
Managerial aspects	Cost efficiency of the good practice, if applicable	Cost efficiency is secured by large serial production and automated production with minimal no. of employees on the production line.
	Quality assurance aspects, if applicable	Controlled production according to EN 15650 and NF 264.
	Risk management aspects, if applicable	Risk quantification is calculated by looking at the likelihood that a specific risk factor may occur and then

Element	Guiding questions	Answers
		the impact to the organization if it does occur. Risk management is in processes and assets.
Implementation guidelines	How can the Good practice be implemented?	Industry 4.0 is implemented in the production of fire dampers.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	Personnel trained to work in smart factory production and finances to invest and upgrade the production with new technologies and solutions.
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	Validation process is provided by processing large amounts of data in real-time, which prevents errors. Finished product is inspected by quality control manager and gets a signature and mark that it is safe and produced according to standards, norms and guidelines.
RESULTS / IMPACT		
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The impact is positive and reads in exporting fire dampers into new markets, new customers, achieving profit and new employments.
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	Limitations are in computer software to achieve some functionality.

Element	Guiding questions	Answers
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	The biggest selling points are product quality and smart factory production which results in better product performance.
Need assessment	What else would be needed in order to improve the impact of the Good practice	Bigger production space.
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Data processing and implementation of industry 4.0.
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	With industry 4.0 they have achieved production efficiency with less energy consumption.
	REPLICABILITY AND UP SCALING	
Replicability and further application	How can the solution / good practice be useful for other SMEs?	System that they have implemented is applicable to similar production type, semi-automated with manual assembly.
	What are the possibilities of extending the good practice more widely?	This production process can be implemented into other production lines, which is planned for the near future.
	FINAL REMARKS	
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	Data processing and implementation of industry 4.0. has resulted in concurring new markets, export expansion and new customers, new employments and energy efficiency.

Element		Guiding questions	Answers
Disclaimer Acknowledgements	/	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	This information can be disseminated by printing material and online releases.

Element	Guiding questions	Answers
	INTRODUCTION	
	Data identification, logo, contact person, possible representative image(s).	
Company information		Veski d.o.o., Contact person: Ozren Orešković, Managing Director, Oreškovićeva 8j, Zagreb Tel:+385 1 6445 516 Fax:+385 1 3667 155 Mob:+385 91 502 7375 www.veski.hr
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	VESKI d.o.o.
	Provide a concise description of the good practice being addressed	Veski d.o.o. was established in 1990 in Zagreb. Their field of expertise is vibration and on-line advanced machine condition monitoring. Their specialty is also measurement and signal processing. Their services include advanced signal analysis, design, manufacturing and installation of in-house solutions for on-line machine condition monitoring and protection

Element	Guiding questions	Answers
		systems on hydro power plants. This also implies better asset management by the end user. CoDiS On-line monitoring is a product that is developed and suited for future usage within “smart power plants” and is ready for Industry 4.0. Data collection, smart sensors, IoT, and consequently Big Data Analysis is what will be the base of future industry.
GOOD PRACTICE DESCRIPTION		
Detailed description	How did the SME create good practice / new product? What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management? Describe what are the technical solutions and innovations: of the good practice	Constant development of new ideas and implementation of industry trends combined with experience of their founders resulted with good product. They try to implement new ideas using new technologies available. Being a small company gives them a competitive edge in implementing and testing those ideas in real environment so their development and testing process is much shorter than one of large competitors. 

Element	Guiding questions	Answers
		Their solution is based on National Instruments PAC (CompactRIO) technology. It is an open platform that allows them to implement smart and advanced algorithms in pour CoDiS platform, which they use for machine condition prediction. Algorithms include mathematical models of generators that can be used to predict different faults and create failure mode signatures.
Benchmarking	Highlights (or keywords) of the Best Practice	Machine Condition Monitoring, algorithms, Software
	Good practice applied in : (NACE code)	C26.5.1 - Manufacture of instruments and appliances for measuring, testing and navigation.
	How does your solution related to others provided by competitors	Their solution is mostly different as their final product is a hardware (measurement device) that is completely software reconfigurable, meaning it can accommodate any type of signal from any type of sensors installed on hydro generator or in the plant, whereas their competitors have dedicated hardware modules that can't be used for different measurements. That gives them a flexibility to completely custom tailor the solution and implement algorithms dedicated for each machine.

Element	Guiding questions	Answers
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	 Case studies, Application notes, papers: http://veski.hr/index.php?page=library#application-notes Video WEB: www.veski.hr
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Worldwide (HR, BiH, Macedonia, Hungary, Slovenia, USA, Canada, Australia, New Zealand etc…)
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Power plant personnel (maintenance and reliability engineers), Plant owners, Utility owners
Targeted customers and scale of use	Select the target group of customers: 53. SMEs (<250 employees)	1. SMEs (<250 employees) 2. Large companies

Element	Guiding questions	Answers
	54. Large companies 55. Public institutions 56. End customer (Business to Customer)	
	Other, please specify	
	METHODOLOGICAL APPROACH	
Managerial aspects	Cost efficiency of the good practice, if applicable	Their system is used to provide information to plan management which users use to have cost effective maintenance, and to plan the activities. This is proven to save the maintenance costs by 30% and more. But more importantly it makes machines more available for production which can sometimes mean hundreds of thousands of USD and more annually.
	Quality assurance aspects, if applicable	System provides better quality assurance to end user as they have an insight on their machine condition and can act accordingly.
	Risk management aspects, if applicable	Reduces the end-user risk of machine failures and all risk consequently.
Implementation guidelines	How can the Good practice be implemented?	Their products are implemented within the end users power facility. Usually it implies sensor installation, cabeling and instrument installation. In the end Software is configured and installed in the end user's operation centre.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	Skilled personnel (electricians and engineers), planned machine outage.
	VALIDATION PROCESS	

Element	Guiding questions	Answers
Validation	Provide a brief description of the good practice validation process.	Their products are usually validated by end user as a result of more efficient maintenance or as direct savings by early fault detection which stops larger fault from occurring and thus directly saves assets.
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	Using their products, their customers have managed to reduce their maintenance and plan the activities. Also they have helped in preventing the malfunctions by predicting the critical situations and alerting the customer. This has been done automatically from their device.
	SUCCESS FACTORS AND CONSTRAINTS	
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	Their product is very specific and it requires specific skills to be able to implement and use it. Limitations would be inadequate knowledge of end users and consequently their reluctance to implement and embrace new technologies in their day to day activities.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	Key selling points: - Flexibility - End to end solution (complete package all in one) - Custom tailoring of GUI to every end user - Advanced algorithms
Need assessment	What else would be needed in order to improve the impact of the Good practice	More marketing resources to improve visibility. Implementation of AI to improve the software capabilities.
	LESSON LEARNED	

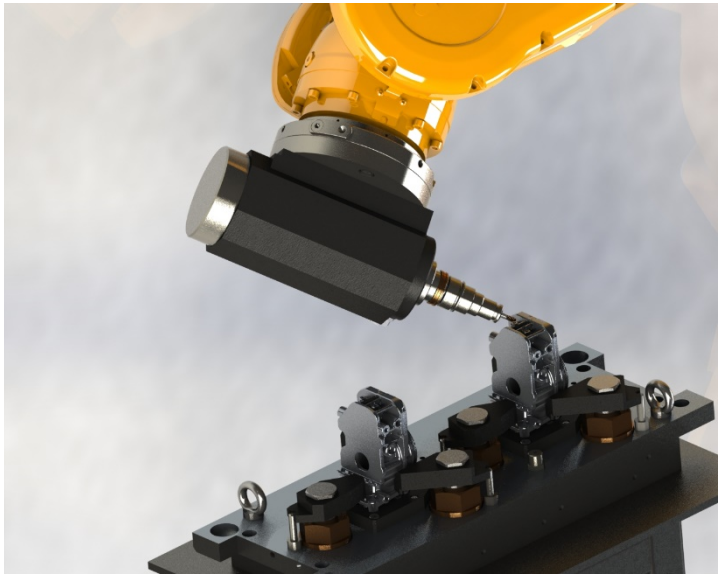
Element	Guiding questions	Answers
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Cooperation and outsourcing of specific sub components is the key to faster results when developing and implementing new ideas.
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	Constant improvements and implementation of cutting edge technologies which keeps you ahead of competitors. Proper and thorough training of every employee, from basic to more advanced subjects.
	REPLICABILITY AND UP SCALING	
Replicability and further application	How can the solution / good practice be useful for other SMEs?	To design and develop new product it is essential to have know-how but also know-why. Other step is to identify uniqueness of product and how it will find its way on the market. Today, in IoT and Industry 4.0, it is impossible to have a standalone product so the key is how to integrate into the big picture and contribute.
	What are the possibilities of extending the good practice more widely?	The product(s) can be used in any type of industry, with modifications applied to target specific demands and challenges.
	FINAL REMARKS	
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	Their products are used for predictive maintenance, asset management and machine protection. The base is on-line data collection, analysis and use of smart algorithms that are able to predict and detect small changes that would point to irregular behaviour.

Element		Guiding questions	Answers
			On hydro machines the biggest challenge is how to integrate signals from various and different parts of machine and how to correlate them properly. With that capability end users can benefit from using and implementing new technologies in maintenance process in many aspects: - Safety – direct impact on safety of asset and people - Costs – cutting unnecessary maintenance costs - Better machine availability – shorten the maintenance period and put machine into more operation – earn more money - Learn more about real machine behaviour in exploitation where different and sometimes unexpected situations occur
Disclaimer Acknowledgements	/	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	This information can be disseminated by printing material and online release.

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	HSTec HIGH SPEED TECHNIQUE Contact person: Kristina Verunica Tel. 00385 23 205 428, fax. 00385 23 205 406, e- mail: kristina.verunica@hstec.hr, web: www.hstec.hr
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	HSTec, High Speed Technique
	Provide a concise description of the good practice being addressed	5. HSTec is specialized in the development, design and manufacture of high speed motorized spindles, direct drives and other high speed technologies, as well as engineering, design and automation of special machine tools and systems.
	GOOD PRACTICE DESCRIPTION	
Detailed description	How did the SME create good practice / new product?	7. The company was founded in 1997 by SAS Zadar, a company specializing in the field of production of special machine tools and the German company Bosch-Rexroth (formerly INDRAMAT), a world famous company in the production of electric drives and control systems.

Element	Guiding questions	Answers
		3. Since it's founding, HSTEC has developed a wide range of motorized spindles and electric drives for direct application in machining centres and machine tools. A flexible team of highly skilled mechanical and electrical engineers with great working experience in development, design and production of special machine tools and implementation of industrial robots offers creative solutions in industrial automation.). HSTec's R&D team is focused on individualized production offering development, design, calculations and optimization, production and assembly of machine tool components according to customer requests. The high standard of product quality control continues after the implementation of the product at the customer, thus managing the product's lifecycle.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	The company incorporates novel technologies in the production processes, such as: - machines for the production of high efficiency and low energy consumption - dynamic sampling of the product lifecycle - incorporation of digital and ICT systems into production processes - lean management guidelines - a high level of product quality assurance and control provided by the strict standards (ISO 9001:2015) and top quality devices and machines - production of smart products with the monitoring sensors and the ability to communicate and network via the monitoring signals

Element	Guiding questions	Answers
		- ERP (Enterprise Resource Planning) integrated management system - HRM includes continuous monitoring and upgrading of the ICT system and overall work environment, continuous investment in education of employees and work tools, such as software and hardware, continuous work evaluation and appropriate awards and/or advancement opportunities, providing additional health insurance - Risk management principles and guidelines are incorporated into management decisions.
	Describe what are the technical solutions and innovations: of the good practice	Technical solutions and innovations arise from the continuous involvement in novel technologies, creating products that are not only innovative, but are also the solution to the unsolved problems in production processes, such as energy efficiency, digital machine networking, implementing solutions in hazardous environment and thus eliminating possible personal injuries in the production process. 

Element	Guiding questions	Answers
	Highlights (or keywords) of the Best Practice	high speed technology, engineering, robotic automation, motor spindle…
	Good practice applied in : (NACE code)	C28.9.1, C28.9.6, C28.9.9
Benchmarking	How does your solution related to others provided by competitors	All innovative technical solutions have been discovered throug the present situation in their environment and in consultations with partners and potential customers. As manufacturer of prototype solutions, in order to remain competitive, they must pay attention to all possible customer requirements and on the global strategy and guidelines for future development, such as Industry 4.0.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	 Awards: Platinum key for continuity in company excellence HSTEC d.d.

Element	Guiding questions	Answers
		(http://www.hstec.hr/novosti/platinasti-kljuc-za-kontinuitet-u-izvrsnosti-tvrtki-hstec-dd/51.html), Annual reward of Zadar County to HSTEC d.d. (http://www.hstec.hr/novosti/godisnja-nagrada-zadarske-zupanije-tvrtki-hstec-dd/49.html), Zlatna kuna 2016 and 2012 for the most successful SME in the Zadar County. Websites: www.hstec.hr (pictures, videos), youtube.com (HSTEC).
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	HSTec is an export oriented company with the following geographical coverage: Germany 50% Croatia 28% Slovenia 10% Austria 5% USA 5% Other countries: 2%
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Target audience and potential customers are companies mainly from the automotive industry, and in a small percentage, glassworks and plastic mould industry.
Targeted customers and scale of use	Select the target group of customers: 57. SMEs (<250 employees) 58. Large companies 59. Public institutions	SMEs, large companies and universities.

Element	Guiding questions	Answers
	60. End customer (Business to Customer)	
	Other, please specify	
	METHODOLOGICAL APPROACH	
Managerial aspects	Cost efficiency of the good practice, if applicable	Investment efficiency, process efficiency, resource and energy consumption efficiency.
	Quality assurance aspects, if applicable	Quality assurance of the product and services, continuous improvement of the product, services and processes, key process indicators of efficiency. However, the main tool for quality assurance is the efficient quality management and awareness of all employees striving to develop the best possible product and service.
	Risk management aspects, if applicable	Risk management aspects such as the strengths, weaknesses, opportunities and threats regarding the future development are incorporated into managerial decisions.
Implementation guidelines	How can the Good practice be implemented?	It can be implemented if all necessary resources are available, however it can depend on the environment (i.e. if the environment is productive and all necessary suppliers are nearby, it can be a very positive start).
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	The resources necessary for implementation are: highly qualified and educated personnel, finance, infrastructure (production plant, top quality production machinery, devices and ICT system, adequate software tools), and timespan of ca. 1 year.
	VALIDATION PROCESS	

Element	Guiding questions	Answers
Validation	Provide a brief description of the good practice validation process.	The good practice has been validated by every satisfied customer. The customer satisfaction survey is being continuously monitored, which is one of the main starting points where products and services are being improved. All products and services are monitored even after the delivery, using the Product Lifecycle Management. Thus they are able to witness the lifespan of products as well as some possible aspects of the product needed to be improved.
RESULTS / IMPACT		
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	Satisfied customers, product improvement, taking part in development of future smart factories by improving their product according to guidelines of Industry 4.0 strategy. Their employees are continuously improving their skills and knowledge, the company's employment rate is continuously rising which is being positively affected on the development of the Zadar County.
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	Limitations are mainly in the ability to find skilled professionals who are willing to work in small towns. The educational system needs to be up-grated so the company continuously invests time and money to improve the level of knowledge of its employees. Limitations are found in the local area, where there is a minor percentage of suppliers, almost all suppliers are located at least 300 km from the company location

Element	Guiding questions	Answers
		(which negatively affects the time management and transportation costs).
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	Their products and services are made according to customer requests and are mainly prototypes. The company's know-how is a great sales point, where they consult their customers on what solution to choose. Their ability to produce only one prototype product for a reasonable price differentiates them from the competing brands that only sell standard products. The company differentiates from other companies in having all the necessary departments on the same location: development and design department, production and assembly department, quality control department, product testing department, logistics department, after sales, service department etc. and thus is able to offer a competitive solution incorporating knowledge, high-quality product, product monitoring and servicing.
Need assessment	What else would be needed in order to improve the impact of the Good practice	More highly qualified and trained personnel, an improved industrial environment where most suppliers would be located and thus easily connected with the company.
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Always strive to be ahead of your competitors by knowledge and quality. Work continuously on improvement of your business processes, resources, personnel, products and services.

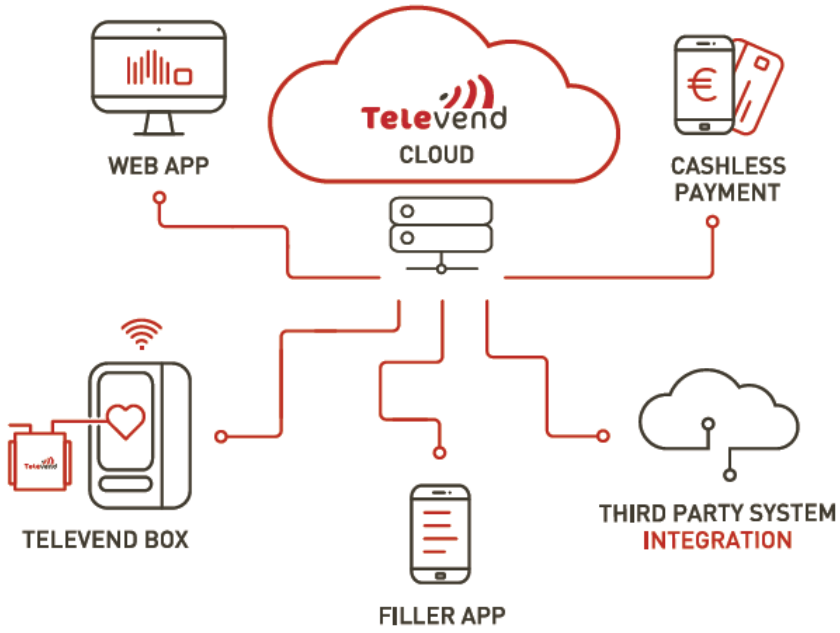
Element	Guiding questions	Answers
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	As mentioned above: *Always strive to be ahead of the competitors by knowledge and quality; Continuous work on improvement of business processes, resources, personnel and products and services.*
	REPLICABILITY AND UP SCALING	
Replicability and further application	How can the solution / good practice be useful for other SMEs?	A good practice can be useful for other SMEs in regard to implementing the solutions for energy efficiency, production efficiency, production process automation by incorporation of digital and ICT systems, HR management and continuous investment in education of employees, risk management that is efficient and prospective and process organization according to lean management principles and guidelines.
	What are the possibilities of extending the good practice more widely?	Opportunities are in growth of companies that have the best practice or merging several companies and thus lead to an increase and spread of the good practice.
	FINAL REMARKS	
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The impact is global and irreversible: future demands are based not only on automation of processes and products, but also on digitalisation and implementation of monitoring sensors in order to communicate throughout the network of production machines and between several smart factories.

Element	Guiding questions	Answers
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	This information can be disseminated by printing material and online release.

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	INTIS d.o.o. Contact person: Vilim Lončar Bani 73A, 10010 Zagreb tel: +385 1 7890-855 mob: +385 98 412-616 fax: +385 1 7890-888 vilim.loncar@intis.hr www.intis.hr 

Element	Guiding questions	Answers
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	Televend logo - the IoT product of INTIS for online monitoring of vending machines. **Televend Smart Vending**
	Provide a concise description of the good practice being addressed	Televend Smart Vending platform is a unique combination of Hardware and Software products which organize and optimize daily business in vending operator company. It is the most important and most useful technical improvement in the last ten years in vending industry. There is no need for investment in huge software modules and there is no need for internal IT specialists: powerful platform is in the Cloud. It is real proof that 4th Industrial revolution hasstarted. Platform consists of: 20. Televend Box which is inserted in the vending machine and communicates via GSM with the Cloud 21. Televend Cloud which supports vending operator's daily business using real time data 22. Televend Mobil App which supports fillers and technicians on their daily tasks 23. Televend Virtual bank which allows consumers to close loop payment and marketing actions 24. T- Wallet Mobil App – consumers application for cashless payment via Smartphone

Element	Guiding questions	Answers



The company's goal is to have complete centralization of production and development since their IoT product Televend consists of complex hardware and software components that are closely related.
In the schematics of their system it is visible that every development on a hardware installed into the vending machine is connected to the cloud solutions.

Element	Guiding questions	Answers
		By keeping the production and design of their hardware and software development both in house, they are: 1. Deeply integrating software and hardware with engineering and team cooperation making them more flexible and competitive on the market 2. Ensuring massive cost efficiency as they assemble a product by acquiring key components in house – their short term goal is also to bring in house electronic boards production which they plan to invest in very soon.
GOOD PRACTICE DESCRIPTION		
Detailed description	How did the SME create good practice / new product?	They have combined many different technologies to be able to deliver a versatile and useful solution for a very challenging market. TELEVEND CLOUD is central point of modern Smart Vending Company. It is a powerful platform which could completely change vending operator business model, guiding company in the most optimal way. Benefits of TELEVEND Smart Vending concept are unbelievable. It will suggest exactly what is the most optimal way how to organize tomorrow's actions, saving time and money. All is based on real time data and historical based predictions, using advanced mathematical algorithms and methods. Connected machines are all controlled from one centre which allowes them to make optimal decisions. This allows them to react immediately in case of an error on any machine. It allows them to provide top precise cash collection up to last cent. Reports are on daily bases showing Key Performance Indicators of any machine in real time. Dynamic planogram management will adjust every machine to best performing product choice. Expiry date management will take care of product usability proposing to move short lasting product to "faster" machines.

Element	Guiding questions	Answers
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	Experienced engineers, who have been working on the complex projects in industrial automation, were assigned to design a robust hardware with GSM Internet connection which connects to a vending machine along with an efficient assembly line. It was crucial to find reliable suppliers flexible to support highly growing demands of a new product and to keep the development in house in order to quickly react to new requirements from various customers as there are many vending machine types and many different requests to tackle in the industry. Novel technology – the product is a state of the art IoT, Industry 4.0. example. The complex infrastructure in which hardware, associated with a vending machine is bidirectional communicating in real-time with the cloud web and mobile applications. Production processes – Every coffee vending machine is a small factory. Televend Cloud vending operators are able to predict the need of a visit to a vending machine which is a highest single logistical cost for the operator. Quality assurance – every software development of complex web and mobile application goes to deep testing of their Q&A team. They also have a special team working on the testing of the firmware made to work with various vending machines. They have in house developed testing units for each electronic board. Risk Management & cost efficiency– they have a specialized procuring department taking care of ensuring enough stock of critical components and also constantly evaluating suppliers and watching the movement on market which is critical for optimal pricing.

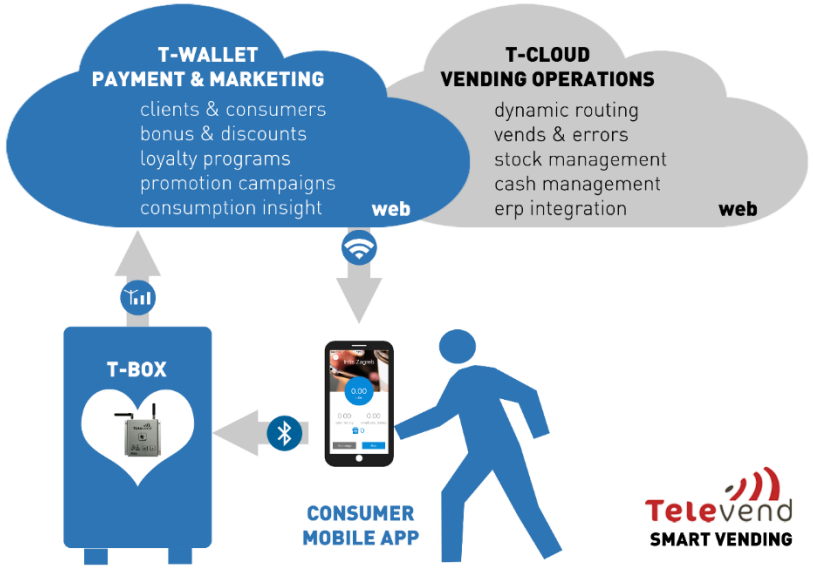
Element	Guiding questions	Answers
	Describe what are the technical solutions and innovations: of the good practice	 T-BOX is a small device installed into old and new vending machines. It collects all useful data from the machine and payment systems including sales, cash details and errors, and sends it in real time to the cloud. T-CLOUD gives online control of vending machines network in real time - sales and stock data, cashflow data, machine and payment system errors and remote machine settings. T-CLOUD also includes a mobile application

Element	Guiding questions	Answers
		for refill operators and servicers making their daily routine more productive. T-WALLET is a closed loop mobile app for customers allowing quick payment with a smartphone on machines, using only QR code or Bluetooth. It Interacts with customers and creates customized marketing and loyalty programs. SMART ROUTING ALGORITHM helps drastically reduce the number of visits and to optimize a planogram. T-CLOUD enables creation of daily routes based on a smart mathematical model which helps to prioritize the visits. A flexible routing model allows you to choose between pre-kitting model, or live routing with mobile app based on real time stock levels from all your machines. GEO ROUTING - optimal routes are calculated and visualized on the map, along with the time necessary to visit all machines, making daily route planning very fast and smart. Fillers get the sequence of visits shown on a map, so they can easily navigate through the intended route. Product list and machine tasks communicate on each machine. CASHFLOW REPORT provides an exact information on how much money is left in each tube/BNA in the machine. It also gives information on how much is sold using cash/cashless system and how much was topped up to

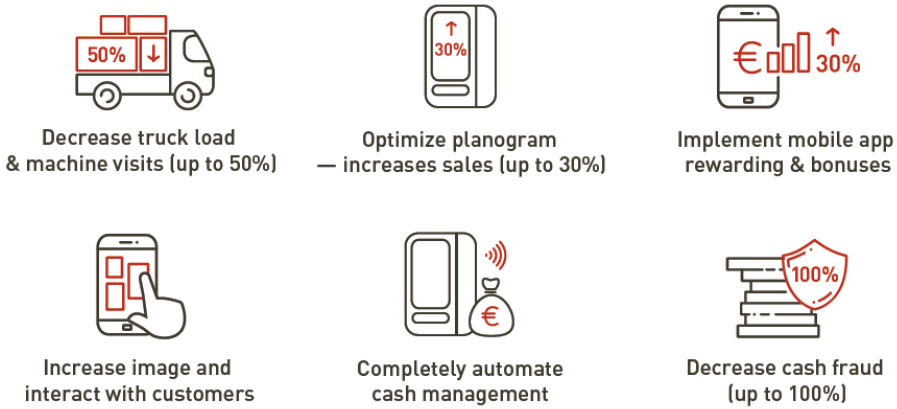
Element	Guiding questions	Answers
		cashless devices. The most important info is how much money does the filler needs till the centre and how much money he needs to bring to machines if the tubes are empty. CASH CONFORMITY Televend Cloud is connected to the counting machine enabling cash conformity analysis and complete automation of cash handing. Fillers scan the barcode on the cash bag using Televend Mobile App. Cash bags are brought to the counting machine.
	Highlights (or keywords) of the Best Practice	Smart Vending, IoT Showcase, State of the art Industry 4.0. product, Real time vends & events • Real time cash Planogram analysis • Pre-kitting • Live routing Geo routing • Cash conformity • Machine urgency Rewarding schemes • Rule editor • Customer mobile app Service mobile app • Loyalty programs • Vending academy Prediction algorithm • Expiry date management Report builder • Erp integration api • Virtual eva dts Age verification • Offline machine management
	Good practice applied in : (NACE code)	J62 - Computer programming, consultancy and related activities J62.0 - Computer programming, consultancy and related activities J62.0.1 - Computer programming activities J62.0.2 - Computer consultancy activities

Element	Guiding questions	Answers
		J63 - Information service activities J63.1 - Data processing, hosting and related activities; web portals J63.1.1 - Data processing, hosting and related activities J63.1.2 - Web portals J58.2 - Software publishing C26 - Manufacture of computer, electronic and optical products C27.3.2 - Manufacture of other electronic and electric wires and cables J61 - Telecommunications J61.1 - Wired telecommunications activities J61.1.0 - Wired telecommunications activities J61.2 - Wireless telecommunications activities
Benchmarking	How does your solution related to others provided by competitors	The solution includes a highly versatile and rounded up product for Vending machines management including hardware, web application, staff mobile app, mobile app for end customers, cashless payment, ERP integration. Unsignificant number of competitors offer such flexibility as a product coming from a single source company.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other	https://televend.eu/ https://www.facebook.com/televend/ https://www.youtube.com/watch?v=sHUdQkwjSnc&t=190s Intis is a member of the biggest vending association in Europe – EVA. Televend is actively present and exists on the biggest EU vending fairs for already four consecutive years – EU Vend Koln, Venditalia Milano. Also they present on Evex, Vendiberica (spain), UK vending fair etc.

Element	Guiding questions	Answers
	material about the Good practice implementation (if existing).	Televend Wallet is mobile payment and marketing solution tailored for vending. End consumers use mobile application to pay or recharge with just simple tap of mobile on vending machine. Vending operators use web application to track consumer payments, feedbacks and activities in real time and create loyalty and rewarding programs. Operators can configure mobile application “look and feel” and that way create their own vending payment service. Solution is based on Televend Box hardware which provides vending operators with most advanced Smart Vending Operations features to optimize and improve their daily business. One hardware, two solutions.



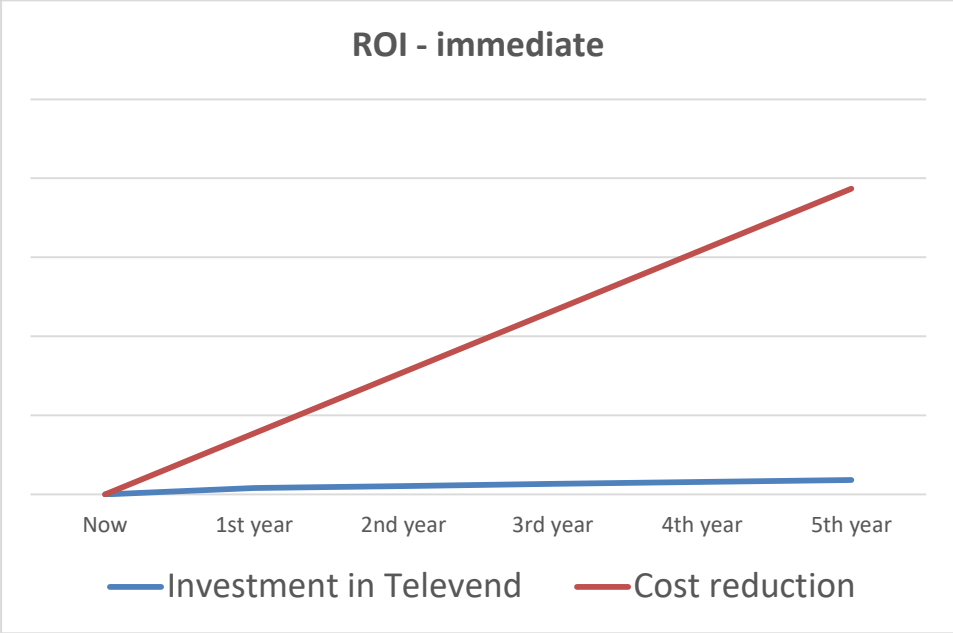
Element	Guiding questions	Answers
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	The product is designed and produced in our headquarters in Zagreb, Croatia. The product is sold in more than 40 countries in EU, and distributed by specialized partners from Germany, Austria, Spain, Portugal, UK, Slovenia, Hungary.
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Their customers are the biggest vending operators in EU and vending machine producers.
Targeted customers and scale of use	Select the target group of customers: 61. SMEs (<250 employees) 62. Large companies 63. Public institutions 64. End customer (Business to Customer) Other, please specify	SMEs and Large companies Also, their product enables their customers to communicate with End Consumers (4) through Televend Wallet mobile application.
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	The key driver of the solution is exactly to increase logistical efficiency of the vending operator:

Element	Guiding questions	Answers
		
	Quality assurance aspects, if applicable	All software and hardware components are tested by their QA team and product possess all quality certificates which ensures sales on the global market.
	Risk management aspects, if applicable	N/A
Implementation guidelines	How can the Good practice be implemented?	Solution is implemented by their key account managers who work closely with the clients, educating them on the software and hardware implementation, and they also have customer support in daily communication with the customers.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	The team for this project is consisted of 50 people working in following departments: • cloud development team • basic infrastructure development team • It system support • mobile app dev team • firmware development team • hardware development team

Element	Guiding questions	Answers
		• wallet dev team • testers team, • product management team , • customer support team, • production management • sales • procurement, • QA team • management
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	Every development is done according to the best development practice. After every development cycle, QA team is responsible that improvements and new developments are delivered to the customers.
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	Case studies show massive improvement in cost efficiency of vending operators in many areas. Following table shows a measured case study with one customer who owns 3200 vending machines whit a solution for all mentioned areas which proved that following savings are possible. *Recalculation on 3200 machines during a 6-month period (230 snack & cold drink machines and 3 fillings)*

Reason	**Annual cost**
Unnecessary visits	2.030.191,30 EUR

Element	Guiding questions	Answers	
		Expired products	85.176,57 EUR
		Working capital cost	24.192,00 EUR
		Failed vend	378.657,39 EUR
		Price incorrect	10.685,22 EUR
		Cashless malfunction	584.000,00 EUR
		Coin changer fail	467.200,00 EUR
		Planogram	583.680,00 EUR
		Total:	**4.163.781,91 EUR**

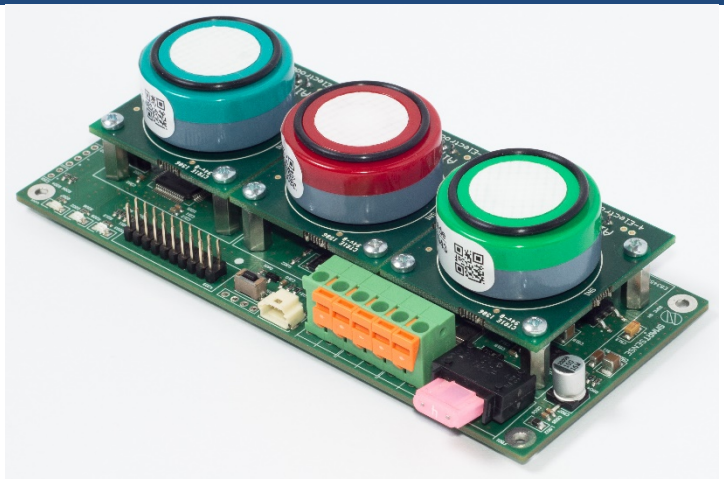
Element	Guiding questions	Answers
		

SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	Compatibility is one of the main challenges on the market with almost thousand different machine types. Different communication protocols are required: EXECUTIVE, MDB, BDV, EVA DTS, CSI etc. Low cost and industrial design are needed as much as an easy installation. There are also a lot of requirements for small electronic devices. Other biggest challenge is a slow speed of implementation with most important customers and a lot of need for employees education.
	Selling points – list the real or perceived benefit of a good practice that differentiates	• Real time sales and stock level monitoring • Real time errors & event lists – alarm management

Element	Guiding questions	Answers
	it from the competing brands and gives its client a logical reason to prefer it over other brands	• Cash collection management • Smart Route optimization – by urgency factor calculation • Expiry date management • Dynamic planogram analysis & optimal product placements • Rentability analysis - per machine, customer, product... • User role based concept – restrictions on widgets per users • Reporting editor with detailed filtering and export possibilities • Remote configuration • third party systems data integration • One devicewhich is cashless at the same time • Cashless payment and virtual bank
Need assessment	What else would be needed in order to improve the impact of the Good practice	Creation of Smart Vending Academy for distributors and vending operators educatation.
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Big customers are key for success. It is important to be very carefull with filtering all of the development requests – there are many customers and many different requirements. Listening to all of them at once would be impossible, but we need to prioritize development with extreme care.
SUSTAINABILITY		
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	Monthly fee per connected machine is the key to the long term sustainability of the product.
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	Besides key selling points and their customer benefits, a positive market response is beneficial to many suppliers, as the company has many different hardware components for assembly and often assigns different technology consultants.

Element	Guiding questions	Answers
	What are the possibilities of extending the good practice more widely?	Present the product on global market – not only EU. This requires a lot of effort in establishing a worldwide distribution and partner networking.
	FINAL REMARKS	
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	In recent years, the most important change in the sales industry has occurred. Industry 4.0 or IoT (Internet of Things) is at the door. In a short time all machines will become points on Internet, what will open a completely new page in our sector. Vending sector will become "smarter" and activities of vending operators will become optimized and coordinated. Old term "telemetry" is outdated. Transmitting of data from vending machines is not enough. New term is - Smart Vending which is based on smart bidirectional communication between vending machines and business intelligence in the Cloud. It brings unimagined possibilities and new business models in vending. It will change this sector completely - like Interned did in other sectors.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	This information can be disseminated by printing material and online release.

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	SMART SENSE d.o.o. Hana Matanović, CEO Zagrebačka cesta 145a 10000 Zagreb Tel:+38599 4441918, 01/ 558 4284 e-mail: hana.matanovic@smart-sense.hr www.smart-sense.hr
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	Smart Sense – Smart City AirQ Environmental Monitoring System
	Provide a concise description of the good practice being addressed	Station for air quality monitoring (Smart Sense AirQ) is based on flexible Smart Sense platform, making it suitable for deployment in various measurement applications. This platform can be upgraded with different sensor technologies and it can implement different communication protocols.

Element	Guiding questions	Answers
		

System enables remote control, monitoring and configuration of AirQ system and OTA software upgrades managed by Smart Sense server.

Monitoring station uses very sensitive electrochemical gas sensors. Each gas sensor is factory calibrated and lasts for up to 24 months, depending on air pollution. Gas sensors can be easily exchanged on the field without a need for deinstallation of monitoring station.

For monitoring particles, the laser optical sensing modules is used.

