DOCUMENT TITLE:

GOOD PRACTICE REPORT FOR CROATIA

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

Acronym: Smart Factory Hub

Work package	WP4: Improving Knowledge Base
Activity	A 4.2: Good practice handbook tool
Deliverable	D 4.2.2: Regional good practice report
Date of issue	13.12.2017.
Document issued by	HAMAG-BICRO
Contributors	NA
Version	A1.0
Number of Pages	88

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

Contents

INTRODUCTION

Regional Good Practice Report for Croatia 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.

HAMAG-BICRO collected the following good practices cases:

No.	Name of the Good Practice	Classification[1]
1	HSTec - High Speed Technique	Responsive manufacturing
2	Televend Smart Vending	Intelligent products
3	Production of FIRE DAMPERS	Responsive manufacturing
4	Smart Sense – Smart City AirQ Environmental Monitoring System	Intelligent sensors
5	VESKI d.o.o.	Intelligent sensors

[1] According to the GOOD PRACTICE GUIDELINES

1 GP1: HSTec - High Speed Technique

HSTec
HIGH SPEED TECHNIQUE

HSTec – High Speed Technique

Contact person: Kristina Verunica
Address: Zagrebačka ulica 100, Zadar, Croatia
Phone: +385 23 205 428
E-mail: kristina.verunica@hstec.hr
Website: www.hstec.hr

Keywords : high speed technology, engineering, robotic automation, motor spindle
Good practice applied in: (NACE code) : C - Manufacturing

HSTec is specialized in the development, design and manufacture of high speed motorized spindles, direct drives and other high speed technologies, as well as engineering, design and automation of special machine tools and systems.

1.1 GOOD PRACTICE DESCRIPTION

The company was founded in 1997 by SAS Zadar, a company specializing in the field of production of special machine tools and the German company Bosch-Rexroth (formerly INDRAMAT), a world famous company in the production of electric drives and control systems. Since its founding, HSTEC has developed a wide range of motorized spindles and electric drives for direct application in machining centres and machine tools. A flexible team of highly skilled mechanical and electrical engineers with great working experience in development, design and production of special machine tools and implementation of industrial robots offers creative solutions in industrial automation. HSTec's R&D team is focused on individualized production offering development, design, calculations and optimization, production and assembly of machine tool components according to customer requests. The high standard of product quality control continues after the implementation of the product at the customer, thus managing the product's lifecycle. The company incorporates novel technologies in the production processes, such as:

- machines for the production of high efficiency and low energy consumption;
- dynamic sampling of the product lifecycle;
- incorporation of digital and ICT systems into production processes,
- lean management guidelines,
- a high level of product quality assurance and control provided by the strict standards (ISO 9001:2015) and top quality devices and machines;
- production of smart products with the monitoring sensors and the ability to communicate and network via the monitoring signals;
- ERP (Enterprise Resource Planning) integrated management system;

- HRM includes continuous monitoring and upgrading of the ICT system and overall work environment, continuous investment in education of employees and work tools, such as software and hardware, continuous work evaluation and appropriate awards and/or advancement opportunities, providing additional health insurance;
- risk management principles and guidelines are incorporated into management decisions.

Technical solutions and innovations arise from the continuous involvement in novel technologies, creating products that are not only innovative, but are also the solutions to the unsolved problems in production processes, such as energy efficiency, digital machine networking, implementing solutions in hazardous environment and thus eliminating possible personal injuries in the production process.

Fig. 1 Machine part

All innovative technical solutions have been discovered through the present situation in their environment and in consultations with partners and potential customers. As a manufacturer of prototype solutions, in order to remain competitive, they must pay attention to all possible customer requirements and on the global strategy and guidelines for future development, such as Industry 4.0.

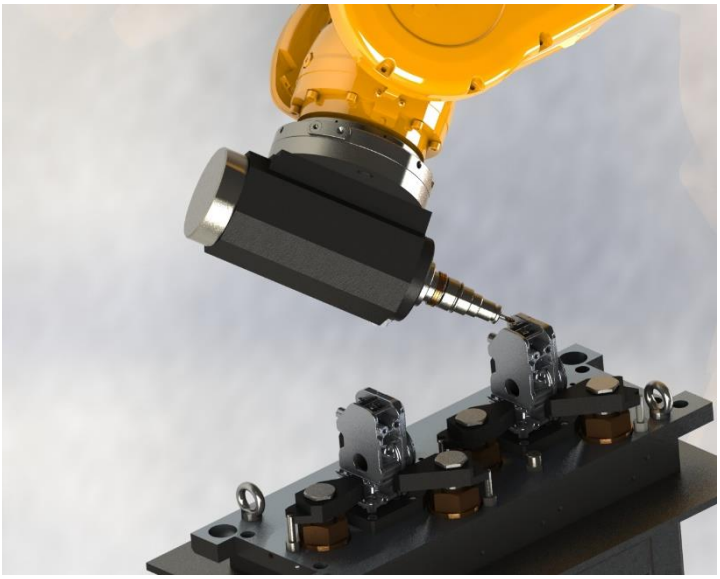

Fig. 2 Machine tool

Awards:
Platinum key for continuity in company excellence HSTEC d.d. (http://www.hstec.hr/novosti/platinasti-kljuc-za-kontinuitet-u-izvrsnosti-tvrtki-hstec-dd/51.html),
Annual reward of Zadar County to HSTEC d.d. (http://www.hstec.hr/novosti/godisnja-nagrada-zadarske-zupanije-tvrtki-hstec-dd/49.html),
Zlatna kuna 2016 and 2012 for the most successful SME in the Zadar County.
Website: www.hstec.hr

1.2 OBJECTIVE AND TARGET AUDIENCE

HSTec is an export oriented company with the following geographical coverage:
Germany 50%, Croatia 28%, Slovenia 10%, Austria 5%, USA 5% and other countries 2%.
Target audience and potential customers are companies mainly from the automotive industry, and in a small percentage, glassworks and plastic mould industry, that is SMEs, large companies and universities.

1.3 METHODOLOGICAL APPROACH

Efficiency of the good practice impacts investment, process, resource and energy consumption, and the quality assurance aspects are quality assurance of the product and services, continuous improvement of the product, services and processes and key process indicators of efficiency. However, the main tool for quality assurance is the efficient quality management and awareness of all employees striving to develop the best possible product and service. Risk management aspects are strengths, weaknesses, opportunities and threats regarding the future development and they are incorporated into managerial decisions. The solution can be implemented if all necessary resources are available, however it can depend on the environment (i.e. if the environment is productive and all necessary suppliers are nearby, it can be a very positive start). The resources necessary for implementation are: highly qualified and educated personnel, finance, infrastructure (production plant, top quality production machinery, devices and ICT system, adequate software tools), and timespan of ca. 1 year.

1.4 VALIDATION PROCESS

The good practice has been validated by every satisfied customer. The customer satisfaction survey is being continuously monitored, which is one of the main starting points where products and services are being improved. All products and services are monitored even after the delivery, using the Product Lifecycle Management. Thus they are able to witness the lifespan of products as well as some possible aspects of the product needed to be improved.

1.5 RESULTS / IMPACT

Satisfied customers, product improvement, taking part in development of future smart factories by improving their product according to the guidelines of Industry 4.0 strategy. Their employees are continuously improving their skills and knowledge, the company's employment rate is continuously rising which is being positively affected on the development of Zadar County.

