DOCUMENT TITLE:

GOOD PRACTICE REPORT FOR ROMANIA

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

Acronym: Smart Factory Hub

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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	

Contents

1 INTRODUCTION

Regional Good Practice Report for Romania contains five good practices collected using the Good Practice Template developed in D4.2.1.

The data in this report was collected during September – December 2017 as part of the project entitled "*Improving RD and Business Policy for Transnational Cooperation in the Manufacturing Industry – Smart Factory Hub (SFH)*".

These five examples are the basis of the regional report, the Handbook tool report and the Good Practice Handbook, which together with the Mapping tool will allow project partners to present and promote specific smart manufacturing solutions. Based on the collected data, the Handbook tool report will be prepared by the UTC-N, WP4 leader.

The handbook will be available in electronic format on the web portal, while, for disseminating the work package, also 250 handbooks will be printed, which will be available to the participants at the closing dissemination event.

The data collected during this period will also be used for ex-ante evaluation.

UTC-N collected the following good practices cases:

No.	Name of the Good Practice	Classification[1]
1	PALLETIZED WAREHOUSE INVENTORY SCANNING USING DRONES	Smart supply network
2	OPTIMIZING ALL BUSINESS PROCESSES BY IMPLEMENTING A CUSTOMIZED ERP SOLUTIONS – ASiS ERP	Next-Gen manufacturing systems
3	APPLIED FMEA FOR MANUFACTURING PLASTIC COMPONENTS IN THE AUTOMOTIVE INDUSTRY	Data Analytics
4	PROCESS IMPROVEMENTS USING SIMULATION SOFTWARE	Data Analytics
5	AUTOMATED PRODUCTION LINE WITH INDUSTRIAL ROBOTS FOR MANUFACTURING CARDBOARD PALLETS	Robotics
6	VIRTUAL ENVIRONMENTS TO CREATE SUSTAINABLE INNOVATIONS	Cloud Storage / Processing

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[1] According GOOD PRACTICE GUIDELINES

1 GP1: CLOUD ERP[2] FOR SMART INTEGRATION

ALFASOFTWARE

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Keywords : Traceability, stock optimisation, production achievements, ERP IoT, integrating production devices with ERP, data driven company
Good practice applied in: (NACE code) :   C - Manufacturing

*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).*

1.1 GOOD PRACTICE DESCRIPTION

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).

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.
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.

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[2] ERP – Electronic Resource Planning

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.

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.

Traceability, stock optimisation, production achievements, ERP IoT, integrating production devices with ERP, data driven company

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.

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.

1.2 OBJECTIVE AND TARGET AUDIENCE

The production solution described earlier was implemented in the company named Fibrex Co, from Crasna, Salaj county, Transylvania, Romania. 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.

1.3 METHODOLOGICAL APPROACH

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.

The validation of the solution was achieved through direct implementation into companies that use the system for managing production processes such as:

Ramira Baia Mare has as main activity the machining of mechanical parts and the production of devices for assembly lines from the automotive industry. Among the beneficiaries of this company were huge actors from the automotive industry such as: Daimler, Nissan, Volkswagen, Audi, Peugeot-Citroën, Dacia and many others. Anvis Group is an internationally resonant name in the manufacturing, design and development of anti-vibration systems (AVS) for the automotive industry, expansion joints for various industries, including railways, as well as other fields, such as the manufacturing of rubber blends. Inteva Products has decided to implement the ASiS ERP to manage its financial and accounting activities in Romania. The American group has two factories, in Salonta and Oradea, that provide automotive parts and components to prestigious companies from the automotive industry in Europe. 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. 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 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 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.

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:

- 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

Every implementation project takes between 3 months to 1 year, depending on the complexity of business processes.

1.4 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.

1.5 RESULTS / IMPACT

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.

1.6 SUCCESS FACTORS AND CONSTRAINTS

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. 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. 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.

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.

1.7 LESSON LEARNED & SUSTAINABILITY

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 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.