GOOD PRACTICE DESCRIPTION

Element	Guiding questions	Answers
Detailed description	How did the SME create good practice / new product?	Smart Sense is a Croatian IT company consisting of both tech magicians and business savants, on a mission of closing the gap between physical and cyber world with innovative state-of-the-art IoT solutions. Their strong suit is Smart sensor development with a main interests in a Smart Home and Smart City solutions, infrastructure and human body monitoring. Their ultimate goal is to enable a more delightful everyday life for the end users so they can relax and enjoy the Smart sense complete home/life solutions. Their focus of interest is Internet of Things, the idea of techtopia where all things around us are connected, communicating and working in perfect harmony. This task is distant, expensive and not easily achievable so for this purpose only, they write their own software, create their own hardware and tread bravely towards the interconnected reality and the Holy Grail of networking: The Internet of Everything. Smart Sense core team has successfully implemented numerous projects in cooperation with industry and Faculty of electrical engineering and computing within EU framework program.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	Novel technology, production processes, quality assurance

Element	Guiding questions	Answers
Benchmarking	Describe what are the technical solutions and innovations: of the good practice	Smart City AirQ monitoring station collects data and sends data to Smart Sense cloud server. Server application (Smart Sense AirQ central cloud application) collects, analyses and saves measuring data and according to customer request presents them through AirQ WEB application. On the other hand, server application enables control and configuration of AirQ station. AirQ station can be configured to send data not only to Smart Sense cloud server but also to any other IoT system. Software platform can be extended in a way to be able to support all current and future application protocols.
	Highlights (or keywords) of the Best Practice	Smart Sense – Smart City AirQ Environmental Monitoring System
	Good practice applied in : (NACE code)	J62.0.9.
	How does your solution related to others provided by competitors	Comparing to competitors, their solution uses European standard for presenting air pollution in the area (CAQI-Common Air quality index). Therefore they are monitoring five types of gases and three types of particles which are important for calculation of AQI. These gases have been validated in cooperation with Andrija Štampar Teaching Institute of Public Health which differentiate the company from their competitors and brings them additional value in monitoring air quality.Solution is white labelled.

Element	Guiding questions	Answers
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	White papers: 171108-TR-AirQ_Triggers_benefits_action.pdf 171109-HM-Smart Sense_Smart City AirQ.pdf Technical data sheet: DS-AQ170413-04.pdf Video: https://www.youtube.com/watch?v=EeBM_cvT7jI&feature=youtu.be (Smart City Bonn – video by Deutsche Telekom)
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	References: - Smart City pilot project in Dubrovnik, Croatia - Andrija Stampar Teaching Institute of Public Health, Zagreb - Smart City pilot project in Bonn - Baud Telecom Company – Riyadh - Croatian Telecom – Zagreb - Smart City Koprivnica, Croatia - OTE group, Chalkida, Greece
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Target stakeholders: Smart Sense is using service provider (Deutsche Telekom, Croatian Telekom, Nokia, Huawei, Ericsson,

Element	Guiding questions	Answers
		…) sales and marketing strength to sell Smart Sense – Smart City AirQ Environmental Monitoring System. Target audiences are Smart Cities and various city institutions using air quality data.
Targeted customers and scale of use	Select the target group of customers: 65. SMEs (<250 employees) 66. Large companies 67. Public institutions 68. End customer (Business to Customer) Other, please specify	Target group of customers are Public institutions through service provider sales channel.
	METHODOLOGICAL APPROACH	
Managerial aspects	Cost efficiency of the good practice, if applicable	N/A
	Quality assurance aspects, if applicable	N/A
	Risk management aspects, if applicable	N/A
Implementation guidelines	How can the Good practice be implemented?	By making initial business research regarding market potential and product development, by using processes that have been effective in previous projects, using qualitative materials and components used in product development and reliable partners who can help them in development and production processes.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	HW, SW and business experts, financial support, infrastructure, reliable production partners.
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	Good practice is validated by the result of product research and development which is AirQ solution created within certain time, money and scope with

Element	Guiding questions	Answers
		developed all upfront defined functionalities. This solution is tested and verified before commercializing.
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	**Benefits:** Instead of buying very expensive fixed measurement stations (around 150.000-200.000 EUR), according to EU directive 2008/50/EC, Cities are allowed to supplement existing fix measurements with indicative measurements. This enables them to cut down costs and to get better overview of air quality around the City. Collected data (Indicative measurements) can be shared/sold to health and environment agencies who can then use this data for making modelling techniques, air quality assessment throughout the city and air quality predictions. Better overview of City air quality provides health and environmental agencies with exact information on worst pollutants on certain locations. Action plan based on this information can help Cities in reducing air pollution on critical points to a level acceptable for living. This would directly cut off medical and economic costs. Places with good air quality can put this information on a display and make it available to citizens and tourists,

Element	Guiding questions	Answers
		especially on places like National parks, City centre, Beaches… Better overview of air quality enables better traffic management, e.g. redirect traffic in order to reduce air pollution on critical points, avoid closing whole City centre for cars because of the lack of relevant information on air quality. **Actions:** Real-time traffic surveillance and control – i.e. dynamically modifying speed limit, traffic light period or closing off critical areas for general traffic. Real time pollution incident detection and location, identification of safe evacuation routes, precise alarming. Conduct pollution characterization research – long term improvement actions. Comprehensive pollution maps, influence travel advice, weather forecasts for joggers, children and sensitive population.

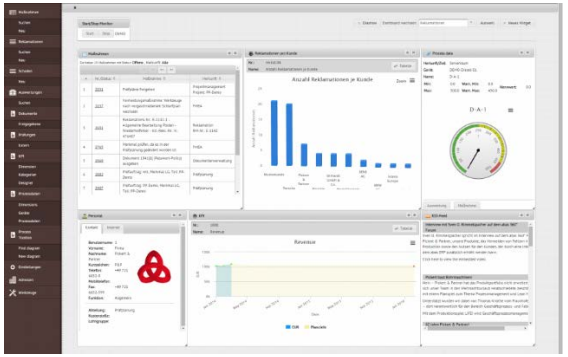
Element	Guiding questions	Answers
		Parking management and pricing depending on air pollution; e.g. bigger prices for parking in the centre of town when pollution is rising.
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	Big development and production costs; limited number of suppliers who are critical for production process; no local presents outside of Croatia Smart Sense – Smart City AirQ Environmental Monitoring System best-selling points are: Collaboration with Andrija Stampar Teaching Institute of Public Health in Croatia in validating Smart Sense AirQ Monitoring Station data with professional environmental station data. Solutions is “white-label” conceived, so service providers could sell it as their own. Easy scaling and adjustments to customer requirements.
Need assessment	What else would be needed in order to improve the impact of the Good practice	Employee education, larger production series, more field tests in different environments. Using benefits of Smart Sense – Smart City AirQ Environmental Monitoring System, and taking actions like: - Real-time traffic surveillance and control

Element	Guiding questions	Answers
		- Real time pollution incident detection and location - Conduct pollution characterization research - Comprehensive pollution maps - Parking management
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Each development process and solution is unique and you have to adjust certain parts of good practice to a specific element of each project.
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	By each development process, they are improving Good practice and are adjusting this good practice to their needs, in that context good practise will be used in future development processes and further in putting their solutions on the market and selling them to end customers.
	REPLICABILITY AND UP SCALING	
Replicability and further application	How can the solution / good practice be useful for other SMEs?	Using data from Smart Sense – Smart City AirQ Environmental Monitoring System other SME could develop new solutions for: - Real-time traffic surveillance and control - Real time pollution incident detection and location - Conduct pollution characterization research - Comprehensive pollution maps - Parking management
	What are the possibilities of extending the good practice more widely?	Wider Smart City Initiatives and approach to other service provider in Smart City Initiatives worldwide

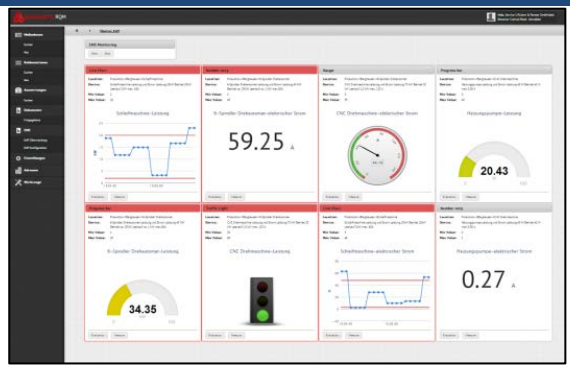
Element	Guiding questions	Answers
	FINAL REMARKS	
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	Smart Sense – Smart City AirQ Environmental Monitoring System: - Promote City as a place to live in - Promote City as a tourist destination - Help in problems with traffic management and regulations - Ensures better model for Air Quality index in urban area
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	This information can be disseminated by printing material and online release.

Germany

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	 Pickert & Partner GmbH Händelstraße 10, 76327 Pfinztal, Germany Tel.: +49 721/66520 www.pickert.de info@pickert.de Contact Person: Sven O. Rimmelspacher Sven.rimmelspacher@pickert.de
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice Provide a concise description of the good practice being addressed	Industry Cockpit CHARM The industrial cockpit RQM. CHARM is an easy-to-use tool for individual and dynamic cockpits to monitor production, reaction and alerting in real time as well as for decision support.
	GOOD PRACTICE DESCRIPTION	
Detailed description	How did the SME create good practice / new product? What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management? Describe what are the technical solutions and innovations: of the good practice	Production process, cost efficiency The technical solution is that the data, which are important during production, can be clearly displayed

Element	Guiding questions	Answers
		with CHARM. The innovation is that all data is displayed in a bundled form, thus saving unnecessary searching.
	Highlights (or keywords) of the Best Practice	Industry cockpit
	Good practice applied in : (NACE code)	C26 – Manufacture of computer, electronic and optical products
Benchmarking	How does your solution related to others provided by competitors	This is the only tool that bundles these parts. Other technologies also represent cockpits. However, they do not display exactly the same tools.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	

Element	Guiding questions	Answers



source: http://www.pickert.de/caq-mes/information/industriecockpit-charm/

A mobile version is available, too.

OBJECTIVE AND TARGET AUDIENCE

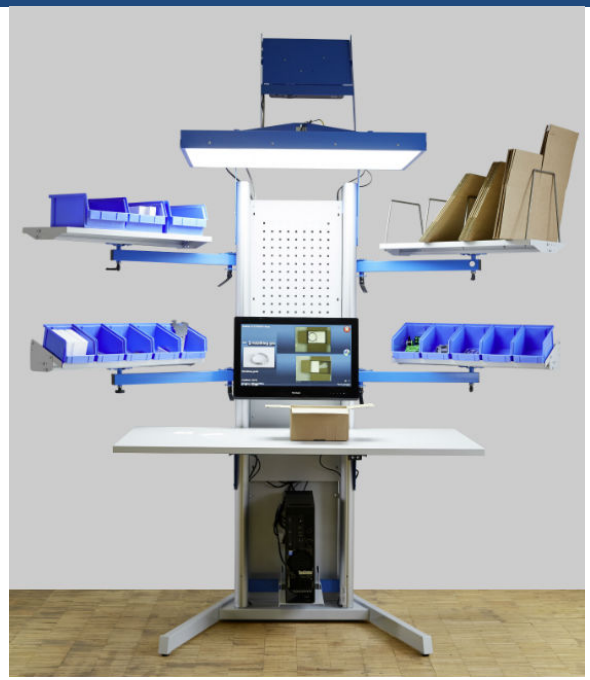
Element	Guiding questions	Answers
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	CHARME was tested at the Pickert & Partner GmbH and at the Industrial Automation Show 2017, too.
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	For all companies that have a high amount of data and want to show each employee the data that is relevant for him/her with regard to the order being processed.
Targeted customers and scale of use	Select the target group of customers: 69. SMEs (<250 employees) 70. Large companies 71. Public institutions 72. End customer (Business to Customer) Other, please specify	SMEs (<250 employees), large companies
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	From the costs perspective, the solution proved to be highly efficient, as it requires minimum intervention (only for initial commissioning, maintenance and software updates) and further investments after implementation are not needed, except in the case of training newly employed operators.
	Quality assurance aspects, if applicable	The employee receives information for the process and thus reduces the susceptibility to errors. The solution led to a significant decrease in the number of faulty and defective products reported by customers, which in turn increased customer satisfaction.
	Risk management aspects, if applicable	

Element	Guiding questions	Answers
Implementation guidelines	How can the Good practice be implemented?	The implementation is simple through standardization and the use of plugins. A step-by-step demand-oriented expansion is possible through the approach configuration instead of programming.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	At the start, capital is needed to install the new technologies.
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	The validation process compares the time it takes to get the necessary information with CHARM, with the time it takes without getting the plug-in to get the information it needs.
RESULTS / IMPACT		
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	Employees save valuable time by seeing all important information instantly without having to search for it. Unimportant information is also hidden.
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	A technical limitation is that the plug-ins must be updated regularly. The hardware must also be kept up to date.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	As already mentioned, CHARME supports the worker with exactly the information that is important for him. These vary from person to person and from order to order. This ability to provide the right information to the right person at the right time is one of CHARME's most important tasks.
Need assessment	What else would be needed in order to improve the impact of the Good practice	

Element	Guiding questions	Answers
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	This program is something new that many employees have to arrange with, because they are not used to this kind of information provision.
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	This good practice saves resources, as all information is displayed on the screen and therefore no printed documentation is required.
	REPLICABILITY AND UP SCALING	
Replicability and further application	How can the solution / good practice be useful for other SMEs?	This solution can be implemented for a wide range of companies without any industry-specific ties. It should be noted, however, that it requires a financial commitment and that the organisational culture should be open to the use of new technologies.
	What are the possibilities of extending the good practice more widely?	The system is currently undergoing further development in order to provide guided support even for more complex tasks.
	FINAL REMARKS	
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The solution requires a financial commitment at the beginning, but the new technology can save a lot of time and effort. This makes it worthwhile for companies with a huge amount of information.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	The company describing this good practice doesn't guarantee the successfulness of the solution and can't be held liable for its failure in application.

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	OPTIMUM datamanagement solutions Hirschstraße 12-14, 76133 Karlsruhe, Germany Tel.: +49 (0) 721 / 5704495-0 https://www.optimum-gmbh.de/ info@optimum-gmbh.de contact person: Wolfgang Mahanty Tel.: +49 (0) 721 / 570 44 95-0
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice Provide a concise description of the good practice being addressed	“der schlaue Klaus” – “the smart Klaus” The intelligent database supported image processing software "Smart Klaus" was developed as an assistance system that offers a perfect solution to these challenges. Where RFID and barcodes reach their limits, industrial image recognition plays to its strengths along the entire supply chain - sometimes in combination with existing systems - or can even replace them with intelligent feature recognition.
	GOOD PRACTICE DESCRIPTION	
Detailed description	How did the SME create good practice / new product?	

Element	Guiding questions	Answers
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	The production process is thus facilitated
	Describe what are the technical solutions and innovations: of the good practice	One or more cameras record the passing products. The software checks the image for certain characteristics. Intelligent algorithms then recognize distinctive points and compare them with the database. On the basis of the stored characteristics, the "Clever Klaus" now identifies and checks the products. If the system detects an error, the "Clever Klaus" outputs a signal in the form of a tone or screen hint. The employee receives a note.
	Highlights (or keywords) of the Best Practice	Intelligent image processing for industry 4.0
	Good practice applied in : (NACE code)	C28.2.3 Manufacture of office machinery and equipment (except computers and peripheral equipment)
Benchmarking	How does your solution related to others provided by competitors	There are similar solutions which, like the clever Klaus, support the worker. However, they all have other advantages and disadvantages. But smart Klaus is the solution with the most functions and the best development.

Element	Guiding questions	Answers
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	 Source: https://www.handling.de/2--handhabung-und-montage-optimum.htm Award "100 Orte für Industrie 4.0 in Baden-Württemberg"
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	It was tested at the OPTIMUM GmbH

Element	Guiding questions	Answers
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	The solution can also be used by other companies that are willing to integrate image processing into their manufacturing processes, especially those that have staff involved in the assembly of products. The practice has a high degree of portability and can be adapted to companies in various industries.
Targeted customers and scale of use	Select the target group of customers: 73. SMEs (<250 employees) 74. Large companies 75. Public institutions 76. End customer (Business to Customer) Other, please specify	SMEs (<250 employees) and large companies
	METHODOLOGICAL APPROACH	
Managerial aspects	Cost efficiency of the good practice, if applicable	From the costs perspective, the solution proved to be highly efficient, as it requires minimum intervention (only for maintenance and software updates) and further investments after implementation are not needed, except in the case of training newly employed operators.
	Quality assurance aspects, if applicable	The employee receives information for the process and thus reduces the susceptibility to errors. The solution led to a significant decrease in the number of faulty and defective products reported by customers, which in turn increased customer satisfaction.
	Risk management aspects, if applicable	

Element	Guiding questions	Answers
Implementation guidelines	How can the Good practice be implemented?	OPTIMUM integrates the “smart Klaus” into the existing system and process. Depending on the customer's requirements, it is equipped with one or more cameras, a computer with individually adapted software and database management. A lighting unit ensures consistent measurement results.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	The companies need capital to integrate the new technologies.
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	The validation process compares the manufacturing time before and after the implementation
RESULTS / IMPACT		
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The solution has a positive effect for employees and the companies. The employees can fix their mistakes immediately as soon as they made it. It also makes their work easier by giving them instructions on what to do and this saves them time, what results in less cost for the companies.
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	The system must have a certain technical state of art, otherwise the implementation is only possible with great effort or not at all.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	As mentioned previously, as direct results of the implementation significantly increased productivity and customer satisfaction were obtained.

Element	Guiding questions	Answers
		Operators also welcomed this technology as it made their activities easier, faster and “worker-friendly”.
Need assessment	What else would be needed in order to improve the impact of the Good practice	
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Human-machine interaction is very important and should be developed further, as this is an important point of Industry 4.0. The more people are confronted with it, the more acceptance increases. The “smart Klaus” can not only support you directly in the production process, but also in goods receipt, returns, quality assurance, order picking and goods issue.
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	At the moment the price of new technology is high, but in the future the price will decrease, so that it is really pays off.
	REPLICABILITY AND UP SCALING	
Replicability and further application	How can the solution / good practice be useful for other SMEs?	This solution can be implemented to a wide range of companies, without being tied specifically to a certain industry branch. It must be noted, however, that it initially requires a financial commitment and the organizational culture should be open to the use of new technologies.
	What are the possibilities of extending the good practice more widely?	The system is currently undergoing further development to provide guided support for even more complex tasks.

Element	Guiding questions	Answers
	FINAL REMARKS	
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The solution requires a financial commitment, but compared to the advantages it offers (increase in productivity, increase in customer satisfaction, reduction of assembly time, reduction of errors, and more efficient operation), it is worthwhile for companies.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	The company describing this good practice doesn't guarantee the successfulness of the solution and can't be held liable for its failure in application.

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	Schnaithmann Schnaithmann Maschinenbau GmbH Fellbacher Str.49, 73630 Remshalden-Grunbach Germany +49 (0) 7151/ 9732-0 https://www.schnaithmann.de/home/ info@schnaithmann.de Contact person: Volker Siebert
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice Provide a concise description of the good practice being addressed	cubu:S cubu:S is an intelligent and networkable infrastructure for manual workstations, primarily for assembly, packaging and order picking. The system was developed to support the employees at the assembly station to minimize possible user errors.
	GOOD PRACTICE DESCRIPTION	
Detailed description	How did the SME create good practice / new product?	In a joint project with Esslingen University of Applied Sciences and the Protective Workshop in Heilbronn, an assistance system was developed that guides employees step by step through assembly and

Element	Guiding questions	Answers
		commissioning processes on the basis of movement recognition.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	Production processes, cost efficiency
	Describe what are the technical solutions and innovations: of the good practice	The technical solution is that a motion sensor from consumer electronics was integrated into the system. By combining it with a commercially available beamer and a PC, it was possible to design a flexible system with minimal hardware requirements.
	Highlights (or keywords) of the Best Practice	Keywords: assistive technology
	Good practice applied in : (NACE code)	C28.2.3 Manufacture of office machinery and equipment (except computers and peripheral equipment)
Benchmarking	How does your solution related to others provided by competitors	A completely new kind of human-machine interaction is realized in the system itself. The use of “intelligent” component containers opens up unimagined possibilities for flexibility along the entire value chain.

Element	Guiding questions	Answers
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	 Source:https://www.schnaithmann.de/news/news-uebersicht/montage-assistenzsysteme/
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	It is used in Germany at the Schnaithmann GmbH
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	All companies that are faced with the challenge of an increasing variety of variants and at the same time a declining number of units with a constantly changing workforce, but still want to produce economically efficient and high quality products can benefit from it
Targeted customers and scale of use	Select the target group of customers: 77. SMEs (<250 employees) 78. Large companies 79. Public institutions 80. End customer (Business to Customer) Other, please specify	SMEs (<250 employees) and large companies
METHODOLOGICAL APPROACH		

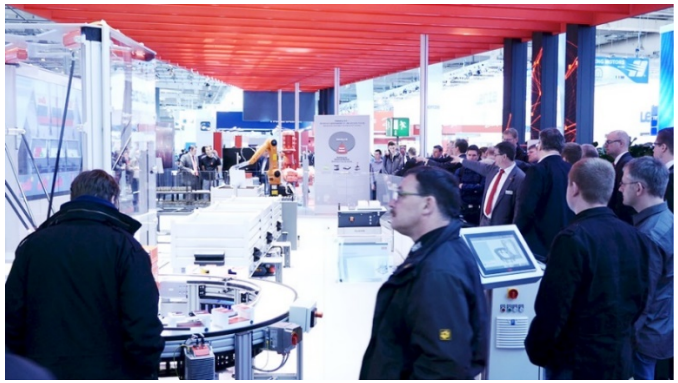
Element	Guiding questions	Answers
Managerial aspects	Cost efficiency of the good practice, if applicable	From the costs perspective, the solution proved to be highly efficient, as it requires minimum intervention (only for maintenance and software updates) and further investments after implementation are not needed, except in the case of training newly employed operators.
	Quality assurance aspects, if applicable	The employee receives information for the process and thus reduces the susceptibility to errors. The solution led to a significant decrease in the number of faulty and defective products reported by customers, which in turn increased customer satisfaction.
	Risk management aspects, if applicable	
Implementation guidelines	How can the Good practice be implemented?	Parts to be removed or picked are made available on a Kanban shelf. Necessary working information is projected directly into the working area as video, photo or instruction. Therefore, tools are needed to make this possible.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	The companies need capital to integrate the new technologies.
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	The validation process compares the manufacturing time before and after implementation.
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	It has a positive effect because employees can fix it immediately as soon as they make a mistake. It also

Element	Guiding questions	Answers
		makes their work easier by giving them instructions on what to do and this saves them time.
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	The system must have a certain technical state of art, otherwise the implementation is only possible with great effort or not at all.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	As mentioned previously, as direct results of the implementation significantly increased productivity and customer satisfaction were obtained. Operators also welcomed this technology as it made their activities easier, faster and “worker-friendly”.
Need assessment	What else would be needed in order to improve the impact of the Good practice	
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Human-machine interaction is very important and should be advanced, as this is an important point of Industry 4.0. The more people are confronted with it, the more acceptance increases.
SUSTAINABILITY		
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	Currently the price of the technology can be prohibitive, however, due to future technological progress their price will decrease and the cost of implementation will be reduced. Moreover, the system it reduces the need for printed documentation.
REPLICABILITY AND UP SCALING		

Element	Guiding questions	Answers
Replicability and further application	How can the solution / good practice be useful for other SMEs?	This solution can be implemented to a wide range of companies, without being tied specifically to a certain industry branch. It must be noted, however, that it initially requires a financial commitment and the organizational culture should be open to the use of new technologies.
	What are the possibilities of extending the good practice more widely?	The system is currently undergoing further development to provide guided support for even more complex tasks.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The solution requires a financial commitment, but compared to the advantages it offers (increase in productivity, increase in customer satisfaction, reduction of assembly time, reduction of errors, and more efficient operation), it is worthwhile for companies.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	The company describing this good practice doesn't guarantee the successfulness of the solution and can't be held liable for its failure in application.

Element	Guiding questions	Answers
INTRODUCTION		
Company information	Data identification, logo, contact person, possible representative image(s).	CENTIGRADE Centigrade GmbH Science Park 2, 66123 Saarbrücken, Germany Tel.: +49 681 959 3110 www.centigrade.de info@centigrade.de Contact person: Jörg Niesenhaus Tel.: +49 208 883 672 89 projects@centigrade.de
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	SEW-EURODRIVEs
	Provide a concise description of the good practice being addressed	A production line of the future, the Smart Factory, is presented in the smallest possible space. In order to make them functional, various systems are used: autonomous transport and assembly vehicles (AGVs) are combined and the most advanced industrial robots are coupled with state-of-the-art user interfaces. These support the user with gesture control, 3D real-time visualization and augmented reality.
GOOD PRACTICE DESCRIPTION		
Detailed description	How did the SME create good practice / new product?	Together with the world market leader in drive technology, Centigrade worked on an exhibit for Hannover Messe 2015.

Element	Guiding questions	Answers
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	Production processes
	Describe what are the technical solutions and innovations: of the good practice	The control panel brings together all the information necessary for a quick decision by the user. He thus has an intelligent, permanently up-to-date schedule in front of him. He hardly has to modify it any more - but if he wants to, he only needs a single, fingers-fast tap. Cameras on the ceiling track the movement of the storage containers with the product. Thanks to Augmented Reality, users can see where their goods are located at any time on the control panel of the intralogistics station - 3D models and additional information are rendered live into the video stream of the cameras on the ceiling. Users can easily drag live data to their smartphones or tablets via Touch Live. Maintenance workers in the factory no longer have to run to every device for simple maintenance steps.
	Highlights (or keywords) of the Best Practice	Keyword: assistive technology
	Good practice applied in : (NACE code)	C26 – Manufacture of computer, electronic and optical products
Benchmarking	How does your solution related to others provided by competitors	It is one of the first technologies that enables the digital monitoring and modification of the production process from start to finish.

Element	Guiding questions	Answers
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	Award: German Design Award Special 2017 Industrie Preis 2016 Best of  source: https://www.centigrade.de/de/referenzen/portfolio/sew-industrie-4-0 

Element	Guiding questions	Answers
		source: https://www.centigrade.de/de/referenzen/portfolio/sew-industrie-4-0
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	SEW EURODRIVE was tested at the Hannover Messe 2015.
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Every manufacturing company is a potential user, since the production process has several work steps that can be digitally monitored and controlled by SEW-EURODRIVEs.
Targeted customers and scale of use	Select the target group of customers: 81. SMEs (<250 employees) 82. Large companies 83. Public institutions 84. End customer (Business to Customer) Other, please specify	SMEs (<250 employees), large companies
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	From a cost perspective, it is initially a very large effort, since all parts of the production process have to be connected, and tablets have to be purchased to control the processes.
	Quality assurance aspects, if applicable	Because everything is networked with each other, it is easy to locate and fix an error.
	Risk management aspects, if applicable	

Element	Guiding questions	Answers
Implementation guidelines	How can the Good practice be implemented?	To implement the solution, the existing structures are analysed and a detailed plan is drawn up as to how everything can be linked.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	In the beginning, a large amount of money is needed because many new interfaces are created and must be networked. This results in high costs and a large expenditure of time.
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	The production line was vailidized at the Hannover Messe 2015
RESULTS / IMPACT		
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The results are very positive, for workers and for the companies. The employees will therefore have less work, as they can control everything from a central point and see directly where there may be problems. For the companies it is easy, to see where potentials are and where problems.
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	The technology must be maintained regularly to prevent errors.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	This production line with the nets is not unrivalled. However, each provider offers different advantages. Every company has to find the right supplier for its needs.
Need assessment	What else would be needed in order to improve the impact of the Good practice	

Element	Guiding questions	Answers
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Everyone does not directly accept a fully networked production line, as they do not know this. However, the user-friendliness makes every day work much easier. The more people involved, the greater the acceptance of new technologies will be.
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	At the moment, the price for technology is very high. However, in a few years, the price will increase. In addition, with the networked production line, resources are conserved, as some parts of the production will be eliminated.
	REPLICABILITY AND UP SCALING	
Replicability and further application	How can the solution / good practice be useful for other SMEs?	The production line makes work easier and clearer for employees. Errors can also be assigned and rectified directly.
	What are the possibilities of extending the good practice more widely?	For example, show production lines at trade fairs can reach new customers.
	FINAL REMARKS	
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The solution requires a financial commitment at the beginning, but compared to the advantages it offers, such as shortening the production time, it is a good investment for companies.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	The company describing this good practice doesn't guarantee the successfulness of the solution and can't be held liable for its failure in application.

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	WITTENSTEIN alpha WITTENSTEIN bastian GmbH Lise-Meitner-Str. 10, 70736 Fellbach, Germany Tel.: +49 711 57564 71072 www.wittenstein.de info@wittenstein.de Contact person: Dr. Peter Stephan Peter.stephan@wittenstein.de
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	Milkrun 4.0
	Provide a concise description of the good practice being addressed	The challenge for WITTENSTEIN bastian GmbH was to avoid a media discontinuity between the paper-based planning board for controlling order processing and IT-supported production planning. The media discontinuity resulted in long and inflexible production planning cycles. This meant that workers could not call up the information directly at the machine and digitally transfer it back to the production planning system. This has changed with the introduction of Industry 4.0 technology: In addition to increased flexibility in

Element	Guiding questions	Answers
		production planning and improved information transfer, a transparent and consistent database for extended approaches to production planning and failure analysis has been established.
	GOOD PRACTICE DESCRIPTION	
Detailed description	How did the SME create good practice / new product?	
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	Production processes
	Describe what are the technical solutions and innovations: of the good practice	WITTENSTEIN bastian GmbH has further developed existing IT back-end production systems and networked them with each other. LED screens are now showing the planning status electronically. In addition, all machines and order papers were provided with a DataMatrix code, which means that identification is also carried out digitally. Tablet PCs enable mobile access to the production planning system. Problems and causes of problems that endanger the execution of the order are fully recorded in an escalation database. Problem causes can thus be methodically and analytically eliminated. The database also provides the basis for applying Big Data algorithms. In the future, it will be possible to analyze fundamental interrelationships with regard to materials, tools, setup parts, production machines and suppliers. This improves the processing of orders

Element	Guiding questions	Answers
	Highlights (or keywords) of the Best Practice	Keyword: production planning
	Good practice applied in : (NACE code)	C-Manufacturing
Benchmarking	How does your solution related to others provided by competitors	It is one of the first technologies that enables the digital monitoring and modification of the production process from start to finish.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	 source: http://www.plattform-i40.de/I40/Redaktion/DE/Anwendungsbeispiele/046-elektronische-plantafel-und-mobiles-produktionsmanagement-wittenstein-ag/beitrag-lektronische-plantafel-und-mobiles-produktionsmanagement-wittenstein-ag.html
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	The mobile assistance system was tested in real-life environments before the competition.
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	All companies that want to make their logistic processes more efficient are potential customers.

Element	Guiding questions	Answers
Targeted customers and scale of use	Select the target group of customers: 85. SMEs (<250 employees) 86. Large companies 87. Public institutions 88. End customer (Business to Customer) Other, please specify	SMEs (<250 employees), large companies
	METHODOLOGICAL APPROACH	
Managerial aspects	Cost efficiency of the good practice, if applicable	From a cost perspective, it is first of all a great effort that has to be done until the journeys of the route train are automated. However, this effort is worthwhile because it gives employees more productive time for the actual main activities of picking, shipping and warehousing.
	Quality assurance aspects, if applicable	Consistent quality is ensured by demonstrating the processes and making them transparent. Potential for improvement and potential sources of error can be identified and then eliminated.
	Risk management aspects, if applicable	
Implementation guidelines	How can the Good practice be implemented?	First of all, the route train is automated so that it only drives when necessary. A tablet is attached to the route train so that the employee always sees the current transport orders in front of him/her and can process them.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	In the beginning, a large amount of money is needed because many new interfaces are created and must be networked. This results in high costs and a large expenditure of time.

Element	Guiding questions	Answers
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	The tests were carried out in the competence and transfer centre of BIBA and the prototype test in the shop window factory in the real environment.
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The results are very positive, for workers and for the companies. The employees will therefore have more time for their real work as they can control everything from a central point and see directly where there is a lack of material. For the companies it is easy, to see where potentials are and where problems.
	SUCCESS FACTORS AND CONSTRAINTS	
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	The technology must be maintained regularly to prevent errors. This production line with the nets is not unrivalled. However, each provider offers different advantages. Every company has to find the right supplier for its needs.
Need assessment	What else would be needed in order to improve the impact of the Good practice	
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Not all employees will be able to deal with it immediately, but the new technology will make their work easier. You will find this out as soon as you have tried it.
	SUSTAINABILITY	

Element	Guiding questions	Answers
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	At the moment, the price for technology is very high. However, in a few years, the price will increase. In addition, with the networked logistic, resources are conserved.
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	This solution is also helpful for other SMEs, as they also have logistics problems. By implementing such a system, a lot of time and money can be saved.
	What are the possibilities of extending the good practice more widely?	
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The solution requires a financial commitment at the beginning, but is a good investment for companies compared to the advantages it offers, such as shortening production time due to the always up-to-date deliveries.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	The company describing this good practice doesn't guarantee the successfulness of the solution and can't be held liable for its failure in application.

Austria

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	plasmo Industrietechnik GmbH Dresdner Straße 81 – 85, 1200 Vienna/Austria T +43 1 236 2607-0 F +43 1 236 2607-99 Jasmin Zeleznik, MA (Marketing & Communication)
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice Provide a concise description of the good practice being addressed	Quality Assurance Solutions for automated production processes and additive manufacturing applications plasmo offers quality assurance solutions that enable our customers to implement a secure, efficient and cost-optimized production mainly in automated metal working industry. plasmo has a large clientele of top global companies established in different industries (automotive, steel, mobility, aerospace industry, suppliers etc.).
	GOOD PRACTICE DESCRIPTION	
Detailed description	How did the SME create good practice / new product?	plasmo systems inspect the quality of components of i.e. vehicles, aircraft, ships, turbines, furnaces, household appliances, windows or steel structures to make these and many other products safer and more

Element	Guiding questions	Answers
		efficient. Our solutions capture all relevant data for process optimization (errors, defects, process deviations, tracking of component data) and visualisation adopted to the relevant user level.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	Plasmo solutions enable a fault-free production and documentation of produced components as well as a visualisation of deviations in the production process. To produce 100% quality and avoid call back actions as well as produce as efficient as possible is our customers' goal and our purpose. plasmo contributes to these goals by providing absolute transparency of the respective production process and considering customisation requirements. This transparency supports the worker in optimization of all steps and starting the necessary measures in case of detection of failures or process deteriorations. This means, that the investment in monitoring systems and training activities helps to reduce the risk of defective parts or components which may havel been returned by the customer of our customers. Plasmo solutions are often installed in combination with other non-destructive technologies like eddy current tests or ultrasonic inspection methods just to be sure that all produced components fulfil all internal and external specifications.
	Describe what are the technical solutions and innovations: of the good practice	The plasmo portfolio ranges from monitoring of welding and laser brazing processes, control of weld seams,

Element	Guiding questions	Answers
		geometric shapes and surfaces up to tailored solutions in the field of machine vision and analysis software. Plasmo has an own business field for AM monitoring activities. In addition plasmo plasmo builds on know-how including the following disciplines: hardware development, software development, optical sensors, laser technique, machine and computer vision, mechatronics, physics and mathematical algorithms as well as deep learning. All solutions and customisation procedures are implemented at plasmo. For all solutions plasmo provides a global service and training network.
	Highlights (or keywords) of the Best Practice	Quality Assurance, Process Control, Process Monitoring, AM
	Good practice applied in : (NACE code)	25620
Benchmarking	How does your solution related to others provided by competitors	Our solutions are independent from the plant or laser and optics manufacturer. This is important because our customers wish to obtain the best (customized) solution for their own application.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or	Find datasheets, articles, case studies on our website! http://www.plasmo.eu/en/ http://www.plasmo.eu/en/plasmo-quality-assurance-quality-control-laser-welding/press/ http://www.plasmo.eu/en/solutions/products/

Element	Guiding questions	Answers
	other material about the Good practice implementation (if existing).	https://www.youtube.com/channel/UCQlbT_SQd6zEKY2x9PiXSjg
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	plasmo is represented with its products and services worldwide. While it´s headquarter is based in Vienna, the company maintains 2 branches (USA, Detroit-Plymouth MI & Stuttgart-DE) and a worldwide network of partners and resellers.
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Various automobile manufacturers like Audi, BMW, Daimler, GM, Opel, PSA, Suzuki, Volvo, VW, Ford, Tesla as well as companies in the steel industry such as ThyssenKrupp, Salzgitter, Tokyu Steel and Posco, SMS trust in quality assurance solutions of plasmo. A partnership with EOS is the basis of our initiative to offer quality assurance solutions for industrial 3D metal printing based on powderbed applications. In addition plasmo offers a combination of plasmo systems to machine builders in AM industries especially for DED based AM processes.
Targeted customers and scale of use	Select the target group of customers: 89. SMEs (<250 employees) 90. Large companies 91. Public institutions 92. End customer (Business to Customer) Other, please specify	Large companies, SMEs especially job shops and Public institutions Others: research institutions and private public partnerships like pilot factory in Vienna, Aspern Seestadt.
METHODOLOGICAL APPROACH		

Element	Guiding questions	Answers
Managerial aspects	Cost efficiency of the good practice, if applicable	Minimize the number and costs of rejects and claims by 50%; Optimization of cycle time by 20%, process optimisation by 20%, reduction of machine stand stills or interruptions nearly to zero, efficient tool to plan predictive maintenance activities.
	Quality assurance aspects, if applicable	Increase the quality of produced parts, optimization of the production process in general, consider safety and optical aspects. Plasmo solutions make quality visible.
	Risk management aspects, if applicable	Our solutions capture all relevant data for process optimization (errors, defects, process deviations including full traceability etc.) to keep the quality of our customer´s products at the highest possible level. Plasmo provides additional technical consulting services for interpretation and further use of production data, individualised illustration by dashboards and implementation of process optimisation measures. Plasmo solutions are monitoring solutions contributing to minimisation of production failures.
Implementation guidelines	How can the Good practice be implemented?	The expert team assists its customers from the moment the control task is defined until implementation of the control system. Starting with support from the decision phase, if and how and which technology can be implemented in automated production and what is needed for implementation including relevant expertise (planning phase), training and accompanied services and consulting. All relevant internal or external

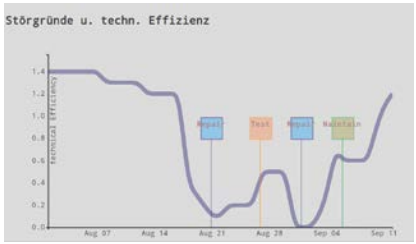
Element	Guiding questions	Answers
		standards are considered in the technology selection and implementation of the monitoring systems as well as intercultural issues.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	Production manager, quality representative, production staff, service & maintenance department, electrical and control engineering department. Production line should produce first trial parts. Also old production lines can be upgraded by a retro-fit package. Time span: from planning to implementation incl. training (about 16 weeks)
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	plasmo gathers all relevant process data, correlates and evaluates this data. This evaluation enables identifying the real cause of a defect and provides visualisation tools serving for continuous improvement of the process.
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	Customers have told us that plasmo quality assurance solutions make their production process significantly more efficient (by optimization of the production process and further reducing costs created by new insights due to the implementation of monitoring systems – “customers know their production processes better” and use the existing information for defined measures).
	SUCCESS FACTORS AND CONSTRAINTS	

Element	Guiding questions	Answers
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	resources and know-how in various disciplines (mechatronic, electronic, measurement and control systems, laser material processing, plant construction & engineering, industrial automation), awareness and trust in the new technology, misunderstanding of benefits of the system, lack of knowledge of best practices from our customers (use cases)
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	**Flexibility:** Our solutions are independent from the integrator or laser manufacturer. **Customized solutions:** the plasmo quality platform offers solutions adoptable to individual requirements of production processes. **Expertise:** plasmo aggregates all necessary disciplines for the implementation of quality assurance systems in house, in the headquarter in Vienna. Plasmo works cooperates with research institutes and industrial partners to focus all expertise optimally on plasmo's core topic: quality assurance and monitoring of production processes. All plasmo systems are industrialised and accepted in automotive, steel and aerospace industry as well as in electro mobility.
Need assessment	What else would be needed in order to improve the impact of the Good practice	gain experience with the provided technology during tests in laboratory and industrial circumstances, adequate training and additional technology consulting, involvement of production and quality manager as well as purchasing and maintenance department to

Element	Guiding questions	Answers
		understand the benefits, limited rental time with possibility to return the product, offering a proof of concept phase to confirm covering the most important individual requirements. Success stories of best practice cases highlight the needs and provide an impression how customers use plasmo solutions.
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	With plasmo solutions, our customers are able to produce the highest quality as possible and to better understand their production process. It is necessary to provide use cases and highlight benefits and possibilities of plasmo systems, make additional use of generated information by data created during the production process. Adequate trainings adopted to the know-how level of the trained organization and remote & hotline services are necessary to increase the awareness for the new technology, provide demonstration facilities. Expected benefits need to be illustrated explain to companies' stakeholders, especially the champions.
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	plasmo hardware-independent solutions offer the opportunity to plan quality assurance in your production flexibly. This ensures sustainability.
	REPLICABILITY AND UP SCALING	

Element	Guiding questions	Answers
Replicability and further application	How can the solution / good practice be useful for other SMEs?	The provided solutions are also relevant for SMEs, especially job shops. plasmo contributes to making quality visible and gaining more information about the production process.
	What are the possibilities of extending the good practice more widely?	At corporation level: In addition plasmo provides a detailed track record for all components produced (long-term archive) which can be used in case of call back actions or process comparisons (i.e. comparison of the same applications in different locations and plants. Dissemination of good practice more widely: reference business cases and use cases published at congresses or journals, illustrate a list of reference customers to visit reference installations.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	plasmo offers tailor made quality assurance solutions that enable our customers to implement a secure, efficient and cost-optimized production.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	NDA (non-disclosure agreement) for new customers as well as agreement on data hosting and security, agreement on use of photos and videos (if required) All information illustrated in this tab can be published and disseminated online and printed.