1.6 SUCCESS FACTORS AND CONSTRAINTS

Limitations are mainly in the ability to find skilled professionals who are willing to work in small towns. The educational system needs to be upgraded so the company continuously invests time and money to improve the level of knowledge of its employees. Limitations are found in the local area where there is a minor percentage of suppliers. Almost all suppliers are located at least 300 km from the company location which negatively affects the time management and transportation costs. The products and services are made according to customer requests and are mainly prototypes. The company's know-how is a great sales point, where they consult their customers on what solution to choose. Their ability to produce only one prototype product for a reasonable price differentiates them from the competing brands that only sell standard products. The company also differentiates from other companies in having all the necessary departments at the same location: development and design department, production and assembly department, quality control department, product testing department, logistics department, after sales, service department etc., and thus is able to offer a competitive solution incorporating knowledge, high-quality product, product monitoring and servicing. In order to improve the impact of the Good practice they need more highly qualified and trained personnel and an improved industrial environment where most suppliers would be located and thus easily connected with the company.

1.7 LESSON LEARNED & SUSTAINABILITY

Always strive to be ahead of your competitors through knowledge and quality. Work continuously on improvement of your business processes, resources, personnel, products and services.

1.8 REPLICABILITY AND UP SCALING

A good practice can be useful for other SMEs in regard to implementing the solutions for energy efficiency, production efficiency and production process automation by incorporation of digital and ICT systems, HR management and continuous investment in education of employees, risk management that is efficient and prospective and process organization according to lean management principles and guidelines. Opportunities are in growth of companies that have the best practice or merging several companies which leads to an increase and spread of the good practice.

1.9 FINAL REMARKS

The impact is global and irreversible: future demands are based not only on automation of processes and products, but also on digitalisation and implementation of monitoring sensors in order to communicate throughout the network and between several smart factories.

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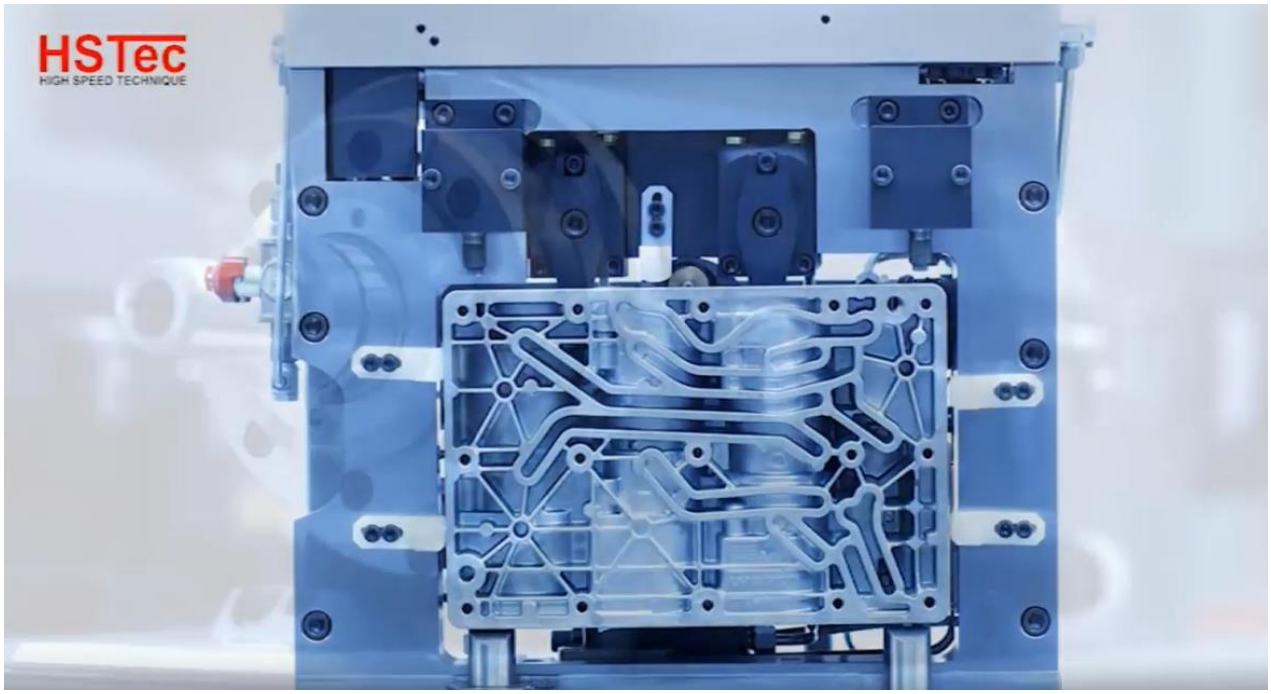

2 GP2: Televend Smart Vending

INTIS d.o.o.

Contact person: Vilim Lončar
Adress: Bani 73A, 10010 Zagreb, Croatia
Phone: +385 1 7890-855
E-mail: vilim.loncar@intis.hr
Website: www.intis.hr

Keywords : smart vending, IoT showcase, planogram analysis, geo routing, cash conformity, customer mobile app, loyalty programs, prediction algorithm, offline machine management

Good practice applied in: (NACE code) :	J – computer programming C - manufacturing

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

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

2.1 GOOD PRACTICE DESCRIPTION

They have combined many different technologies to be able to deliver a versatile and useful solution for a very challenging market. TELEVEND CLOUD is central point of modern Smart Vending Company. It is a powerful platform which could completely change vending operator business model, guiding company in the most optimal way. Benefits of TELEVEND Smart Vending concept are remarkable. It will suggest the most optimal way of organizing tomorrow's actions,

saving time and money. Everything is based on real time data and historical based predictions, using advanced mathematical algorithms and methods. Connected machines are all controlled from one centre which allows them to make optimal decisions and to react immediately in case of an error on any machine. It allows them to provide precise cash collection up to the last cent. Reports are on daily bases showing Key Performance Indicators of any machine in real time. Dynamic planogram management will adjust every machine to the best performing product choice. Expiry date management will take care of product usability proposing to move short lasting product to “faster” machines.

Experienced engineers who have been working on the complex projects in industrial automation, were assigned to design a robust hardware with GSM Internet connection which connects to a vending machine along with an efficient assembly line. It was crucial to find reliable suppliers flexible to support highly growing demands of a new product and to keep the development in-house in order to quickly react to new requirements from various customers as there are many vending machine types and many different requests to tackle in the industry.

Novel technology – the product is a state of the art IoT, Industry 4.0 example - the complex infrastructure in which hardware, associated with a vending machine, directly communicates in real-time with the Cloud web and mobile applications.

Production processes – every coffee vending machine is a small factory. Televend Cloud vending operators are able to predict the need of a visit to a vending machine which is a highest single logistical cost for the operator.

Quality assurance – every software development of complex web and mobile application goes to deep testing of their Q&A team. They also have a special team working on the testing of the firmware made to work with various vending machines. They have developed testing units for each electronic board in-house.

Risk Management & cost efficiency– they have a specialized procuring department taking care of ensuring enough stock of critical components and also constantly evaluating suppliers and watching the movement on market which is critical for optimal pricing.

Fig. 1 T-BOX device

T-BOX is a small device installed into old and new vending machines. It collects all useful data from the machine and payment systems including sales, cash details and errors, and sends it in real time to the Cloud.
T-CLOUD gives online control of vending machine network in real time - sales and stock data, cashflow data, machine and payment system errors and remote machine settings. T-CLOUD also includes a mobile application for refill operators and servicers making their daily routine more productive.
T-WALLET is a closed loop mobile app for customers allowing quick payment by smartphone, using only QR code or Bluetooth. It Interacts with customers and creates customized marketing and loyalty programs.