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.

1.8 REPLICABILITY AND UP SCALING

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.

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 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).

1.9 FINAL REMARKS

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

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.

List of attachments:
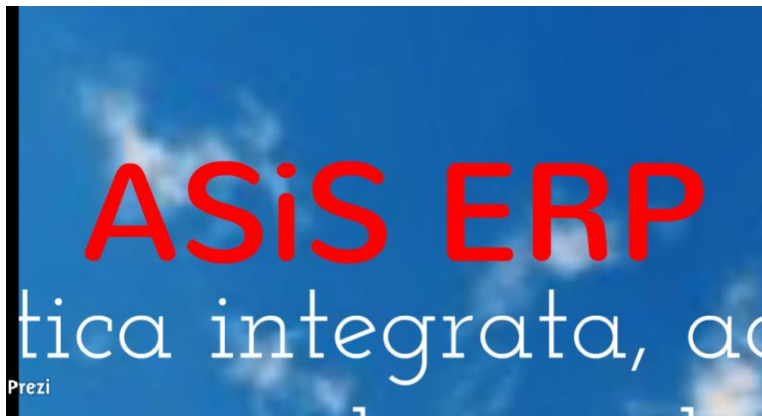Attachment 1: Video presentation of ASiS: https://www.youtube.com/watch?v=RjkKjw4iOMY&t
Attachment 2: Presentation of solution: https://prezi.com/ei6bl8bh_obk/asis-erp/
Attachment 3: Presentation of solution: https://prezi.com/embed/_vnjvkekq4xk/

2 GP2: APPLIED FMEA FOR MANUFACTURING PLASTIC COMPONENTS IN THE AUTOMOTIVE INDUSTRY

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Keywords : Failure prevention; Risk analysis; PFMEA	
Good practice applied in: (NACE code) :	Manufacture of other plastic products: C2229

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.

2.1 GOOD PRACTICE DESCRIPTION

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. 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. Checking methods include: appearance check, dimensional check (with measuring instruments – CMM caliper, micrometer, control gauges), verifying incoming documentation (quality certification, checklists)

2.2 OBJECTIVE AND TARGET AUDIENCE

The instrument is successfully used within the Thomas Romania Plastic manufacturing company, a division of the Thomas Tontec group, operating in Cluj-Napoca, Romania. Target audience/potential customers and stakeholders : Mass production, Production with limited series, Manufacturing of customizable products.

2.3 METHODOLOGICAL APPROACH

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. 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. 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. 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 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. 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.

2.4 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.

2.5 RESULTS / IMPACT

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.

2.6 SUCCESS FACTORS AND CONSTRAINTS

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.

2.7 LESSON LEARNED & SUSTAINABILITY

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.

2.8 REPLICABILITY AND UP SCALING

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.
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).

2.9 FINAL REMARKS

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. 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.

List of attachments:
NA

3 GP3: PALLETIZED WAREHOUSE INVENTORY SCANNING USING DRONES

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Keywords : drones, inventory, warehouse

Good practice applied in: (NACE code) :　　H - Transporting and storage, more specifically H52.1 - Warehousing and storage

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.

3.1 GOOD PRACTICE DESCRIPTION

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.

Figure 1 *Drone "view" in warehouse inventory*

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.

3.2 OBJECTIVE AND TARGET AUDIENCE

The solution described previously has been applied in the Pepsi Romania warehouse.
The solution can be applied by any other company that requires a real time inventory report of the current inventory within their warehouses.

3.3 METHODOLOGICAL APPROACH

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 from the end user and it is mostly maintenance for the drones.
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.
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.

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 system can be scaled to a large number of drones. Each drone will be allocated to a specific area within the warehouse.

3.4 VALIDATION PROCESS

The validation was done within the customer warehouse and the system is working without having to do a lot of maintenance.

3.5 RESULTS / IMPACT

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.

3.6 SUCCESS FACTORS AND CONSTRAINTS

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. 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.