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	5. Data identification, logo, contact person, possible representative image(s).	CDI, Cooperation Development Innovation  Armin Hattmannsdorfer Birkenweg 7 4221 Steyregg office@cdi.co.at +43 676 814 69 279
Name and brief description.	6. Name or acronym: what is the name that captures the essence of the good practice 7. Provide a concise description of the good practice being addressed	FIT (Factory Incident Tracker): Problem Analysis in productive environments for long term failure preventation Small and Medium Enterprises are lacking of ERP / MES Software that is in fact to big for their scale. Furthermore producing companies focus on fast solution of any incidents that may occur and then pass the further analysis.

Element	Guiding questions	Answers
		3. The good practise of said solution is to track, analysis and avoid often occuring failures in the long run. This might as well shorten the expenditures of maintainance, could lead to easily keep delivery goals and in long run give SME the possibility to do efficiency and effectness planing with a low level technique.
	GOOD PRACTICE DESCRIPTION	
Detailed description	29. How did the SME create good practice / new product? 30. What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management? 31. Describe what are the technical solutions and innovations: of the good practice 32. Highlights (or keywords) of the Best Practice 33. Good practice applied in : (NACE code)	Risk management as a part of evaluating any patterns of incidents in a productive environment Long term quality assurance A very handy easy to use webapplication that is combined with a short eye to eye customizing with IT and Production consultants Sponsored by Upper Autrian TIM and FFG
Benchmarking	How does your solution related to others provided by competitors	Any competitors have been not yet evaluated after a research of half a year with TIM and FH Oberösterreich
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	 This is a crop of the dashboard, that provides data to the customer; blue line is a technical process (here the production output of a bunch of machines). Blue orange

Element	Guiding questions	Answers
		and olive boxes represent Incidents of said process. These incidents later have to be analyzed.
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Upper Austria
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	SME (below 150 Employees) that have rather none or few IT Systems yet implemented or not using data for long term Problem Analysis
Targeted customers and scale of use	Select the target group of customers: 1. SMEs (<250 employees) 2. Large companies 3. Public institutions 4. End customer (Business to Customer) Other, please specify	SME
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	Cost Cuts by process analysis, critical / longest path meth.
	Quality assurance aspects, if applicable	New method set combined of: FMEA, functional description, asset management, risk evaluation and mitigation
	Risk management aspects, if applicable	See above
Implementation guidelines	How can the Good practice be implemented?	Implemented by (BI, KPI, Data) workshop, small adaption of dashboard, review from time to time

Element	Guiding questions	Answers
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	HTML Browser, eventually data base or some kind of standard data format that can be read through a browser
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	
	SUCCESS FACTORS AND CONSTRAINTS	
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	
Need assessment	What else would be needed in order to improve the impact of the Good practice	
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	
	REPLICABILITY AND UP SCALING	
	How can the solution / good practice be useful for other SMEs?	

Element	Guiding questions	Answers
Replicability and further application	What are the possibilities of extending the good practice more widely?	
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	Company: Business Upper Austria – OÖ Wirtschaftsagentur GmbH; Logo: ;  Department: Mechatronik Cluster; Contct person: Manuel Brunner; Representative: 
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice Provide a concise description of the good practice being addressed	Industry 4.0 Maturity Model The Maturity Model is a structured methodology to evaluate the Industry 4.0 status quo of a company, create a tailor-made vision and derive an individual road map to get from status quo to the vision.
	GOOD PRACTICE DESCRIPTION	
Detailed description	How did the SME create good practice / new product?	

Element	Guiding questions	Answers
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	This model is a new approach to structure the technological change process through Industry 4.0 in a company and realized as a software cloud application on license. Production processes, organizational processes, machines, software applications can be investigated with the model and the outcome will lead to cost efficiency and process optimization. Enclosed to the software tool is a benchmark database where all investigations are saved anonymous.
	Describe what are the technical solutions and innovations: of the good practice	The maturity model is the first known approach to describe the Industry 4.0 status of an entity with 24 criteria including a derivation of a road map for implementation.
	Highlights (or keywords) of the Best Practice	Benchmark, maturity, implementation road map, experience in 16 cases
	Good practice applied in : (NACE code)	C28, C23.42, C26.1, C31.01, C31.09, C28.15,
Benchmarking	How does your solution related to others provided by competitors	No other model is focused on processes and detailed entities and includes a derivation of a road map.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	www.reifegradmodell.at

Element	Guiding questions	Answers
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Upper Austria, Lower Austria, Bavaria.
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Mostly producing companies but also service provider.
Targeted customers and scale of use	Select the target group of customers: 93. SMEs (<250 employees) 94. Large companies 95. Public institutions 96. End customer (Business to Customer) Other, please specify	The model was tested in large companies as well as in SMEs
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable Quality assurance aspects, if applicable Risk management aspects, if applicable	When using the model, cost efficiency could be an aim.
Implementation guidelines	How can the Good practice be implemented?	Attending a one day training and using the given process and software.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	The training costs EUR 500,-- for a day and the licence EUR 1.000,-- in the first year and after that EUR 500,-. Or you engage a consultant. For an investigation a company can calculate with about a week and 3 days of providing staff.
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	Since the launch of the Model (01/2017) it was used in 16 companies and so the process is validated.

Element	Guiding questions	Answers
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The beneficiaries get a detailed road map for implementation of Industry 4.0. Thus save money, be more flexible and getting ideas of new business models.
	SUCCESS FACTORS AND CONSTRAINTS	
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	The Model is not a tool for assessing a whole company and make general improvement suggestions. It is a specialized tool going in depth a providing an action plan.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	Individuality, investigation on the spot, tailor-made implementation road map, not limited to a branch, software support.
Need assessment	What else would be needed in order to improve the impact of the Good practice	More investigations to keep the benchmark database growing.
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Implementation of smart factory projects in companies is difficult.
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	The Model is launched
	REPLICABILITY AND UP SCALING	
Replicability and further application	How can the solution / good practice be useful for other SMEs?	This software can be used in nearly every SME and providing them to make the first steps towards a smart factory

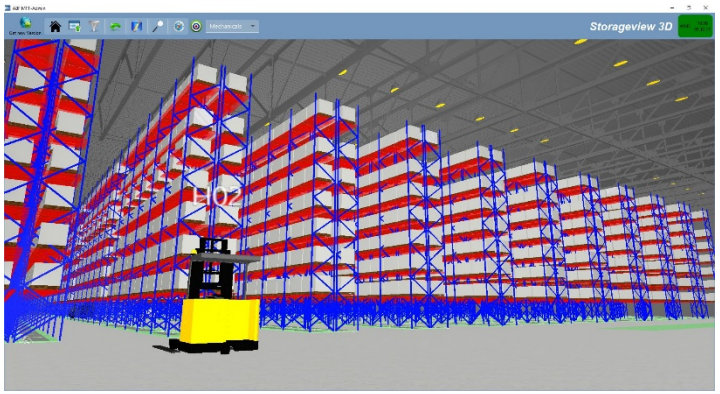
Element	Guiding questions	Answers
	What are the possibilities of extending the good practice more widely?	Get new data for the benchmark, develope more services and also get more references for the maturity model and thus improve quality.
	FINAL REMARKS	
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The maturity model is in use and delivers great results wherever implemented. It delivers a tailor-made road map for a company to become a smart factory.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	yes

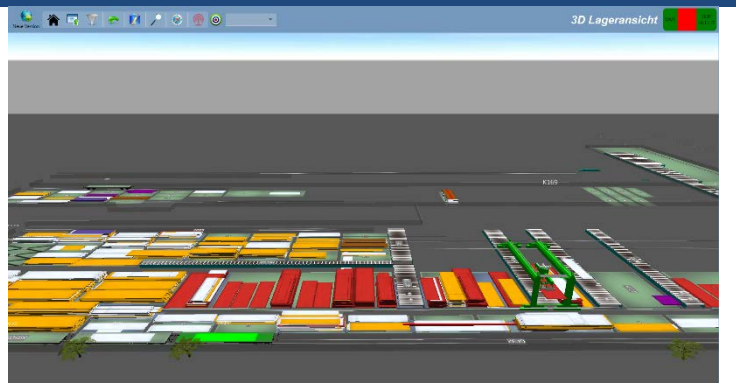
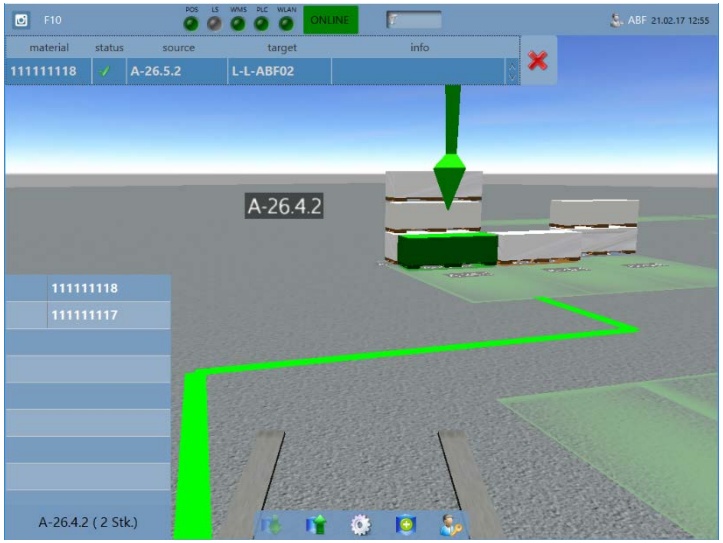
Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	ABF – Industrielle Automation GmbH Deggendorfstrasse 6, 4030 Linz, Austria Christian Hiebl, +43 676 83041 218 mailto:christian.hiebl@abf.at
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	***OneBase*** – MFT
	Provide a concise description of the good practice being addressed	This industry independent intralogistics solution integrates a high-performance warehouse management system with continual material tracking for the in-plant logistics processes. With a multitude of modules, this flexible, total solution forms the basis for modern logistics. The material movements are posted automatically and the products get continuously tracked through the warehouse. Hereby the operator has an exact and complete overview where each and every piece of material is in the logistics chain at any time.

Element	Guiding questions	Answers
		Optimization algorithms and a dynamic, adaptive set of rules automatically ensure the ongoing calculation of the necessary transport orders for quick processing of all the required in-plant material transports. This optimized real-time procedure leads to efficient usage of the available warehousing and transport capacities and assures the efficient material flow.
	GOOD PRACTICE DESCRIPTION	
Detailed description	How did the SME create good practice / new product?	Longstanding proven intralogistics methods and the extensive know-how as integrator of Real Time Locating Systems (RTLS) formed the basis for ***OneBase*** – MFT.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	***OneBase*** – MFT provides innovative material tracking and control functions for the intralogistics in the industry's production processes. This solution optimizes the efficiency of the customer's intralogistics.
	Describe what are the technical solutions and innovations: of the good practice	The solution provides a situation adaptive warehouse management, a forklift guidance system, a crane tracking system, a tight integration of the production facilities and interfaces with the existing IT infrastructure to form a complete solution for the optimization of the production and intralogistics processes. The innovation is the continuous material tracking of every movement within the intralogistics chain, by integrating RTLS on forklift trucks, cranes, milk runs and AGVs. The system determines the vehicle position precisely in a X, Y

Element	Guiding questions	Answers
		coordinate system. All movements are tracked and controlled, starting from the goods receipt, covering the work in progress movements and managing the final products. Using a RTLS and load detection sensors the movements can be tracked fully automatic in block and high-bay warehouses although the warehouse is managed in manual operation.
	Highlights (or keywords) of the Best Practice	***OneBase*** – MFT, Material flow tracking, warehouse management system, forklift guidance system, crane control system, 3D warehouse, RTLS, Real Time Locating System, automatic load detection, hands-free, fleet management
	Good practice applied in : (NACE code)	C
Benchmarking	How does your solution related to others provided by competitors	The ABF intralogistics solution is probably the most modern RTLS material tracking solution including a highly optimized warehouse management system. In comparison to warehousing solutions based on barcodes or RFID technology the RTLS based ***OneBase*** – MFT solution can be realized with very high accuracy (X, Y, Z coordinate within the warehouse) and offers by this the highest possible grade of digitalization and automation of the customer's intralogistics processes.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant	Award: Finalist in the Austrian logistics award

Element	Guiding questions	Answers
	information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	Website: www.abf.at/en/products/warehousing-solution-onebase-mft Videos: MFT forklift guidance system: https://www.youtube.com/watch?v=AWZAJdSPVZE MFT for automatic cranes: https://www.youtube.com/watch?v=awHp9qwBB68 MFT in a crane warehouse: https://www.youtube.com/watch?v=qCnquzsHqwM MFT in a steel wire rod production: https://www.youtube.com/watch?v=xkJG1aGwkxc Pictures of realization examples:

Element	Guiding questions	Answers
		 

Element	Guiding questions	Answers
		 
OBJECTIVE AND TARGET AUDIENCE		

Element	Guiding questions	Answers
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Brazil, Mexico, Spain, Germany, Austria
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	The target customers are industrial production facilities and logistic centres that are handling big material units (e.g. steel coils or steel heavy plates, wood products) or storing products in pallets, containers, lattice boxes.
Targeted customers and scale of use	Select the target group of customers: 97. SMEs (<250 employees) 98. Large companies 99. Public institutions 100. End customer (Business to Customer) Other, please specify	1 and 2
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	- No time consuming search times for material - No time consuming material identification times (scan-less material identification - No time consuming manual warehouse bookings in the warehouse management system and ERP system - Permanent inventory - Optimization of the intralogistics fleet by route optimized transport order handling - Time and cost
	Quality assurance aspects, if applicable	- Avoiding manual operator mistakes in the warehousing process (wrong material in production, wrong storage location) and while shipment of final goods.

Element	Guiding questions	Answers
		- Reducing downtimes of production aggregates by time efficient supply of materials
	Risk management aspects, if applicable	MFT improves the safety of used personnel and equipment resources.
Implementation guidelines	How can the Good practice be implemented?	Implementation of ***OneBase*** – MFT intralogistics software solution with RTLS components on the means of transport (forklifts, cranes, …) as well as the integration or mounting of additional sensors for automatic load detection. Integration of in and outbound facilities of the production aggregates and the IT systems (MES, ERP).
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	Personnel: IT, process, logistics Finance: ROI between 1 and 3 Infrastructure: IT Hardware, WiFi Timespan: Realization within 5 to 12 months
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	The impact can be validated if the results of the solution realization can be compared to an actual situation survey, which could be done in advance.
RESULTS / IMPACT		
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	More transparency in intralogistics and enablement for automatic warehouse management by continuous material tracking and situation adaptive material flow control.
SUCCESS FACTORS AND CONSTRAINTS		

Element	Guiding questions	Answers
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	The automatic load detection depends on the possible accuracy of the used RTLS. On cranes the positioning precision sometimes also depends on the used hoist. To assure a continuous and error free material tracking the accuracy of the RTLS needs to be less than the half size of the transport unit's shortest side. On forklifts the solution works fine with transport units of a size bigger than a Euro pallet. Automatic vehicles or manipulators with a fixed hoist can achieve a higher positioning precision.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	***OneBase*** – MFT and its automated intralogistics environment introduces a high grade of innovation and significant improvement in quality and efficiency of logistics and production supply processes, because: - The warehouse management will no longer be done in the minds of the operators - You know where the material precisely is at any time - Intralogistics availability around the clock - No more barcode scanning and manual mistakes, because the automatic load detection avoids manual actions for identification (hands-free) - Situation adaptive transport management with route optimized transport orders under consideration of the current transporter position (forklift, cranes, AGVs …) - Fleet management and optimization

Element	Guiding questions	Answers
		- Digitalization of the intralogistics processes - Performance optimization for manually operated vehicles (automated load detection, guidance systems for better orientation within the warehouse by a state-of-the-art 3D environment, transport orders) - Improvement of human and machine safety by providing location related safety function like collision avoidance and speed control
Need assessment	What else would be needed in order to improve the impact of the Good practice	The best impact will be achieved, for customers who have a middle to big sized fleet of transport vehicles and have big warehouse areas and / or numerous production areas that need to be supplied with WIP material.
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	The ***OneBase*** – MFT solution is able to optimize the intralogistics processes, efficiency and costs.
SUSTAINABILITY		
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	The improvement of a well automated intralogistics transportation fleet (e.g. forklift trucks) will lead to a reduction of travelled distances and to possible reduction of needed vehicles. By this there is not only a rise of efficiency in terms of costs but also in terms of energy consumption and exhaust emissions.
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	The solution can be useful for any industrial production facilities and logistic centres that are handling big material units (e.g. steel coils or steel heavy plates,

Element	Guiding questions	Answers
		wood products) or storing products in pallets, containers, lattice boxes. The high grade of standardization allows to use the solution in different kind of industries. It also applies to different means of transports no matter if manually or automatically operated.
	What are the possibilities of extending the good practice more widely?	The solution has very good scalability features. Roll-out to the customer's other facilities as well as internationalization is supported.
	FINAL REMARKS	
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	***OneBase*** – MFT and its automated intralogistics environment introduces a high grade of innovation in the logistics and production supply processes because: - The warehouse management will no longer be done in the minds of the operators - You know where the material precisely is at any time - Availability around the clock - No more barcode scanning and manual mistakes, because the automatic load detection avoids manual actions for identification (hands-free) - Situation adaptive transport management with route optimized transport orders under consideration of the current transporter position (forklift, cranes, AGVs …) - Fleet management and optimization - Digitalization of the intralogistics processes

Element		Guiding questions	Answers
			- Performance optimization for manually operated vehicles (automated load detection, guidance systems for better orientation within the warehouse by a state-of-the-art 3D environment, transport orders) Improvement of human and machine safety by providing location related safety function like collision avoidance and speed control
Disclaimer Acknowledgements	/	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	No

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	Evolaris next level GmbH  Dr. Christian Kittl 

Element	Guiding questions	Answers
Name and brief description.		Ing. Markus Streibl, BSc.
	Name or acronym: what is the name that captures the essence of the good practice	Impact of a Live-Video-Assistance-System on the problem-solving-competence of service and maintenance employees
	Provide a concise description of the good practice being addressed	By using the EVOLARIS Live-Video-Assistance-System named EVOCALL, the problem-solving process can be influenced positively. EVOCALL is able to replace non-effective communication channels. Besides, in combination with a "work-shadowing" approach, the on-site presence of experts as well as the repair times can be reduced.
GOOD PRACTICE DESCRIPTION		
Detailed description	How did the SME create good practice / new product?	The system was created based on research work conducted within the COMET Centre of Excellence Programme and knowledge gained from a project funded by the Austrian Research promotion Agency (FFG). Building on these outcomes, a first prototype was created in the course of a master thesis and then iteratively improved with lead customers.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	Novel technology, production processes
	Describe what are the technical solutions and innovations: of the good practice	audio-visual support of service- and maintenance employees based on a WebRTC solution.

Element	Guiding questions	Answers
	Highlights (or keywords) of the Best Practice	WebRTC solution, audio-visual support, reduced repair time, reduced on-site presence, positive influenced problem-solving process
	Good practice applied in : (NACE code)	C33
Benchmarking	How does your solution related to others provided by competitors	Simple to use, high user experience, support different devices, clear and licence model (concurrent licences)
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	eAWARD Winner 2017; https://evocall.evolaris.net/
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Primarily Austrian HQ and internationally operating companies. Countries they used EVOCALL: USA, China, Bulgaria, Hungary, Spain, UK,…
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Service and maintenance employees and the head of departments, After Sales, IT Support, …
Targeted customers and scale of use	Select the target group of customers: 101. SMEs (<250 employees) 102. Large companies 103. Public institutions 104. End customer (Business to Customer)	Beginning from SMEs less than 40 employees, up to large companies (more than 2500 employees) to public institutes (university)

Element	Guiding questions	Answers
	Other, please specify	
	METHODOLOGICAL APPROACH	
Managerial aspects	Cost efficiency of the good practice, if applicable	Minimize on-site presence of experts, minimize travelling cost, reduce repair time, increase plant availability
	Quality assurance aspects, if applicable	n.a.
	Risk management aspects, if applicable	n.a.
Implementation guidelines	How can the Good practice be implemented?	Typically a company interested would do a proof of concept with EVOLARIS consisting of: an initial workshop to identify the processes and stakeholders with the highest impact potential, training and hands-on experience of the smartglass-based solution; assistance for integrating the solution into the internal IT environment; 3 monthly test licenses
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	EVOCALL WebApplication – Computer for Expert, Smartphone for Fieldclient, Chrome Browser on both devices (minimum resources). Timespan incl. Kick-off Workshop less than one day. Financial resources: costs for concurrent licence – 460€ per licence per month
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	The solution was implemented with two lead customers, TGW logistics and AVL List. After a first trail with a single device at each site, a test phase with approx.. 10 devices took place, evaluating the solution regarding the stability and performance (e.g. by testing it in a live-

Element	Guiding questions	Answers
		like setting between AVL HQ in Graz, Austria, and a AVL subsidiary in the US) and regarding the acceptance of the solution by various employees, which was measured via qualitative interviews.
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	Reduce the response time. Before between 24h – 36h worldwide, in combination with EVOCALL round about 30 Minutes.
	SUCCESS FACTORS AND CONSTRAINTS	
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	Limitations are network shares and network (WLAN) infrastructure constraints (e.g. firewall ports needed to be opened)
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	placed in data centre, high secured communication, in combination with smart glass hands free;: Minimize on-site presence of experts, minimize travelling cost, reduce repair time, increase plant availability
Need assessment	What else would be needed in order to improve the impact of the Good practice	User acceptance
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Even if the companies are working in the same field, there are often quite different processes that need to be reflected and supported by the solution. Customizing is an important requirement for user acceptance.
	SUSTAINABILITY	

Element	Guiding questions	Answers
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	Minimize travelling of experts
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	The solution requires only the WebApp license, a browser and smartphone and can thus be easily deployed. For hands-free operations, smartglasses are advisable, which cost about 1.500 EUR each.
	What are the possibilities of extending the good practice more widely?	Communication, marketing, congress presence
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	Minimize on-site presence of experts, minimize travelling cost, reduce repair time, increase plant availability
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	Information can be used online and printed

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	 HELMUT NÖHMAYER Business Development Robotics & Assistiv Systems --- PROFACTOR GmbH Im Stadtgut A2 A-4407 Steyr /Austria Tel.: +43 7252 885 305 Mob: +43 664 60885 305 Fax.: +43 7252 885 101 email.: helmut.noehmayer@profactor.at www.profactor.at ATU 38420507
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice Provide a concise description of the good practice being addressed	XROB Makes robot usage simple. 4. ONE ROBOT. ONE AUTOMATION-SOFTWARE. 5. CHANGE PROCESSES EASILY WITHIN A FEW MINUTES.

Element	Guiding questions	Answers
		5. With XRob users with minimal training experiences are able to create robotic processes in a new and effective way. The system is designed to be cost effective also for small companies. 7. 8. The benefits are 9. » Easy & fast configuration – no programming 0. skills required 1. » Fast retooling for a high number of variants 2. » Intuitive process setup within few minutes 3. » Easy integration into existing environment 4. and processes 5. » Versatile and expandable » Supports all popular robot brands
	GOOD PRACTICE DESCRIPTION	
Detailed description	How did the SME create good practice / new product?	In funded R&D Projects the software architecture was developed and is now widen with different features and applied already in industry.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	It is a novel technology, which can be used also for small lot sizes. It is more cost efficiency as it shorten ramp up time and no expert is need to configurate the robot for new tasks.
	Describe what are the technical solutions and innovations: of the good practice	The software system XRob allows the creation of complex robot applications within a few minutes. With unique and easy-to-use features significant speed up will be accomplished during ramp up. This makes the

Element	Guiding questions	Answers
		operation more efficient and flexible than common programming methods. The novel software architecture allows easy and intuitive creation of processes and configuration of the components of a robot system by only one single user interface. Onboard key technologies are: • On-board 3D modeling of work spaces for automatic collision model • Process simulator with automatic path planning • Inline 2D/3D position recognition • Object recognition in real-time • Mobile user interface
	Highlights (or keywords) of the Best Practice	Flexible robotics Human machine interaction One interface Easy-to-use features Automatic path planning Fast configuration of complex processes
	Good practice applied in : (NACE code)	C - Manufacturing
Benchmarking	How does your solution related to others provided by competitors	The single user interface is unique.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters,	https://www.youtube.com/watch?v=RnLznMFj5Y8&t=2s https://www.profactor.at/en/solutions/flexible-robotic/

Element	Guiding questions	Answers
	pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Austria/Germany. Main application fields » Pin picking » Handling » Assembling » Inspection » Screwing Key references » 3-D inspection of engines parts » Screwing Assistant for engine assembly » Automatic crankshaft picking » Automotive: Acoustics inspection » Flexible screwing station
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	
Targeted customers and scale of use	Select the target group of customers: 105. SMEs (<250 employees) 106. Large companies 107. Public institutions 108. End customer (Business to Customer) Other, please specify	SMEs (<250 employees) Large companies

Element	Guiding questions	Answers
	METHODOLOGICAL APPROACH	
Managerial aspects	Cost efficiency of the good practice, if applicable Quality assurance aspects, if applicable Risk management aspects, if applicable	
Implementation guidelines	How can the Good practice be implemented?	With its partners, PROFACTOR develops customized pilot plants and prototypical plants for the evaluation of the latest robotic technologies. The range extends from feasibility studies to real systems – which are implemented and realized together with experienced system integrators.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	The teaching duration was extracted by video recordings. The average teaching time decreased from 6:25 to 3:36. The usage of physical guidance increased from 0% to 71,57%. This shift to physical robot guidance was also measureable in two dimensions of user experience Scale) and Performance Expectancy (PE). PE describes one's belief that using the system will help to attain gain in job performance, and was measured using two items which were derived from. The implemented XRob programming system supports a linear programming approach, robot motion

Element	Guiding questions	Answers
		commands, sensorics-data handling, Computer Vision algorithms and software-templates. XRob supports more possibilities like vision-based, automated compensation of position deviations. This fact led to increased duration for the whole parametrization process from 13 to 20 minutes caused by the additional functions (Computer Vision).
RESULTS / IMPACT		
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	Cost savings
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	
Need assessment	What else would be needed in order to improve the impact of the Good practice	
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Amongst others, the following were tested at the project partner BMW Motoren Steyr plant: Haptic Technologies (Forced Feedback), Image Processing Techniques Spatial Augmented Reality and a Tangibles User interfaces (TUI) were

Element	Guiding questions	Answers
		used. here balls or hoppers mark the positions that the robot must approach. The technologies were evaluated in a three-step user study with assemblers aged 20-60 years. The persons did not have any previous knowledge of robotics, their requirements to the Interaction could therefore describe them without bias. At the beginning, the robot only had one operator panel. The system has been made more and more flexible by various sensors. Ultimately, it was equipped with a combination of projection, 3D and gesture detection. The interaction time could thus be reduced to less than half of the time required for the interaction. The results showed that even complex systems, the are suitable for batch size 1, can be operated efficiently by non-professionals This requires automatic service functions in the background that the user does not perceive.
SUSTAINABILITY		
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	
REPLICABILITY AND UP SCALING		
	How can the solution / good practice be useful for other SMEs?	

Element	Guiding questions	Answers
Replicability and further application	What are the possibilities of extending the good practice more widely?	
	FINAL REMARKS	
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	 **Benjamin Schwärzler, MSc** **Chief Executive Officer, Tablet Solutions GmbH** **T. +43 1 992 90 28 | M. +43 650 466 466 2** **W. www.workheld.com | Mehr Infos zu WorkHeld**
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice Provide a concise description of the good practice being addressed	**WorkHeldVoiceAssistant:** WorkHeld seamlessly connects field technicians with their project coordinators in the head office. Construction plans, checklists and work orders are continuously updated and defects can be reported immediately. WorkHeld enables all involved parties to always be up to date on the project progress.
	GOOD PRACTICE DESCRIPTION	
Detailed description	How did the SME create good practice / new product?	We developed a new form of interaction for workers and technicians with low IT skills

Element	Guiding questions	Answers
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	Novel Technology: AI based voice assistant similar to Amazon Alexa or Apple Siri build with NLP (natural language processing) and Speech to Text Technologies.
	Describe what are the technical solutions and innovations: of the good practice	Voice Assistant that runs on smartphones and tablets and can be connected to headsets.
	Highlights (or keywords) of the Best Practice	AI, Artificial Intelligence, Voice Assistant, NLP, NLU, Speech Recognition.
	Good practice applied in : (NACE code)	Manufacturing, Plant Equipment Engineering, Field Services
Benchmarking	How does your solution related to others provided by competitors	It can be compared to field management solutions without voice assistance or other Voice Assistants like Apple Siro or Amazon Alexa.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	• DBS Award, • Handelsblatt Industriegipfel - **vielversprechendsten Start-Up Lösung** • **Born Global Champion** • **Etc.**
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Austria and the DACH region

Element	Guiding questions	Answers
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	
Targeted customers and scale of use	Select the target group of customers: 109. SMEs (<250 employees) 110. Large companies 111. Public institutions 112. End customer (Business to Customer) Other, please specify	SME's and Large companies
	METHODOLOGICAL APPROACH	
Managerial aspects	Cost efficiency of the good practice, if applicable	20-30 % (estimated)
	Quality assurance aspects, if applicable	
	Risk management aspects, if applicable	Data Security Measures have to applied.
Implementation guidelines	How can the Good practice be implemented?	Design a good conversational interface for specific usecases before you start with implementation. Conversational User Interfaces are the future of human machine interaction but have to be designed to feel natural. Than build on top of existing NLP Frameworks.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	Conversation Design and Developers
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	We validated it with industrial clients.
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	They are more motivated to document their work and have access to data an information even though they are not highly skilled in IT.

Element	Guiding questions	Answers
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	Dialects can be problematic.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	Voice Assistants open up completely new forms of interaction with IT systems and can be applied to all sorts of Use-cases.
Need assessment	What else would be needed in order to improve the impact of the Good practice	
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Good conversation design is essential.
SUSTAINABILITY		
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	nA
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs? What are the possibilities of extending the good practice more widely?	Easy Access and Interaction with complex IT systems Can be applied to almost all business processes.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	Voice Recognition is expected to have a major impact on all industries in the next 1-3 years. Lets make sure the manufacturing industry is a technology leader this time!
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	YES

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	XiTrust Secure Technologies GmbH Headquarters Grazbachgasse 67, 8010 Graz Austria +43 6 991 410 2032 office@xitrust.com Contact person: DI Katrin Riemer Tel.: +43 (0) 699 14 10 20 17 Katrin.Riemer@xitrust.com XiTrust is your provider for all services concerning electronic signatures. For more than 15 years, we have been advising clients seeking tailored solutions for business processes without cross-media conversion. Our innovative products grow with the requirements that your company places on them now and in the future.
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	Secure QR-Code (sQR)

Element	Guiding questions	Answers
	Provide a concise description of the good practice being addressed	The sQR features another level of security and offers new possibilities regarding the use of QR codes with respect to authentication. Basically, the sQR contains information such as the ID, name of a person or machine, respectively. This information is electronically signed to ensure data integrity. An APP which is able to check the validity of this signature has been developed. Additionally, it is also possible to encrypt the information of the QR Code and to decrypt it with the corresponding public key within the APP. After the information is decrypted and the signature is validated, the APP provides a possibility to verify the real identity of a person or a machine. In case of a person, there is the additional possibility to compare a photo and in case of a machine, additional information regarding the location of the machine can be provided.
GOOD PRACTICE DESCRIPTION		
Detailed description	How did the SME create good practice / new product?	Implementation was realized together with a partner company which was responsible for the APP development.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	
	Describe what are the technical solutions and innovations: of the good practice	The fact that the information within the QR code can be signed and/or encrypted represents a novel approach regarding authentication.
	Highlights (or keywords) of the Best Practice	Signed and encrypted QR code

Element	Guiding questions	Answers
	Good practice applied in : (NACE code)	The sQR was part of a research project and customer project.
Benchmarking	How does your solution related to others provided by competitors	When it comes to signing and encryption of QR codes, there is no comparable solution on the market to the best of the author's knowledge.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	There is a pending patent for this innovative technology.
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Worldwide
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	All institutions that issue a secure identification card for a person and all big production/logistic companies with many locations over the world. Additionally, the sQR-Code can also be used for instructions for a specific machine
Targeted customers and scale of use	Select the target group of customers: 113. SMEs (<250 employees) 114. Large companies 115. Public institutions	All institutions that issue a secure identification card for a person and all big production/logistic companies with many locations over the world. Additionally, the sQR-

Element	Guiding questions	Answers
	116. End customer (Business to Customer)	Code can also be used for instructions for a specific machine
	Other, please specify	
	METHODOLOGICAL APPROACH	
Managerial aspects	Cost efficiency of the good practice, if applicable	
	Quality assurance aspects, if applicable	All the information within the QR code cannot be read or changed.
	Risk management aspects, if applicable	
Implementation guidelines	How can the Good practice be implemented?	There is no additional device needed for the identification card and there is also no specific device needed for the APP, which also works offline.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	This depends on the amount of QR codes that need to be issued. The process of issuing such codes is not very time consuming and then just the process of handing out these codes is left. Generally speaking, the implementation of these QR code can be easily integrated into existing workflows.
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	The keys for decrypting the information are available within the APP and for validating the signature one needs the public keys.
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	Proof of identity of the person/machine can be ensured by easy means.
	SUCCESS FACTORS AND CONSTRAINTS	
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	Only a limited amount of data can be stored within a QR code. In case of machines, the QR code itself has to be

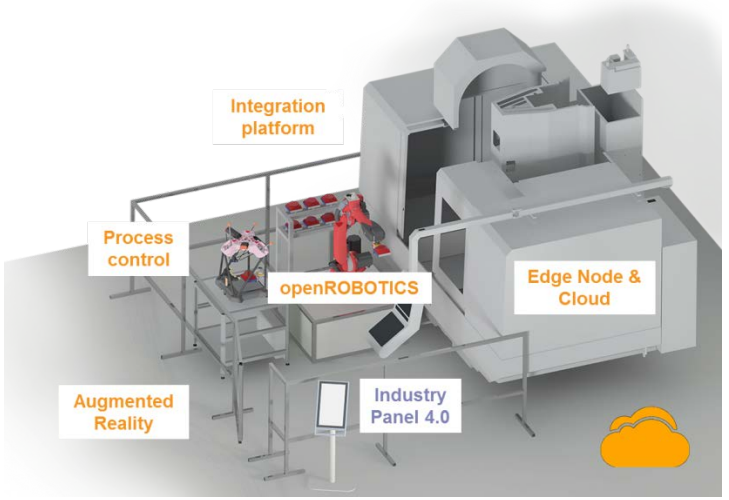
Element	Guiding questions	Answers
		applied in a way that malpractice is prevented. Furthermore, it has to be ensured that the camera of the device where the APP is installed (e.g., mobile phone, virtual reality glasses) is capable of scanning the QR code properly.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	The use of QR codes which contain signed and/or encrypted information features a fast and easy solution for strong authentication of a person/machine.
Need assessment	What else would be needed in order to improve the impact of the Good practice	
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	The described solution represents a great possibility to connect the analogue world with the digital world, however, the user acceptance strongly correlates with the level of experience concerning the technologies involved.
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	
	REPLICABILITY AND UP SCALING	
Replicability and further application	How can the solution / good practice be useful for other SMEs?	They can use the secure QR Code for strong authentication of persons or machines, e.g. if they are a production/logistic company.
	What are the possibilities of extending the good practice more widely?	This solution can be easily transferred to basically every use case where QR codes come into play, such as vouchers or e-tickets.