SMART ROUTING ALGORITHM helps to drastically reduce the number of visits and optimize a planogram. T-CLOUD enables to create daily routes based on a smart mathematical model which helps to prioritize the visits. A flexible routing model allows you to choose between pre-kitting models, or live routing with mobile app based on real time stock levels from all your machines.
GEO ROUTING - optimal routes are calculated and visualized on the map, along with the time necessary to visit all machines, making daily route planning very fast and smart. Fillers get the sequence of visits shown on a map, so they can easily navigate through the intended route. Product list and machine tasks communicate on each machine.
CASHFLOW REPORT provides an exact information on how much money is left in each tube/BNA in the machine. It also gives information on how much is sold using cash/cashless system and how much was topped up to cashless devices. The most important info is how much money does the filler needs 'till the centre and how much money they need to bring to machines if the tubes are empty.
CASH CONFORMITY - Televend Cloud is connected to the counting machine, enabling cash conformity analysis and complete automation of cash handing. Fillers scan the barcode on the cash bag using Televend Mobile App. Cash bags are brought to the counting machine.

The solution includes a highly versatile and rounded up product for Vending machines management, including hardware, web application, staff mobile app, mobile app for end customers, cashless payment and ERP integration. There is an insignificant number of competitors.

Intis is a member of the biggest vending association in Europe – EVA.
Televend is actively present and exists on the biggest EU vending fairs for already four consecutive years – EU Vend Koln, Venditalia Milano. Also they present on Evex, Vendiberica (spain), UK vending fair etc.

Televend Wallet is a mobile payment and marketing solution tailored for vending. End consumers use mobile application to pay or recharge. Vending operators use web application to track consumer payments, feedbacks and activities in real time and create loyalty and rewarding programs. Operators can configure mobile application "look and feel" and that way create their own vending payment service. Solution is based on Televend Box hardware which provides vending operators with most advanced Smart Vending Operations features to optimize and improve their daily business. One hardware, two solutions.

Fig. 2 How it works

2.2 OBJECTIVE AND TARGET AUDIENCE

The product is designed and produced in their headquarters in Zagreb, Croatia. The product is sold in more than 40 countries in EU, and distributed by specialized partners from Germany, Austria, Spain, Portugal, UK, Slovenia and Hungary. Their customers are the biggest vending operators in EU and vending machine producers (SMEs and large companies). Their product enables their customers to communicate with end consumers through Televend Wallet mobile application.

2.3 METHODOLOGICAL APPROACH

The key of the solution is increasing logistical efficiency of the vending operator:

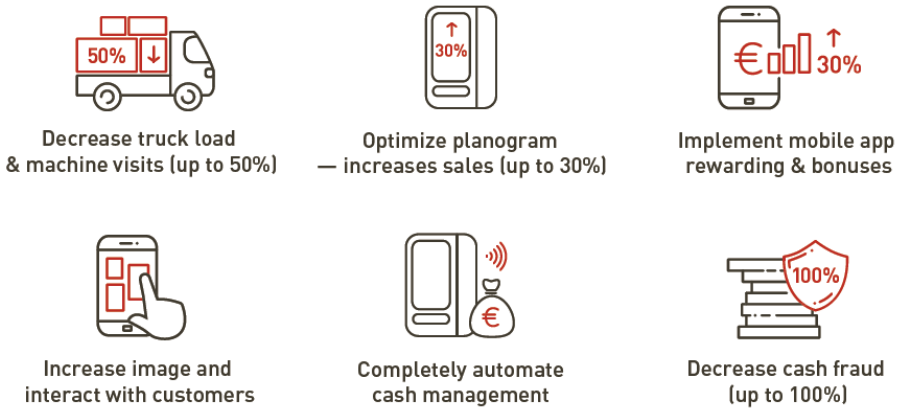

Fig. 3 Why it works

All software and hardware components are tested by their QA team and product possess all quality certificates which ensures sales on the global market. Solution is implemented by their key account managers who work closely with the clients, educating them on the software and hardware implementation, and they also have customer support in daily communication with the customers. The team for this project consists of 50 people working in the following departments:

- cloud development team
- basic infrastructure development team
- IT system support
- mobile application development team
- firmware development team
- hardware development team
- wallet development team
- testers team,
- product management team ,
- customer support team,
- production management
- sales
- procurement,
- QA team
- management

2.4 VALIDATION PROCESS

Every development is done according to the best development practice. After every development cycle, QA team is responsible that the improvements and new developments are delivered to the customers

2.5 RESULTS / IMPACT

Case studies show massive improvement in cost efficiency of vending operators in many areas. Following table shows a measured case study with one customer who owns 3200 vending machines whit a solution for all of the mentioned areas which proved that following savings are possible:

Recalculation of 3200 machines during a 6-month period (230 snack & cold drink machines, 3 fillings)

Reason	Annual cost
unnecessary visits	2.030.191,30 EUR

expired products	85.176,57 EUR
working capital cost	24.192,00 EUR
failed vend	378.657,39 EUR
price incorrect	10.685,22 EUR
cashless malfunction	584.000,00 EUR
coin changer fail	467.200,00 EUR
planogram	583.680,00 EUR
Total:	**4.163.781,91 EUR**

Fig. 4 Measured case study

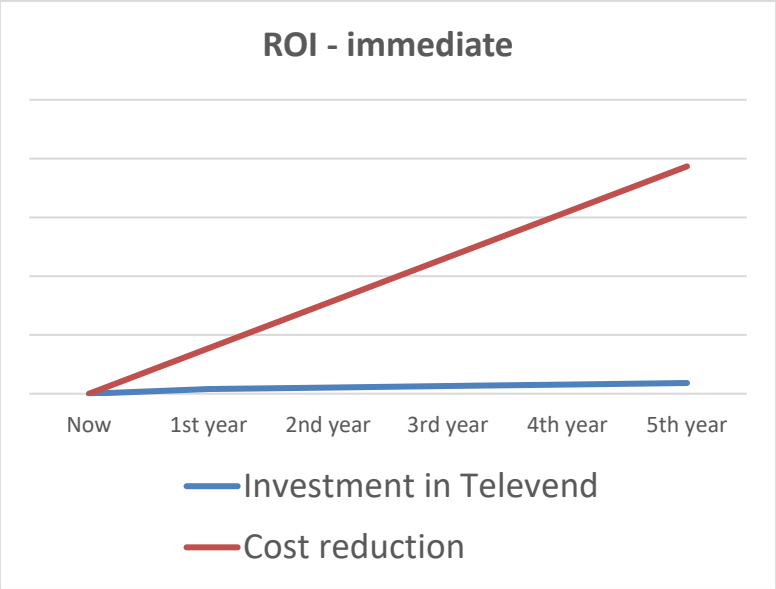

Fig. 5 Cost reduction in 5 years

2.6 SUCCESS FACTORS AND CONSTRAINTS

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

- real time sales and stock level monitoring
- real time errors & event lists – alarm management
- cash collection management
- smart Route optimization – by urgency factor calculation
- expiry date management
- dynamic planogram analysis & optimal product placements
- rentability analysis - per machine, customer, product...
- user role based concept – restrictions on widgets per users
- reporting editor with detailed filtering and export possibilities
- remote configuration
- third party systems data integration
- one device which is cashless at the same time
- cashless payment and virtual bank

In order to improve the impact of the Good practice there is a need for creation of Smart Vending Academy for distributors and vending operator's education.