3.7 LESSON LEARNED & SUSTAINABILITY

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.

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
- The maintenance costs are not high

3.8 REPLICABILITY AND UP SCALING

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.
In the future it is possible to improve the functionality of the drones to do more complex tasks within the warehouse facility.

3.9 FINAL REMARKS

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.
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.

List of attachments:

Attachment 1: Video material that presents how the solution work in a warehouse

4 GP4: PROCESS IMPROVEMENTS USING SIMULATION SOFTWARE

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Keywords : Process simulation; improvement through simulation;	
Good practice applied in: (NACE code) :	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines: 28.1.1.

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.

4.1 GOOD PRACTICE DESCRIPTION

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.
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;

- 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.
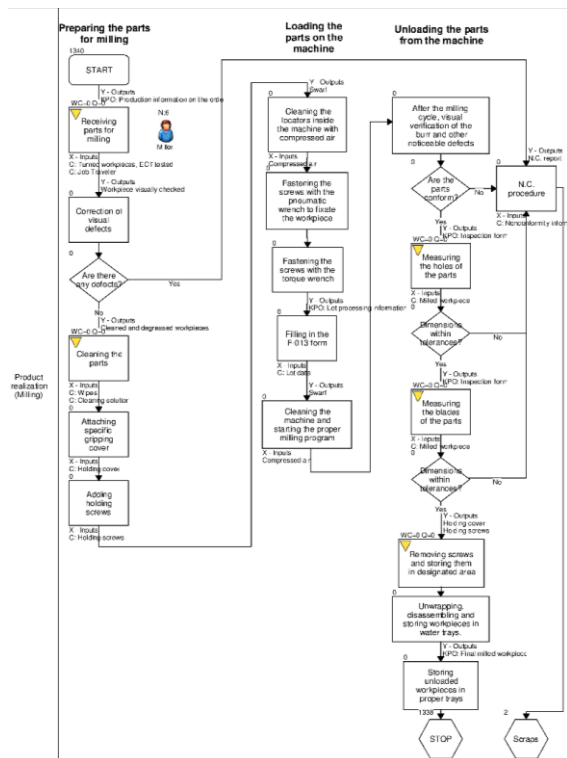

Figure 2 The figures above represent the functioning of a real-life and its corresponding simulated process.

4.2 OBJECTIVE AND TARGET AUDIENCE

The solution was tested and implemented in Turbocam Romania, with headquarters in Târgu-Mureș, in Romania's Transylvania region. The target audience/potential customers are : mass production; production with limited series; manufacturing of customizable products, any type of SME, which documented and structured its activities into processes, or large enterprise.

4.3 METHODOLOGICAL APPROACH

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. This solution supports both the older version of ISO 9001:2008 Quality Management Standard approach, the process approach, and the philosophy promoted by 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. 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 recommended to document and record how the changes affected real-life processes. 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).

4.4 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 entered into simulations was rechecked to determine what went wrong or why were these results obtained.

4.5 RESULTS / IMPACT

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.

4.6 SUCCESS FACTORS AND CONSTRAINTS

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. 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. Moreover, infinite scenarios can be tested without committing any resources for setting up and starting real-life processes, which translates to minimum risks and reduced costs for managing and maintaining this solution. 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.

4.7 LESSON LEARNED & SUSTAINABILITY

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.

4.8 REPLICABILITY AND UP SCALING

The solution is readily available to all SMEs, which are open for relying on the computational power of modern devices and the increased performance of innovative software programs for improving their processes 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.

4.9 FINAL REMARKS

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.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.

List of attachments:
NA

5 GP5: AUTOMATED PRODUCTION LINE WITH INDUSTRIAL ROBOTS FOR MANUFACTURING CARDBOARD PALLETS

INNO ROBOTICS SRL

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Keywords : Automated production line; Assembling and palletizing; Flexible system; Cardboard products.	
Good practice applied in: (NACE code) :	C17.2.1 - Manufacture of corrugated paper and paperboard and of containers of paper and paperboard

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).