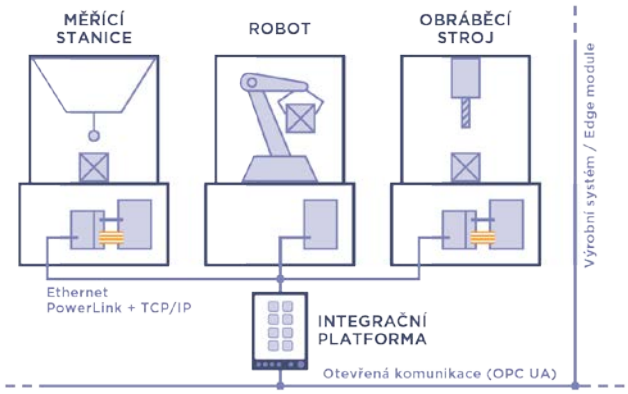
Element	Guiding questions	Answers
	FINAL REMARKS	
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	This solution can be implemented very easy and ensures the integrity, authenticity and confidentiality of the information within the QR Code. For this reason, it is the ideal tool to authenticate a person or machine and to provide important instructions of a machine in order to activate or repair it. This secure QR Code in conjunction with the APP perfectly connects the analog world with the digital world in a secure manner as the information is signed and encrypted.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	

Czech Republic

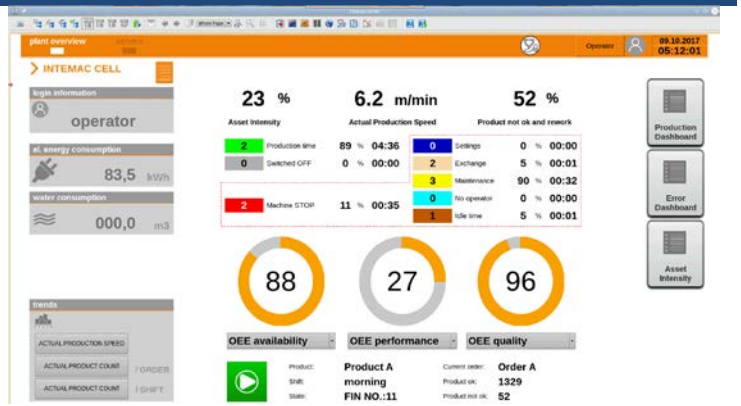
Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	Data identification : **Intemac Solutions, s.r.o.,** Logo:  Contact person: Ing. Zdeněk Fiala, Ph.D. Blanenská 1288/27, 664 34 Kuřim, Czech Republic, Phone: +420 606 097 793 E-mail: fiala@intemac.cz Website: www.intemac.cz
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	PRODUCTION CELL 4.0
	Provide a concise description of the good practice being addressed	Production Cell 4.0 is being developed as a base unit of future smart factories. The cell is formed by interconnected devices that are involved in the partial steps of the production of metal workpieces. The motivation is to prepare a cell for easy adaptation of production for SMEs. The cell is used to test principles and develop new industry-related technologies in connection with Industry 4.0.
	GOOD PRACTICE DESCRIPTION	
Detailed description	How did the SME create good practice / new product?	Several subjects participated on the development of production cell 4.0. The machine was provided by TAJMAC-ZPS, measuring station by Renishaw, B + R Automation developed an open platform, a robot for the demonstration of integrated robotics was borrowed by

Element	Guiding questions	Answers
		COMAU, SMC delivered clamping elements, and thanks to Sewio Networks the movement of people around the cell can be tracked.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	This solution is strongly tied with the “Smart Factory” concept, as several novel technologies (namely cyber physical systems, intelligent sensors, robotics and cloud processing) were incorporated directly and contributed to the production of a specific product. The benefits can be seen in the area of quality assurance.
	Describe what are the technical solutions and innovations: of the good practice	The cell forms a functional production unit linking a CNC machine, a robot and a measuring station. The uniform system solves proprietary communication with each device and communicates externally with open protocols. Thanks to modular architecture the device can be easily modified and the system can be supplemented by other software applications. The so-called production control process remains the basis of the production cell - the measuring station in the cell checks the quality of each workpiece after finishing. When a deviation is detected, the workpiece, including the necessary corrections, is sent back to the machine for repair. This greatly reduces the need of the operator to interfere with machine settings during the manufacturing process. Key capabilities include horizontal and vertical connectivity of the cell with other manufacturing systems. For the cell, the so-called edge node

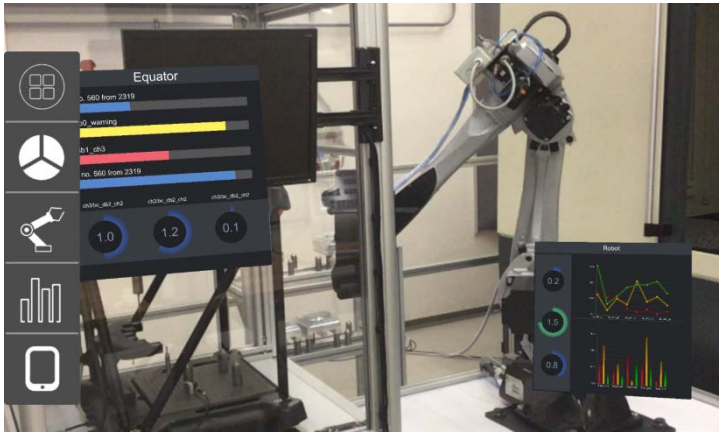
Element	Guiding questions	Answers
		connection into the cloud platform was prepared where the data mining is being conducted to search for deeper connections. The cell is controlled by a system opened for user applications and the third-party applications. The data are displayed in augmented reality, monitoring of people movement is being done, condition monitoring of CNC machine and, last but not least, quality control of production process. 
	Highlights (or keywords) of the Best Practice	Specific keywords: continuous measurement and adjustment, predictive diagnosis, integrated robotics, augmented reality, Edge Node, cloud processing.

Element	Guiding questions	Answers
Benchmarking	Good practice applied in : (NACE code) How does your solution related to others provided by competitors	Good practice applied in the field of: Machining (NACE code C25.6.2). Uniqueness consist in interconnection of a whole range of new technologies to a functional concept that is ready for deployment in production. Operation od the production cell is built on the principles of the so-called Testbed. The cell is opened to other industrial partners.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	Visualization of communication and integration platform principle.  Edge Node – visualization and data processing

Element	Guiding questions	Answers



Augmented reality - all important information in one device, quick managerial reports.



Element	Guiding questions	Answers
		Video material that presents how the solution work is provided here: https://www.youtube.com/watch?v=IQJph5c7xo0
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	The solution described previously was developed, tested and validated in Czech Republic.
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	The production cell 4.0 is usable in small and medium-sized companies as well as in large companies which are focused on machining operations.
Targeted customers and scale of use	Select the target group of customers: 117. SMEs (<250 employees) 118. Large companies 119. Public institutions 120. End customer (Business to Customer) Other, please specify	1. SMEs (<250 employees) 2. Large companies
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	Minimize on-site presence of experts, reduce changing time, increase machine availability, predictive maintenance will detect a possible failure on time.
	Quality assurance aspects, if applicable	Avoid human interaction and thus human faults. Quality is further ensured by following measures. - Control of the machining process by workpiece probe. - Process control by the control system Renishaw Equator.

Element	Guiding questions	Answers
		- Calibration of each manufactured part. - The parts carry correction data and are automatically sent back for repair.
	Risk management aspects, if applicable	Data Security Measures have to applied.
Implementation guidelines	How can the Good practice be implemented?	The methodology for implementing this solution comprised of the following steps: 1. Analysis of the production system – mapping of customer requirements on the resulting functionality, mapping of control systems and compatibility options. 2. Creating a concept for the operation of the production cell with customer approval. 3. If necessary, purchase and installation of missing devices. 4. Modification of the uniform system for mutual communication of all devices - programming of specific functions. 5. System testing and validation - functionality, accuracy, speed, data processing and visualization.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	**Personnel**: IT, technology and process department **Finance**: very variable, can't be predicted **Infrastructure**: machines, IT hardware, LAN **Timespan**: Realization depends on complexity. It may vary for 3 to 6 months.
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	The good practise was validated with industrial clients.
	RESULTS / IMPACT	

Element	Guiding questions	Answers
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The impact of the good practise is highly positive, as the scrap rates are reduced to almost 0% and the process of self-adjustment is fully automatic. Data about the machining process are displayed virtually and in time so the customer has all the necessary information for decision making.
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	NA
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	The benefit of Production Cell 4.0 is based on the interconnection of new technologies into a functional unit and in the same time openness to the technologies of other industrial partners. Those interested can even engage their devices (such as the material transport system or 3D printer), use it to test their own technologies or develop features that they would like to prefer in their business.
Need assessment	What else would be needed in order to improve the impact of the Good practice	Thanks to the open platform the production cell is prepared also for new technology advances and thus can serve as a testbed.
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	The described solution represents a great possibility to interconnect devices in one fully automated manufacturing cell however the user acceptance strongly correlates with the level of experience concerning the technologies involved.

Element	Guiding questions	Answers
		Customizing is an important requirement for user acceptance.
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	NA
	REPLICABILITY AND UP SCALING	
Replicability and further application	How can the solution / good practice be useful for other SMEs?	This solution can be implemented to a wide range of companies, without being tied specifically to a certain industry branch. It must be noted, however, that it initially requires a high financial commitment and the organizational culture should be open to the use of new technologies.
	What are the possibilities of extending the good practice more widely?	The benefit of Production Cell 4.0 is based on the interconnection of new technologies into a functional unit and in the same time openness to the technologies of other industrial partners. Those interested can even engage their devices (such as the material transport system or 3D printer), use it to test their own technologies or develop features that they would like to prefer in their business.
	FINAL REMARKS	
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The core of the Production Cells 4.0. is formed by a platform linking a machine with a handling robot and a measuring station. The cell enables the so-called adaptive process of production - the measuring station can evaluate the workpiece quality after completing the machining process and, when finding the imperfections,

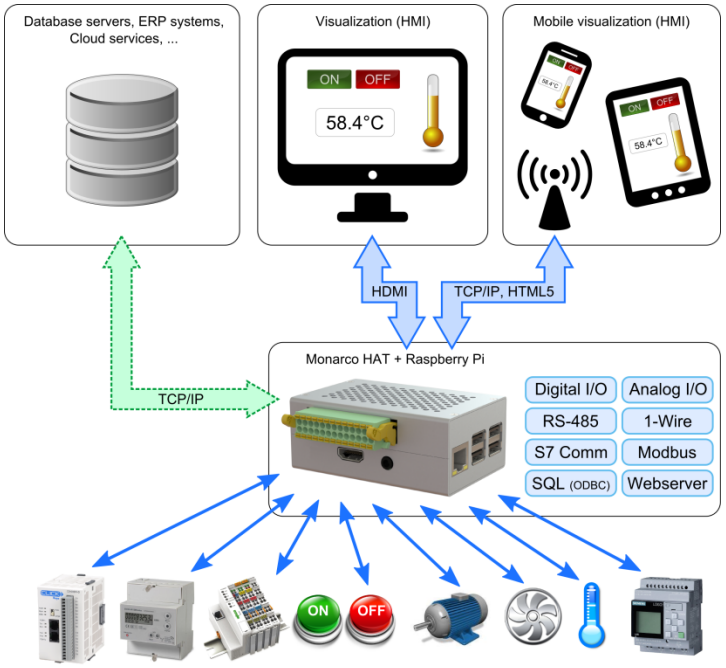
Element		Guiding questions	Answers
			send information to the machine that will repair the workpiece. The system can work completely automatically without human intervention, which eliminates errors. Reports and data from machines are instantly available in various display formats thanks to cloud computing. The cell with a uniform system demonstrates the advantages of automation combined with the needs of small-scale production where one of the key requirements is the need to change the input of production several times a day.
Disclaimer Acknowledgements	/	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	We are agree with on-line and printed dissemination of the information from this questionnaire.

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	Data identification : REX Controls s.r.o., Logo: Contact person: Ing. Pavel Balda, Ph.D.). Jeřabinová 30, 326 00 Plzeň, Czech Republic, . Phone: +420 605 212 971 . E-mail: info@rexcontrols.cz Website: www.rexcontrols.cz Product website: www.monarco.io
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	Monarco HAT
	Provide a concise description of the good practice being addressed	Monarco HAT is an add-on board which provides input-output interfaces following industrial automation standards for the Raspberry Pi (B+ and newer) minicomputer. It is designed according to the HAT (Hardware Attached on Top) specification. It enables collection of data from machines for its visualisation or evaluation.
	GOOD PRACTICE DESCRIPTION	
Detailed description	How did the SME create good practice / new product?	This product was created in response to the demand of SMEs for upgrading or retrofitting existing control systems of machines. Monarco HAT is based around ARM Cortex-M3 microcontroller (MCU) which provides

Element	Guiding questions	Answers
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management? Describe what are the technical solutions and innovations: of the good practice	a wide set of embedded peripherals missing on the Raspberry Pi itself. It offers PWMs for all digital outputs, versatile counters including quadrature encoder signal decoders, digital-to-analog and analog-to-digital converters, and RS-485 communication etc. ARM MCU can also provide very deterministic IO timing compared to Raspberry Pi with Linux. This solution is strongly tied with the “Smart Factory” concept, as a novel technology, namely intelligent sensors/actors are implemented. Below are the applications we had in mind when we designed the add-on board which we call the Monarco HAT. - Reading and archiving data from standard industrial sensors. - Monitoring of machines. - Providing communication gateway between various devices. - Feedback control in non-critical applications. Here are a few examples of devices whose outputs can be handled by Monarco HAT digital inputs: - utility meters (electricity, gas, water) with pulse output, - standard quadrature encoders for position/velocity measurement, - gear tooth sensors for position/velocity measurement,

Element	Guiding questions	Answers

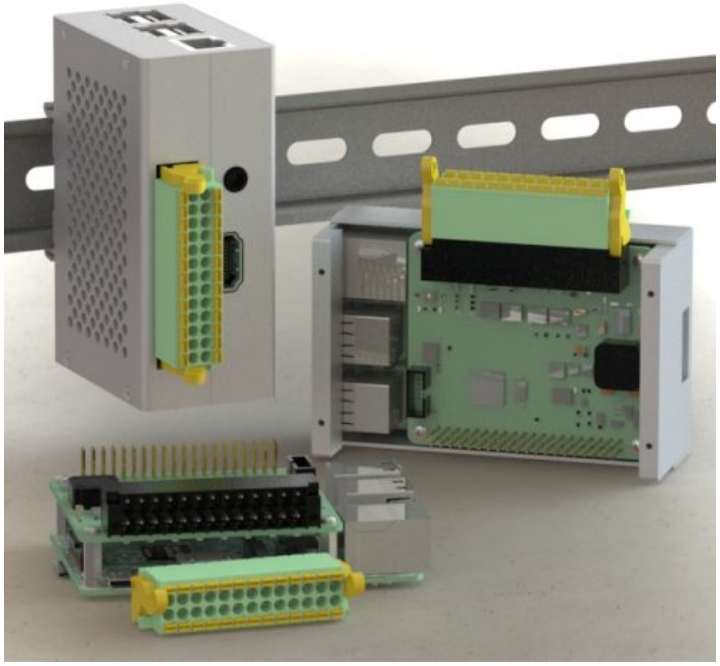
- motor controllers with pulse/direction or quadrature position output,
- various industrial sensors (temperature, pressure, distance) with frequency output.



The first choice for programming is the REX Control System, which is best described by the following features:

- Graphical programming without hand-coding.

Element	Guiding questions	Answers
		- Programming control units on a standard PC or laptop. - User interface for desktop, tablet and smartphone (HMI). - Wide family of supported devices and input-output units (including Monarco HAT). - Industry-proven control algorithms. - Easy integration into business IT infrastructure (ERP/BMS). - REST API for seamless integration into Industry 4.0 and (I)IoT solutions.
Benchmarking	Highlights (or keywords) of the Best Practice	Specific keywords: Monitoring of machines, Monarco HAT, Raspberry Pi, REX control system.
	Good practice applied in : (NACE code)	Good practice applied in the field of: Manufacturing (NACE code C).
	How does your solution related to others provided by competitors	Uses normal and quite common Raspberry Pi minicomputer but supplement it with additional normally not available interfaces, effectively turning it into a PLC or a mini industrial PC (IPC).

Element	Guiding questions	Answers
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	 Video material that presents how the solution work is provided here: Raspberry Pi as a 1-Wire data bridge for Siemens LOGO https://www.youtube.com/watch?v=rdosVtdxJac Raspberry Pi controlling a frequency inverter

Element	Guiding questions	Answers
		https://www.youtube.com/watch?time_continue=74&v=APXEFQKF5Tw Raspberry Pi reading a 0-10 V ultrasonic sensor https://www.youtube.com/watch?time_continue=45&v=oXTaTk1jbEY Extending I/O of the Monarco HAT via RS-485 https://www.youtube.com/watch?v=3G5M0xRgNss
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	The solution described previously was developed, tested and validated in Czech Republic. The utilisation is worldwide.
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Monarco HAT with its REX Control System can be applied in various scenarios in various industry fields. Its versatility ensures its uses in large as well as in small and medium size companies.
Targeted customers and scale of use	Select the target group of customers: 121. SMEs (<250 employees) 122. Large companies 123. Public institutions 124. End customer (Business to Customer) Other, please specify	3. SMEs (<250 employees) 4. Large companies
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	There are indirect cost savings connected with describes solution. The data which is being collected

Element	Guiding questions	Answers
		and evaluated influence the overall productivity by well-timed decision making. Furthermore the purchase cost of Monarco HAT is quite low which ensures that this solution is also affordable for SMEs.
	Quality assurance aspects, if applicable	Clear visualisation and electronical data transfer eliminates mistakes which may occur if the data was processed manually (pen and paper) by workers.
	Risk management aspects, if applicable	Data Security Measures have to be applied.
Implementation guidelines	How can the Good practice be implemented?	The methodology for implementing this solution comprised of the following steps: 6. Feasibility study (establish whether the solution can be implemented – checking electrical compatibility at signal level, checking availability of sensors and actuators, studying the programming tools, budget analysis, potential benefits and weak points); 7. Acquire the hardware platform and programming tools; 8. Develop software based on the solution (programming the mini PLC to collect the required data, perform the requested operations and); 9. Deploy the resulting controller/data logger/communication gateway at floor level of the factory; 10. Verify the impact (compared to historical data and/or evaluate benefits of collecting new data).
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	**Personnel**: IT, PLC programmers

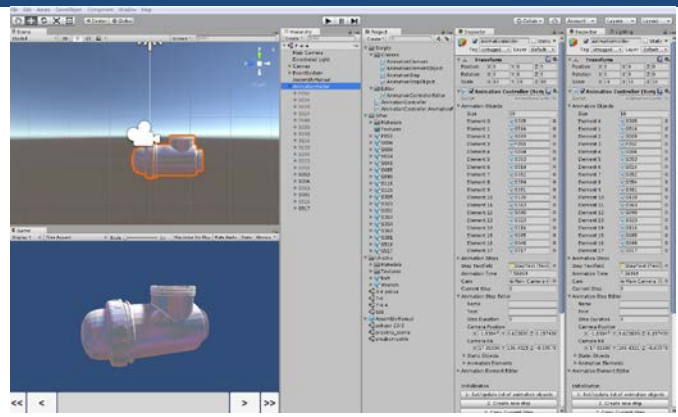
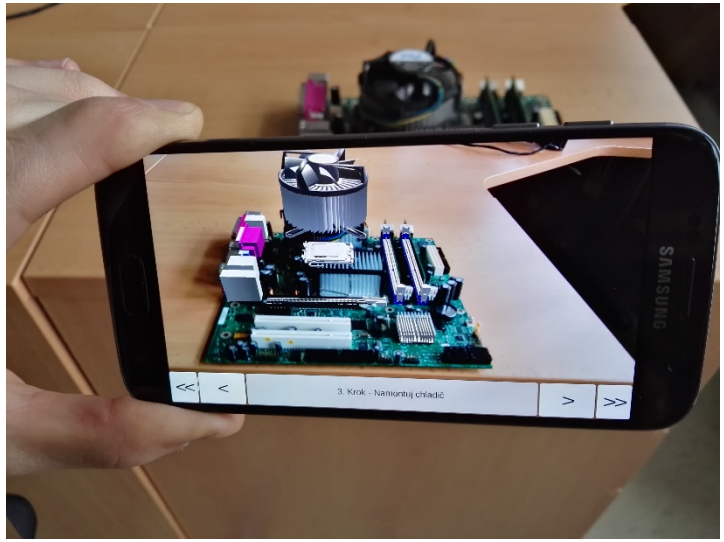
Element	Guiding questions	Answers
		Finance: Plain board with optional housing – 129 €, Automation kit with RexCore Plus – 279 €, Automation kit with RexCore Pro – 359 € **Infrastructure**: IT Hardware, LAN **Timespan**: Delivery time is about 3-5 business days within Europe and 10-12 days outside Europe. Realization on the spot in one day for single implementation.
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	The good practise was validated with industrial clients worldwide. (USA, Australia, Taiwan, Republic of South Africa, Germany, Austria, Belgium, Norway, etc.)
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The impact of the solution was highly positive, the new collected data and interconnection between individual machines led to an increase in productivity and lowering failure rates in final quality tests on production lines.
	SUCCESS FACTORS AND CONSTRAINTS	
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	The solution cannot be directly mounted on moving parts of machines. The reason is the memory card holder, which is not designed for use in vibrating environments.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	Monarco HAT was developed by control engineers for control engineers. So far it is the only board aimed at industrial automation and following the HAT standard.

Element	Guiding questions	Answers
		Years of experience in automation domain and electronics design were put into the product design. Although Monarco HAT is a very young product, our records indicate very low failure rates. Hundreds of satisfied customers are enjoying the benefits of using the solution. The device is universal and can be used for all tasks in automation and cybernetics. Low entry costs make it attractive also for SMEs and even end customers.
Need assessment	What else would be needed in order to improve the impact of the Good practice	NA
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Operating temperature and vibrations are known to be the most critical. What happens when the Raspberry Pi fails? Not having real-time data on displays at floor level can hurt, but certainly not as much as stopping the whole production line. If necessary, will it be possible to switch to another hardware platform without starting software development from scratch? Those are the types of questions you should be asking before deploying the solution in the field. In short, using this platform gives you freedom, but keep in mind that freedom comes with responsibilities.
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	NA

Element	Guiding questions	Answers
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	This solution can be implemented to a wide range of companies, without being tied specifically to a certain industry branch.
	What are the possibilities of extending the good practice more widely?	The Monarco HAT is upgraded continuously in its functions regarding the needs of industrial practice. The upgrades are mainly on software basis.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The use of Raspberry Pi and the Monarco HAT in industrial automation opens new possibilities for IoT and Industry 4.0 projects. This platform has proven to work well in symbiosis with existing control systems and controllers, providing additional CPU power, memory, storage and communication capabilities, which the traditional platforms are missing.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	We are agree with on-line and printed dissemination of the information from this questionnaire.

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	Data identification : Regional Technological Institute, Logo: FACULTY OF MECHANICAL ENGINEERING UNIVERSITY OF WEST BOHEMIA — REGIONAL TECHNOLOGICAL INSTITUTE Contact person: Ing. Pavel Žlábek, Ph.D. 3. Univerzitní 8, 306 14 Plzeň, Czech Republic, 4. Phone: +420 377 638 711 5. E-mail: zlabek@rti.zcu.cz Website: www.rti.zcu.cz
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	VIRTUAL REALITY WORK INSTRUCTIONS
	Provide a concise description of the good practice being addressed	The goal was to create a virtual work instructions that will shorten the time needed to train new employees to improve work performance, reduce mistakes, and ease work by eliminating inappropriate assembly and further disassembly of parts. The shorter the training of new employees is, the sooner they will be able to perform their work and produce flawless products. These instructions are also useful if the operator gets into an unfamiliar situation and if he have to do some work for the first time.
	GOOD PRACTICE DESCRIPTION	
Detailed description	How did the SME create good practice / new product?	A first prototype was created in the course of a master thesis. The system was further developed within the

Element	Guiding questions	Answers
		research work conducted in the RoRTI project from National Sustainability Programme funded by the Ministry of education and then validated and improved with lead customers.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	This solution is strongly tied with the “Smart Factory” concept in concrete with mobile workforce. The workers are provided with virtual working instruction presented on LCD display.
	Describe what are the technical solutions and innovations: of the good practice	The innovative nature of this solution is that it provides animated instructions for the operators training and work which makes their activities more efficient. The instruction can be performed as fully virtual or in mixed reality (augmenter reality). The visualisation with smart glasses (Vuzix) was tested however the satisfaction was very low. Thus the simple visualisation on LCD display – tablet, smartphone was provided. The system was developed with aid of Unity 3D software package. Preparation of virtual assembly in Unity 3D

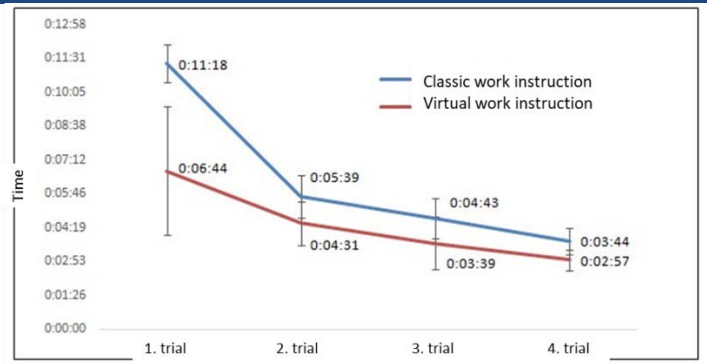
Element	Guiding questions	Answers
		
		Augmented reality work instruction
		

Element	Guiding questions	Answers
Benchmarking	Highlights (or keywords) of the Best Practice Good practice applied in : (NACE code) How does your solution related to others provided by competitors	Specific keywords: virtual work instructions, augmented reality, assistive technology, operator empowerment. Good practice applied in the field of: Manufacture of consumer electronics (NACE code C26.4.0). The application of the current technology extended over to other industry branches, but its use differed in nature from this type of application (e.g. Daimler applied Vuzix glasses for quality-control and other type of product inspection activities, while UPS (United Parcel Service Inc.) used it for reducing labelling on packages). In both of these cases the AR glasses are required however the comfort by using the AR glasses is not very high. The technology has still its limitation. For our solution we choose simple visualisation on display.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	The animation of virtual assembly is provided.
OBJECTIVE AND TARGET AUDIENCE		

Element	Guiding questions	Answers
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	The solution described previously was developed, tested and validated in Czech Republic.
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Solution can be applied by other companies that are willing to integrate virtual reality or augmented reality technology into their manufacturing process, especially those that have operators involved in product assembly activities. The practice has a high degree of portability and can be adapted to companies operating in various industry branches.
Targeted customers and scale of use	Select the target group of customers: 125. SMEs (<250 employees) 126. Large companies 127. Public institutions 128. End customer (Business to Customer) Other, please specify	5. SMEs (<250 employees) 6. Large companies
	METHODOLOGICAL APPROACH	
Managerial aspects	Cost efficiency of the good practice, if applicable	If a company recruits new workers, they have to be trained and the faster they learn, the sooner they can effectively perform the necessary tasks. Virtual guides are not only suitable for training of new employees, but they can be effectively used if there is a wide range of products in the company. If the employees don't perform these processes daily, they do not need to remember the exact procedures and steps.

Element	Guiding questions	Answers
	Quality assurance aspects, if applicable	In addition to promptly training of new employees and thus increasing their performance, the errors are reduced or completely eliminated, and the resulting ease of work due to inappropriately mounted parts and subsequent removal of faulty components occurs. Virtual working instructions can be easily done in language versions and therefore are also suitable for foreign agency workers. There is also no possibility for operators when using virtual instructions to skip a step and thus create a scrap. In the case of virtual instructions, every step after completion has to be confirmed by pressing the button and therefore can't be omitted by mistake.
	Risk management aspects, if applicable	N/A
Implementation guidelines	How can the Good practice be implemented?	The methodology for implementing this solution comprised of the following steps: 11. Analysis phase – decision about form of work instruction (VR or AR), selection of work instructions and products to be processed, budget analysis, mapping of company's IT infrastructure and databases; 12. Development phase – digitisation of products and its components (creation of 3D models), creation of animations, in case of AR mapping the 3D models on real object; 13. Implementation phase – upload to company's database, fine-tune the visualisation, train the operators.

Element	Guiding questions	Answers
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	**Personnel**: IT department, technology and process department **Finance**: Depends on no. of products and thus number of work instruction to be prepared, also on the complexity of the products and finally the type of work instruction (VR, AR). One working instruction costs around 550 €. If more instruction are being prepared than the costs for one instruction is being lowered as the 3D components may be interchangeable. **Infrastructure**: IT Hardware, LAN, database entry. **Timespan**: Time also depend on the complexity of the project. Timeframe is usually around 1-3 months also with implementation on the spot.
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	Twelve workers (6 males and 6 females) tested the assembly of two complex products of a similar type, of which they had previously no information. The product was assembled according to both paper and virtual instructions. They have always done four repetitions of the assembly. With every further round, work has accelerated (see chart). The results show that the virtual instruction was much more efficient than paper in the first round, and this was repeated in the following rounds also.

Element	Guiding questions	Answers
		
RESULTS / IMPACT		
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The impact of the solution was highly positive, as the assembly time was reduced by 40% in the first trial round, by 22% in the second trial round, by 23% in the third trial round and by 20% in the fourth trial round. From these results can be seen that the virtual work instructions enables around 20% faster assemblies. Moreover as the printed documentation is reduced significantly the reduction is also in the printing costs.
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	The technology is universal however the software is programed directly for specific products. If the product is updated or modified the same goes also for the software which needs to be updated as well. The quality of company's internal databases and also the speed of connection is essential.

Element	Guiding questions	Answers
		The augmented reality work instructions has still many limitations. Marker technology is sensitive for the distance from marker and vison angle. The object fitting technology is limited by the size of the product which can maximally be around 30x30 cm.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	The solution and technology is not brand new. The virtual reality and augmented reality work instructions are implemented also in other companies. But it is usually domain of larger companies. Our solution and its development is rather cheep a thus can be implemented also in SMEs.
Need assessment	What else would be needed in order to improve the impact of the Good practice	NA
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	The success of the implementation depends on the capability of overcoming the resistance of workers regarding the technological change. If they give it a try usually they are more satisfied. During the testing phase most of the workers followed the animations. The accompanying text was read only when assembly was difficult or if there was another problem.
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	The technology has still some limitations in these days however due to future technological progress the development can be foreseen.

Element	Guiding questions	Answers
		Moreover the system reduces the need for printed documentation and thus is environmental friendly.
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	This solution can be implemented to a wide range of companies, without being tied specifically to a certain industry branch. The technology is transferable however the work instruction preparation must be taken into account which requires a medium financial commitment. Also the workers must be open to utilize new technologies.
	What are the possibilities of extending the good practice more widely?	The technology is limitation for now especially in augmented reality application. With technology development we will be able to track greater objects without markers.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The virtual work instructions are promising new technology of work organisation. Either the full virtual reality solution or augmented reality solution can be applied. The AR still has some technology limitation but fully VR instructions works fine. Validation showed time reduction of assembly in comparison to classical work instructions by around 20%. The costs for printing are reduced or eliminated totally. The solution can be used widely through many industrial sectors. Also it is very

Element		Guiding questions	Answers
			effective in those types of productions where high variability occurs, where the production is running in small batches or where often changes of products portfolio appears.
Disclaimer Acknowledgements	/	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	We are agree with on-line and printed dissemination of the information from this questionnaire.

Slovakia

Element	Guiding questions	Answers
	INTRODUCTION	
	Data identification, logo, contact person, possible representative image(s).	PERFECTION IN AUTOMATION A MEMBER OF THE ABB GROUP
Company information		**B + R automatizace, spol. s r.o. - organizačná zložka** Trenčianska 17 915 01 Nové Mesto nad Váhom, Slovakia Contact person: Ing.Juraj Bielesch Phone: +421 907 174 055 Fax: - E-mail: Juraj.Bielesch@br-automation.com Web: www.br-automation.com
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice (key words).	**Orange BOX** Data acquisition IIoT Industrial Internet of Things OEE – evaluation of productivity and effectivity of production devices Measuring of energy consumption Predictive maintenance

Element	Guiding questions	Answers
	Provide a concise description of the good practice being addressed.	There are existing production enterprises, which are equipped with machines and lines, which are not capable to communicate with superior systems. Orange Box creates a gate to ERP, MES, Edge, Fog and Cloud solutions for these older machines. It provides technologies from Industry 4.0 without the need of programming. It interprets OEE and states of machine in real time. Extension to this is an Edge system, which provide all tools for data analysis and reporting, trends tracking, etc. OrangeBox was implemented in company Nestlé.
GOOD PRACTICE DESCRIPTION		
Detailed description	How did the SME create good practice/new product?	Robust control systems B&R provided HW platform for data acquiring (productivity, quality, energy consumption, operating state, …) from machine in real time. These control systems perform data acquisition, their evaluation and display, and in consequence their transfer through communication standards as OPC UA, MQTT,…. into superior control system, where analysis and reports are created.
	What is the relationship to Smart Factory (SFH) approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	OrangeBox allows **upgrade to Smart factory** of almost any production factory. It provides new communication technology OPC UA, MQTT, even for machines without own control system. Results of consequent data analysis have immediate impact on arrangements for increasing the productivity, effectivity, quality and energetic effectivity of machines and lines. At the same time it allows to follow the effects of changes on individual parameters, watching the trends and compering them with historical data.
	Describe what are the technical solutions and innovations: of the good practice.	OrangeBox is IIoT device, which creates the gate between the machine and analytical tool (server , cloud, edge controller). Innovation of this solution lies in

Element	Guiding questions	Answers
		its configurability without the need of programming or IT knowledge about OPC UA or MQTT. Moreover, the knowledge of PLC programming is also not needed.
		
	Highlights (or keywords) of the Best Practice	Quick implementation Configurability Simplicity Flexibility Knowledge of programming is not needed
	Good practice applied in: (NACE code)	C10-C11

Element	Guiding questions	Answers
Benchmarking	How does your solution related to others provided by competitors	Unique solution on the market, which provide not only converter of protocols or signal acquisition, but also data processing and displaying in real time directly near the selected machine. It is not necessary to program OrangeBox, for the ensuring of the connectivity it is needed to know the addresses only (or signals).
Additional information's materials	/ Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	 https://www.br-automation.com/en/about-us/customer-magazine/striking-brownfield-gold/ https://www.br-automation.com/en/events/br-sps-ipc-drives/innovations-2017/no-more-unplanned-downtime/ https://www.br-automation.com/en/downloads/#categories=catalogues-and-brochures/products/orange-box/

Element	Guiding questions	Answers
		https://www.br-automation.com/en/downloads/catalogues-and-brochures/products/aprol/dwldwl10000370103/
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Slovak Republic, Germany, Austria
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	All production enterprises
Targeted customers and scale of use	Select the target group of customers: 1. SMEs (<250 employees) 2. Large companies 3. Public institutions 4. End customer (Business to Customer) 5. Other, please specify	1. SMEs (<250 employees) ☒ 2. Large companies ☒ 3. Public institutions ☐ 4. End customer (Business to Customer) ☐ 5. Other, (please specify) ☐:
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	System is essential for objective analysis of productivity, effectivity, energy consumption, etc. whereby return is determined by quality and speed of established actions.

Element	Guiding questions	Answers
	Quality assurance aspects, if applicable	Quality monitoring, search for contexts and trends tracking are the basic elements of system. Depth of knowledge about the impact on quality is proportional to the number of monitored variables and factors.
	Risk management aspects, if applicable	N/A
Implementation guidelines	How can the Good practice be implemented?	Implementation of basic system is simple and a handy maintenance technician is sufficient for the implementation. In the case of more difficult implementations, system integrator is needed.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	Handy technician, necessary HW, available network infrastructure, system can be implemented in 1 hour
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	N/A
RESULTS/IMPACT		
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries?	After implementation of minimal configuration at a customer and after 2 days of measuring, this system was able to organizational actions, which increased overall utility of machine over 20%. Analysis brought surprising relations. Investment returns were defined on level of 3 weeks.
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view.	System is dependent on analytical abilities of the customer and possibilities of accepting necessary actions.