2.7 LESSON LEARNED & SUSTAINABILITY

Big customers are key for success.
It is important to be very careful with filtering all of the development requests – there are many customers and many different requirements. Listening to all of them at once would be impossible, but there is a need to prioritize development with extreme care.

Monthly fee per connected machine is the key to the long term sustainability of the product.

2.8 REPLICABILITY AND UP SCALING

Besides key selling points and their customer benefits, a positive market response is beneficial to many suppliers as the company has many different hardware components for assembly and often assigns different technology consultants. Present the product on the global market – not only EU. This requires a lot of effort in establishing a worldwide distribution and partner networking.

2.9 FINAL REMARKS

In recent years, the most important change in the sales industry has occurred. Industry 4.0 or IoT (Internet of Things) is here. Vending sector will become "smarter" and activities of vending operators will become optimized and coordinated. Old term "telemetry" is outdated. Transmitting

of data from vending machines is not enough. New term is - Smart Vending which is based on smart bidirectional communication between vending machines and business intelligence in the Cloud. It brings unimagined possibilities and new business models in vending. It will change this sector completely - like Interned did in other sectors.

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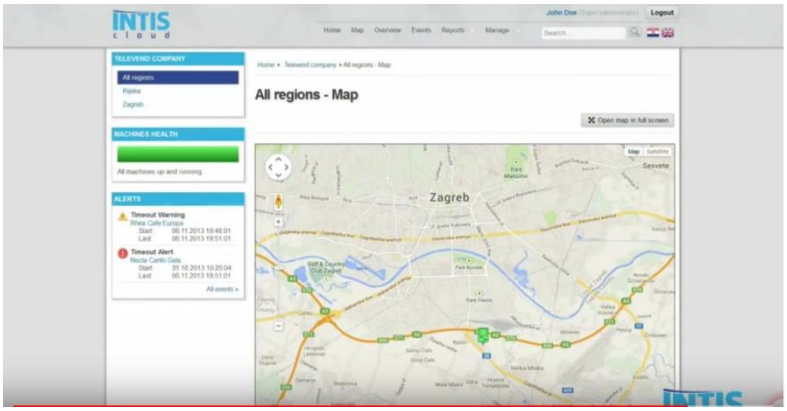
Attachment 6: Installation tutorial http://bit.ly/2Bc0BtQ



3 GP3: Production of FIRE DAMPERS

KLIMAOPREMA d.d.
Contact person: Helena Hrastnik
Address: Gradna 78a, 10430 Samobor, Croatia
Phone: +385 1 3362 513
E-mail: info@klimaoprema.hr
Web site: www.klimaoprema.hr

Keywords: one peace casing, aerodynamical design, easy installation, low weight
Good practice applied in: (NACE code) : C - manufacturing

In the production of fire dampers Klimaoprema is using smart specialization. Production process is divided into phases. Product has a QR code which is read by the camera and gives information on how much time the product has spent in which production phase and which employee was working on it. In this way they detect if and where the error occurred, they analyse the time necessary for production, control the quality, the product and the whole production process in advance.

3.1 GOOD PRACTICE DESCRIPTION

Klimaoprema developed new smart production of fire dampers by following customer needs and demands on the new markets. They developed new and innovative smart production of fire dampers by using new technologies which created cost effective production processes. Production lines are developed in cooperation between Klimaoprema's engineers and renowned European machinery manufacturers. Technical solutions and innovations in fire dampers production are: light, strong one peace casing, easy installation, unique fire performance on the market, low pressure drop, damper blade smaller than nominal size – no possible collision with air duct, EI 120S fire resistance at 500 Pa.


Fig. 1 Klimaoprema's working area

Fire dampers produced in Klimaoprema have unique design, better performance and more efficient production compared to competitors.

Fig. 2 Klimaoprema's production line

3.2 OBJECTIVE AND TARGET AUDIENCE

Fire dampers are distributed all over the world, but mostly in France. They are produced according to EN 15650, tested according to EN 1366-2, classified according to EN 13501-3, have certificate of Constancy of performance and Declaration of constancy of performance according to Regulation (EU) No. 305/2011. The target audience/potential customers are installers, engineering companies and wholesalers.

3.3 METHODOLOGICAL APPROACH

Cost efficiency is secured by large serial production and automated production with minimal no. of employees on the production line. Quality is ensured by controlled production according to EN 15650 and NF 264. Risk quantification is calculated by looking at the likelihood that a specific risk factor may occur and then the impact to the organization if it does occur. Risk management is in processes and assets. Resources necessary for implementation are personnel trained to work in smart factory production, and finances to invest and upgrade the production with new technologies and solutions.

3.4 VALIDATION PROCESS

Validation process is provided by processing large amounts of data in real-time, which prevents errors. Finished product is inspected by quality control manager and gets a signature and mark that it is safe and produced according to standards, norms and guidelines.

3.5 RESULTS / IMPACT

The impact is positive and reads in exporting fire dampers into new markets, new customers, achieving profit and new employments.

3.6 SUCCESS FACTORS AND CONSTRAINTS

Limitations are in computer software to achieve some functionality. The biggest selling points are product quality and smart factory production which results in better product performance. In order to improve the impact of the Good practice there is a need for a bigger production space.

3.7 LESSON LEARNED & SUSTAINABILITY

Key messages and lessons learned are data processing and implementation of industry 4.0 with which they have achieved production efficiency with less energy consumption.

3.8 REPLICABILITY AND UP SCALING

System that they have implemented is applicable to similar production type, semi-automated with manual assembly. This production process can be implemented into other production lines, which is planned for the near future.

3.9 FINAL REMARKS

Data processing and implementation of industry 4.0 has resulted in concurring new markets, export expansion and new customers, new employments and energy efficiency.

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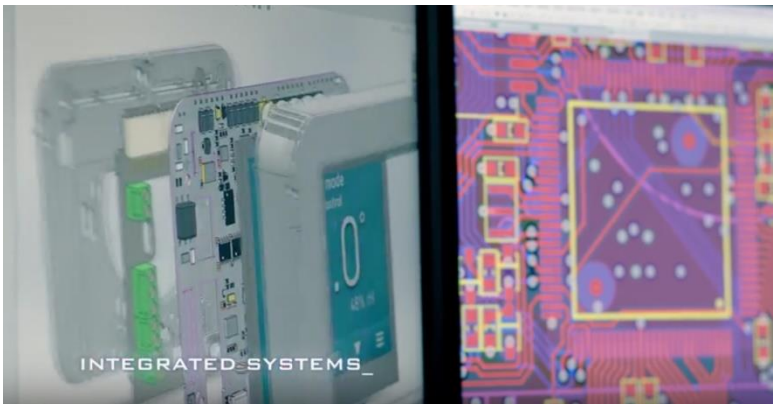

4 GP4: Smart Sense – Smart City AirQ Environmental Monitoring System

SMART SENSE d.o.o.