5.1 GOOD PRACTICE DESCRIPTION

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 electronic 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;
- 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.
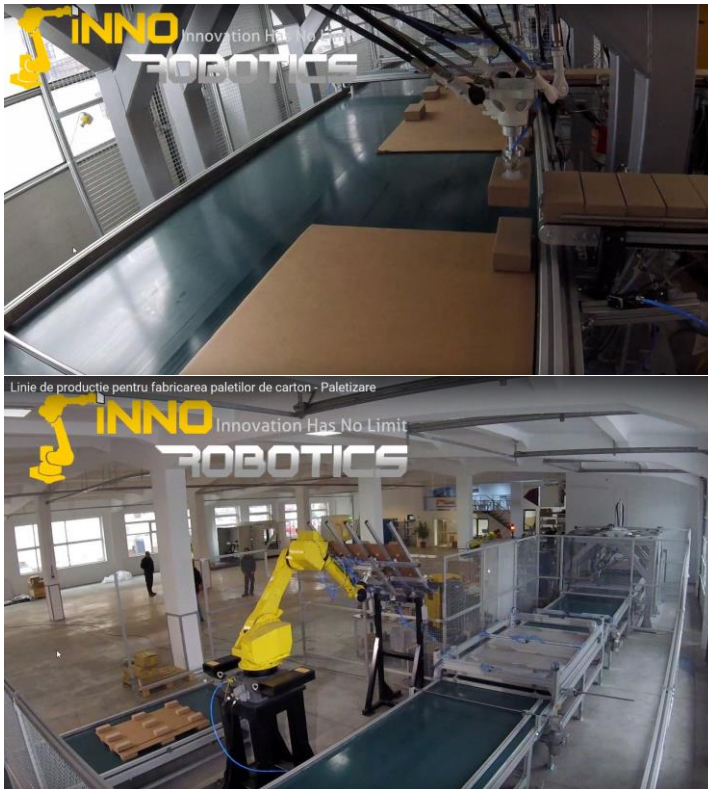

Fig. 1   Inno Robotics solution for cardboard pallets manufacturing

The solution is 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 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. 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 production line combines robots (2x6R and 2x Fanuc Delta robots) with automatic raw material feeding systems. Therefore, in the case of the base cardboard, 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.

5.2 OBJECTIVE AND TARGET AUDIENCE

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. Potential customers can be furniture manufacturers, plastic component manufacturers, aluminium element manufacturers, etc.

5.3 METHODOLOGICAL APPROACH

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. The entire solution is automatic after the parameters are being defined. Also, the quality of the produced pallets 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. 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. 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.

5.4 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.

5.5 RESULTS / IMPACT

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.

5.6 SUCCESS FACTORS AND CONSTRAINTS

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. The automation, the increased productivity, the constant quality of products and the flexibility are the selling points of this production system. 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.

5.7 LESSON LEARNED & SUSTAINABILITY

The most important lesson learned is that the most critical stage of implementation is the identification of all 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. 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.

5.8 REPLICABILITY AND UP SCALING

The solution can be implemented both individually and jointly by 2-3 SMEs. The solution offers an alternative to the wooden pallets.

5.9 FINAL REMARKS

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.

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.