Element	Guiding questions	Answers
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands.	User friendly Data in real time Mountable in any environment Configurable without programming knowledge OPC UA and MQTT connectivity on Edge, ERP, MES, Cloud, …
Need assessment	What else would be needed in order to improve the impact of the Good practice?	Improvements in analysis, enhancing the number of measuring points
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Ideal tool for already existing production enterprises, view about OEE in real time (before once a shift or day). Frequently surprising detection of weak places in productivity, effectivity energy consumption and other unexpected relations.
SUSTAINABILITY		
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	Continuous implementation of actions, and their regular evaluation with enhancing of measuring points.
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	System is created for repeated usage and it is not designed only for specific enterprise, factory or technology.
	What are the possibilities of extending the good practice more widely?	Extending of solution is limited only by willingness to invest in increasing the productivity of existing enterprises.
FINAL REMARKS		

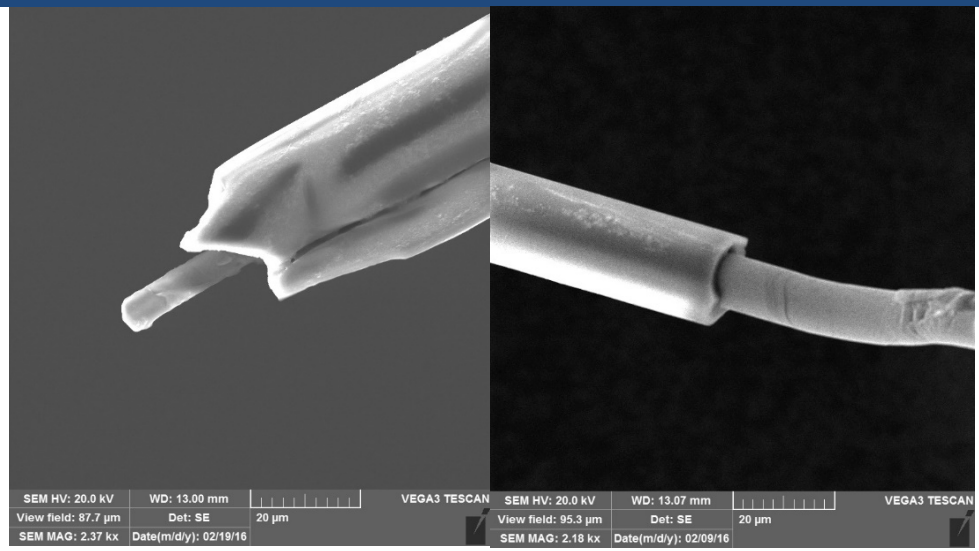
Element	Guiding questions	Answers
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	OrangeBox is configurable tool for measuring and evaluating the productivity, effectivity, and energy consumption, and it is suitable for predictive maintenance. Ideal tool for already existing production enterprises, view about OEE in real time (before once a shift or day). Frequently surprising detection of weak places in productivity, effectivity energy consumption and other unexpected relations.
	FINAL REMARKS	
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	The company describing this good practice doesn't guarantee the successfulness of the solution and can't be held liable for its failure in application. We agree with on-line and printed dissemination of the information from this questionnaire.

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	Data identification : RVmagnetics, a.s., Logo:  Contact person: Michal Borza – member of BoD Hodkovce 21, 04421 Hodkovce Slovakia Phone: (+421) 918 88 55 38 Fax: - E-mail: info@rvmagnetics.com Web: www.rvmagnetics.com
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice (key words). Provide a concise description of the good practice being addressed.	Smallest passive contactless sensors of physical quantities (temperature, pressure, magnetic field, position…); in the world. European Defence Agency used RVmagnetics´s sensors to measure the structural health of carbon fibres composites. Czech construction company used RVmagnetics´s sensors to measure the forces during the construction of a train bridge. With Singapore partner RVmagnetics are creating the smart composites based on microwire technology.

Element	Guiding questions	Answers
		With partner RVmagnetics creates new generation, effective, more robust and simple railroad sensor to monitor the traffic and other parameters.
GOOD PRACTICE DESCRIPTION		
Detailed description	How did the SME create good practice/new product?	EDA needed to know what the quality of composites material is used in European defence program. Goal of the project was to compare the technologies of structural health monitoring and improve the manufacture process, effectivity, etc. RVmagnetics´s microwire technology was compared with standard invasive and non-invasive techniques with excellent results. Czech construction company need to measure the forces during the construction of new innovative train bridge. RVmagnetics developed new non-destructive measuring system, with zero error, which shows what kind of forces are inside of concrete.
	What is the relationship to Smart Factory (SFH) approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	RVmagnetics bring to the market absolutely new generation of physical quantities sensors, based on microwire technology which offer to RVmagnetics´s partners create smart goods from their standard portfolio. RVmagnetics´s technology is ideal for IoT world and Industry 4.0
	Describe what are the technical solutions and innovations: of the good practice.	With RVmagnetics´s technology could be goods of our partners smarter, more effective, self-diagnosed and much more. The innovative nature of this solution is that it provides non-invasive testing, monitoring and measuring method for composites materials, which monitors the production process, application process and values from real use. With this

Element	Guiding questions	Answers
		technology partners can save the material costs, produce smarter goods and bring new added value for their partners.
	Highlights (or keywords) of the Best Practice	Specific keywords: sensors; structural health monitoring; non-invasive; innovative; magnetic; IoT; Industry 4.0.
	Good practice applied in: (NACE code)	Good practice applied in the field of: Construction of bridges and tunels (42.13) Manufacture of instruments and appliances for measuring, testing and navigating (26.51)
Benchmarking	How does your solution related to others provided by competitors	There is no non-invasive monitoring/testing/measuring technology for composites or any others goods, with online and real-time data. Compared other indirect competitors RVmagnetics´s technology has these benefits: 1) **Small dimensions** – microwires can be embedded into the various structures without changing of mechanical properties of the structure (e.g. glass- and carbon- fibre composites, polymers, Ti implants, etc.); 2) **Multifunctionality** – single microwires can sense temperature, stress and position at the same time 3) **Glass-coating** is biocompatible, protects metallic nucleus from corrosion, short-circuits etc.; 4) **Contactless** sensing because of magnetic nature; 5) **Imperishable** – when a microwire is broken, two sensors are obtained (like braking a magnet results in getting two magnets)

Element	Guiding questions	Answers
		6) Small dimensions allow constructions of **network of sensors**; 7) **Low energy consumptions** – can be powered by little battery or photovoltaic cells; 8) **Simple sensing process** – no electronics is necessary inside the construction; 9) Production process allows to produce **thousands of sensors** in short time; 10) **Real time data** – 1000x/sec;
Additional information's materials	/	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	At this link you can find the basic presentation, videos, onepager and also academic/scientific papers about the technology: https://www.dropbox.com/sh/i6yqas0q7cn5i1e/AADZwFi2B_vtxps_m3hUP3rla?dl=0

Element	Guiding questions	Answers
		
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Spain; Czech Republic; Slovakia; In negotiation process with partners from: Singapore, Japan, UK, Lithuania, USA
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Solution can be applied by other companies which are looking for the innovation which brings the new high added value to their products, which can be transfer to their customers, and also by companies which are looking to solve their problems which are not possible solved by current state of technology.

Element	Guiding questions	Answers
Targeted customers and scale of use	Select the target group of customers: 6. SMEs (<250 employees) 7. Large companies 8. Public institutions 9. End customer (Business to Customer) 10. Other, please specify	6. SMEs (<250 employees) ☒ 7. Large companies ☒ 8. Public institutions ☐ 9. End customer (Business to Customer) ☐ 10. Other, (please specify) ☐:
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	RVmagnetics provides as simple as possible solution which we offer to our partners. From the costs perspective, the solution can save up to 30% of material costs for selected sectors (composites materials), or provide new and high added value with minimum initial costs.
	Quality assurance aspects, if applicable	New and high added value for products; new information of production process which could be transformed to higher profit.
	Risk management aspects, if applicable	N/A
Implementation guidelines	How can the Good practice be implemented?	The methodology for implementing this solution comprised of the following steps: 1. Feasibility study (establish whether the solution can be implemented – interviews with operators, budget analysis, potential benefits and weak points; information about the environment); 2. Create the HW and SW prototype. 3. Testing 4. Implementation 5. Verify the impact

Element	Guiding questions	Answers
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	Companies should also commit resources for the following aspects: - conducting an initial feasibility study for determining if or how the solution can be applied specifically in case of each; - (Technical) cooperation in production prototype process. - Costs of solution or exclusive license - Costs of sensor The timespan for fully implementing the solution is between 6-18 months.
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	The validation process is done after each period of development resp. application in the external condition which were selected by partner.
RESULTS/IMPACT		
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries?	From the costs perspective, the solution can save upto 30% of material costs for selected sectors (composites materials), or provide new and high added value with minimum initial costs.
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view. Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing	Technical: 1. Temperature over 600 °C; 2. Depth inside the material for contactless sensing over 30 cm. Unique solution based on revolutionary technology which brings high added value for our partner and their customers. Benefits:

Element	Guiding questions	Answers
	brands and gives its client a logical reason to prefer it over other brands.	1. **Small dimensions** – microwires can be embedded into the various structures without changing of mechanical properties of the structure (e.g. glass- and carbon- fibre composites, polymers, Ti implants, etc.); 2. **Multifunctionality** – single microwires can sense temperature, stress and position at the same time 3. **Glass-coating** is biocompatible, protects metallic nucleus from corrosion, short-circuits etc.; 4. **Contactless** sensing because of magnetic nature; 5. **Imperishable** – when a microwire is broken, two sensors are obtained (like braking a magnet results in getting two magnets) 6. Small dimensions allow constructions of **network of sensors**; 7. **Low energy consumptions** – can be powered by little battery or photovoltaic cells; 8. **Simple sensing process** – no electronics is necessary inside the construction; 9. Production process allows to produce **thousands of sensors** in short time; 10. **Real time data** – 1000x/sec;
Need assessment	What else would be needed in order to improve the impact of the Good practice?	Partners which are open to implement unique solutions based on revolutionary technology.
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	The success of the implementation depends on on the way how RVmagnetics can show the benefits of technology to our partner and how our partner has capacity to adopt new revolutionary technologies and RVmagnetics
	SUSTAINABILITY	

Element	Guiding questions	Answers
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	Cost efficient and high added value bring the benefit which provide the sustainability of implementation of RVmagnetics´s technology.
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	This solution can be implemented to a wide range of companies, It must be noted, and however, that it initially requires a financial commitment and the organizational culture should be open to the use of new revolutionary technologies.
	What are the possibilities of extending the good practice more widely?	Partners which are looking for the innovations.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	In the Industry 4.0 and IoT world will be necessary to have information from each part and each aspect of production process. These information could save the material costs up to 30%, increase the effectivity and deliver new added value for customers.
FINAL REMARKS		
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	The company describing this good practice doesn't guarantee the successfulness of the solution and can't be held liable for its failure in application. We agree with on-line and printed dissemination of the information from this questionnaire.

Element	Guiding questions	Answers
INTRODUCTION		
Company information	Data identification, logo, contact person, possible representative image(s).	Data identification**: ANEXT a.s., BRATISLAVA** Logo:  Contact person: **Juraj Smutný – Managing Partner** **Hurbanovo námestie 3, 811 06 BRATISLAVA, Slovenská republika** Phone: +421 2 38 105 760; +421 917 566 566 Fax: +421 2 321 144 266; Email: mailto:info@anext.sk Public relations: publicrelations@anext.sk Website: http://www.anext.sk/
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	Computer vision using deep neural networks NEURONIT in industrial production
	Provide a concise description of the good practice being addressed	VW Bratislava in its production of specially glued body parts to check their quality experimentally deploys deep neural networks from Anext. The intention is to limit the impact of the human factor in the automotive industry in the spirit of the concept Industry 4.0.
GOOD PRACTICE DESCRIPTION		

Element	Guiding questions	Answers
Detailed description	How did the SME create good practice / new product?	**VW Bratislava** started cooperation with the company Anext in late 2017. This year was successful finished development deep neural network NEURONIT for different application industrial outputs. One of them is deployment in the area advanced industrial computer vision with elements of AI.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	This solution is strongly tied with the “Smart Factory” concept, as a novel technology, advanced industrial computer vision with elements of AI were incorporated directly and contributed to the production of a specific product.
	Describe what are the technical solutions and innovations: of the good practice	The innovative nature of this solution is that it **provides fully automatic quality control of the robotically applied layer of adhesive glues**. The proposed workstation is completely unattended and guarantees the quality of the finished parts in production.
	Highlights (or keywords) of the Best Practice	Specific keywords: **deep neural network advanced industrial computer vision, AI.**
	Good practice applied in : (NACE code)	Good practice applied in the field of: Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers (NACE code C29.2).
Benchmarking	How does your solution related to others provided by competitors	The application of the current technology extended over to other industry branches, but its use differed in nature from this type of application . When this solution was implemented, it was the first of its kind that made use of deep neural network advanced industrial computer vision with elements of AI. Currently used for the purpose computer vision system without elements of AI (for example Cognex). Just adding elements of AI makes the system fully autonomous in the spirit of the concept Industry 4.0.

Element	Guiding questions	Answers
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	All additional information is available at the company Anext.
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	The solution described previously was applied in **VOLKSWAGEN SLOVAKIA, a. s., Bratislava** (further only VW Bratislava), a Manufacturer of cars and parts of the Volkswagen brands, factory situated in Bratislava-Devínska Nová Ves, Slovakia. (Website: https://www.volkswagen.sk/)
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Solution can be applied by other companies that are willing to integrate deep neural network advanced industrial computer vision with elements of AI into their manufacturing process, especially those that have operators involved in product assembly activities. The practice has a high degree of portability and can be adapted to companies operating in various industry branches.

Element	Guiding questions	Answers
Targeted customers and scale of use	Select the target group of customers: 129. SMEs (<250 employees) **130. Large companies** 131. Public institutions 132. End customer (Business to Customer) Other, please specify	Large company
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	From the costs perspective, the solution proved to be highly efficient, as it requires minimum intervention (only background to analysis in form required neural network and maintenance and software updates) and further investments after implementation are not needed..
	Quality assurance aspects, if applicable	The solution led to a significant decrease in faulty and non-conforming products reported by customers, which, in turn, increased customer satisfaction.
	Risk management aspects, if applicable	N/A
Implementation guidelines	How can the Good practice be implemented?	**Th**e methodology for implementing this solution comprised of the following steps: 1. Feasibility study (establish whether the solution can be implemented – interviews with operators, budget analysis, potential benefits and weak points); 2. Acquire hardware part of the solution (computing servers, high-precision cameras); 3. Develop software part of the solution (containing wire-harness assembly steps and additional information, both auditive and visual);

Element	Guiding questions	Answers
		4. Implement the solution into the assembly process (train neural network for properly using the equipment); **5.** Verify the impact (% in errors or scrap reduction, assembly duration shortening, etc.) compared to previous data.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	For future successful implementation, companies should follow the steps described in the "Methodological approach" section and should appoint a project manager who will oversee the acquisition of equipment, software development contracting and the training of selected operators. Companies should also commit resources for the following aspects: - conducting an initial feasibility study for determining if or how the solution can be applied specifically in case of each company and what will be its impact (can be carried out internally or by contracting specialized consultancy companies); - acquiring equipment computing servers, high-precision cameras); - developing a custom application, specific to each company's assembly process, which will be installed on the production line; - selecting and training the operators which will be using the The timespan for fully implementing the solution stretched over a period of 6 months.
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	The validation process was completed within the customer factory and comprised in the analysis and comparison of the error / scrap rates and the assembly time needed by operators before and after implementation.
RESULTS / IMPACT		

Element	Guiding questions	Answers
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The impact of the solution was highly positive, as the scrap rates were reduced to almost 0% and the assembly time was reduced with an average too. These led to an increase in productivity and customer satisfaction.
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	The quality of advanced computer vision strongly depends on the quality of learning deep neural network based on the quality of the data provided.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	This solution was the first of its kind, as not any other company made use of this type of practice, especially in its assembly process. As mentioned previously, as direct results of the implementation significantly increased productivity and customer satisfaction were obtained.
Need assessment	What else would be needed in order to improve the impact of the Good practice	The system performs better if the component devices have better technical specifications (e.g. computing servers, high-precision cameras) and the quality of the data provided to deep neural network must be as good as possible
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	The success of the implementation depends on the capability of overcoming the resistance of workers regarding the technological change. The reliability and performance of the system is directly related to the initial investment, as hardware and devices with lower technical specifications function at a reduced performance.
SUSTAINABILITY		

Element	Guiding questions	Answers
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	Currently the price of the solutions can be prohibitive, however, due to future technological progress their price will decrease and the cost of implementation will be reduced.
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	This solution can be implemented to a wide range of companies, without being tied specifically to a certain industry branch. It must be noted, however, that it initially requires a medium financial commitment and the organizational culture should be open to the use of new technologies.
	What are the possibilities of extending the good practice more widely?	Currently, the remote assistance feature of this system is under development, for assuring guided support for even more complex tasks.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The solution requires a medium financial commitment, however, compared to the benefits it offers (scrap reduction almost 0%, time needed for assembly reduced increased productivity, increased customer satisfaction, elimination of printed documentation, making operators' activities more efficient) it can easily be supported by any company. Moreover, the implementation of these types of solutions increases a company's readiness to adopt the new industrial revolution's principles, promoted under "Industrie 4.0".
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	The company describing this good practice doesn't guarantee the successfulness of the solution and can't be held liable for its failure in application. We are agree with on-line and printed dissemination of the information from this questionnaire.

Element	Guiding questions	Answers
INTRODUCTION		
Company information	Data identification, logo, contact person, possible representative image(s).	Data identification**: ANEXT a.s., BRATISLAVA** Logo: ANEXT Contact person: **Juraj Smutný – Managing Partner** **Hurbanovo námestie 3, 811 06 BRATISLAVA, Slovenská republika** Phone: +421 2 38 105 760; +421 917 566 566 Fax: +421 2 321 144 266; Email: mailto:info@anext.sk Public relations: publicrelations@anext.sk Website: http://www.anext.sk/
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	Computer vision using deep neural networks NEURONIT in industrial production
	Provide a concise description of the good practice being addressed	VW Bratislava in its production of specially glued body parts to check their quality experimentally deploys deep neural networks from Anext. The intention is to limit the impact of the human factor in the automotive industry in the spirit of the concept Industry 4.0.
GOOD PRACTICE DESCRIPTION		

Element	Guiding questions	Answers
Detailed description	How did the SME create good practice / new product?	**VW Bratislava** started cooperation with the company Anext in late 2017. This year was successful finished development deep neural network NEURONIT for different application industrial outputs. One of them is deployment in the area advanced industrial computer vision with elements of AI.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	This solution is strongly tied with the “Smart Factory” concept, as a novel technology, advanced industrial computer vision with elements of AI were incorporated directly and contributed to the production of a specific product.
	Describe what are the technical solutions and innovations: of the good practice	The innovative nature of this solution is that it **provides fully automatic quality control of the robotically applied layer of adhesive glues**. The proposed workstation is completely unattended and guarantees the quality of the finished parts in production.
	Highlights (or keywords) of the Best Practice	Specific keywords: **deep neural network advanced industrial computer vision, AI.**
	Good practice applied in : (NACE code)	Good practice applied in the field of: Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers (NACE code C29.2).
Benchmarking	How does your solution related to others provided by competitors	The application of the current technology extended over to other industry branches, but its use differed in nature from this type of application . When this solution was implemented, it was the first of its kind that made use of deep neural network advanced industrial computer vision with elements of AI. Currently used for the purpose computer vision system without elements of AI (for example Cognex). Just adding elements of AI makes the system fully autonomous in the spirit of the concept Industry 4.0.

Element	Guiding questions	Answers
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	All additional information is available at the company Anext.
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	The solution described previously was applied in **VOLKSWAGEN SLOVAKIA, a. s., Bratislava** (further only VW Bratislava), a Manufacturer of cars and parts of the Volkswagen brands, factory situated in Bratislava-Devínska Nová Ves, Slovakia. (Website: https://www.volkswagen.sk/)
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Solution can be applied by other companies that are willing to integrate deep neural network advanced industrial computer vision with elements of AI into their manufacturing process, especially those that have operators involved in product assembly activities. The practice has a high degree of portability and can be adapted to companies operating in various industry branches.

Element	Guiding questions	Answers
Targeted customers and scale of use	Select the target group of customers: 133. SMEs (<250 employees) **134. Large companies** 135. Public institutions 136. End customer (Business to Customer) Other, please specify	Large company
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	From the costs perspective, the solution proved to be highly efficient, as it requires minimum intervention (only background to analysis in form required neural network and maintenance and software updates) and further investments after implementation are not needed..
	Quality assurance aspects, if applicable	The solution led to a significant decrease in faulty and non-conforming products reported by customers, which, in turn, increased customer satisfaction.
	Risk management aspects, if applicable	N/A
Implementation guidelines	How can the Good practice be implemented?	The methodology for implementing this solution comprised of the following steps: 1. Feasibility study (establish whether the solution can be implemented – interviews with operators, budget analysis, potential benefits and weak points); 2. Acquire hardware part of the solution (computing servers, high-precision cameras); 3. Develop software part of the solution (containing wire-harness assembly steps and additional information, both auditive and visual);

Element	Guiding questions	Answers
		4. Implement the solution into the assembly process (train neural network for properly using the equipment); 5. Verify the impact (% in errors or scrap reduction, assembly duration shortening, etc.) compared to previous data.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	For future successful implementation, companies should follow the steps described in the "Methodological approach" section and should appoint a project manager who will oversee the acquisition of equipment, software development contracting and the training of selected operators. Companies should also commit resources for the following aspects: - conducting an initial feasibility study for determining if or how the solution can be applied specifically in case of each company and what will be its impact (can be carried out internally or by contracting specialized consultancy companies); - acquiring equipment computing servers, high-precision cameras); - developing a custom application, specific to each company's assembly process, which will be installed on the production line; - selecting and training the operators which will be using the The timespan for fully implementing the solution stretched over a period of 6 months.
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	The validation process was completed within the customer factory and comprised in the analysis and comparison of the error / scrap rates and the assembly time needed by operators before and after implementation.
RESULTS / IMPACT		

Element	Guiding questions	Answers
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The impact of the solution was highly positive, as the scrap rates were reduced to almost 0% and the assembly time was reduced with an average too. These led to an increase in productivity and customer satisfaction.
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	The quality of advanced computer vision strongly depends on the quality of learning deep neural network based on the quality of the data provided.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	This solution was the first of its kind, as not any other company made use of this type of practice, especially in its assembly process. As mentioned previously, as direct results of the implementation significantly increased productivity and customer satisfaction were obtained.
Need assessment	What else would be needed in order to improve the impact of the Good practice	The system performs better if the component devices have better technical specifications (e.g. computing servers, high-precision cameras) and the quality of the data provided to deep neural network must be as good as possible
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	The success of the implementation depends on the capability of overcoming the resistance of workers regarding the technological change. The reliability and performance of the system is directly related to the initial investment, as hardware and devices with lower technical specifications function at a reduced performance.
SUSTAINABILITY		

Element	Guiding questions	Answers
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	Currently the price of the solutions can be prohibitive, however, due to future technological progress their price will decrease and the cost of implementation will be reduced.
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	This solution can be implemented to a wide range of companies, without being tied specifically to a certain industry branch. It must be noted, however, that it initially requires a medium financial commitment and the organizational culture should be open to the use of new technologies.
	What are the possibilities of extending the good practice more widely?	Currently, the remote assistance feature of this system is under development, for assuring guided support for even more complex tasks.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The solution requires a medium financial commitment, however, compared to the benefits it offers (scrap reduction almost 0%, time needed for assembly reduced increased productivity, increased customer satisfaction, elimination of printed documentation, making operators' activities more efficient) it can easily be supported by any company. Moreover, the implementation of these types of solutions increases a company's readiness to adopt the new industrial revolution's principles, promoted under "Industrie 4.0".
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	The company describing this good practice doesn't guarantee the successfulness of the solution and can't be held liable for its failure in application. We are agree with on-line and printed dissemination of the information from this questionnaire.

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	MATADOR Automation, s.r.o. Matador GROUP Továrenská 1, 018 41 Dubnica nad Váhom, Slovak Republic Contact person: **Ing. Maroš Mudrák** Head of Development of special robotic applications Mobile: +421 908 948 928 E-mail: maros.mudrak@matador-group.eu **I** Web: www.matador-group.eu
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice (key words).	Collaborative robot integrated in industrial environment of Smart Factory
	Provide a concise description of the good practice being addressed.	Integration of collaborative robot into an industrial environment with the aim of removal non-ergonomic and not effective human labour. Integration and implementation of application, which requires high precision and accuracy, and high safety in terms of sharing the workplace between robot and humans. This solution was integrated in Škoda Vrchlabí (Czech republic).
	GOOD PRACTICE DESCRIPTION	
Detailed description	How did the SME create good practice/new product?	In 2014 company started to focus its activities on higher degree of robotics. Trends in this field showed that one of the most important integrations will be robots

Element	Guiding questions	Answers
		capable of cooperation with humans. Our company has own development and research capacities, that is why we created this solution.
	What is the relationship to Smart Factory (SFH) approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	Solution is fully compatible with Smart Factory and it follows the trends in Smart Factory. It is fully integrated with other systems and it can communicate with its environment in IoT meaning, but also in communication with humans.
	Describe what are the technical solutions and innovations: of the good practice.	Design of safe workplace with multi-axis robot, which can help the human operator, eventually it can replace him within difficult operations. Repeatability and full integrity between operators without the necessity of safety barriers usage.
	Highlights (or keywords) of the Best Practice	Collaborative robot
	Good practice applied in: (NACE code)	29
Benchmarking	How does your solution related to others provided by competitors	Our solution is more suitable for workplaces if there is no more place for safety elements needed for standard robotic applications.
Additional information's materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are /	More information can be found: http://www.matador-group.eu/domov/ Solution was integrated in ŠKODA Auto, Vrchlabí (Czech republic) as an assembly cell used for servo mechanics of automated gear. It was first integration of

Element	Guiding questions	Answers
	encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	collaborative robotics in group Volkswage, and it was awarded as the most innovative act in 2015 in Slovak republic. Other integration was in ŠKODA Auto Mladá Boleslav (Czech republic) for tracking and inspecting the quality of products from suppliers.

OBJECTIVE AND TARGET AUDIENCE		
	What is the geographical range where the good practice has been used / tested / validated:	Czech republic, ŠKODA Auto Vrchlabí

Element	Guiding questions	Answers
Geographical coverage and target audience	country, region, Danube Region if is relevant and possible	
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Target customers are all industrial corporations, which perform assembly tasks or manipulation with parts performed by human operator.
Targeted customers and scale of use	Select the target group of customers: 11. SMEs (<250 employees) 12. Large companies 13. Public institutions 14. End customer (Business to Customer) 15. Other, please specify	11. SMEs (<250 employees) ☒ 12. Large companies ☒ 13. Public institutions ☐ 14. End customer (Business to Customer) ☐ 15. Other, (please specify) ☐:
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	Removal of human operator in process of not effective production
	Quality assurance aspects, if applicable	Quality is ensured by fully integration and repeatability of solution itself.
	Risk management aspects, if applicable	N/A

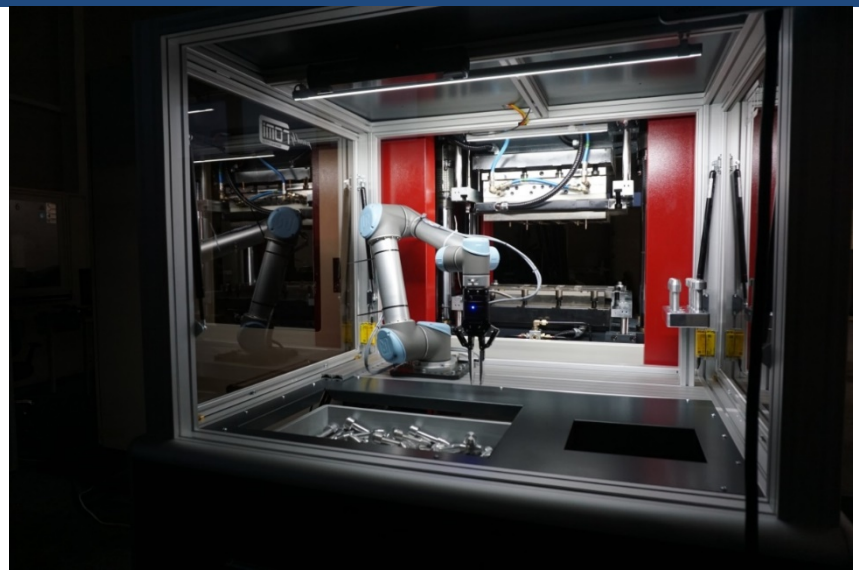
Element	Guiding questions	Answers
Implementation guidelines	How can the Good practice be implemented?	Before implementation, very precise analysis of specific application is done. Consequently, safety risks and their elimination are evaluated and implemented.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	It is needed to realize and accept the technology by the people, which will cooperate with the robot. They must accept him as a partner, not as a replacement. Every integration is modified for specific environment and it needs full cooperation between integrator and customer, which better knows the specification of his environment.
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	Validation was performed by customer and on the basis of error rate and safety conditions, which correspond with technical specifications and standards in EU.
RESULTS/IMPACT		
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries?	Removal of non-ergonomic work. This increased performance of production process.
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view.	If the safety risks concerning human harming are too high and these overall risks are impossible to eliminate, our solution cannot be implemented.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands.	Integration with safety barriers and direct cooperation between robot and human.
Need assessment	What else would be needed in order to improve the impact of the Good practice?	Find suitable partner for wider integration and increasing acceptance between humans, which will cooperate with the robot.

Element	Guiding questions	Answers
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Technology is ready for implementation into production and safety risk is minimal concerning cooperation between robot and humans.
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	N/A
	REPLICABILITY AND UP SCALING	
Replicability and further application	How can the solution / good practice be useful for other SMEs?	Implementation will increase the quality of production and reduce non-ergonomic work of human workers.
	What are the possibilities of extending the good practice more widely?	Our solution can be used in any type of production.
	FINAL REMARKS	
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	Our solution is specified by implementation of collaborative robots, which can be implemented near the human workers or they can directly cooperate their actions with humans in production process. Integration of such solution will increase the quality of production operations and repeatability of production itself.
	FINAL REMARKS	
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	The company describing this good practice doesn't guarantee the successfulness of the solution and can't be held liable for its failure in application. We agree with on-line and printed dissemination of the information from this questionnaire.

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	Photoneo s.r.o. Jamnického 3 841 05 Bratislava Slovenská republika IČO: 47353309 Ján Žižka, zizka@photoneo.com Web: www.photoneo.com 
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice (key words).	Bin picking
	Provide a concise description of the good practice being addressed.	Photoneo's Bin picking solution works with our family of industrial grade 3D scanners PhoXi Scan. Using advanced 3D algorithms, it runs at high speed and with a high precision. It allows the user to scan object or input a CAD model, select grip points and alternative grip points. The container is scanned and objects are picked one by one. Such solution was implemented in ROMI Industrial Systems s.r.o., company from Slovakia. Similar solutions are already implemented in companies ZF, Hydac, and Boge.

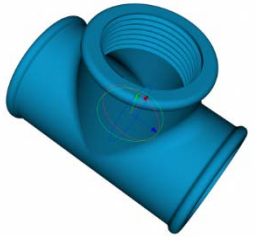
Element	Guiding questions	Answers
GOOD PRACTICE DESCRIPTION		
Detailed description	How did the SME create good practice/new product?	Company has developed own 3D scanner called PhoXi Scan and own software for control of the robot based on ROS. Bin picking Solution is composed of these parts: 1. Robot 2. 3D scanner 3. Bin Picking SDK Software All these parts were implemented for our customer ROMI Industrial Systems s.r.o. (more details: http://www.romi-is.com/?page_id=42).
	What is the relationship to Smart Factory (SFH) approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	The demanding needs on automation require nowadays complex systems which very often can be achieved only with the help of industrial robots. Therefore we cooperate with different robot producers and integrate their robots in to our production solutions. Bin picking by Photoneo is a new technology, which leads to autonomous bin picking workplace. Such workplace is an essential part of Smart Factory. Increasing the efficiency of robotic work cells is directly connected to autonomous robot problem. Such solutions are requested in Smart Factory. The robotic vision and 3D scanning systems become more and more important for automation solutions since the need to automate even smaller production quantities and therefore create flexible automation solutions is growing.
	Describe what are the technical solutions and innovations: of the good practice.	Our solution brings new approach (technology) to bin picking by robot. We are capable to analyse 3D data in bins and compare it with CAD model of the picked part. Analysis then decides which part is seizable for the robot. By the application of such procedure the robot is able to pick all the parts in bin without any help of human. This brings very effective solutions in industries, where assemblies or similar process are needed.

Element		Guiding questions	Answers
		Highlights (or keywords) of the Best Practice	Bin picking
		Good practice applied in: (NACE code)	
Benchmarking		How does your solution related to others provided by competitors	Our solution is completely different to those providing by competitors. Bin picking is well known problem and robots are capable to solve this problem when the parts are placed in known positions. Our solution does need to know the precise position of the part and this is great comparative advantage in compare with our competitors.
Additional information's materials	/	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	All other informations are available at: http://www.photoneo.com 

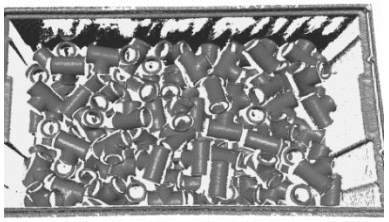
Element	Guiding questions	Answers
		 https://www.youtube.com/watch?v=8aOiKJ5_QsU
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	The solution described above was applied in Slovakia in the company ROMI Industrial Systems s.r.o.
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Automotive, electronics, food etc.

Element	Guiding questions	Answers
Targeted customers and scale of use	Select the target group of customers: 16. SMEs (<250 employees) 17. Large companies 18. Public institutions 19. End customer (Business to Customer) 20. Other, please specify	1. SMEs (<250 employees) ☒ 2. Large companies ☒ 3. Public institutions ☐ 4. End customer (Business to Customer) ☐ 5. Other, (please specify) ☐:
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	N/A
	Quality assurance aspects, if applicable	Solution led to more efficient production and reduction of costs for human labour.
	Risk management aspects, if applicable	N/A
Implementation guidelines	How can the Good practice be implemented?	Our good practice can be applied to any customer, which requires autonomous removing of components from the bins. First we will provide primary study of the workplace and then if all aspects of the customer are redeemable, we provide also the integration of solution including various types of robots. Application of bin picking is very easy. Created software solution allows it in three steps: 1. Insert CAD model.

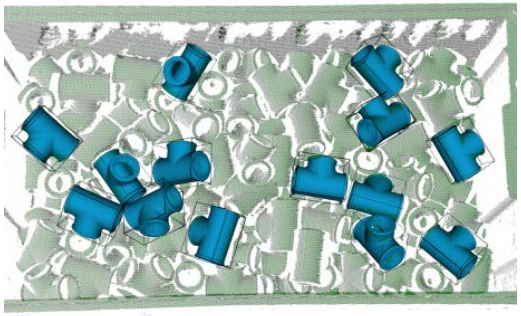
Element	Guiding questions	Answers



2. Capture 3D scene.



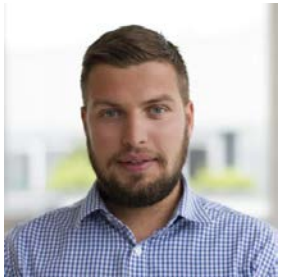
3. Get localized results.



Element	Guiding questions	Answers
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	As any automation device, the primary costs are higher than recruit some human labour. However, if production volumes are also higher, then the costs are also reduced. Our customer must count with several months for implementation.
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	Solution was validated in, and the reliability of solution is usually over 90% (i.e. from 1000 parts 900 is autonomously picked). However, this depends on the shape of part and bin. Some more complicated parts can fit into each other and this will decrease the reliability. Another interesting parameter is the time of unloading. This also depends on part and bin. However, full 3D scanning and data processing of our solution does not last longer than 1 s.
RESULTS/IMPACT		
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries?	Impact of this solution is positive in the manner of more efficient autonomous production. However, there is also negative impact in taking part of people's work.
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view.	System is limited as a standard robotic workplace, especially from the safety point of view. Some limitations are also defined by parts which the robotic grippers are able to pick. And other limitations are based on the kinematics of the robot. This depends on the used robot and the shape of the bin.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands.	1. detects 1 objects in 200 ms 2. allows multiple gripping points 3. avoids obstacles, walls 4. locates the object with a high precision of 0.5 mm 5. Smart memory (allows the robot to remember positions of all objects which are ready to be gripped after one scan. This allows a further speedup, since

Element	Guiding questions	Answers
		after first object is gripped and removed from the container, other objects are immediately queued in smart memory and are available to be picked without the need to analyze the scene.) 6. simple to use graphical user interface for configuration of localization process 7. robust detection and localization of occluded parts with respect to potential gripping point 8. Parallel, simultaneous localization of multiple instances, asynchronous results stream
Need assessment	What else would be needed in order to improve the impact of the Good practice?	Solution is dependent on used hardware and software. We are developing our software to be more intelligent. And we are also developing more advanced PhoXi sensor. However, our solution is dependent on robotic producers and if robot properties improve, our solution will be also improved.
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	The success of implementation depends on mutual cooperation of integrator and customer. We strongly recommend using an experienced integrator. This is the basics for successful implementation.
SUSTAINABILITY		
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	Currently the price of the solutions can be prohibitive, however, due to future technological progress their price will decrease and the cost of implementation will be reduced.
REPLICABILITY AND UP SCALING		
	How can the solution / good practice be useful for other SMEs?	The solution can be implemented in a wide range of industrial companies (automotive, food, electronics). Our product can be also used as a smaller part of more complex system, when system requires:

Element	Guiding questions	Answers
Replicability and further application		1. 3D object recognition 2. Inspection of object placement 3. General inspection and analysis
	What are the possibilities of extending the good practice more widely?	Solution can be expanded by more appropriate software and new versions of PhoXi scanner.
	FINAL REMARKS	
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The solution requires higher initial investment costs and skilled integrator. At the end, very effective autonomous bin picking application arises. This solution is especially characterized by unknown positions of the picked parts.
	FINAL REMARKS	
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	The company describing this good practice doesn't guarantee the successfulness of the solution and can't be held liable for its failure in application. We agree with on-line and printed dissemination of the information from this questionnaire.