Contact person: Hana Matanović, CEO
Adress: Zagrebačka cesta 145a, Zagreb, Croatia
Phone: +385 1 558 4284
E-mail: hana.matanovic@smart-sense.hr
Website: www.smart-sense.hr

Keywords : Smart Sense – Smart City AirQ Environmental Monitoring System
Good practice applied in: (NACE code) : J – computer programming

Station for air quality monitoring (Smart Sense AirQ) is based on flexible Smart Sense platform, making it suitable for deployment in various measurement applications. This platform can be upgraded with different sensor technologies and it can implement different communication protocols. System enables remote control, monitoring and configuration of AirQ system and OTA software upgrades managed by Smart Sense server. Monitoring station uses very sensitive electrochemical gas sensors. Each gas sensor is factory calibrated and lasts for up to 24 months, depending on air pollution. Gas sensors can be easily exchanged on the field without a need for deinstallation of monitoring station. For monitoring particles, the laser optical sensing module is used.

4.1 GOOD PRACTICE DESCRIPTION

Smart Sense is a Croatian IT company consisting of both tech magicians and business savants, on a mission of closing the gap between physical and cyber world with innovative state-of-the-art IoT solutions. Their strong suit is Smart sensor development with a main interests in a Smart Home and Smart City solutions, infrastructure and human body monitoring. Their ultimate goal is to enable a more delightful everyday life for the end users so they can relax and enjoy the Smart sense complete home/life solutions. Their focus of interest is Internet of Things, the idea of *techtopia* where all things around us are connected, communicating and working in perfect harmony. This task is distant, expensive and not easily achievable so for this purpose only, they write their own software, create their own hardware and tread bravely towards the interconnected reality and the Holy Grail of networking: The Internet of Everything. Smart Sense core team has

successfully implemented numerous projects in cooperation with industry and Faculty of electrical engineering and computing within EU framework program. Smart City AirQ monitoring station collects and sends data to Smart Sense cloud server. Server application (Smart Sense AirQ central cloud application) collects, analyses and saves measuring data and according to customer request presents them through AirQ WEB application. On the other hand, server application enables control and configuration of AirQ station. AirQ station can be configured to send data not only to Smart Sense cloud server but also to any other IoT system. Software platform can be extended in a way to be able to support all current and future application protocols. Comparing to competitors, their solution uses European standard for presenting air pollution in the area (CAQI-Common Air quality index). Therefore they are monitoring five types of gases and three types of particles which are important for calculation of AQI. These gases have been validated in cooperation with *Andrija Štampar Teaching Institute of Public Health* which differentiate the company from their competitors and brings them additional value in monitoring air quality. Solution is white labelled.

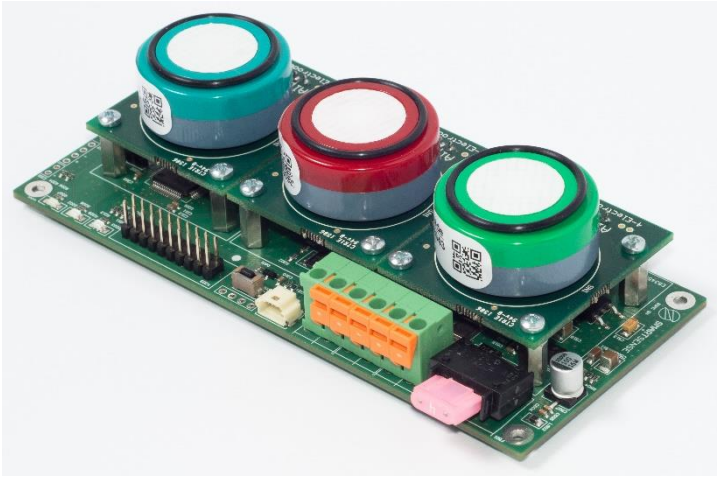

Fig. 1 Smart Sense product

4.2 OBJECTIVE AND TARGET AUDIENCE

The geographical range where the good practice is being used is:

- Smart City pilot project in Dubrovnik, Croatia
- Andrija Štampar Teaching Institute of Public Health, Zagreb
- Smart City pilot project in Bonn
- Baud Telecom Company – Riyadh
- Croatian Telecom – Zagreb
- Smart City Koprivnica, Croatia
- OTE group, Chalkida, Greece

Smart Sense is using service provider (Deutsche Telekom, Croatian Telekom, Nokia, Huawei, Ericsson…) sales and marketing strength to sell Smart Sense – Smart City AirQ Environmental Monitoring System. Target audiences are Smart Cities and various city institutions using air quality data. Target group of customers are public institutions through service provider sales channel.

4.3 METHODOLOGICAL APPROACH

Good practice can be implemented by making initial business research regarding market potential and product development, using processes that have been effective in previous projects, using qualitative materials and components used in product development, and reliable partners who can help them in development and production processes. Resources necessary for implementation are HW, SW and business experts, financial support, infrastructure and reliable production partners.

4.4 VALIDATION PROCESS

Good practice is validated by the result of product research and development which is AirQ solution created within certain time, money and scope with developed all upfront defined functionalities. This solution is tested and verified before commercializing.

4.5 RESULTS / IMPACT

Instead of buying very expensive fixed measurement stations (around 150.000-200.000 EUR), according to EU directive 2008/50/EC, cities are allowed to supplement existing fix measurements with indicative measurements. This enables them to cut down costs and to get better overview of air quality around the city. Collected data (Indicative measurements) can be shared/sold to health and environment agencies who can then use this data for making modelling techniques, air quality assessment throughout the city and air quality predictions. Better overview of city air quality provides health and environmental agencies with exact information on worst pollutants in certain locations. Action plan based on this information can help cities in reducing air pollution on critical points to a level acceptable for living. This would directly lower medical and economic costs. Places with good air quality can put this information on a display and make it available to citizens and tourists, especially in places like national parks, city centres, beaches… Better overview of air quality enables better traffic management, e.g. redirect traffic in order to reduce air pollution on critical points, avoid closing whole City centre for cars because of the lack of relevant information on air quality.

Actions:
Real-time traffic surveillance and control – i.e. dynamically modifying speed limit, traffic light period or closing off critical areas for general traffic.
Real time pollution incident detection and location, identification of safe evacuation routes, precise alarming.
Conduct pollution characterization research – long term improvement actions.
Comprehensive pollution maps, influence travel advice, weather forecasts for joggers, children and sensitive population.
Parking management and pricing depending on air pollution; e.g. bigger prices for parking in the centre of town when pollution is rising.

4.6 SUCCESS FACTORS AND CONSTRAINTS

Limitations are big development and production costs and limited number of suppliers who are critical for production process. Smart Sense – Smart City AirQ Environmental Monitoring System best-selling points are:

- collaboration with Andrija Štampar Teaching Institute of Public Health in Croatia in validating Smart Sense AirQ Monitoring Station data with professional environmental station data,
- solution is “white-label” conceived so service providers could sell it as their own,
- easy scaling and adjustments to customer requirements.

In order to improve the impact of the Good practice they need employee education, larger production series and more field tests in different environments. Using benefits of Smart Sense – Smart City AirQ Environmental Monitoring System, and taking actions like:

- real-time traffic surveillance and control
- real time pollution incident detection and location
- conduct pollution characterization research
- comprehensive pollution maps
- parking management

4.7 LESSON LEARNED & SUSTAINABILITY

Each development process and solution is unique and you have to adjust certain parts of good practice to a specific element of each project. By each development process, they are improving good practice and are adjusting this good practice to their needs. In that context good practise will be used in future development processes and further in putting their solutions on the market and selling them to end customers.