List of attachments:
Attachment 1: Video with solution: https://www.youtube.com/watch?v=VOc5RQow86M
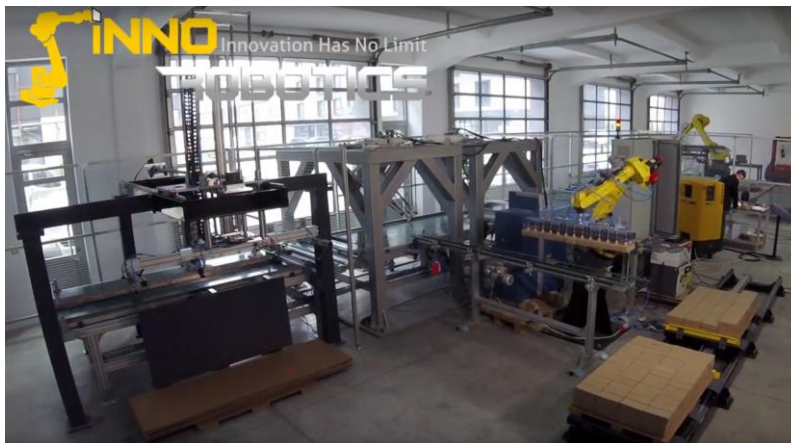
6 GP6: VIRTUAL ENVIRONMENTS TO CREATE SUSTAINABLE INNOVATIONS

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Keywords : 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)

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.

6.1 GOOD PRACTICE DESCRIPTION

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.

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.

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.

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.
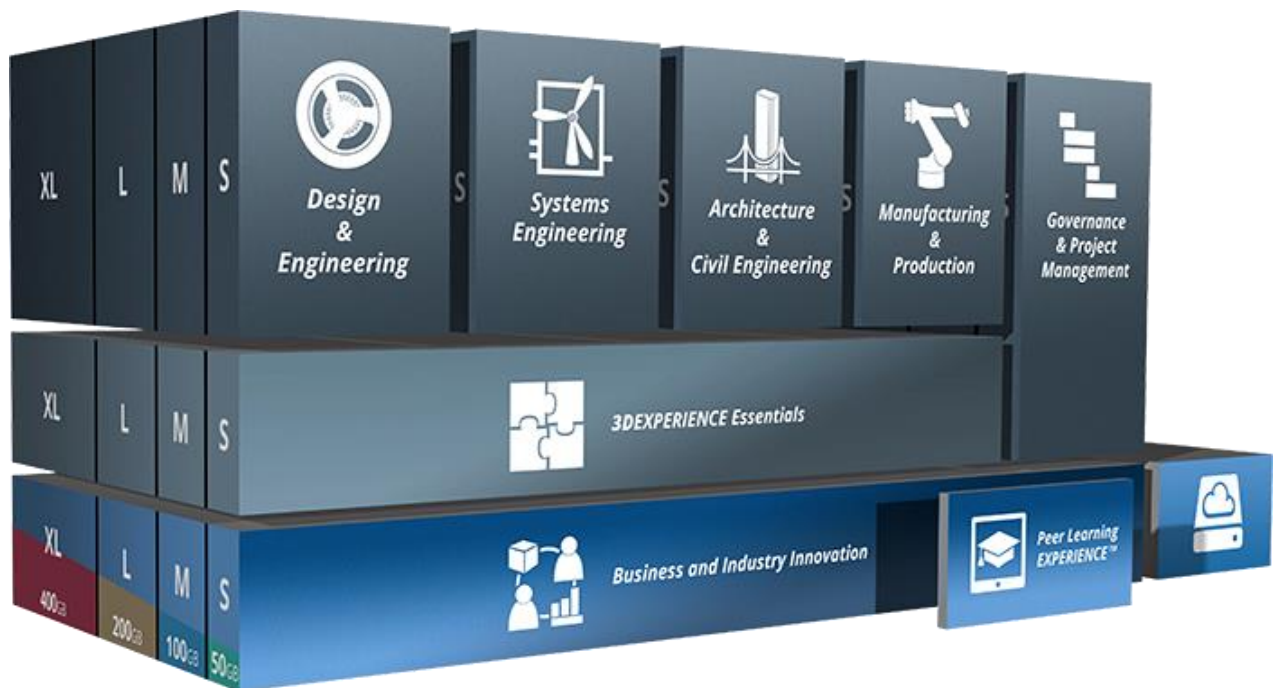

Figure 3 3D experience architecture[3]

6.2 OBJECTIVE AND TARGET AUDIENCE

The solution was tested in Transylvania region from Romania. We will focus on the Automotive Industry, especially on small medium businesses (SMB).