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	*Data identification, logo, contact person, possible representative image(s).*	UAVONIC s.r.o. Galvaniho 17/B 821 04 Bratislava Slovak Republic IČO: 47648244 DIČ: 2024018161 IČ DPH: SK2024018161 Contact person: Ing. Juraj Dudáš, dudas@uavonic.com, WEB: www.uavonic.com 
Name and brief description.	*Name or acronym: what is the name that captures the essence of the good practice (key words).* *Provide a concise description of the good practice being addressed.*	Volumetric measurements by UAV Volumetric measurement by UAV devices is a modern method allowing for example inspection of outdoor storage with high capacity. This method can replace employees with standard measuring devices, which have higher inaccuracies and their usage is time consuming or there is a risk of potential injury. Volumetric measurements by UAV are composed of aerial pictures created by calibrated

Element	Guiding questions	Answers
		cameras or laser scanners. This data are consequently processed in software, which creates digital 3D model of measured material. Accuracy of this process is higher than the other standard measuring methods. Such volumetric measurements were proposed and implemented in Mondi SCP a.s.
GOOD PRACTICE DESCRIPTION		
Detailed description	*How did the SME create good practice/new product?*	Company created this solution due to intensive work of experienced and technically competent employees and also due to cooperation of segment specialist from Mondi SCP a.s.
	What is the relationship to Smart Factory (SFH) approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	Our approach is characterized by novel technologies as precise cameras or laser scanners and by intelligent software solutions. It is clear that smart factory needs smart control and smart control is characterized by smart and precise measuring. Our approach brings novel approach to volumetric measurements in any segment of the industry.
	Describe what are the technical solutions and innovations: of the good practice.	Technical solution is characterized in two ways: 1. novel hardware – precise cameras with laser scanners 2. novel software – data fusion and fast volumetric measurements of high capacity storage
	Highlights (or keywords) of the Best Practice	volumetric measurements
	Good practice applied in: (NACE code)	17
Benchmarking	*How does your solution related to others provided by competitors*	Our company routinely works with current solutions and we try to add value by implementing unmanned technologies into standard industrial services. This gives us comparative benefit in compare with our competitors.

Element		Guiding questions	Answers
Additional information's materials	/	*Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).*	WWW.UAVONIC.COM, https://www.linkedin.com/company/uavonic/ 

Element	Guiding questions	Answers
		 
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	*What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible*	The solution described previously was applied in Mondi SCP a.s. factory situated in Ružomberok, Slovakia.
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Industrial enterprises, academic sector, agriculture, forestry, construction, environmental sectors
Targeted customers and scale of use	*Select the target group of customers:* *21. SMEs (<250 employees)* *22. Large companies*	1. SMEs (<250 employees) ☒ 2. Large companies ☒ 3. Public institutions ☒

Element	Guiding questions	Answers
	23. Public institutions *24. End customer (Business to Customer)* *25. Other, please specify*	4. End customer (Business to Customer) ☐ 5. Other, (please specify) ☐:
	METHODOLOGICAL APPROACH	
Managerial aspects	*Cost efficiency of the good practice, if applicable*	N/A
	Quality assurance aspects, if applicable	Solution led to a significant optimization of logistics in company.
	Risk management aspects, if applicable	N/A
Implementation guidelines	*How can the Good practice be implemented?*	Depends individually on the application and request of the customers. We are able to provide basic study for the customer and then the customer decides, if he/she is able to cooperate on such solution.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	At least some experts on specified problems (e.g. volumetric measurements of wood's storage will need forestry expert) are necessary to be presented during the first steps.
	VALIDATION PROCESS	
Validation	*Provide a brief description of the good practice validation process.*	It is hard to validate volumetric measurements of high capacity storage. Validation can be done only by standard measuring devices, which are usually much more inaccurate than laser scanners or cameras. However, the measurement can be validated in industrial process, e.g. amount of consumed wood. Validation in Mondi SCP a.s. was performed this way.

Element	Guiding questions	Answers
	RESULTS/IMPACT	
Solution impact	*What has been the impact (positive or negative) of this good practice on the beneficiaries?*	Impact of this solution is positive in the manner of control of whole producing process. Partner exactly knows, what amount of material he has available for production and consequently he can optimize whole logistic and save the costs.
	SUCCESS FACTORS AND CONSTRAINTS	
Limitations and Strong points	*Describe limitations, both from the technical and implementation point of view.*	System is limited by environment around the storage. If the storage is outside, our system is not able to measure when the weather is not suitable for the flight of UAV. Moreover, it is also limited in some dusty or in other ways disadvantageous for UAV technology.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands.	1. Safety 2. High resolution 3. Costs saving 4. Time efficiency
Need assessment	*What else would be needed in order to improve the impact of the Good practice?*	Solution is dependent on used hardware and software. With the development of more precise sensors and more intelligent software the solution will acquire even more precise results.
	LESSON LEARNED	
Lessons learned	*What are the key messages and lessons learned to take away from the good practice experience*	The success of implementation depends on mutual cooperation of integrator and customer. Reliability and performance of whole system is dependent on initial investment to technologies, but our company can provide such solution also as service.

Element	Guiding questions	Answers
	SUSTAINABILITY	
Sustainability of Good Practice	*Describe aspects related to sustainability of the Good Practice, if applicable*	Currently the price of the solutions can be prohibitive, however, due to future technological progress their price will decrease and the cost of implementation will be reduced.
	REPLICABILITY AND UP SCALING	
Replicability and further application	*How can the solution / good practice be useful for other SMEs?* *What are the possibilities of extending the good practice more widely?*	The solution can be implemented in a wide range of industrial companies (forestry, construction, metallurgy etc.), but also in agriculture or other branches. Solution can be expanded by more efficient hardware elements (especially laser scanners and computers) and in future such systems should be autonomous. However, this is still in development.
	FINAL REMARKS	
Conclusion	*Conclude specifying / explaining the impact and usefulness of the good practice.*	The solution requires higher initial investment costs and skilled workers (UAVs, software, etc.). However, our company provides the solution as a service. So the aspects about the implementation are removed for the partners.
	FINAL REMARKS	
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	The company describing this good practice doesn't guarantee the successfulness of the solution and can't be held liable for its failure in application. We agree with on-line and printed dissemination of the information from this questionnaire.

Ba/30-11-2017/ Doc. Ing. František Duchoň, PhD./ SOPK-PP

Element	Guiding questions	Answers
INTRODUCTION		
Company information	Data identification, logo, contact person, possible representative image(s).	Data identification**: ANEXT a.s., BRATISLAVA** Logo:  Contact person: **Juraj Smutný – Managing Partner** **Hurbanovo námestie 3, 811 06 BRATISLAVA, Slovenská republika** Phone: +421 2 38 105 760; +421 917 566 566 Fax: +421 2 321 144 266; Email: mailto:info@anext.sk Public relations: publicrelations@anext.sk Website: http://www.anext.sk/
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	Using **deep neural networks NEURONIT with advanced Computer vision** in industrial production
	Provide a concise description of the good practice being addressed	**Plastic Omnium** in its production of automotive bumpers to check their quality experimentally deploys deep neural networks from Anext. The intention is to limit the impact of the human factor in the automotive industry in the spirit of the concept Industry 4.0.

Element	Guiding questions	Answers
GOOD PRACTICE DESCRIPTION		
	How did the SME create good practice / new product?	**Plastic Omnium** started cooperation with the company Anext in late 2017. This year was successful finished development **deep neural network NEURONIT** for different application industrial outputs. One of them is deployment in the area **advanced industrial computer vision with elements of AI**.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	This solution is strongly tied with the "Smart Factory" concept, as a novel technology, **advanced industrial computer vision with elements of AI** were incorporated directly and contributed to the production of a specific product.
Detailed description	Describe what are the technical solutions and innovations: of the good practice	The innovative nature of this solution is that it provides fully automatic quality control of the robotically applied layer of adhesive glues. The proposed workstation is completely unattended and guarantees the quality of the finished parts in production.
	Highlights (or keywords) of the Best Practice	Specific keywords: **deep neural network advanced industrial computer vision, AI.**
	Good practice applied in : (NACE code)	Good practice applied in the field of: Manufacture of other parts and accessories for motor vehicles (NACE code C29.32).
Benchmarking	How does your solution related to others provided by competitors	The application of the current technology extended over to other industry branches, but its use differed in nature from this type of application . When this solution was implemented, it was the first of its kind that made use of deep neural

Element	Guiding questions	Answers
		network advanced industrial computer vision with elements of AI. Currently used for the purpose computer vision system without elements of AI (for example Cognex). Just adding elements of AI makes the system fully autonomous in the spirit of the concept Industry 4.0.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	All additional information is available at the company Anext.
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	The solution described previously was applied in **Plastic Omnium Auto Exteriors, s.r.o. (Ltd.) , a** Manufacturer of plastic parts for automotive industry, factory situated in Lozorno, Slovakia. (Web: http://www.plasticomnium.com)
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Solution can be applied by other companies that are willing to integrate deep neural network advanced industrial computer vision with elements of AI into their manufacturing process, especially those that have **operators involved in product assembly activities.** The practice has a high degree of portability and can be adapted to companies operating in various industry branches.

Element	Guiding questions	Answers
Targeted customers and scale of use	Select the target group of customers: 137. SMEs (<250 employees) 138. Large companies 139. Public institutions 140. End customer (Business to Customer) Other, please specify	**1. SMEs (<250 employees)** **2. Large companies**
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	From the costs perspective, the solution proved to be highly efficient, as it requires minimum intervention (only background to analysis in form required neural network and maintenance and software updates) and **further investments after implementation are not needed..**
	Quality assurance aspects, if applicable	The solution led to a significant decrease in faulty and non-conforming products reported by customers, which, in turn, increased customer satisfaction.
	Risk management aspects, if applicable	N/A
Implementation guidelines	How can the Good practice be implemented?	**T**he methodology for implementing this solution comprised of the following steps: 1. Feasibility study (establish whether the solution can be implemented – interviews with operators, budget analysis, potential benefits and weak points); 2. Acquire hardware part of the solution (computing servers, high-precision cameras);

Element	Guiding questions	Answers
		3. Develop software part of the solution (containing wire-harness assembly steps and additional information, both auditive and visual); 4. Implement the solution into the assembly process (train neural network for properly using the equipment); **5.** Verify the impact (% in errors or scrap reduction, assembly duration shortening, etc.) compared to previous data.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	For future successful implementation, companies should follow the steps described in the "Methodological approach" section and should appoint a project manager who will oversee the acquisition of equipment, software development contracting and the training of selected operators. Companies should also commit resources for the following aspects: - conducting an initial feasibility study for determining if or how the solution can be applied specifically in case of each company and what will be its impact (can be carried out internally or by contracting specialized consultancy companies); - acquiring equipment computing servers, high-precision cameras); - developing a custom application, specific to each company's assembly process, which will be installed on the production line; - selecting and training the operators which will be using the The timespan for fully implementing the solution stretched over a period of 6 months.
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	The validation process was completed within the customer factory and comprised in the analysis and comparison of the error / scrap rates and the assembly time needed by operators before and after implementation.

Element	Guiding questions	Answers
RESULTS / IMPACT		
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The impact of the solution was highly positive, as the scrap rates were reduced to almost 0% and the assembly time was reduced with an average too. These led to an increase in productivity and customer satisfaction.
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	The quality of advanced computer vision strongly depends on the quality of learning deep neural network based on the quality of the data provided.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	This solution was the first of its kind, as not any other company made use of this type of practice, especially in its assembly process. As mentioned previously, as direct results of the implementation significantly increased productivity and customer satisfaction were obtained.
Need assessment	What else would be needed in order to improve the impact of the Good practice	The system performs better if the component devices have better technical specifications (e.g. computing servers, high-precision cameras) and the quality of the data provided to deep neural network must be as good as possible
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	The success of the implementation depends on the capability of overcoming the resistance of workers regarding the technological change. The reliability and performance of the system is directly related to the initial investment, as hardware and devices with lower technical specifications function at a reduced performance.
SUSTAINABILITY		

Element	Guiding questions	Answers
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	Currently the price of the solutions can be prohibitive, however, due to future technological progress their price will decrease and the cost of implementation will be reduced.
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	This solution can be implemented to a wide range of companies, without being tied specifically to a certain industry branch. It must be noted, however, that it initially requires a medium financial commitment and the organizational culture should be open to the use of new technologies.
	What are the possibilities of extending the good practice more widely?	Currently, the remote assistance feature of this system is under development, for assuring guided support for even more complex tasks.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The solution requires a medium financial commitment, however, compared to the benefits it offers (scrap reduction almost 0%, time needed for assembly reduced increased productivity, increased customer satisfaction, elimination of printed documentation, making operators' activities more efficient) it can easily be supported by any company. Moreover, the implementation of these types of solutions increases a company's readiness to adopt the new industrial revolution's principles, promoted under "Industrie 4.0".
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	The company describing this good practice doesn't guarantee the successfulness of the solution and can't be held liable for its failure in application. We are agree with on-line and printed dissemination of the information from this questionnaire.

Element	Guiding questions	Answers
INTRODUCTION		
Company information	Data identification, logo, contact person, possible representative image(s).	Data identification : Sova Digital a.s., Logo: SOVA DIGITAL Product Lifecycle Management Contact person: **Milan Lokšík – Managing Partner** **Bojnická 3, 831 04 Bratislava,Slovak Republic (SK)** tel.: 00421/ 2/ 4333 0643, 4333 0372 fax: 00421/ 2/ 4333 9505 Email: info@sova.sk, info@industry4.sk; Website: www.sova.sk, http://industry4.sk/
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice Provide a concise description of the good practice being addressed	**THE DIGITAL TWIN OF AN INDUSTRIAL PRODUCTION LINE WITHIN THE INDUSTRY 4.0 CONCEPT** In **Embraco Slovakia s.r.o.,** Sova Digital focusing on the continuous optimization of production processes, proactive maintenance, and continuous processing of process data. Basic goal is to support the existing production structures within the automotive industry and the most efficient use of resources by augmented production and planning strategies, such as the digital twin.

Element	Guiding questions	Answers
GOOD PRACTICE DESCRIPTION		
Detailed description	How did the SME create good practice / new product?	**Embraco Slovakia s.r.o** started cooperation with the company Sova Digital a.s. in late 2016. Sova Digital offered integration of the digital twin (DT). A DT is essentially a functional system of continuous process optimization, which is formed by the cooperation of physical production lines with a digital "copy. It creates the digital factory environment, in which the company can optimize the operation directly through the production chain, manipulate parameters and production processes; adapting the product to market requirements.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	This solution is strongly tied with the "Smart Factory" concept, as a novel technology. Digital twin collects and evaluates the information continuously, allowing, among other things, to shorten and streamline the production cycle, reduce the rise time of introducing new products, detecting inefficient settings of the underlying processes. The concept of the digital twin, therefore, is built on the principle known today as Industry 4.0.
	Describe what are the technical solutions and innovations: of the good practice	The digital twin is formed by the physical production line and its digital "copy". The major feature of this arrangement is the interface, through which data exchange takes place. **The digital part is based on the simulation tool called Plant Simulation (PS)** made by SIEMENS. The digital simulation model of the production line was created in this environment. This model was a detailed virtual copy of the physical process.

Element	Guiding questions	Answers
	Highlights (or keywords) of the Best Practice	Specific keywords: **digital twin, optimization of production, genetic algorithm, data collection**
	Good practice applied in : (NACE code)	**Manufacture of other pumps and compressors (NACE code C28.13).**
Benchmarking	How does your solution related to others provided by competitors	The application of the current technology extended over to other industry branches, but its use differed in nature from this type of application . When this solution was implemented, it was the first of its kind that made use integration of the digital twin.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	All additional information are available at the company Sova Digital.
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	The solution described previously was applied in **EMBRACO SLOVAKIA s.r.o. (Ltd.),** a Manufacturer of a full range of condensing units using R134a, R404A, R290 and R600 refrigerants in low and high torque versions and a wide range of refrigeration, freezing and air conditioning applications, factory situated in Spišská Nová Ves, Slovakia. (Webside: http://www.embraco.sk/)

Element	Guiding questions	Answers
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	
Targeted customers and scale of use	Select the target group of customers: 141. SMEs (<250 employees) 142. Large companies 143. Public institutions 144. End customer (Business to Customer) Other, please specify	1. SMEs (<250 employees) 2. Large companies
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	From the costs perspective, the solution proved to be highly efficient, as it requires **minimum intervention** (only software and extra sensors when they needed) **and further investments after implementation are not needed..**
	Quality assurance aspects, if applicable	The solution led to a significant decrease in faulty and non-conforming products reported by customers, which, in turn, increased customer satisfaction.
	Risk management aspects, if applicable	N/A
Implementation guidelines	How can the Good practice be implemented?	6. Solution can be applied by other companies that are willing to integrate digital twin and the digital simulation model of the production line for continuous process optimization.The practice has a high degree of portability and can be adapted to companies operating in various industry branches.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	SMEs (<250 employees)

Element	Guiding questions	Answers
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	The validation process was completed within the customer factory and comprised in the analysis and comparison of the error / scrap rates and the assembly time needed by operators before and after implementation.
RESULTS / IMPACT		
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The impact of the solution was highly positive, as the scrap rates were reduced and the assembly time was reduced with an average too. **These led to an increase in productivity and customer satisfaction.**
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	The quality of DT of the plant is strongly based on the quality of the data provided. Based on this, we can build a **high quality simulation model** for software needs (Siemens Technomatix PS).
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	This solution was the first of its kind, as not any other company made use of this type of practice, especially in its assembly process. As mentioned previously, as direct results of the implementation significantly increased productivity and customer satisfaction were obtained.
Need assessment	What else would be needed in order to improve the impact of the Good practice	The system performs better if the component devices have better technical specifications (e.g. data servers, high-precision sensors) and the quality of the data provided to Siemens Technomatix PS software.
LESSON LEARNED		

Element	Guiding questions	Answers
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	The success of the implementation depends on the capability of overcoming the resistance of workers regarding the technological change. The reliability and performance of the system is directly related to the initial investment, as hardware and devices with lower technical specifications function at a reduced performance.
SUSTAINABILITY		
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	Currently the price of the solutions can be prohibitive, however, due to future technological progress their price will decrease and the cost of implementation will be reduced.
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	This solution can be implemented to a wide range of companies, without being tied specifically to a certain industry branch. It must be noted, however, that it initially requires a medium financial commitment and the organizational culture should be open to the use of new technologies.
	What are the possibilities of extending the good practice more widely?	Currently, the remote assistance feature of this system is under development, for assuring guided support for even more complex tasks.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The solution requires a medium financial commitment, however, compared to the benefits it offers (scrap reduction, time needed for assembly reduced increased productivity, increased customer satisfaction. Moreover, the implementation of these types of solutions increases a company's readiness to adopt the new industrial revolution's principles, promoted under "Industrie 4.0".

Element	Guiding questions	Answers
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	The company describing this good practice doesn't guarantee the successfulness of the solution and can't be held liable for its failure in application. We agree with on-line and printed dissemination of the information from this questionnaire.

Ba/23-11-2017/ Doc. Ing. Ján Vachálek, PhD./ SOPK-PP

Element	Guiding questions	Answers
INTRODUCTION		
Company information	Data identification, logo, contact person, possible representative image(s).	Data identification : Sova Digital a.s., Logo: SOVA DIGITAL Product Lifecycle Management Contact person: **Milan Lokšík – Managing Partner** **Bojnická 3, 831 04 Bratislava,Slovak Republic (SK)** tel.: 00421/ 2/ 4333 0643, 4333 0372 fax: 00421/ 2/ 4333 9505 Email: info@sova.sk, info@industry4.sk; Website: www.sova.sk, http://industry4.sk/
	Name or acronym: what is the name that captures the essence of the good practice	**DIGITAL INTERNAL LOGISTICS VERIFICATION THROUGHOUT THE PLANT**

Element	Guiding questions	Answers
Name and brief description.	Provide a concise description of the good practice being addressed	In **Honeywell Turbo s. r. o.,** Sova Digital focusing on the continuous optimization of production processes, proactive maintenance, and continuous processing of process data. Basic goal is to support the existing production structures within the industry and the most efficient use of resources by augmented production and planning strategies, such as the digital twin.
GOOD PRACTICE DESCRIPTION		
Detailed description	How did the SME create good practice / new product?	Honeywell Turbo s. r. o., started cooperation with the company Sova Digital a.s. in late 2016. Sova Digital offered integration of the digital internal logistics verification throughout the plant this is essentially for a functional system of continuous process optimization, which is formed by the cooperation of physical production lines with a digital "copy. It creates the digital factory environment, in which the company can optimize the operation directly through the production chain, manipulate parameters and production processes; adapting the product to market requirements.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	This solution is strongly tied with the "Smart Factory" concept, as a novel technology. Digital internal logistics verification throughout the plant collects and evaluates the information continuously, allowing, among other things, to shorten and streamline the production cycle, reduce the rise time of introducing new products, detecting inefficient settings of the underlying processes. The concept of the digital twin, therefore, is built on the principle known today as Industry 4.0.
	Describe what are the technical solutions and innovations: of the good practice	The Digital internal logistics verification throughout the plant is formed by the physical production line and its digital "copy". The major feature of this arrangement is the interface, through which data exchange takes place. The digital part is based on the simulation tool called Plant Simulation (PS) made by

Element	Guiding questions	Answers
		SIEMENS. The digital simulation model of the production line was created in this environment. This model was a detailed virtual copy of the physical process.
	Highlights (or keywords) of the Best Practice	Specific keywords: **digital, logistics, optimization of production, genetic algorithm, data collection**
	Good practice applied in : (NACE code)	**Manufacture of other parts and accessories for motor vehicles** (Branche code NACE: C29.32).
Benchmarking	How does your solution related to others provided by competitors	The application of the current technology extended over to other industry branches, but its use differed in nature from this type of application . When this solution was implemented, it was the first of its kind that made use integration of the digital twin.
Additional information's materials /	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	All additional information are available at the company Sova Digital.
OBJECTIVE AND TARGET AUDIENCE		
	What is the geographical range where the good practice has been used / tested / validated:	The solution described previously was applied in **Honeywell Turbo s. r. o.** (Ltd), a Manufacturer of motor vehicles, engines, vehicles, parts and accessories for

Element	Guiding questions	Answers
Geographical coverage and target audience	country, region, Danube Region if is relevant and possible	motor vehicles and other means of transport, the factory situated in **Záborská (district Prešov), Slovakia.** (Webside: http://turbo.honeywell.com/)
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Solution can be applied by other companies that are willing to integrate digital internal logistics verification throughout the plant into their manufacturing process, especially those that have operators involved in product assembly activities. The practice has a high degree of portability and can be adapted to companies operating in various industry branches.
Targeted customers and scale of use	Select the target group of customers: 145. SMEs (<250 employees) 146. Large companies 147. Public institutions 148. End customer (Business to Customer) Other, please specify	**1. SMEs (<250 employees)** **2. Large companies**
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	From the costs perspective, the solution proved to be highly efficient, as it requires minimum intervention (only software and extra sensors when they needed) and further investments after implementation are not needed..
	Quality assurance aspects, if applicable	The solution led to a significant decrease in faulty and non-conforming products reported by customers, which, in turn, increased customer satisfaction.
	Risk management aspects, if applicable	N/A
	How can the Good practice be implemented?	7. Solution can be applied by other companies that are willing **to integrate digital twin and the digital simulation model of the production line for**

Element	Guiding questions	Answers
Implementation guidelines		**continuous process optimization**.The practice has a high degree of portability and can be adapted to companies operating in various industry branches.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	SMEs (<250 employees)
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	The validation process was completed within the customer factory and comprised in the analysis and comparison of the error / scrap rates and the assembly time needed by operators before and after implementation.
RESULTS / IMPACT		
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The impact of the solution was highly positive, as the scrap rates were reduced and the assembly time was reduced with an average too. These led to an increase in productivity and customer satisfaction.
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	The quality of Digital internal logistics verification throughout the plant is strongly based on the quality of the data provided. Based on this, we can build **a high quality simulation model for software needs** (Siemens Technomatix PS)
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	This solution was the first of its kind, as not any other company made use of this type of practice, especially in its assembly process. As mentioned previously, as direct results of the implementation significantly increased productivity and customer satisfaction were obtained.

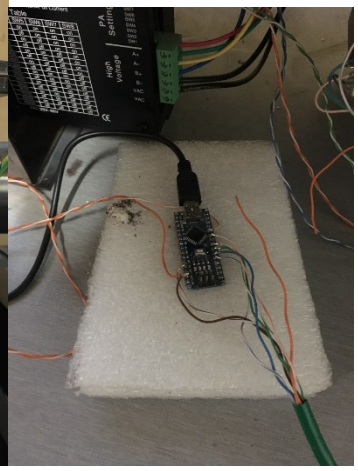
Element	Guiding questions	Answers
Need assessment	What else would be needed in order to improve the impact of the Good practice	The system performs better if the component devices have better technical specifications (e.g. data servers, high-precision sensors) and the quality of the data provided to Siemens Technomatix PS software.
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	The success of the implementation depends on the capability of overcoming the resistance of workers regarding the technological change. The reliability and performance of the system is directly related to the initial investment, as hardware and devices with lower technical specifications function at a reduced performance.
SUSTAINABILITY		
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	Currently the price of the solutions can be prohibitive, however, due to future technological progress their price will decrease and the cost of implementation will be reduced.
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	This solution can be implemented to a wide range of companies, without being tied specifically to a certain industry branch. It must be noted, however, that it initially requires a medium financial commitment and the organizational culture should be open to the use of new technologies.
	What are the possibilities of extending the good practice more widely?	Currently, the remote assistance feature of this system is under development, for assuring guided support for even more complex tasks.
FINAL REMARKS		

Element	Guiding questions	Answers
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The solution requires a medium financial commitment, however, compared to the benefits it offers (scrap reduction, time needed for assembly reduced increased productivity, increased customer satisfaction. Moreover, the implementation of these types of solutions increases a company's readiness to adopt the new industrial revolution's principles, promoted under "Industrie 4.0".
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	The company describing this good practice doesn't guarantee the successfulness of the solution and can't be held liable for its failure in application. We are agree with on-line and printed dissemination of the information from this questionnaire.

Bulgaria

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	**Mechanic Design and Construction** **Konstantin Kamberov - CEO** **www.mdc-bg.com** **ul. "Magnaurska shkola" 13, 1784 7-Mi Kilometar, Sofia** **tel: +359 2 974 47 48** **email: info@mdc-bg.com**
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	ALES – Automatic Laser Engraving System
	Provide a concise description of the good practice being addressed	The system is a good practice for implementing automatic technologies in a hand process in order to optimize the process and increase the productivity of the company. The good practice consist of a laser, a metal disc with slots for placing the metal plates, which is rotated by a stepper motor, controlled by an Arduino computer.
	GOOD PRACTICE DESCRIPTION	
Detailed description	How did the SME create good practice / new product?	The idea and the creation of the good practice came with the need of the factory to be competitive on the

Element	Guiding questions	Answers
		market. The automation of the process increase the productivity and reduce the production cost.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	Implementing computer in the manufacturing and automation of the production process is the base of the SFH approach. Self-operating system improves the production process, cost efficiency as well as the risk management.
	Describe what are the technical solutions and innovations: of the good practice	The technical solution if the good practice is simple, but effective. Arduino computer controls the stepper motor rotating the metal disc allowing the laser to brand higher number of products in smaller amount of time.
	Highlights (or keywords) of the Best Practice	Laser, Stepper motor, Arduino, Automation
	Good practice applied in : (NACE code)	C25 - Manufacture of fabricated metal products, except machinery and equipment
Benchmarking	How does your solution related to others provided by competitors	The system is custom made so it is not known whether there is a competitor using similar solution for the process production.

Element	Guiding questions	Answers
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	  

Element	Guiding questions	Answers

Element	Guiding questions	Answers
	OBJECTIVE AND TARGET AUDIENCE	
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	The solution described above was used in Sofia, Bulgaria, on the territory and for the benefit of the company in order to increase the productivity and optimize the production process
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Small, medium manufacturing companies.
Targeted customers and scale of use	Select the target group of customers: 149. SMEs (<250 employees) 150. Large companies 151. Public institutions 152. End customer (Business to Customer) Other, please specify	SMEs (<250 employees)
	METHODOLOGICAL APPROACH	
Managerial aspects	Cost efficiency of the good practice, if applicable	The automation of the production process increase the productivity and lowers cost for manufacturing.
	Quality assurance aspects, if applicable	The consistency of the stepper motor ensures the quality of the laser engraving.
	Risk management aspects, if applicable	The automation of the production require human intervention only when the process is finished. This ensures the safety of the worker since the laser is harmful for the human sight.
Implementation guidelines	How can the Good practice be implemented?	The simplicity of the system allows easy implementation.

Element	Guiding questions	Answers
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	The needed resources for implementation are financial for buying the necessary technologies and personnel for programing the functionality and calibrating the laser with the motor.
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	The validation process was completed within the work process in the factory and comprised in the analysis and comparison of the productivity before and after implementation of the good practice.
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	With the implementation of the good practice the increase of the production is nearly 200% as well the automation process saves the personnel time.
	SUCCESS FACTORS AND CONSTRAINTS	
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	The limitations from technical point are the size of the metal product and placing it in horizontal position for engraving. No limitation in implementation.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	Since the system is custom made there is no other known system for this type of production. The system is easy to work with and the automation process has low power consumption.
Need assessment	What else would be needed in order to improve the impact of the Good practice	The system have been improved with a visual and sound signal indicating the finishing of the process. The further automation of the whole process will be a good way for improving the impact of the good practice –

Element	Guiding questions	Answers
		automatic unload of the finished products and setting the metal plates for the next batch.
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	The automation of the process because of the good practice saves time, less personnel needed, increases productivity with all that the factory has increased its competitiveness.
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	N/A
	REPLICABILITY AND UP SCALING	
Replicability and further application	How can the solution / good practice be useful for other SMEs?	The solution is a good example of implementing smart technologies in order to increase the productivity and save time in the work process.
	What are the possibilities of extending the good practice more widely?	
	FINAL REMARKS	
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	Creating and implementing the good practice in the work process increased the productivity and the competitiveness of the manufacturer.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	NO

Element	Guiding questions	Answers
INTRODUCTION		
Company information	Data identification, logo, contact person, possible representative image(s).	SPESIMA SPESIMA GmbH Address: Bul. Asen Yordanov 9, Sofia 1592, Bulgaria Phone: +359 (2) 973 87 62 Fax: +359 (2) 979 09 45 Email: info@spesima.eu Web: www.spesima.eu
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice Provide a concise description of the good practice being addressed	Computer Numerical Control (CNC) Machine – M550/M450/ The CNC – mchine RAIS model M550 and M450 are computer operated drilling and cutting machines designed for manufacturing metal parts for the foundry industry.
GOOD PRACTICE DESCRIPTION		
Detailed description	How did the SME create good practice / new product? What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management? Describe what are the technical solutions and innovations: of the good practice	Driven by the need to increase the productivity and stay competitive, the company implemented the CNC machines in the production process. Implementing the CNC machines in the manufacturing allows faster production and quality assurance. The Computer Numerical Control Machines are controlled by a computer. Coordinates are uploaded

Element	Guiding questions	Answers
		into the machine controller from a separate CAD program. Being controlled form a computer the machines produce consistent and high-quality work
	Highlights (or keywords) of the Best Practice	Computer Numerical Control, CNC, Metal products, Foundry industry Automation, Precision, Productivity,
	Good practice applied in : (NACE code)	C28 - Manufacture of machinery and equipment n.e.c.
	How does your solution related to others provided by competitors	CNC Machine M550 has more than 50 nozzles allows wide spectre of metal processing. M550 also has automatic rotator for 3D processing.
Benchmarking		CNC Machine M450 don't has such a high precession as M550, but has drilling with integrated cooling which reduces the time for deep drilling and increase the productivity.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	CNC M550 http://www.raisbg.com/page.php?15 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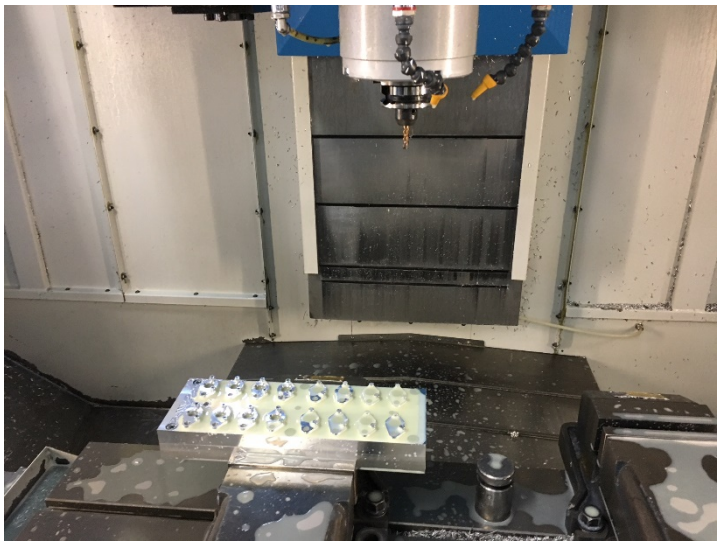


Element	Guiding questions	Answers

CNC M450
http://www.raisbg.com/page.php?13

Element	Guiding questions	Answers
		
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Both machines are bought and used for the benefits of the company in Sofia, Bulgaria.
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	The good practice could be useful for companies in the foundry industry
Targeted customers and scale of use	Select the target group of customers: 153. SMEs (<250 employees) 154. Large companies 155. Public institutions 156. End customer (Business to Customer)	1. SMEs (<250 employees) 2. Large companies

Element	Guiding questions	Answers
	Other, please specify	
	METHODOLOGICAL APPROACH	
Managerial aspects	Cost efficiency of the good practice, if applicable	The CNC machine can produce a one-off as effectively as repeated identical production and can reduce waste, frequency of errors, and the time the finished product takes to get to market which reduces manufacturing costs
	Quality assurance aspects, if applicable	The CNC machines characterize with high precision work and improves products quality. Automation and precision are the key benefits of cnc machines. All ball screws - high precision, class P3, Ø40 mm OD, with a double nut, pre-loaded to control backlash. High precision of positioning and smooth operation.
	Risk management aspects, if applicable	Fully enclosed electrical cabinet with heat exchanger, accordance to CE requirements.
Implementation guidelines	How can the Good practice be implemented?	The implementation of CNC machines in the factories is easy and the benefits are instantly visible
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	Financial resources are needed for the implementation are in regards of acquiring of the machines. The easy use of the system allows one worker per machine for operating the production process.
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	The CNC Machines are bought with certificate for validation form **RAIS Ltd**. from Pazardjik, Bulgaria
	RESULTS / IMPACT	

Element	Guiding questions	Answers
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The impact of the good practice is good with increased production and quality. The personnel for the manufacturing is reduced since the process is automated
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	The models of the CNC machines are not the latest out on the market, however the factory is ready to implement newer models in their production.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	The stability of machines manufactured by RAIS outperforms all others in this frame size. Precision linear guides and ball screws from "Bosch Rexroth" are built-in. The machines are designed and implemented in full production by the company experts. Precision in assembly, test and control means provides quality on each machine, meeting the requirements of EN ISO standard for machining centres. The Management System Quality creates all the prerequisites to meet customer requirements.
Need assessment	What else would be needed in order to improve the impact of the Good practice	The company has already planned to acquire newer model of the CNC machines M700 for greater precision and higher quality products
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	The CNC machines typically produces consistent and high-quality work and improves factory productivity. Automation and precision are the key benefits of implementing cnc machining in the production process.

Element	Guiding questions	Answers
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	N/A
	REPLICABILITY AND UP SCALING	
Replicability and further application	How can the solution / good practice be useful for other SMEs?	The CNC machines typically produces consistent and high-quality work and improves factory productivity. Automation and precision are the key benefits of implementing cnc machining in the production process.
	What are the possibilities of extending the good practice more widely?	The CNC machines are ready to be implemented in SMEs for producing metal components for machinery.
	FINAL REMARKS	
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The CNC machines typically produces consistent and high-quality work and improves factory productivity. Automation and precision are the key benefits of implementing cnc machining in the production process.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	No

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	**IT Industrial Technologies** **Etien Tenev – CTO** Telephone: (+359 2) 9624221 E-mail: info@smd-assembly.com **http://www.smd-assembly.com/**
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	IT Photovoltaic System - IT PS
	Provide a concise description of the good practice being addressed	Photovoltaic System installed on the roof and the parking lot of the factory providing electricity and lowering the company's expenses.The system is custom made from metal frames, photovoltaic panels, voltage invertors and switch, serving as both shelter and electricity provider.
	GOOD PRACTICE DESCRIPTION	
Detailed description	How did the SME create good practice / new product?	The high electricity expenses of the factory, made it necessary to find an alternative solution for power supply using new technologies.