4.8 REPLICABILITY AND UP SCALING

Using data from Smart Sense – Smart City AirQ Environmental Monitoring System other SME could develop new solutions for:

- real-time traffic surveillance and control
- real time pollution incident detection and location
- conduct pollution characterization research
- comprehensive pollution maps
- parking management

Wider Smart City Initiatives and approach to other service provider in Smart City Initiatives worldwide

4.9 FINAL REMARKS

Smart Sense – Smart City AirQ Environmental Monitoring System:

- promote City as a place to live in
- promote City as a tourist destination
- help in problems with traffic management and regulations
- ensures better model for Air Quality index in urban area

Disclaimer / Acknowledgements

This information can be disseminated by printing material and online release.

List of attachments:

Attachment 1: Screenshot from the application
Attachment 2: Green Light for Smart City Bonn: http://bit.ly/2Bz7K4n

5 GP5: VESKI d.o.o.

Veski d.o.o.

Contact person: Ozren Orešković
Adress: Oreškovićeva 8j, Zagreb, Croatia
Phone: +385 1 6445 516
E-mail: info@smart-sense.hr
Website: www.veski.hr

Keywords : machine condition monitoring, algorithms
Good practice applied in: (NACE code) : C - manufacturing

Veski d.o.o. has been established in 1990 in Zagreb. Their field of expertise is vibration and online advanced machine condition monitoring. Their specialty is also measurement and signal processing. Their services include advanced signal analysis, design, manufacturing and installation of in-house solutions for online machine condition monitoring and protection systems on hydro power plants. This also implies better asset management by the end user. CoDiS Online monitoring is a product that is developed and suited for future usage within “smart power plants” and is ready for Industry 4.0. Data collection, smart sensors, IoT, and consequently Big Data Analysis is what will be the base of future industry.

5.1 GOOD PRACTICE DESCRIPTION

Constant development of new ideas and implementation of industry trends combined with experience of their founders resulted with good product. They try to implement new ideas using new technologies available. Being a small company gives them a competitive edge in implementing and testing those ideas in real environment so their development and testing process is much shorter than the one of the large competitors.

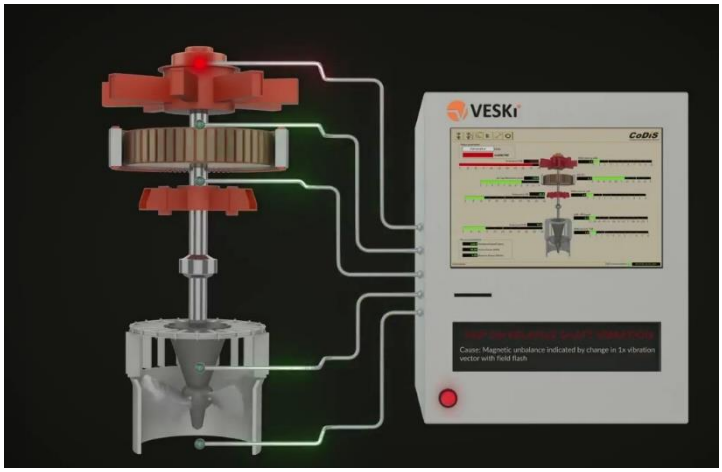

Fig. 1 Veski product

Their solution is based on National Instruments PAC (CompactRIO) technology. It is an open platform that allows them to implement smart and advanced algorithms in CoDiS platform which they use for machine condition prediction. Algorithms include mathematical models of generators that can be used to predict different faults and create failure mode signatures. Their solution is mostly different as their final product is a hardware (measurement device) that is completely software-reconfigurable, meaning it can accommodate any type of signal from any type of sensors installed on hydro-generator or in the plant, whereas their competitors have dedicated hardware modules that can't be used for different measurements. That gives them a flexibility to completely custom tailor the solution and implement algorithms dedicated for each machine.


Fig. 2 Veski machine

5.2 OBJECTIVE AND TARGET AUDIENCE

The geographical range where the good practice has been used is Croatia, Bosnia and Herzegovina, Macedonia, Hungary, Slovenia, USA, Canada, Australia, New Zealand and etc…
The target audience and stakeholders are power plant personnel (maintenance and reliability engineers), plant and utility owners.

5.3 METHODOLOGICAL APPROACH

Their system is used to provide information to plan management which users use to have cost effective maintenance and to plan the activities. This is proven to save the maintenance costs by 30% and more. But more importantly it makes machines more available for production which can sometimes mean more than hundreds of thousands of USD annually. System provides better quality assurance to the end user as they have an insight in their machine condition and can act accordingly, and it reduces the end-user risk of machine failures and all risk consequently. Their products are implemented within the end-user power facilities. Usually it implies sensor installation, cabling and instrument installation. In the end, software is configured and installed in the end-user's operation centre. The resources necessary for implementation are skilled personnel (electricians and engineers) and planned machine outage.

5.4 VALIDATION PROCESS

Their products are usually validated by the end-user as a result of more efficient maintenance or as direct savings by early fault detection which stops larger fault from occurring and thus directly saves assets.

5.5 RESULTS / IMPACT

Using their products, their customers have managed to reduce their maintenance and plan the activities. Also they have helped in preventing the malfunctions by predicting the critical situations and alerting the customer. This has been done automatically from their device.

5.6 SUCCESS FACTORS AND CONSTRAINTS

Their product is very specific and it requires specific skills to be able to implement and use it. Limitations would be inadequate knowledge of end-users and consequently their reluctance to implement and embrace new technologies in their day to day activities.
Key selling points are:

- flexibility
- end to end solution (complete package all in one)
- custom tailoring of GUI to every end-user
- advanced algorithms

In order to improve the impact of the Good practice they need more marketing resources to improve visibility, and implementation of AI to improve the software capabilities.

5.7 LESSON LEARNED & SUSTAINABILITY

Cooperation and outsourcing of specific sub-components is the key to faster results when developing and implementing new ideas. The key to sustainability of the Good Practice is constant improvements and implementation of cutting edge technologies which keeps you ahead of competitors, and also proper and thorough training of every employee, from basic to more advanced subjects.

5.8 REPLICABILITY AND UP SCALING

To design and develop new product it is essential to have know-how but also know-why. Other step is to identify uniqueness of product and how it will find its way to the market. Today, in IoT and Industry 4.0, it is impossible to have a standalone product so the key is how to integrate into the big picture and contribute. The product(s) can be used in any type of industry, with modifications applied to target specific demands and challenges.

5.9 FINAL REMARKS

Their products are used for predictive maintenance, asset management and machine protection. The base is online data collection, analysis and use of smart algorithms that are able to predict and detect small changes that would point to irregular behaviour. On hydro-machines the biggest challenge is how to integrate signals from various and different parts of machine and how to correlate them properly. With that capability end-users can benefit from using and implementing new technologies in maintenance process in many aspects:

- safety – direct impact on safety of asset and people
- costs – cutting unnecessary maintenance costs
- better machine availability – shorten the maintenance period and put the machine into more operation – earn more money
- learn more about the real machine behaviour in exploitation where different and sometimes unexpected situations occur