6.3 METHODOLOGICAL APPROACH

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.

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. 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. The solution has a high degree of portability and

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[3] Source : https://academy.3ds.com/en/software/3dexperience-for-academia

can be adapted to companies operating in various industry branches (https://www.3ds.com/industries/). 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.

6.4 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.

6.5 RESULTS / IMPACT

The impact of the solution was positive, scrap rates were reduced and the assembly time was also reduced.

6.6 SUCCESS FACTORS AND CONSTRAINTS

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.

6.7 LESSON LEARNED & SUSTAINABILITY

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). 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.

6.8 REPLICABILITY AND UP SCALING

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. 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.

6.9 FINAL REMARKS

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)
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.

List of attachments:
Attachment 1: Video Understanding the 3DEXPERIENCE Platform in under 5 minutes: https://www.youtube.com/watch?v=hk-KiV35yeo

7 LEESON 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.

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

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. The assistance provided from the UTC-N in completing the questionnaire was very welcomed.
- **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.

Lesson learned from the perspective of the UTCN

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.

1 GOOD PRACTICE DOCUMENTATION – Applied FMEA for manufacturing plastic components in the automotive industry

Element	Guiding questions	Answers
	INTRODUCTION	
Company information	Data identification, logo, contact person, possible representative image(s).	THOMAS TONTEC 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

Element	Guiding questions	Answers
		which, worth mentioning are: material reception, components incoming check, mold injection (initial setup, startup confirmation, serial production), packaging, storage, delivery.
GOOD PRACTICE DESCRIPTION		
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

Element	Guiding questions	Answers
		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
	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: 1. SMEs (<250 employees) 2. Large companies	Any type of organization, regardless of the field of activity.

Element	Guiding questions	Answers
	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 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.

Element	Guiding questions	Answers
		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 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

Element	Guiding questions	Answers
		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	
	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.

Element	Guiding questions	Answers
	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		
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.

2 TEMPLATE FOR GOOD PRACTICE DOCUMENTATION

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: **ALFA**SOFTWARE 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: 4. **New technology**: it offers a personalized ERP solution, integrating barcode readers and other devices – Internet of Things (IoT) 5. **Production processes**: ASiS focuses on all economic (financial, accounting, cost calculation) and production processes (technology, operations/stages) within a manufacturing company. 6. **Cost efficiency**: ASiS ERP assures cost efficiency because it helps implement

Element	Guiding questions	Answers
		standardized production processes, with information and correlation between stocks of raw materials, customer orders, human resources and machineries. 7. **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. Updated throughout the time according to technological requirements, ASiS ERP is one of the most modern and

Element	Guiding questions	Answers
		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: 5. SMEs (<250 employees) 6. Large companies 7. Public institutions	SMEs (<250 employees)

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.

3   TEMPLATE FOR GOOD PRACTICE DOCUMENTATION

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

Element	Guiding questions	Answers
		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.
	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 factory 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: 9. SMEs (<250 employees) 10. Large companies 11. Public institutions 12. 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 from the end user and it is mostly maintenance for the drones.

Element	Guiding questions	Answers
	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 system can be scaled to a large number of drones.

Element	Guiding questions	Answers
		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.

4 TEMPLATE FOR GOOD PRACTICE DOCUMENTATION

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 Contact person Attila PAPP – Sales Director **Mugurului, Nr. 4, Ap. 1, OP 2 CP 131** **500047 - Brasov, Romania** Tel: +40 (0)268 337141 Fax: +40 (0)268 337149 Mobil: +40 (0)745 312868 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.
	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

Element	Guiding questions	Answers
		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 other material about the Good practice implementation (if existing).	All additional information is available on request.
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 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: 13. SMEs (<250 employees) 14. Large companies 15. Public institutions 16. 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.
	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.

Element	Guiding questions	Answers
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		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	The solution being highly scalable, practically we have no limitation on the deployment size.
	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 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.