Element	Guiding questions	Answers
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	The good practice is tied to the Smart factory hub's approach in relation to the cost efficiency of the production process.
	Describe what are the technical solutions and innovations: of the good practice	The innovation is that the construction of the system is used also as a parking shelter and at the same time is a power supply provider reducing the electricity cost for the production by 50%
	Highlights (or keywords) of the Best Practice	Photovoltaic, Solar, System, Electricity, Green, Cost Efficiency, Power Supply
	Good practice applied in : (NACE code)	C26.4 - Manufacture of consumer electronics
Benchmarking	How does your solution related to others provided by competitors	In Sofia region there is no other factory that is using solar electricity in the production process.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	

Element	Guiding questions	Answers
		
		
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	The solution described above was used in Sofia, Bulgaria, on the territory and for the benefit of the company only
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Small, medium and large manufacturing companies
Targeted customers and scale of use	Select the target group of customers: 157. SMEs (<250 employees)	The system could be installed at: 1. SMEs (<250 employees)

Element	Guiding questions	Answers
	158. Large companies	2. Large companies
	159. Public institutions	3. Public institutions
	160. End customer (Business to Customer)	
	Other, please specify	
	METHODOLOGICAL APPROACH	
Managerial aspects	Cost efficiency of the good practice, if applicable	The good practice is targeted cost efficiency of the production process.
	Quality assurance aspects, if applicable	N/A
	Risk management aspects, if applicable	N/A
Implementation guidelines	How can the Good practice be implemented?	The good practice is easy to be implemented. The company needs to identify the added value of using solar technologies in the production process
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	For implementing the good practice, the company needs to allocate financial resources for building a metal structure and installing photovoltaic panels at any open space near the company. The expenses depends on the size of the company.
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	The validation process was completed within the factory and comprised in the analysis and comparison of the power supply expenses before and after implementation of the system.
	RESULTS / IMPACT	

Element	Guiding questions	Answers
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The implementation of the system has positive impact on company production process related to decrease of production costs.
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	The technical and implementation limitations depends on the open area that the company has. Also the use of the good practice could be limited by national legal issues
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	The system is customly made and the financial investment is lower than the systems offered by other brands.
Need assessment	What else would be needed in order to improve the impact of the Good practice	The system could be improved with installing an accumulator for storing the produced energy when the factory is not working.
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	The good practice is an excellent example of using green energy in the manufacturing process and reducing production cost.
SUSTAINABILITY		
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	-
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	The good practice is an excellent example of using green energy in the manufacturing process and reducing production cost.

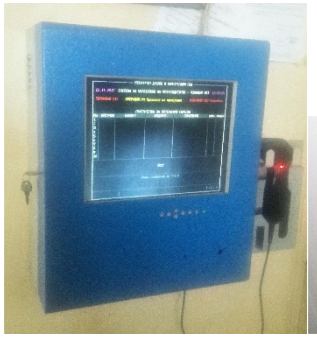
Element	Guiding questions	Answers
	What are the possibilities of extending the good practice more widely?	The good practice could be implemented by every manufacturing company
	FINAL REMARKS	
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The good practice is an excellent example of using green energy in the manufacturing process and reducing production cost.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	NO

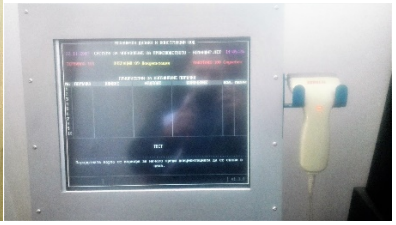
Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	**Mechanic Design and Construction** **Konstantin Kamberov - CEO** **www.mdc-bg.com** **ul. "Magnaurska shkola" 13, 1784 7-Mi Kilometar, Sofia** **tel: +359 2 974 47 48** **email: info@mdc-bg.com**
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	KOMANDIR.NET Product Lifecycle Management (PLM) System
	Provide a concise description of the good practice being addressed	The good practice is a system for manufacturing management aiming to optimize and digitalize the manufacturing process in the factory through: · Automate the preparation of accompanying technological documentation in accordance with ISO 9001: 2000 (order documents, complete maps, route cards, etc).;

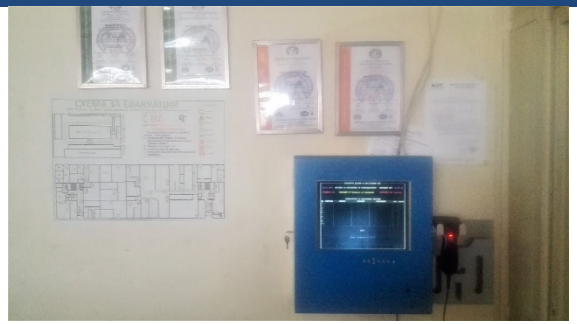
Element	Guiding questions	Answers
		· Automated transmission of tasks from one workplace/machine to another via computer terminals; · Permanent monitoring of the condition of the parts and the nodes; · Timing reports for each product at every operation; · References for workers working on each operation for each detail according to ISO 9001: 2000; · Remote access to production data with the ability to change the priority for order execution; Others. The system consists of network of computer terminals, cloud based server, and computers, smartphones, tablets etc. KOMANDIR.NET system operates using Google apps.
	GOOD PRACTICE DESCRIPTION	
Detailed description	How did the SME create good practice / new product?	The SME created the good practice through finding the need of optimizing the manufacturing process and prioritising the order execution.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	The good practice is strongly linked to the SFH approach by implementing a smart system for optimizing the ensuring production process and cost efficiency and quality assurance.
	Describe what are the technical solutions and innovations: of the good practice	The network of terminals ensures good digital control over the production process. Being cloud based allows

Element	Guiding questions	Answers
		the system to be accessed remotely by any type of digital device. Using google apps makes the implementation cost low and compatible with wide rage of devices.
	Highlights (or keywords) of the Best Practice	Product Lifecycle Management (PLM) System, Optimization, Management, Constant monitoring, Automated process, Remote access, Terminals, Cloud
	Good practice applied in : (NACE code)	C25 - Manufacture of fabricated metal products, except machinery and equipment
Benchmarking	How does your solution related to others provided by competitors	The system is custom made so it is not known whether there is a competitor using similar system in their work process.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	KOMANDIR.NET www.komandir.net


MDC
www.mdc-bg.com
Механичен дизайн и конструкции
Производство на механични конструкции за електрониката и електротехниката 19" шкафове и принадлежности, щанцоване и огъване на детайли от листови материали.
MDC произвежда детайли (от листови и профилни материали) предназначени за: електроника и електротехника, производствено обзавеждане други области на индустрията
Механичен дизайн и конструкции •1784 София • бул. Цариградско шосе 7-ми км
Сграда ЗИТ първи корпус ет.3 • тел.: + 359 2 9744748 • тел.: + 359 88 9744748
факс: + 359 2 9745022 • e-mail: info@mdc-bg.com





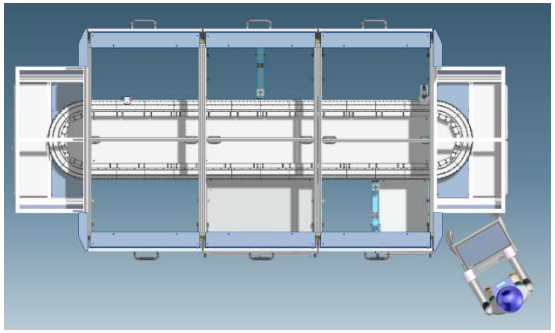
Element	Guiding questions	Answers
		
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	The solution described above was used in Sofia, Bulgaria, on the territory and for the benefit of the company only
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Small, medium and large manufacturing companies; Another systems that need visualisation, monitoring, control and prioritization of different kind of tasks/processes.
Targeted customers and scale of use	Select the target group of customers: 161. SMEs (<250 employees) 162. Large companies 163. Public institutions 164. End customer (Business to Customer) Other, please specify	The system could be installed at: 1. SMEs (<250 employees) 2. Large companies 3. Public institutions
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	N/A

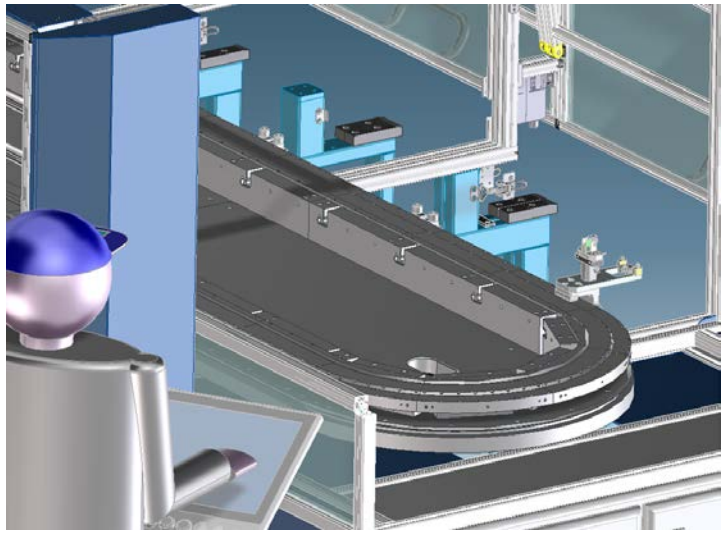
Element	Guiding questions	Answers
	Quality assurance aspects, if applicable	The good practice is targeted quality assurance of the production process
	Risk management aspects, if applicable	N/A
Implementation guidelines	How can the Good practice be implemented?	Because of the remote use of free software on wide range of devices the system is easily implemented for the need of production llifecycle process management.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	For implementing the good practice, the company needs to allocate financial resources for installing terminals on every step of the manufacturing process.
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	The validation process was completed in 6 months within the factory with help of some IT experts nearby, and comprised in the analysis and comparison of the work process and the before and after implementation of the system.
RESULTS / IMPACT		
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The implementation of the system has positive impact on company production process related to time optimization and order prioritizing.
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	Because of low volume of data and performance needed form da system their limitations will be reached when the terminals (and relevant workplaces/machines) are more than 100, and/or the server DB/Internet connection to the cloud reach their

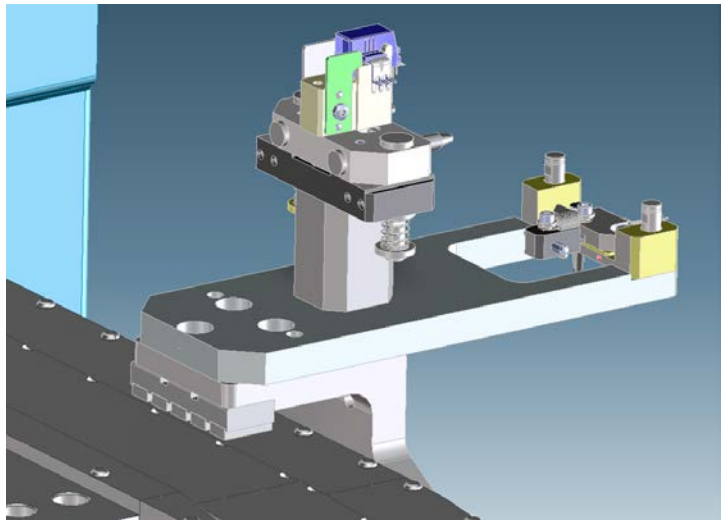
Element	Guiding questions	Answers
		limits, but this is subject of additional researches and tests.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	The system is custom made and it could give an easy way for remote monitoring and reporting of the manufacturing process from the beginning (taking the order) to the finish (completing the order). The use of open source hardware and software reduces the cost of the system significantly.
Need assessment	What else would be needed in order to improve the impact of the Good practice	The system could be improved with installing an audio and video connectivity on every terminal for faster and better management of the work process.
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	The good practice is an example for smart remote organization of the work process in the factory that will increase the manufacturing capabilities, quality of the products and the positive feedback from the clients
SUSTAINABILITY		
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	The system is sustainable because of their low cost not only for the establishing, but also for it's support and improvement, being in the same time high efficient and reliable.
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	The good practice is an example for smart remote organization of the work process in the factory that will increase the manufacturing capabilities, quality of the product and the positive feedback from the clients

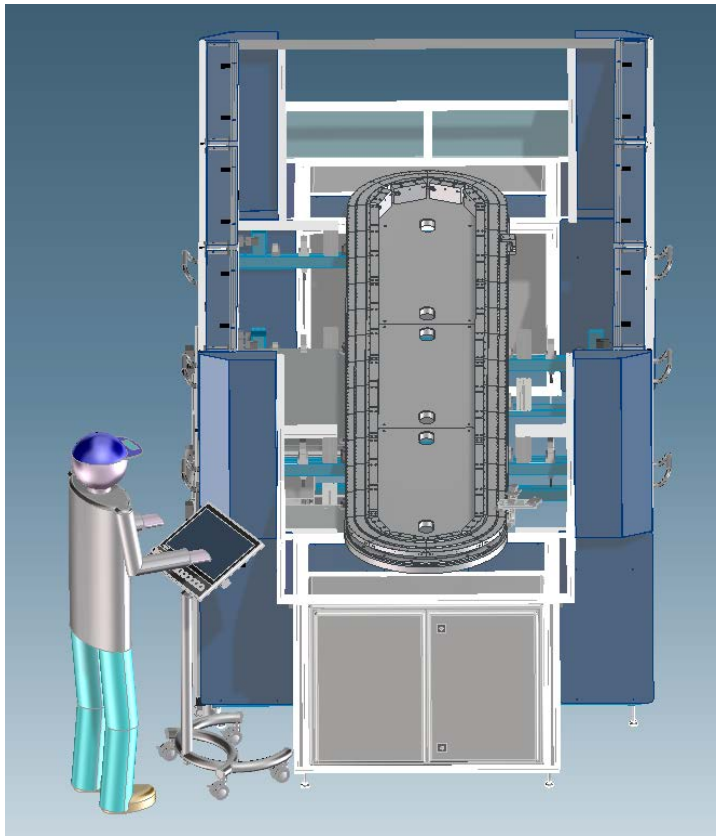
Element	Guiding questions	Answers
	What are the possibilities of extending the good practice more widely?	The good practice could be implemented in every company where there is a need of monitoring a numerous process at once and optimizing the time for completing certain tasks
	FINAL REMARKS	
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The good practice is an example for smart remote organization of the work process in the factory that will increase the manufacturing capabilities, quality of the product and the positive feedback from the clients
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	NO

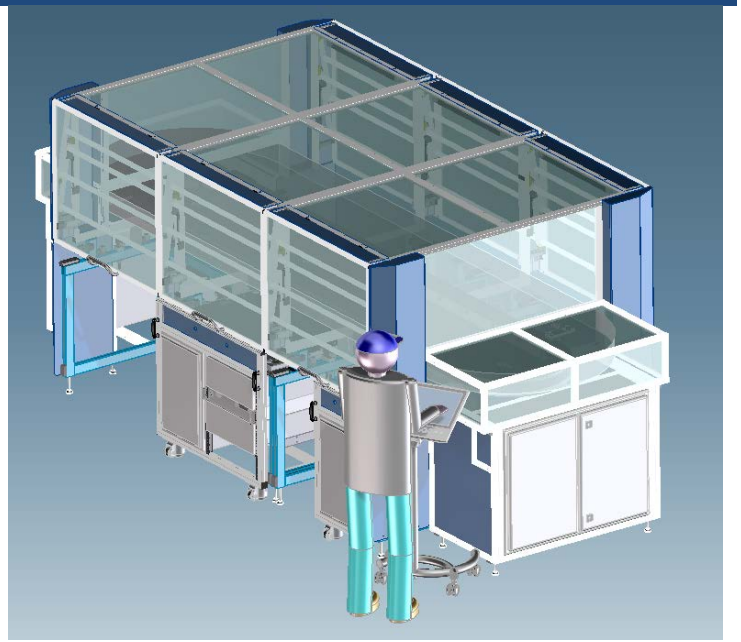
Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	LEM LEM Bulgaria Address: ul. "Iliyansko Shose", 1220 NPZ Voenna rampa, Sofia, Bulgaria Tel: +359 2 424 6333 web: www.lem.com
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	Sigma – modular system
	Provide a concise description of the good practice being addressed	The system Sigma is a modular printing system which consists of flexible conveyor belt and collaborative robots (co-bots)
	GOOD PRACTICE DESCRIPTION	
Detailed description	How did the SME create good practice / new product?	The Sigma system was developed in evolutionary way with the need of the company to increase the productivity.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	The developing of a system like Sigma and integrating robots in the work process increase the production process, assure quality as well as cost efficiency.
	Describe what are the technical solutions and innovations: of the good practice	Collaborative robots (co-bots) integrated in the production increases speed and the precision of manufacturing which is critical in microelectronics components

Element	Guiding questions	Answers
	Highlights (or keywords) of the Best Practice	Microelectronics, Co-bots, Modular, Automation
	Good practice applied in : (NACE code)	C26.4 - Manufacture of consumer electronics
Benchmarking	How does your solution related to others provided by competitors	The modular character of the system allows easier modification and customization of the system, which makes faster development and production of new products
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	 







Element	Guiding questions	Answers
		
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	For now the system is developed and used for the benefits of the company in Sofia, Bulgaria.
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	The good practice could be useful for companies that need quality precise manufacturing.
Targeted customers and scale of use	Select the target group of customers: 1. SMEs (<250 employees) 2. Large companies 3. Public institutions	1. SMEs (<250 employees) 2. Large companies

Element	Guiding questions	Answers
	4. End customer (Business to Customer) Other, please specify	
	METHODOLOGICAL APPROACH	
Managerial aspects	Cost efficiency of the good practice, if applicable	The cost efficiency of the system shows in the lowering the personnel needed for production as well as the expenses for maintaining the co-bots is lower than a minimum wage.
	Quality assurance aspects, if applicable	The precision of the robots is far better than the human production which assures better quality especially in the sector electronic components.
	Risk management aspects, if applicable	N/A
Implementation guidelines	How can the Good practice be implemented?	Because of the modular character of the system the good practice could be easily implemented, and customize for the needs of the company
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	The main resources used for developing the good practice are financial as well as timespan of 3 years for creating testing and validation
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	The evolutionary way of developing Sigma system started the validation process from the beginning. The Validation methods used are lean manufacturing as well as value stream mapping.
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The impact on the company has been positive. Reducing the needed personnel for the same task from 9 to 2 and at the same time increasing the production.

Element	Guiding questions	Answers
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	There are no technical or implementation limitation known at this moment.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	The modular characteristic of the good practice is the biggest advantage which allows the quick modification of the system and quick development of new products
Need assessment	What else would be needed in order to improve the impact of the Good practice	The Sigma system could be improved with sensors for quality control and tracking the production process
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Sigma is a great examples how automation and implementing co-bots in production allows more precise production without slowing the production process.
SUSTAINABILITY		
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	Being modular system Sigma is flexible and easily customizable in order to be able for quick new product development and manufacturing. Every module of the system could be
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	The system could be customize for the need of the SME and by Implementing co-bots in production allows more precise production without slowing the production process
	What are the possibilities of extending the good practice more widely?	Sigma system could be implemented in every SME or Large manufacturer that need precise fast production.
FINAL REMARKS		

Element	Guiding questions	Answers
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	Sigma is a great examples how automation and implementing co-bots in production allows more precise production without slowing the production process.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	NO

Serbia

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	Data identification: EkoLak – d.o.o. Tel: +381 34 355 339 ekolaknatur@gmail.com www.ekolak.rs Contact person: Petrović Nebojša Address: Vučić bb. 34210 Rača
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice Provide a concise description of the good practice being addressed	EcoTherm - a set of coatings for thermal insulation of wood hive EcoTherm is a coating with a very low thermal conductivity coefficient (λ = 0.0016 W / (mk) making it an exceptional isolator in very thin coatings of 0.7-1.0 mm. When applied on a hive, it very favorably affects the microclimate within the hive , prevents the decline of societies due to great cold or heat, bees consume less energy, they are healthier (no crop formation) and bring more honey.
	GOOD PRACTICE DESCRIPTION	
Detailed description	How did the SME create good practice / new product?	Three years ago, we won the production of thermal insulation coatings based on the microsphere, which is

Element	Guiding questions	Answers
		used in construction. At the Belgrade Building Fair in 2016, the product was awarded with a special award. Our family has been in contact with beekeeping for a long time and are aware of the negative effects of extreme temperatures on the escape of society. So we came up with the idea to customize our product for that purpose and help solve this problem.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	All of our products are ecological - water based. We have done health tests. The mechanism is based on the most modern raw materials in the form of microspheres with exceptional thermal insulation characteristics.
	Describe what are the technical solutions and innovations: of the good practice	The main thing is to keep the wood as a natural habitat of bees and to insulate from the outside significantly the thermal insulation properties of the hive. The coating is applied in a thickness of 1 mm and does not affect the dimensions and weight of the hives. This is very important because hives are transported and must be manipulated often with them.
	Highlights (or keywords) of the Best Practice	Thermal insulation protection of wooden hives
	Good practice applied in : (NACE code)	Beekeeping
Benchmarking	How does your solution related to others provided by competitors	Coatings of other manufacturers do not have thermal insulation properties and can not be compared with our coatings. There are beehives made of styrofoam and plastic that have insulation, but it is not a natural habitat of bees and as such is not widely accepted.

Element	Guiding questions	Answers
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	 Flajer Ecotherm za košnice 2.pdf IMS - Izveštaj o ispitivanju.pdf Zdravstvena ispravnost EcoTherm. Declaration of Conformity - EcoTher Useful info: https://www.youtube.com/watch?v=qphwXjKN_I8 https://www.youtube.com/watch?v=HOwlNxoyLBM https://www.youtube.com/watch?v=Q8uApz-mjV4 https://www.youtube.com/watch?v=R0bpln6lheU Presentation of the product in Istanbul, Turkey: https://www.dropbox.com/s/ic6ip2f7pfy8t1d/Prezentacija.pptx?dl=0

Element	Guiding questions	Answers

OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	In the previous period, we tested the product in Serbia and countries in the region (Bosnia and Herzegovina, Montenegro, Croatia, Slovenia, Macedonia, Romania).

Element	Guiding questions	Answers
		The test results are excellent and the beekeepers are very satisfied. In October, we successfully presented the product at the international fair for bee-keeping - Apimondia in Istanbul. There is a lot of interest from around the world, so now we send samples to twenty countries for various tests.
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Target group are beekeepers from around the world! Our product positively affects bee companies in all climate zones. The coating has several positive factors on the beehive and bee company and there is no negative factor.
Targeted customers and scale of use	Select the target group of customers: 5. SMEs (<250 employees) 6. Large companies 7. Public institutions 8. End customer (Business to Customer) Other, please specify	Beekeepers and beekeepers associations all over the world.
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable Quality assurance aspects, if applicable Risk management aspects, if applicable	The investment of beekeepers in our product is not high and it is very fast to pay off. There is no deterioration of societies, healthier and stronger societies and as a result higher honey production.

Element	Guiding questions	Answers
Implementation guidelines	How can the Good practice be implemented? What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	The application of our products to beeswax all over the world can significantly improve beekeeping. The product is environmentally friendly, very easy to use and does not require any expensive equipment and training.
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	The thermal conductivity coefficient was tested at -IMS-Belgrade λ = 0.0016 W / (m.k). It is examined according to health safety by Jugoinspekt - Belgrade A large number of beekeepers with comparative tests confirmed the positive effects of the coating.
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	We did not have negative observations. Positive are numerous: - Prevent the decline of the bee's society due to extreme temperatures and in winter and flying - Prevent the occurrence of mould due to condensation on the walls of the hive - It facilitates the maintenance of microclimate in the hive - Reduces the disorder of bees because they provide a healthier environment - Reduces the consumption of food needed to maintain microclimate - We get a stronger and more numerous society

Element	Guiding questions	Answers
		- Bees can spend more time in collecting pollen ... - The length of the wooden hive is prolonged because the coating has a positive effect on the wood. It prevents rapid spread and shrinkage due to sudden changes in temperature and hence the cracking of wood. -INCREASES HONEY PREDUCTION
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	The product must be applied at a temperature of 14-30 C. The product must not freeze and should not be in direct sunlight.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	Our product is unique on the market. There are no similar products for this purpose. A large number of positive factors and no negative. The product is environmentally friendly, health-minded, easy to apply. We enable the bee's society to maintain the necessary microclimate in a wooden hive as a natural habitat.
Need assessment	What else would be needed in order to improve the impact of the Good practice	In order for EcoTherm to have the right results, it is necessary to follow the instructions for use and apply it to a standard hive.
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Experience has shown that the best results are achieved when the finishes are of a lighter shade of colors.
SUSTAINABILITY		
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	Increasing demand and production would probably result in a reduction in product and its massive use.

Element	Guiding questions	Answers
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs? What are the possibilities of extending the good practice more widely?	This type of thermal insulation coating based on microspheres already has application in construction. Products are perfected every day and we believe that we can find even more useful applications.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	EcoTherm - a set of coatings for thermal insulation of wooden hives is a very useful innovation for beekeeping. By its application, the following positive effects on the wooden hive as a natural habitat are achieved: - Prevent the decline of the bee's society due to extreme temperatures and in winter and flying - Prevent the occurrence of mold due to condensation on the walls of the hive - It facilitates the maintenance of microclimate in the hive - Reduces the disorder of bees because they provide a healthier environment - Reduces the consumption of food needed to maintain microclimate - We get a stronger and more numerous society - Bees can spend more time in collecting pollen ... - The length of the wooden hive is prolonged because the coating has a positive effect on the wood. It prevents

Element		Guiding questions	Answers
			rapid spread and shrinkage due to sudden changes in temperature and hence the cracking of wood. - INCREASES HONEY PRODUCTION
Disclaimer Acknowledgements	/	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	NO

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	Data identification: ICM Electronics DOO Logo: Tel: +381 21 518-458 Tel: +381 21 518-777 e-mail: office@icm.rs Contact person: Nenad Mićić Address: Vase Miskina Crnog 2, 21000 Novi Sad
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	CNC robotic packing, palletizing and welding
	Provide a concise description of the good practice being addressed	We made a robotic welding system that is programmed through the PC and software for 3D modeling of parts. The traditional way of programming robots is with the help of a cone with which the robot learns how to move. Robot programming software reduced the programming time of the robot from several hours to a few minutes and made a robot suitable for companies that produce small series.

Element	Guiding questions	Answers
	GOOD PRACTICE DESCRIPTION	
Detailed description	How did the SME create good practice / new product?	Through conversation with customers, we realized that robotics does not pay off to many domestic companies because no one has a big series. While the robot is programmed, a person can wipe half of the parts manually. For this reason, we started developing an application that will enable the robot to be profitable and to companies that do not have a series.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	This is a new technology that improves production processes in small-scale companies that can not provide welders or have problems with them.
	Describe what are the technical solutions and innovations: of the good practice	In the computer software, the 3D model of the work to be welded is inserted. With a few clicks, the positions are marked where they need to be protected. The software automatically generates a robot program. The operator should just insert a piece on the table and load the program of robots that generated the software.
	Highlights (or keywords) of the Best Practice	Smart, fast, and easy programming of welding robots
	Good practice applied in : (NACE code)	
Benchmarking	How does your solution related to others provided by competitors	The solution is quite different because it accelerates and facilitates the robot programming process and makes the product more applicable to many customers.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section.	

Element	Guiding questions	Answers
	Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Republic of Serbia
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	The solution is globally applicable, and so we will perform on the market.
Targeted customers and scale of use	Select the target group of customers: 9. SMEs (<250 employees) 10. Large companies 11. Public institutions 12. End customer (Business to Customer) Other, please specify	SME, large companies, end customers
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	The robot, on average, replaces 9 welders. Companies that need 9 welders can return investments within a year.
	Quality assurance aspects, if applicable	
	Risk management aspects, if applicable	
Implementation guidelines	How can the Good practice be implemented?	It can be applied in any company that has a welding process.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	Staff and finance.

Element	Guiding questions	Answers
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	So far, the system has been tested only in our production.
	SUCCESS FACTORS AND CONSTRAINTS	
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	It is necessary to have 1 man who knows how to draw in 3D software.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	The machine that has so far been used in companies that have a large series can also be used in companies that have small series.
Need assessment	What else would be needed in order to improve the impact of the Good practice	
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	
	REPLICABILITY AND UP SCALING	
Replicability and further application	How can the solution / good practice be useful for other SMEs?	All companies that have the welding process can use this solution and solve many problems related to MHR, improve quality and speed up the production process.
	What are the possibilities of extending the good practice more widely?	

Element	Guiding questions	Answers
	FINAL REMARKS	
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	All companies that have the welding process can use this solution and solve many problems related to MHR, improve quality and speed up the production process.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	No

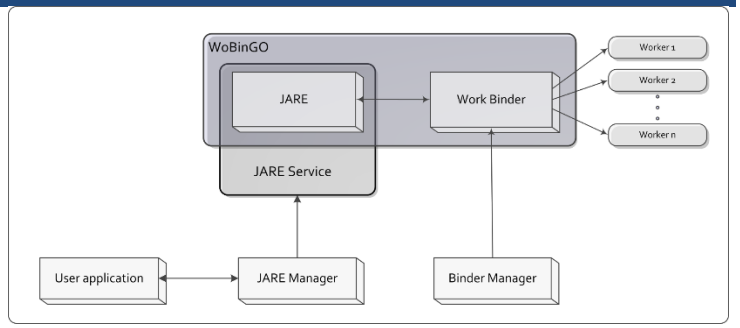
Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	Data identification: **Vodena** Logo: Vodéna Contact person: **Boban Stojanovic** Address: **Kralja Milana IV 19b/5** **34 000 Kragujevac, Serbia** e-mail: **office@vodena.rs** tel: **+381 69 1154375** website: **www.vodena.rs**
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice Provide a concise description of the good practice being addressed	OSICE - Optimization as a Service in Cloud environment OSICE is a Cloud service intended for solving complex optimization problems in the distributed computing environment. It provides all interested third parties, especially low resources stakeholders like SMEs, with the effective tool for the problem solving and decision making. This goal is achieved through the

Element	Guiding questions	Answers
		implementation of the optimization procedures based on evolutionary algorithms (EA) in Cloud computing environment and through the development of simple and intuitive application programming interface (API).
GOOD PRACTICE DESCRIPTION		
Detailed description	How did the SME create good practice / new product?	Vodena is an innovative ICT company established as a research spin-off from the Faculty of Science, University of Kragujevac, Serbia. Our enterprise offers university-strength research, modeling, simulation and data analysis, all integrated through flexible and efficient software applications. After years of experience in solving various optimization problems we have developed a web service for solving optimization problems on supercomputers using evolutionary algorithms. Finally, we have decided to offer the service to the market as a Cloud service.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	OSICE is an innovative ICT concept which will disrupt existing markets of optimization software and create new ones by enabling SMEs to utilize immense computational power of the Cloud for optimization problem solving and decision making, regardless their financial, technological and knowledge level.
	Describe what are the technical solutions and innovations: of the good practice	• Service Oriented Architecture (SOA) approach to the optimization software, which allows the optimization methods to be exposed as an Internet service.

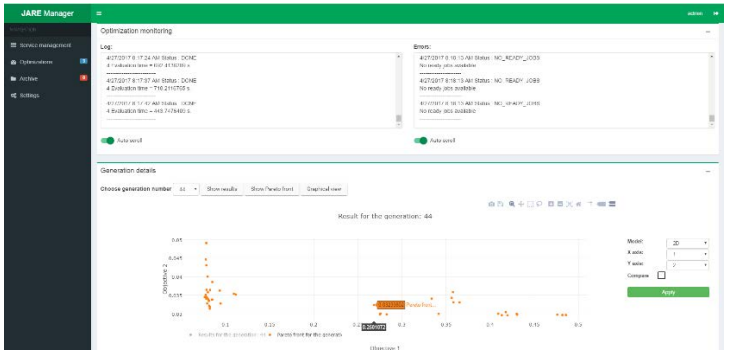
Element	Guiding questions	Answers
		• Fully automatic allocation of the computing resources on HPC or Cloud infrastructure, which provides enough computing power hiding the implementation details from the user. • Frugal utilization of the computing resources in accordance with the current service load, resulting in financial savings and minimal energy consumption.
	Highlights (or keywords) of the Best Practice	Optimization, Cloud, Service, Supercomputing, High performance computing
	Good practice applied in : (NACE code)	Software Development Services (NACE code 62.0)
Benchmarking	How does your solution related to others provided by competitors	According to our best knowledge, direct competition in the field of cloud-based optimization service does not exist at the moment. Currently, commercially available solutions available on the market (IBM, SAS, Lindo Systems Inc., AIMMS B.V., AMPL Optimization Inc., ...), although robust and reliable, are often very expensive and do not offer proper HPC support. On the other hand, open source solutions such as jMetal, OptaPlanner, Scilab, HeuristicLab HIVE, and others are publicly available, but their application requires significant expertise in the field of software development and optimization. Nevertheless, these solutions are still not comprehensive enough. For instance, OptaPlanner does not support multi-core execution, while HeuristicLab HIVE requires that the user establishes computing infrastructure on his own.

Element	Guiding questions	Answers
		The necessity of possessing expertise can be partially overcome by employing a consulting company specialized in solving certain types of optimization problems. Unfortunately, the services offered by these companies are often very expensive and unavailable to SMEs, due to engagement of highly qualified and scarce experts.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	OSICE is a modular system that consists of: ● **WoBinGO** - the framework for parallel execution of the evolutionary algorithms ○ **JARE** - evolutionary algorithms library ○ **Work Binder** - the component in charge of elastic allocation of the distributed HPC/Cloud resources ● **JARE Service** - the optimization service which exposes functionalities of JARE library. ● **JARE Manager** - user exposed web application for optimization management and monitoring. Intended for both experts and users. ● **Binder Manager** - web application for administration, monitoring and management of Work Binder service. Intended for HPC/IaaS admins.

Element	Guiding questions	Answers



Logical architecture of OSICE - component view.



JARE Manager, user view. Monitoring the objectives in real time.

OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Our greatest achievement so far is the development and deployment of comprehensive data analysis and optimization solution employed at “Iron Gate”

Element	Guiding questions	Answers
		hydropower plant on Danube river. The solution uses OSICE as an underlaying optimization engine.
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	The key segment of our identified users are European SMEs, with 50-250 employees, in high-tech manufacturing sector and high-tech knowledge-intensive services sector, especially telecommunications, computer programming, consultancy and related activities, information service activities and scientific research and development. These companies are already familiar with the benefits of business processes optimization, or optimization in design of products and services, and they are in the need for comprehensive, cost-effective and easy-to use optimization solution, or cost-effective alternative to existing in-house optimization solutions.
Targeted customers and scale of use	Select the target group of customers: 13. SMEs (<250 employees) 14. Large companies 15. Public institutions 16. End customer (Business to Customer) Other, please specify	SMEs (<250 employees)
	METHODOLOGICAL APPROACH	
Managerial aspects	Cost efficiency of the good practice, if applicable	Implementation of our cloud-based optimization solution eliminates need for initial investment in HPC equipment, which ranges from 100,000 to 500,000 EUR. Development of HPC based optimization

Element	Guiding questions	Answers
		solutions demands interdisciplinary team, which include domain expert, optimization expert, expert for parallel programing and system administrator. Cost of this team is 200,000 EUR annually. Usage of our product require only domain expert, thus reducing the personnel costs up to 80%.
	Quality assurance aspects, if applicable	A crucial business novelty that OSICE brings to the global market is the offer of the optimization in the form of service that can be accessed over Internet. It is achieved through the technological innovation that combines state-of-the-art distributed evolutionary algorithms, cloud-based computational environment and easy-to-use universal API. This combination overcomes two main obstacles for broader usage of optimization, knowledge gap and technology gap.
	Risk management aspects, if applicable	Due to different internal and external factors, there is a risk of delay in different phases of the project, which can lead to insufficient funding for project completion or market takeover by the competition. Measures to mitigate these risks involve timely assessment of complexity of every activity and provision of sufficient human resources. In spite of invested effort to expose optimization methods as easy-to-use API, there is a standing risk that resulting interface will still be too complex for the user who is not sufficiently familiar with the optimization

Element	Guiding questions	Answers
		techniques. This risk will be diminished by increased understanding of technological level and needs of our potential users. There is also commercial risk that we will not succeed to reach our key customers. Mitigation measures will involve increased marketing activities.
Implementation guidelines	How can the Good practice be implemented?	By accessing **JARE Manager** instance, the expert defines the optimization problem, including the number and types of decision variables, their ranges, optimization goal(s), the algorithm to be used, etc. Moreover, the expert has to supply the evaluator whose role is to assess quality of the potential solution. The evaluator is given in the form of Docker/LXD container or ordinary ZIP that contains the executable(s) and necessary data for the solution fitness evaluation. The evaluator package has to comply to the standardized interface. The execution of the optimization task itself is left to the **WoBinGO** framework, which hides the complexities of the optimization method and underlying computing infrastructure. The user has the ability to follow the progress of the optimization process within **JARE Manager,** through its common numerical and graphical elements expressing the current status. The web application **Binder Manager** is aimed at computing infrastructure administrators. Its main

Element	Guiding questions	Answers
		purpose is to enable fine-grain control of the distributed evaluation process. It plays a role of a bridge between the evaluation requests posed by **JARE** and underlying HPC/IaaS infrastructure controlled by **Work Binder**. The **Binder Manager** largely facilitates a number of common admin tasks like monitoring IaaS instances, cleanup, specifying users' Quality of Service (QoS) requests, etc.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	We offer the solution for two, not necessarily distinct, user categories: experts and users. **Experts** encounter optimization problems in their domain (i.e. in production, computer science or hydrology) and try to get a viable solution. For them, OSICE provides tools for specifying optimization parameters, goals, algorithm to be applied, evaluator, etc. **Users** of the optimization service are not as familiar with the problem domain as experts are. They only use the provided optimization scenario of the service. Since typical optimization tasks take hours to days, users need control to start, pause, resume and stop such runs.
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	The solution has been validated as an underlaying engine of several decision support software in hydrology, power production, finance, etc. The most comprehensive and demanding software that uses OSICE is the power production optimization tool

<table>
<tr><th>Element</th><th>Guiding questions</th><th>Answers</th></tr>
<tr><td></td><td></td><td>employed at “Iron Gate” hydropower plant on Danube river.</td></tr>
<tr><td colspan="3">RESULTS / IMPACT</td></tr>
<tr><td>Solution impact</td><td>What has been the impact (positive or negative) of this good practice on the beneficiaries</td><td>OSICE provides a comprehensive solution comparable to in-house optimization solutions without need for investment in HPC infrastructure and reducing the costs of expert stuff by 80%. In addition, it provides ease-of-use of available commercial solutions, but with possibility to optimize large real-world problems in Cloud-based environment.</td></tr>
<tr><td colspan="3">SUCCESS FACTORS AND CONSTRAINTS</td></tr>
<tr><td>Limitations and Strong points</td><td>Describe limitations, both from the technical and implementation point of view</td><td>In spite of invested effort to expose optimization methods as easy-to-use API, there is a standing risk that resulting interface will still be too complex for the user who is not sufficiently familiar with the optimization techniques. This risk will be diminished by increased understanding of technological level and needs of our potential users.</td></tr>
<tr><td></td><td>Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands</td><td>
<table>
<tr><th></th><th>No initial investment</th><th>No need for expert knowledge</th><th>Ease of use</th><th>Generality</th><th>Distributed computation</th><th>Price</th></tr>
<tr><td>In-house solutions</td><td>✗</td><td>✗</td><td>✓</td><td>✓</td><td>✓</td><td>High</td></tr>
<tr><td>Commercial solutions</td><td>✓</td><td>✓</td><td>✓</td><td>✗</td><td>✗</td><td>Low</td></tr>
<tr><td>OSICE</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>Low</td></tr>
</table>
</td></tr>
</table>

Element	Guiding questions	Answers
Need assessment	What else would be needed in order to improve the impact of the Good practice	• **Better IaaS support**. In its current incarnation, OSICE is fully tested within a pure HPC and HPC-in-the-Cloud infrastructure. Although the first alpha version, which uses cloud IaaS, has been built, this approach needs more thorough testing. • **Accounting and Billing**. Although OSICE logs all events, the accounting and billing feature has to be implemented more seriously. The service has also to provide an easy to use cost estimator. • **Service Level Agreements (SLAs)**. Since users may have versatile QoS requirements, service level agreements play an important role for the optimization service. • **Implementation of security standards and data governing procedures** in relation to administering data transfer, storage and backup.Trust and confidentiality can be critical factors in deciding whether to use the services of an HPC/Cloud provider. • Further improvements of user and admin front ends.
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	According to INFORMS, winners of Franz Edelman Award for Achievements in Operations Research and Management Science made a cumulative financial impact of $240 billion in last 40 years through optimization of business processes. Some of this companies are Syngenta, TNT Express, MISO, HP, GM etc. However, SMEs, which contribute two-thirds of total

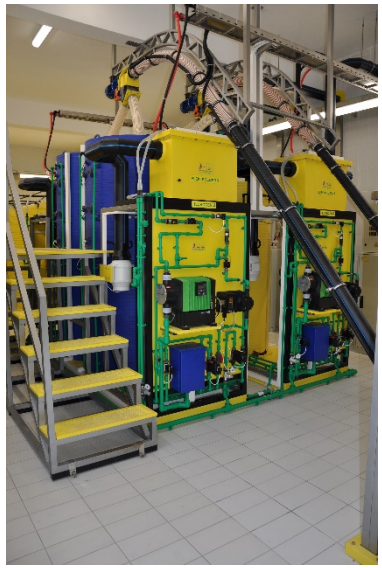
Element	Guiding questions	Answers
		employment and 57% of value added in the EU, **rarely use large scale optimization of real-world problems**, due to the following obstacles: ● **Knowledge gap** Knowledge required for real-world optimization problems can be separated in three main areas: ○ **Modeling of the problem**, which requires domain knowledge of processes in question and expert knowledge in modeling of these processes. ○ **Development of the optimization procedures**, which requires expert knowledge from the area of the optimization methods. ○ **Execution of the optimization procedures on HPC infrastructure**, which requires expert knowledge in distributed computing and HPC system administration. Required human resources with an adequate level of expertise in any of these domains are scarcely available and expensive. ● **Technological gap** Potential users of the advanced ICT solutions for optimization mostly lack the appropriate hardware and ICT infrastructure to fully benefit from its use. For most low resources users, like SMEs, costs related to the investment in equipment and constant need for its maintenance act as a financial barrier.