Disclaimer / Acknowledgements

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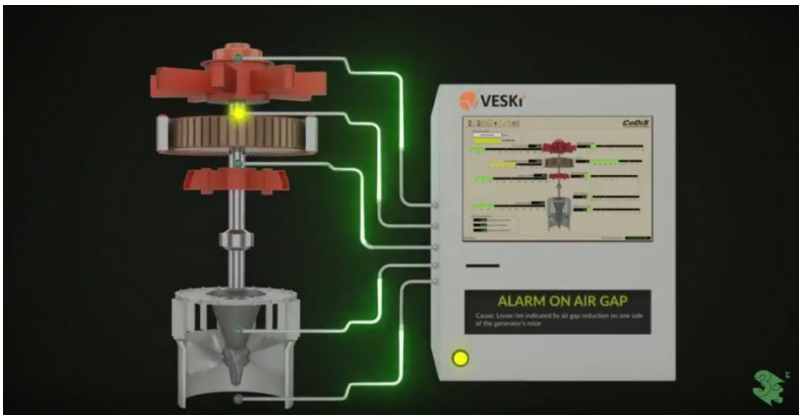
List of attachments:

Attachment 1: Screenshot from the application
Attachment 2: Screenshot from the application
Attachment 3: Case studies, Application notes, papers:
http://veski.hr/index.php?page=library#application-notes
Attachment 4: How Veski product works



6 LESSON LEARNED

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

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:

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

Lesson learned from the perspective of the partner

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

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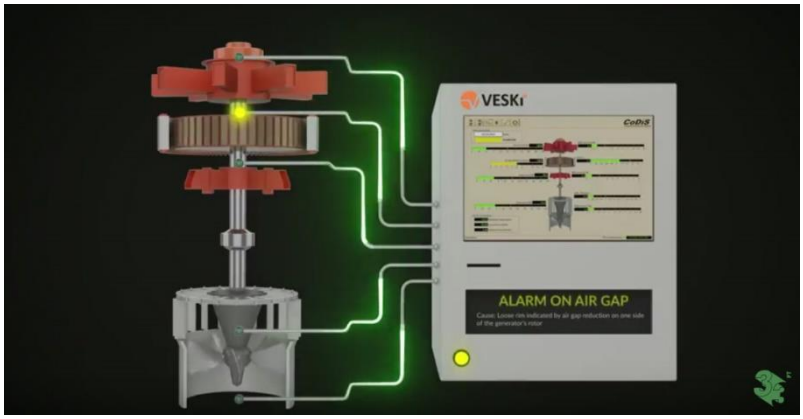

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1 TEMPLATE FOR GOOD PRACTICE DOCUMENTATION

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

Element	Guiding questions	Answers
	Provide a concise description of the good practice being addressed	In the production of fire dampers Klimaoprema is using smart specialization. Production process is divided into phases. Product has a QR code which is read by the camera and gives information on how much time the product has spent in which production phase and which employee was working on it. In this way they detect if and where the error occurred, they analyse the time necessary for production, control the quality, the product and the whole production process in advance.
GOOD PRACTICE DESCRIPTION		
Detailed description	How did the SME create good practice / new product?	Klimaoprema developed new smart production of fire dampers by following customer needs and demands on the new markets.
	What is the relationship to SFH approach: novel technology, production processes, HRM or cost efficiency, quality assurance, risk management?	Klimaoprema developed new and innovative smart production of fire dampers by using new technologies which created cost effective production processes. Production lines are developed in cooperation between Klimaoprema's engineers and renowned European machinery manufacturers.
	Describe what are the technical solutions and innovations: of the good practice	Technical solutions and innovations in fire dampers production are: light, strong one peace casing, easy installation, unique fire performance on the market, low pressure drop, damper blade smaller than nominal size – no possible collision with air duct, EI 120S fire resistance at 500 Pa.

Element	Guiding questions	Answers
		
	Highlights (or keywords) of the Best Practice	One peace casing, aerodynamical design, easy installation, low weight.
	Good practice applied in : (NACE code)	C24.3 - Manufacture of other products of first processing of steel C28.2.5 – Manufacture of non-domestic cooling and ventilation equipment
Benchmarking	How does your solution related to others provided by competitors	Fire dampers produced in Klimaoprema have unique design, better performance and more efficient production compared to competitors.

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).	Klimaoprema video 
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Fire dampers are distributed all over the world, but mostly in France. Fire dampers are produced according to EN 15650, tested according to EN 1366-2, classified according to EN 13501-3, have certificate of Constancy of performance and Declaration of constancy of performance according to Regulation (EU) No. 305/2011.
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	The target audience/potential customers are installers, engineering companies and wholesalers.

Element	Guiding questions	Answers
Targeted customers and scale of use	Select the target group of customers: 1. SMEs (<250 employees) 2. Large companies 3. Public institutions 4. End customer (Business to Customer) Other, please specify	1. SMEs (<250 employees) 2. Large companies 3. Business to Business customers (B2B) 4. Business to Customer customers (B2C)
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	Cost efficiency is secured by large serial production and automated production with minimal no. of employees on the production line.
	Quality assurance aspects, if applicable	Controlled production according to EN 15650 and NF 264.
	Risk management aspects, if applicable	Risk quantification is calculated by looking at the likelihood that a specific risk factor may occur and then the impact to the organization if it does occur. Risk management is in processes and assets.
Implementation guidelines	How can the Good practice be implemented?	Industry 4.0 is implemented in the production of fire dampers.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	Personnel trained to work in smart factory production and finances to invest and upgrade the production with new technologies and solutions.

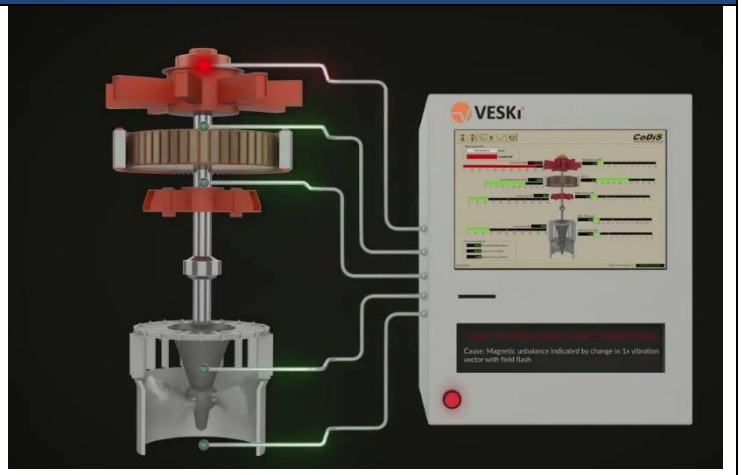
Element	Guiding questions	Answers
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	Validation process is provided by processing large amounts of data in real-time, which prevents errors. Finished product is inspected by quality control manager and gets a signature and mark that it is safe and produced according to standards, norms and guidelines.
RESULTS / IMPACT		
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	The impact is positive and reads in exporting fire dampers into new markets, new customers, achieving profit and new employments.
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	Limitations are in computer software to achieve some functionality.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	The biggest selling points are product quality and smart factory production which results in better product performance.
Need assessment	What else would be needed in order to improve the impact of the Good practice	Bigger production space.
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Data processing and implementation of industry 4.0.

Element	Guiding questions	Answers
SUSTAINABILITY		
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	With industry 4.0 they have achieved production efficiency with less energy consumption.
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	System that they have implemented is applicable to similar production type, semi-automated with manual assembly.
	What are the possibilities of extending the good practice more widely?	This production process can be implemented into other production lines, which is planned for the near future.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	Data processing and implementation of industry 4.0. has resulted in concurring new markets, export expansion and new customers, new employments and energy efficiency.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	This information can be disseminated by printing material and online releases.