Element	Guiding questions	Answers
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		
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.

Element	Guiding questions	Answers
	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.

5 GOOD PRACTICE DOCUMENTATION – Automated production line with industrial robots

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 with 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

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 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: 17. SMEs (<250 employees) 18. Large companies 19. Public institutions 20. 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.

Element	Guiding questions	Answers
	Quality assurance aspects, if applicable	The entire solution is automatic after the parameters are being defined. Also, the quality of the produced pallets 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

Element	Guiding questions	Answers
		product is done in minutes without too many manual adjustments or attempts.
	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 a 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

Element	Guiding questions	Answers
		the pallets is three times smaller than the space in which the pallets were stored.
SUCCESS FACTORS AND CONSTRAINTS		
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.

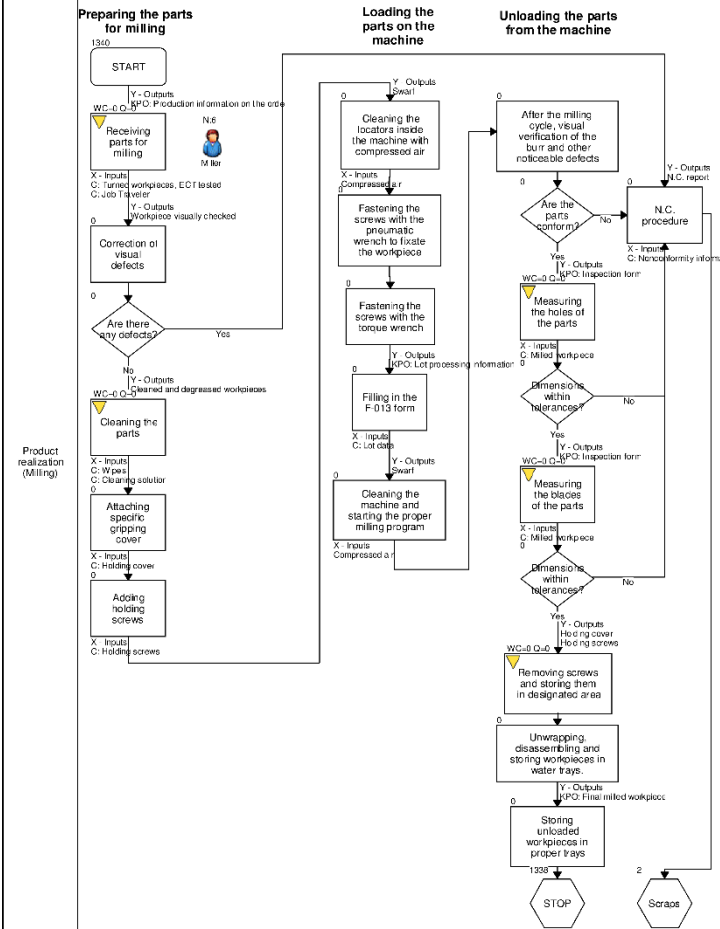| Element	Guiding questions	Answers
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	The most important lesson learned is that the most critical stage of implementation is the identification of all the initial customer requirements. 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.

Element	Guiding questions	Answers
	What are the possibilities of extending the good practice more widely?	N/A
FINAL REMARKS		
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.

6 GOOD PRACTICE DOCUMENTATION – Process improvements using simulation software

Element	Guiding questions	Answers
INTRODUCTION		
Company information	Data identification, logo, contact person, possible representative image(s).	Company name: Turbocam Romania; Company logo: 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

Element	Guiding questions	Answers
		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.
	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;

Element	Guiding questions	Answers
		• Designing, testing and installing performance metrics based on available simulation information; • 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: 21. SMEs (<250 employees) 22. Large companies 23. Public institutions 24. 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
		the newest ISO 9001:2015 standard, in which evidence of risk-based thinking is necessary.
	Risk management aspects, if applicable	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.