Element	Guiding questions	Answers
		Mentioned gaps drive away the potential users from investment in the optimization tools, and consequently reduces their potential to compete in today's markets.
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	
	REPLICABILITY AND UP SCALING	
Replicability and further application	How can the solution / good practice be useful for other SMEs?	OSICE is an innovative ICT concept which will disrupt existing markets of optimization software and create new ones by enabling SMEs to utilize immense computational power of the Cloud for problem solving and decision making, regardless their financial, technological and knowledge level. It will provide comprehensive, cost-effective and easy-to-use HPC-Cloud-based optimization service.
	What are the possibilities of extending the good practice more widely?	Optimization as a service in HPC-Cloud based environment is a new concept, and there is no developed market for it. However it is closely related to the cloud computing market, Platform as a Service (PaaS) market, and operational analytics market. Increasing adoption of cloud-based services and IoT technology among SMEs, growing demand of application development platforms, and technological improvement in PaaS services are the major driving factor for PaaS market. Hence the market for PaaS is expected to grow at US $12 billion with CAGR of 26%

Element	Guiding questions	Answers
		between the years 2016 to 2022. Globally the market for operational analytics is valued at €3.3 billion in 2016, with CAGR of 18% and it is expected to reach €9 billion by 2022. The key driver for the growth of this market is the increasing number of IoT-enabled smart connected devices and sensors, which releases a large amount of heterogeneous data simultaneously. Furthermore, the shifting interests towards cloud deployment, predictive analytics for business, end-to-end automation, and consumer-friendly IoT analytics platform are additional factors driving this market and creating value in the market. Global cloud service market is expected to reach €249 billion by 2022, at 4% of CAGR between 2016 and 2022.
	FINAL REMARKS	
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	Most of real-world optimization problems require computing resources that largely exceed the capacity of modern personal computers. Solving such optimization problems has so far been a privilege of large companies and research institutions, which can afford specialized expert teams and necessary computing infrastructure. Due to inability to provide adequate human and hardware resources, smaller companies and institutions are forced to avoid optimization of their

Element		Guiding questions	Answers
			business procedures, or to rely on commercially available solutions. OSICE is an innovative ICT concept which will disrupt existing markets of optimization software and create new ones by enabling SMEs to utilize immense computational power of the Cloud for problem solving and decision making, regardless their financial, technological and knowledge level. It will provide comprehensive, cost-effective and easy-to-use HPC-Cloud-based optimization service.
Disclaimer Acknowledgements	/	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	The company describing this good practice doesn't guarantee the successfulness of the solution and can't be held liable for its failure in application. We agree with on-line and printed dissemination of the information from this questionnaire.

Element	Guiding questions	Answers
INTRODUCTION		
Company information	Data identification, logo, contact person, possible representative image(s).	SIGMA d.o.o. Kula,Marsala Tita 248/b, Kula, Serbia www.hlorogen.com, office@hlorogen.com +38125731805
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	Production of disinfectant at the place of consumption (in situ)
	Provide a concise description of the good practice being addressed	Production of disinfectant (1% sodium hypochlorite solution; and a mixed disifectant - a mixture of sodium hypochlorite and chlorine dioxide) users expel hazardous chemicals from use in the process of disinfection of drinking and process water.
GOOD PRACTICE DESCRIPTION		
Detailed description	How did the SME create good practice / new product?	First plant for the production of 1% solution of sodium hypochlorite at the place of consumption (in situ) HLOROGEN® was manufactured and instaled in 1996.Since then,over 120 HLOROGEN and OksiHLOROGEN plants have been installed on the territory of Serbia and Montenegro
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	HLOROGEN and OksiHLOROGEN tehnologies are smart solutions for automatic disifectant production at the place of consumption that fully disclose the possibility of human error in the proces of water

Element	Guiding questions	Answers
		disinfection and completely replace the use hazardous chemicals(primarily gas chlorine that is hazardous to human health and life) in water disinfection
	Describe what are the technical solutions and innovations: of the good practice	Technological equipment HLOROGEN at he place of consumption produces 1% solution of sodium hypochlorite in the process of electrolysing of aqueous solution of kitchen salt.To obtain a 1% solution of sodium hypochlorite,only salt,water and electricity are used.  Technological equipment OksiHLOROGEN at the place of consumption produces a mixed disifectant - a

Element	Guiding questions	Answers
		mixture of sodium hypochlorite and chlorine dioxide it the electrolysis process of water solution of salt uses only salt,water and electricity. 
	Highlights (or keywords) of the Best Practice	Ecologically sustainable,safe disinfection,nohazardous substances,at the place of consumption,automatically, In situ.
	Good practice applied in : (NACE code)	C27.9.0 - manufacture of other electrical equipment C28.9.0 - manufacture of other special - purpose machinery
Benchmarking	How does your solution related to others provided by competitors	Less energy consumption more cost-effective due to the use of common unheated kitchen salt,it is safer because it produces dilution solutions that are classified as safe chemicals,a complete solution that combines

Element	Guiding questions	Answers
		the production of disinfectant at the place of consumption,automatic dosing administrated by flow and / or residual user training and service.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	All awards are available on www.hlorogen.com as well as all technical data.
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Vojvodina,Serbia,Montenegro,Romania,Bulgaria,Croatia,Bosnia nad Herzegovina,Slovenia
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Water supply companies, meat industry, food industry, hospitals and spas, swiming pools
Targeted customers and scale of use	Select the target group of customers: 17. SMEs (<250 employees) 18. Large companies 19. Public institutions 20. End customer (Business to Customer) Other, please specify	Water supply companies, sewage treatment, plants, meat industry, food industry, hospitals and spas, pools
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	The use of HLOROGEN and OksiHLOROGEN technology reduces the cost of water disinfection from 3 to 5 times.

Element	Guiding questions	Answers
	Quality assurance aspects, if applicable	The user of HLOROGEN an OksiHLOROGEN technology recieves a modern plant for its own production of disifectant,which becomes independent from the supplier of strategic chemicals for water disinfection and simultaneosly throws away form the use of dangerous chemicals for the lealth and life of people and the enviropment
	Risk management aspects, if applicable	
Implementation guidelines	How can the Good practice be implemented?	The documentation of the site is necessary and it is done by our professional team of the manufacturers of technological equipment HLOROGEN and OksiHLOROGEN in the order to determine the necessary equipment capacities,space for the installation and configuration of technological equipment .After the technological equipment is produced especially for the known customer,after which it is installedand put into operation.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	Trained Personnel for the basic management of the technology of SCADA software,this training is provided by the manufacturer of technological equipment,finance and existing infrastructure.
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	Validation is done through regular bacteriological and physico-chemical analyzes of water.
RESULTS / IMPACT		

Element	Guiding questions	Answers
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	Application of technological equipment HLOROGEN an OksiHLOROGEN reduces the costs of water disinfection increases the independence of user
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	The only limitation is the poor information of potential users about the benefits of this technology for their business process
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	Use of easily available raw materials for the production of disifectant at the place of consumption - kitchen salt,water and elctiricity.this eliminates the use of hazardous substances and chemicals from the proces of water disinfection and ensures greater enviropmental safety of the water treatment plant.Using this technology users' independance from chemical suppliers for disinfectants is achieved.
Need assessment	What else would be needed in order to improve the impact of the Good practice	Better inform potential users and more emphasis on their education in order to get acquainted with the availability of modern technologies in the field of water disinfection.
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	The use of technological equipment HLOROGEN and OksiHLOROGEN prevents the use of hazardous chemicals and materials in the working enviropment and the contact of employees with them.The presence of hazardous materials from the production process and

Element	Guiding questions	Answers
		the enviropment in whitch a large number of people lives or works.
SUSTAINABILITY		
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	Use of easily available raw materials for the production of disinfectant at the place of consumption - kitchen salt, water and electricity. Using this technology users' independance from chemical suppliers for disinfectants is achieved..
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	This technology can be implemented with a large number of users from different fields of production and services: water supply, food industry, hospitals and other health facilities,spas,swiming pools and bathing sites, etc.
	What are the possibilities of extending the good practice more widely?	In addition to the primary users in the field of treatment and distribution of drinking water and wastewater treatment plants,technological equipment HLOROGEN and OksiHLOROGEN is applied in the hospitals, food industy, swiming pools and whereever the sanitary safety of water is essential for the production process of service provision.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	Use of easily available raw materials for the production of disifectant at the place of consumption - kitchen salt,water and electricity.This eliminates the use of hazardous substances and chemicals from the process

Element	Guiding questions	Answers
		of water disinfection and ensures greater enviropmental safety of the water treatment plant.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	No

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	Otto Bock Sava d.o.o., Contact person: Ana Božović, Adress: Industrijska bb, 34000 Kragujevac, info@ottobock.rs, www.ottobock.rs
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	Individual orthopedic cartridges, CAD / CAM technology.
	Provide a concise description of the good practice being addressed	Taking footprint, 3D scanning of prints, computer preparation and correction, machine making
	GOOD PRACTICE DESCRIPTION	
Detailed description	How did the SME create good practice / new product?	Based on good years of experience in the development of individual orthopedic cartridges and modernizing technology, CAD / CAM technology has been used in the production of our orthopedic cartridges.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	CAD / CAM technology speeds up the production process and improves the quality of fabrication of products, with the help of high-quality materials.
	Describe what are the technical solutions and innovations: of the good practice	Fingerprint imaging, 3D imaging scanning, computer preparation and correction, machine manufacturing.
	Highlights (or keywords) of the Best Practice	

Element	Guiding questions	Answers
		3D scanning of prints, CAD / CAM technology
Benchmarking	Good practice applied in : (NACE code) How does your solution related to others provided by competitors	The solution speeds up the production process and produces a high quality product.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	http://www.ottobock.rs/ortotika/ortopedski-ulo%C5%A1ci/

Element	Guiding questions	Answers
		
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Serbia
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	End users and companies.
Targeted customers and scale of use	Select the target group of customers: 21. SMEs (<250 employees) 22. Large companies 23. Public institutions 24. End customer (Business to Customer) Other, please specify	End users and companies.
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable Quality assurance aspects, if applicable Risk management aspects, if applicable	
Implementation guidelines	How can the Good practice be implemented?	

Element	Guiding questions	Answers
		It can be applied in cooperation with other companies and end users.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	
	VALIDATION PROCESS	
Validation	Provide a brief description of the good practice validation process.	
	RESULTS / IMPACT	
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	Positive impact on users.
	SUCCESS FACTORS AND CONSTRAINTS	
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	Working in software, operator on CNC machine
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	A faster production process, high-quality materials, Ottobock orthopaedic cartridges reduce the effects of micro trauma and save the locomotors system.
Need assessment	What else would be needed in order to improve the impact of the Good practice	Positive user experience, good marketing.
	LESSON LEARNED	
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Positive experiences of the users who come to create more pairs of individual orthopaedic cartridges.
	SUSTAINABILITY	
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	
	REPLICABILITY AND UP SCALING	

Element	Guiding questions	Answers
Replicability and further application	How can the solution / good practice be useful for other SMEs? What are the possibilities of extending the good practice more widely?	
	FINAL REMARKS	
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	Since the introduction of CAD / CAM technology in the production of individual orthopedic cartridges, we have three types of products that are selected in relation to the needs of users, high quality materials in application, faster process of production, which has a positive impact on both workers and users, a positive impact on end users.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	NO

Element	Guiding questions	Answers
INTRODUCTION		
Company information	Data identification, logo, contact person, possible representative image(s).	Data identification: Galambos Trans Ltd. Logo: Contact Person: Galambos Tamás managing director info@galambostrans.hu
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	integrated logistic system
	Provide a concise description of the good practice being addressed	Galambos Trans Ltd focuses on unique storage solutions. The integrated logistic systems are built into the multinational manufacturing customer's ERP system – M2M communication.
GOOD PRACTICE DESCRIPTION		
Detailed description	How did the SME create good practice / new product?	The Galambos Trans Ltd developed integrated logistics systems which allows the machine to machine communication. This is in line with the industry 4.0 goals and promote innovative solutions in the storage systems.

Element	Guiding questions	Answers
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	Storage system digitalisation and adaptation for requirements of Industry 4.0 – HRM or cost efficiency
	Describe what are the technical solutions and innovations: of the good practice	The solution combines the multinational customer's ERP systems with the logistic system, so it can minimize the failure risk and also spare time compared to the manual storage systems.
	Highlights (or keywords) of the Best Practice	HRM digitalisation, Industry 4.0
	Good practice applied in : (NACE code)	H52 - Warehousing and support activities for transportation H52.1 - Warehousing and storage
Benchmarking	How does your solution related to others provided by competitors	Competitors are on the market, as unique storage systems are a trend now. But in the regional and national aspect the market niche is satisfying.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	Information about the services: http://galambostrans.hu/en/services/#logisztika http://galamboslogistic.hu/en/services/#logisztika

Element	Guiding questions	Answers
		 

Element	Guiding questions	Answers
		  https://www.youtube.com/watch?v=_ivd6Npggys
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Hungary, West Hungary
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Main audience are the multinational companies and middle-sized companies, as the solution combines the

Element	Guiding questions	Answers
		Enterprise resource planning systems with the storage system. Special innovative creative solutions and value-added processes provide to partners with the services to meet their needs.
Targeted customers and scale of use	Select the target group of customers: **1. SMEs (<250 employees)** **2. Large companies** 3. Public institutions 4. End customer (Business to Customer) Other, please specify	
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	The solution is cost efficient because of the substituted human resource
	Quality assurance aspects, if applicable	The solution is in line with the existing quality assurance systems
	Risk management aspects, if applicable	The solution is in line with the existing risk management
Implementation guidelines	How can the Good practice be implemented?	The implementation of the solution requires technical background and special knowledge, too.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	Human resource, technical devices.
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	The validation was done by internal staff members. The testing phase ensures that differences were minimized.
RESULTS / IMPACT		
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The solution has the advantages like: • saving time through M2M communication • reduced storage errors

Element	Guiding questions	Answers
		• increased transparency • unqualified employees are initiated by machines
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	In case of the company is not using ERP system, it is not possible to harmonize and integrate the unique storage solution system.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	Larger companies are aware of this solution. Based on the references the brand is in a good position at potential customers.
Need assessment	What else would be needed in order to improve the impact of the Good practice	Not identified
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	In order to implement the good practice, technical background and qualified human resources are needed. The innovation skills of the management are one of the major question.
SUSTAINABILITY		
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	The solution is software based and all relevant data are stored in databases which guarantees the sustainability.
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	Especially among Hungarian SMEs, the digitalization of processes and the installation of ERP systems is even more available. Based on this trend, more and more

Element	Guiding questions	Answers
		SMEs will be able to implement this good practice, if they are handling significant stock.
	What are the possibilities of extending the good practice more widely?	Integration of storage system will be possible with other existing internal systems.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The good practice is useful for companies who are dealing with warehousing. It can help them to use an innovative and effective solution which is I line with Industry 4.0 principles.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	No

Element	Guiding questions	Answers
INTRODUCTION		
Company information	Data identification, logo, contact person, possible representative image(s).	Data identification: Julius-Globe Ltd. JULIUS GLOBE KERESKEDELMI ÉS TERMÉKGYÁRTÓ KFT. logo: Quality manager: Mrs. Erika Racz 3. Tel.: 00-36-96-543-286 4. Fax.: 00-36-96-355-161 E-mail: erika.racz@jglobe.hu
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	complete production of machines with built in smart applications
	Provide a concise description of the good practice being addressed	Julius-Globe Ltd. is supplying energy sector, oil rigs and automotive industries. During workshop level production procedure i4.0 applications are utilized – machinary equipped with RFID and built-in routers for distance optimization
GOOD PRACTICE DESCRIPTION		
Detailed description	How did the SME create good practice / new product?	Julius-Globe Ltd. is one of the leading SMEs in Wes-Hungarian region who are using novel technologies on the field of advanced manufacturing. 1. Realised research and development 2. Development of Engine Block (oil of body water) contamination testing equipment

Element	Guiding questions	Answers
		3. Digital display, surface roughness measuring device-specific improvement 4. Support the development of production technology, glass roof blind 5. Raw material feed roller surface material non-stick and wear-resistant experiment 6. Research and introduction of raw material-dependent optimal coating experiments 7. Integration of advanced technologies and measurement equipment manufacturing technology changes into customers' production 8. Manufacturing production of medical device testing - knee replacement - Medical University of Szeged 9. Development of new heat treatment units 10. Development and construction of propeller 11. The aim was to develop new production technologies - development of only from one material screw blade propellers, the longer the blade size and the larger the number of blades. 12. Ideal blade design, development of edge geometries 13. Mounted propeller design manufacturing 14. Manufacturing of a greater number of propeller blades 15. Straight and twisted blade propellers airflow engineering study

Element	Guiding questions	Answers
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	Novel technology, like: • Additive manufacturing • Robotics • Advanced materials
	Describe what are the technical solutions and innovations: of the good practice	• Research and development according to customer orders and needs • 7 development engineers • Used programs: CATIA V5-6 R2016-CAD, CREO 2, ESPRIT
	Highlights (or keywords) of the Best Practice	i4.0 applications are utilized at production level
	Good practice applied in : (NACE code)	C – Manufacturing C27.9.0 - manufacture of other electrical equipment C28.9.0 - manufacture of other special - purpose machinery
Benchmarking	How does your solution related to others provided by competitors	One of the most innovative SME in the region in the advanced manufacturing. Competitors are on lower level in R&D and also the machine park is well equipped.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	http://www.jglobe.hu/Open_doors_open_minds.html http://www.jglobe.hu/Competitiveness_in_Focus__Institutions_for_the_Development_of_SME.html http://www.jglobe.hu/JuliusGlobe_Ltd_named_as_one_of_Europes_best_in_first_ever_One.html

Element	Guiding questions	Answers
		  https://www.youtube.com/watch?v=Kn6GkJyseBQ

Element	Guiding questions	Answers
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Hungary, West-Hungary
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Actors in automotive industry, advanced manufacturing are the main target audience of the company, mainly large companies.
Targeted customers and scale of use	Select the target group of customers: **5. SMEs (<250 employees)** **6. Large companies** **7. Public institutions** 8. End customer (Business to Customer) Other, please specify	
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	Using of the machine park connected to advanced manufacturing, cost reduction is possible
	Quality assurance aspects, if applicable	Quality assurance is present on high level
	Risk management aspects, if applicable	Not identified
Implementation guidelines	How can the Good practice be implemented?	As customer, using the industry 4.0 based solutions makes possible to gain a wider knowledge about advanced manufacturing technologies.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	Cost calculation for the manufacturing and for the raw material
VALIDATION PROCESS		

Element	Guiding questions	Answers
Validation	Provide a brief description of the good practice validation process.	Validation of implemented solution is done by existing team in the company.
RESULTS / IMPACT		
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The solution has positive impacts to the beneficiaries: • cost effective manufacturing • design and production of unique fixtures • less human resource need
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	Mass production needs a different technology than unique production. Innovation skill of management is need for implementation of advanced manufacturing.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	Good references showing a standard quality. Wide range of available machines help the satisfying of the customer demand. Openness for R&D guarantees a permanent innovation level.
Need assessment	What else would be needed in order to improve the impact of the Good practice	Not identified
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Implementing innovative solutions open new door in customer relationship. New segment of market can be targeted, so it is an absolutely long-term investment. Also, the same situation with employing highly qualified workforce.
SUSTAINABILITY		

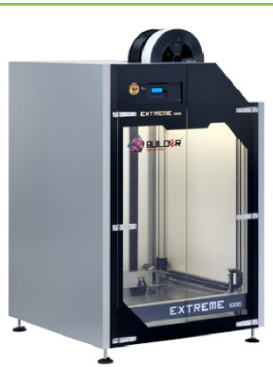
Element	Guiding questions	Answers
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	Based on the market trends in manufacturing, advanced manufacturing and innovative solutions are sustainable in long term.
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	1. Possible know-how transfer a. an SME can be also able to use this service or buy devices and hire qualified employees 2. Cost effective solution for manufacturing
	What are the possibilities of extending the good practice more widely?	New technologies are appearing permanently, so study them and if possible, implement them can assure the extension of the good practice.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The good practice is useful for production oriented SMEs in order to allow them to use advanced manufacturing solutions.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	No.

Element	Guiding questions	Answers
INTRODUCTION		
Company information	Data identification, logo, contact person, possible representative image(s).	Data identification: am-LAB Logo: Contact Person: Joós Attila coordinator joos@am-lab.hu
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	additive manufactory research center
	Provide a concise description of the good practice being addressed	Objectives of am-LAB are: – translate international learnings of PBN into tangible support tool for local SMEs – assist application of i4.0 in the field of additive manufacturing – Educate local business and scholar community about additive manufacturing
GOOD PRACTICE DESCRIPTION		
Detailed description	How did the SME create good practice / new product?	Basically AM-Lab is meant to be working in the additive manufacturing sector, 3D printing is the main direction. The main point is to develop new technical solutions with the use of this modern technology in an

Element	Guiding questions	Answers
		environmentally friendly way and to organize training sessions to university students and to other interested possible end-users like local citizens, representatives of companies and so.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	HRM and quality assurance
	Describe what are the technical solutions and innovations: of the good practice	As in the case of a lot of European regions, the population of Vas County is decreasing and getting older and older. The small towns grow older as the younger generation moving to bigger cities to get more qualitative education and better positions to work in. This tendency forces the organization of new services and brings up questions about the availability of adequate workforce. The labour force must be available not only in space and time, but also in the appropriate competence, which is not possible in a lot of cases in the county. With establishing AM-Lab, the aims to ensure that the project provides the employees with marketable, new knowledge and experience based on the labour market. By doing so, participants can fill in jobs locally, oriented, more profitably with professionally challenging jobs, providing a better

Element	Guiding questions	Answers
		quality of life and provide them with professional development opportunities. For the sake of sustainability, credibility and entrepreneurship, the AM-Lab Centre also provides services to local businesses, as a test centre and as an educational venue.
	Highlights (or keywords) of the Best Practice	3D printing, 3D scanning, digital shape and shape design, 3D scanning and design at industrial level, CAD design, industry 4.0
	Good practice applied in : (NACE code)	C18.1.2 - Other printing
Benchmarking	How does your solution related to others provided by competitors	Am-Lab is the first digital innovation HUB in the region so no existing competitor is identified.

Element	Guiding questions	Answers
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	 

Element	Guiding questions	Answers
		 
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Hungary, Vas county
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	AM-Lab could help a lot with taking the first step towards a quite modern technology like additive

Element	Guiding questions	Answers
		manufacturing to get to know it better and help (mainly) the local population to learn this valuable knowledge and use it.
Targeted customers and scale of use	Select the target group of customers: **9. SMEs (<250 employees)** **10. Large companies** **11. Public institutions** **12. End customer (Business to Customer)** Other, please specify	
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	It is cost efficient because with the help of this technology the workers are able to produce the same number of products or even more in shorter working hours and with less human resources needed.
	Quality assurance aspects, if applicable	The centre has received the ISO qualification.
	Risk management aspects, if applicable	The solution is in line with the existing risk management
Implementation guidelines	How can the Good practice be implemented?	The devices are available in the Center so there is an opportunity to rent them. And the Centre also provides training to help in the use of the devices and gain more knowledge about advanced manufacturing.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	cost calculation for the manufacturing, technical devices, human resources
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	Internal staff members validated the process, ISO controller checked the operation.
RESULTS / IMPACT		

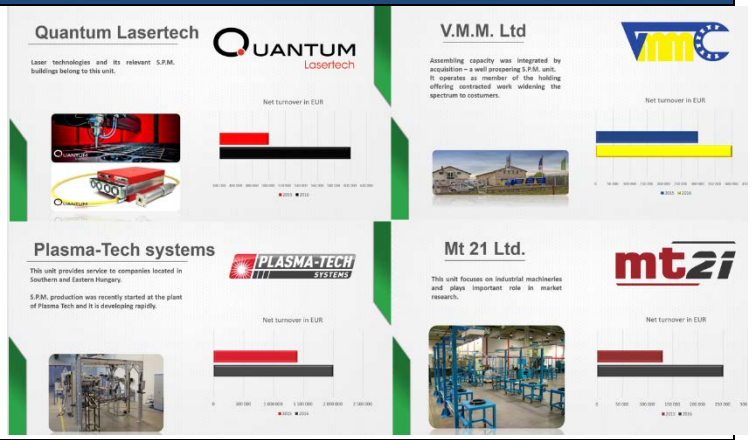
Element	Guiding questions	Answers
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	Advantages: - reducing production time - provides better quality - cost efficient - unique design and production Disadvantages: - educational background is not available for unqualified workforce for further employment
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	Highly qualified employees are needed The newest technologies require special knowledge
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	Available for local stakeholders, too Unique design and production Wide range of machines with special properties
Need assessment	What else would be needed in order to improve the impact of the Good practice	More qualified employees with good innovative skills would be appreciated in order to develop more and more projects and ideas.
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Since PBN is eager to produce tangible results and new, useful solutions to provide for its own region and possibly to an even wider consumer circle, they decided to start to participate in the area of the digital innovation related to Industry 4.0 programme with establishing a kind of subsidiary called AM-Lab. The main lessons learned is that it is possible to turn into real business

Element	Guiding questions	Answers
		model the knowledge what we gained from international projects.
SUSTAINABILITY		
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	Am-lab is sustainable from technological and financial aspect, too. Initiatives like this are also included in the S3 strategy of the country.
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	AM-Lab is not meant to be involved in bulk manufacturing. The main point is to develop new technical solutions with the use of this modern technology in an environmentally friendly way and also to organize training sessions to university students and to other interested possible end-users like local citizens, representatives of companies and so.
	What are the possibilities of extending the good practice more widely?	Through the trained persons more and more SMEs will have a valuable knowledge about the advanced manufacturing.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	From prototyping to low- mid Series production. Different 3D printers with different sizes and technologies with multi-material support.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	No

Element	Guiding questions	Answers
INTRODUCTION		
Company information	Data identification, logo, contact person, possible representative image(s).	Data identification: Vesz-Mont 2000 Ltd. Logo:  Contact Person: Horváth Norbert managing director sales@veszmont.hu
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	special purpose machinery
	Provide a concise description of the good practice being addressed	With respect to Industry4.0 applications the main focuses of Vesz-Mont 2000 Ltd are: - Integrated sensor technology into robotics - Laser-engraving applications into mobile devices
GOOD PRACTICE DESCRIPTION		
Detailed description	How did the SME create good practice / new product?	In 2010 they realized that they need to provide wider service portfolio to our customers. They targeted technologies they were not proficient at the time. Focus was on laser technologies. they were looking for companies with this competency and they were able to

Element	Guiding questions	Answers
		keep moving on this path. Nowadays Vesz-Mont 2000 Ltd - one of the largest S.P.M. builder in Hungary.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	Novel technology special purpose machinery
	Describe what are the technical solutions and innovations: of the good practice	16. Integrated sensor technology 17. Digitalization 18. Cost effective solutions 19. Energy consumption
	Highlights (or keywords) of the Best Practice	Special purpose machinery advanced manufacturing laser technology
	Good practice applied in : (NACE code)	C33.2 - Installation of industrial machinery and equipment
Benchmarking	How does your solution related to others provided by competitors	As Vesz-Mont 2000 Ltd is one of the largest S.P.M. builder in Hungary, competitors are more in complementary role.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	https://www.youtube.com/watch?v=c0PqjNYEUQA

Element	Guiding questions	Answers
		

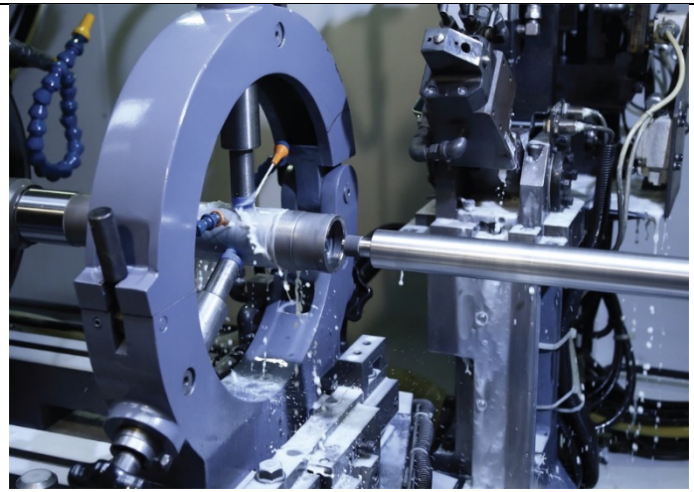
Element	Guiding questions	Answers
		
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Hungary, West Hungary
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	The target group of good practice are all companies that have production in their establishments.
Targeted customers and scale of use	Select the target group of customers: 13. **SMEs (<250 employees)** 14. **Large companies** 15. Public institutions 16. End customer (Business to Customer) Other, please specify	
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	The applied technology are cost efficient compared to the old technologies.

Element	Guiding questions	Answers
	Quality assurance aspects, if applicable	N.a
	Risk management aspects, if applicable	N.a
Implementation guidelines	How can the Good practice be implemented?	Buying or using the available technology of Vesz-Mont Ltd is the way to implement the good practice.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	Human resource who are qualified in this special field, infrastructure, like devices and machine park
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	Validation of implemented solution is done by existing team in the company.
RESULTS / IMPACT		
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	Using of Advanced manufacturing technologies can develop the production of the beneficiaries.
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	N.a
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	Integrated sensor technology Digitalization Cost effective solutions Energy consumption
Need assessment	What else would be needed in order to improve the impact of the Good practice	N.a
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	It is possible to improve every production process and advanced manufacturing can support this activity.
SUSTAINABILITY		

Element	Guiding questions	Answers
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	N.a
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	The solution can be transferred to all sectors of the manufacturing industry.
	What are the possibilities of extending the good practice more widely?	All the positive effects of the implementation can be transferred or repeated, but the infrastructure would be different in every case.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	They developed a readable code connecting workers, machines and parts involved in the production, enabling them recognizing each other. The IIoT (Industrial Internet of Things) device will provide instant information about the production. Manufacturing processes can be optimized more then before – also with respect to energy -, intervening in early stage helping capacity usage close to 100%.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	No

Element	Guiding questions	Answers
INTRODUCTION		
Company information	Data identification, logo, contact person, possible representative image(s).	Data identification: Borsodi Műhely LTd. Logo: 9027 Győr Juharfa utca 8. Tax number: 11461887-2-08 Telephone: +36 96 529 071 Fax: +36 96 529 072 e-mail: info@borsodimuhely.hu www.borsodimuhely.hu
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	machinery manufacturing with industry 4.0 applications
	Provide a concise description of the good practice being addressed	Borsodi Műhely Ltd. focuses on integrating robotics and sensor technology into mounting of the single-purpose assembly lines – both design and production included
GOOD PRACTICE DESCRIPTION		
Detailed description	How did the SME create good practice / new product?	The main aim of the Borsodi Műhely Ltd. is to satisfy the procurers needs. Borsodi Műhely Ltd. has professional experiences in the production of unique and precision accessories and gauges. Thanks for the continuous technological developments, the company has the most modern

Element	Guiding questions	Answers
		technologies and machines, and this guarantees a high level of quality.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	The high quality and internship training for requirement of Industry 4.0 HRM
	Describe what are the technical solutions and innovations: of the good practice	For the perfect quality, Bporsodi Műhely Ltd is ascertaining the quality of the raw materials in its own measuring laboratory
	Highlights (or keywords) of the Best Practice	high quality, custom component manufacturing,intership training,Industry 4.0
	Good practice applied in : (NACE code)	C25.1 - Manufacture of structural metal products C25.1.1 - Manufacture of metal structures and parts of structures
Benchmarking	How does your solution related to others provided by competitors	In a unique way the company provide training for students to ensure labour development in all areas. The company has a good relationship with the University of Győr. The company supports the dual training in the university During the Practicing-training the company provides 3 months for the students. Within this 3 months the students spend 4-5 days in the company. The company has trainees in the field of engineering, finance and human resource too. Typically, students coming to the company during their last semester, and the company offers them an employment contract if they get their

Element	Guiding questions	Answers
		thesis.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	

Element	Guiding questions	Answers
		 Information about the services: http://www.borsodimuhely.hu/ https://www.youtube.com/watch?v=ofWkJRx_E5A https://www.youtube.com/watch?v=_JU_1_ZxCK4&feature=youtu.be http://www.borsodimuhely.hu/en/entrepreneur-of-year-2017-award_3682-n.html
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Hungary, West Hungary

Element	Guiding questions	Answers
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	The main target audiences: students, companies whose can apply the qualified workforce later
Targeted customers and scale of use	Select the target group of customers: **17. SMEs (<250 employees)** **18. Large companies** **19. Public institutions** 20. End customer (Business to Customer) Other, please specify	
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	Basically, it is not cost efficient, but the training price can be payback in a long run.
	Quality assurance aspects, if applicable	The solution is in line with the existing quality assurance.
	Risk management aspects, if applicable	N. a.
Implementation guidelines	How can the Good practice be implemented?	Because of the training, companies get a lot of information about the advanced manufacturing. Thanks for this knowledge later they can teach other SMEs for advanced manufacturing. This process can be causes market development.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	Human resources, technical devices, professionals, modern and novel teaching material, practical time, company field visit
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	Validation was made by internal staff members.
RESULTS / IMPACT		

Element	Guiding questions	Answers
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	Absolutely positive impact is that if we have more qualified workforce on the market, more SMEs are able to employ experts who can help with the installation of advanced manufacturing technologies. It is also a niche on the labour market, so newly trained employees will have a good chance to get suitable position
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	Education is a long-term investment. Technical devices, company relations and good trainers are needed as investment.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	• increase the reputation of the company • more valuable in advanced manufacturing with this example
Need assessment	What else would be needed in order to improve the impact of the Good practice	More cooperation with large companies, possible field visits, international study visits would increase the value of the trainings.
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Borsodi Műhely Ltd. has professional experiences in the production of unique and precision accessories and gauges. We still decided to use their good practice as education- model. This can give the biggest added value in long term and also contribute to the regional development of SMEs in the field of advanced manufacturing.
SUSTAINABILITY		

Element	Guiding questions	Answers
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	N.a.
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	SMEs are able to work together with Borsodi Műhely Ltd, as partner in the production, and also take advantages from the educational activities.
	What are the possibilities of extending the good practice more widely?	Checking the available market needs, more educated experts would be needed in the field of advanced manufacturing. Wider network and cooperation would be welcomed
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	Borsodi Műhely Ltd. has two aspects as good practice. In short term, thanks for the continuous technological developments, the company has the most modern technologies and machines. In long term, the company is active in the educational activities, like organising dual trainings and strongly cooperates with the local university, which can help in the field of lack of well-trained human resources in the advanced manufacturing.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	No