2 TEMPLATE FOR GOOD PRACTICE DOCUMENTATION

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

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

Element	Guiding questions	Answers
	Describe what are the technical solutions and innovations: of the good practice	 Their solution is based on National Instruments PAC (CompactRIO) technology. It is an open platform that allows them to implement smart and advanced algorithms in pour CoDiS platform, which they use for machine condition prediction. Algorithms include mathematical models of generators that can be used to predict different faults and create failure mode signatures.
	Highlights (or keywords) of the Best Practice	Machine Condition Monitoring, algorithms, Software
	Good practice applied in : (NACE code)	C26.5.1 - Manufacture of instruments and appliances for measuring, testing and navigation.
Benchmarking	How does your solution related to others provided by competitors	Their solution is mostly different as their final product is a hardware (measurement device) that is completely software reconfigurable, meaning it can accommodate any type of signal from any type of sensors installed on hydro generator or in the plant, whereas their

Element	Guiding questions	Answers
		competitors have dedicated hardware modules that can't be used for different measurements. That gives them a flexibility to completely custom tailor the solution and implement algorithms dedicated for each machine.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	 Case studies, Application notes, papers:

Element	Guiding questions	Answers
		http://veski.hr/index.php?page=library#application-notes Video WEB: www.veski.hr
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	Worldwide (HR, BiH, Macedonia, Hungary, Slovenia, USA, Canada, Australia, New Zealand etc…)
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Power plant personnel (maintenance and reliability engineers), Plant owners, Utility owners
Targeted customers and scale of use	Select the target group of customers: 5. SMEs (<250 employees) 6. Large companies 7. Public institutions 8. 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	Their system is used to provide information to plan management which users use to have cost effective maintenance, and to plan the activities. This is proven to save the maintenance costs by 30% and more. But more importantly it makes machines more available for production which can sometimes mean hundreds of thousands of USD and more annually.

Element	Guiding questions	Answers
	Quality assurance aspects, if applicable	System provides better quality assurance to end user as they have an insight on their machine condition and can act accordingly.
	Risk management aspects, if applicable	Reduces the end-user risk of machine failures and all risk consequently.
Implementation guidelines	How can the Good practice be implemented?	Their products are implemented within the end users power facility. Usually it implies sensor installation, cabeling and instrument installation. In the end Software is configured and installed in the end user's operation centre.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	Skilled personnel (electricians and engineers), planned machine outage.
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	Their products are usually validated by end user as a result of more efficient maintenance or as direct savings by early fault detection which stops larger fault from occurring and thus directly saves assets.
RESULTS / IMPACT		
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	Using their products, their customers have managed to reduce their maintenance and plan the activities. Also they have helped in preventing the malfunctions by predicting the critical situations and alerting the customer. This has been done automatically from their device.
SUCCESS FACTORS AND CONSTRAINTS		

Element	Guiding questions	Answers
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	Their product is very specific and it requires specific skills to be able to implement and use it. Limitations would be inadequate knowledge of end users and consequently their reluctance to implement and embrace new technologies in their day to day activities.
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	Key selling points: - Flexibility - End to end solution (complete package all in one) - Custom tailoring of GUI to every end user - Advanced algorithms
Need assessment	What else would be needed in order to improve the impact of the Good practice	More marketing resources to improve visibility. Implementation of AI to improve the software capabilities.
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Cooperation and outsourcing of specific sub components is the key to faster results when developing and implementing new ideas.
SUSTAINABILITY		
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	Constant improvements and implementation of cutting edge technologies which keeps you ahead of competitors. Proper and thorough training of every employee, from basic to more advanced subjects.
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	To design and develop new product it is essential to have know-how but also know-why.

Element	Guiding questions	Answers
		Other step is to identify uniqueness of product and how it will find its way on the market. Today, in IoT and Industry 4.0, it is impossible to have a standalone product so the key is how to integrate into the big picture and contribute.
	What are the possibilities of extending the good practice more widely?	The product(s) can be used in any type of industry, with modifications applied to target specific demands and challenges.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	Their products are used for predictive maintenance, asset management and machine protection. The base is on-line data collection, analysis and use of smart algorithms that are able to predict and detect small changes that would point to irregular behaviour. On hydro machines the biggest challenge is how to integrate signals from various and different parts of machine and how to correlate them properly. With that capability end users can benefit from using and implementing new technologies in maintenance process in many aspects: - Safety – direct impact on safety of asset and people - Costs – cutting unnecessary maintenance costs - Better machine availability – shorten the maintenance period and put machine into more operation – earn more money

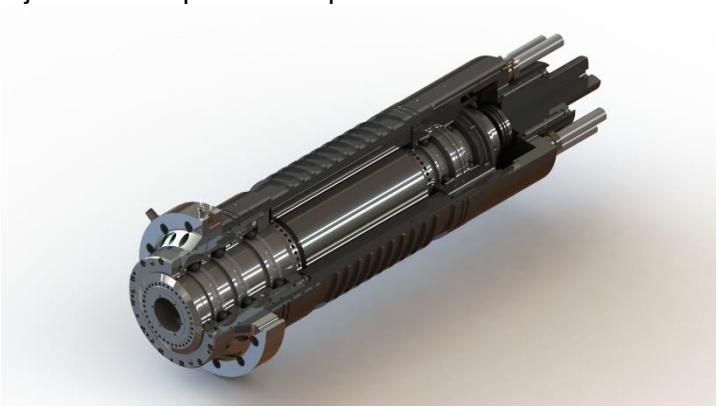
Element	Guiding questions	Answers
		- Learn more about real machine behaviour in exploitation where different and sometimes unexpected situations occur
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	This information can be disseminated by printing material and online release.

3 TEMPLATE FOR GOOD PRACTICE DOCUMENTATION

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

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

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

Element	Guiding questions	Answers
		injuries in the production process. 
	Highlights (or keywords) of the Best Practice	high speed technology, engineering, robotic automation, motor spindle…
	Good practice applied in : (NACE code)	C28.9.1, C28.9.6, C28.9.9
Benchmarking	How does your solution related to others provided by competitors	All innovative technical solutions have been discovered throug the present situation in their environment and in consultations with partners and potential customers. As manufacturer of prototype solutions, in order to remain competitive, they must pay attention to all possible customer requirements and on the global strategy and guidelines for future development, such as Industry 4.0.

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).	 Awards: Platinum key for continuity in company excellence HSTEC d.d. (http://www.hstec.hr/novosti/platinasti-kljuc-za-kontinuitet-u-izvrsnosti-tvrtki-hstec-dd/51.html), Annual reward of Zadar County to HSTEC d.d. (http://www.hstec.hr/novosti/godisnja-nagrada-zadarske-zupanije-tvrtki-hstec-dd/49.html), Zlatna kuna 2016 and 2012 for the most successful SME in the Zadar County. Websites: www.hstec.hr (pictures, videos), youtube.com (HSTEC).

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	HSTec is an export oriented company with the following geographical coverage: Germany 50% Croatia 28% Slovenia 10% Austria 5% USA 5% Other countries: 2%
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Target audience and potential customers are companies mainly from the automotive industry, and in a small percentage, glassworks and plastic mould industry.
Targeted customers and scale of use	Select the target group of customers: 9. SMEs (<250 employees) 10. Large companies 11. Public institutions 12. End customer (Business to Customer) Other, please specify	SMEs, large companies and universities.
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	Investment efficiency, process efficiency, resource and energy consumption efficiency.
	Quality assurance aspects, if applicable	Quality assurance of the product and services, continuous improvement of the product, services and processes, key process indicators of efficiency. However, the main tool for quality assurance is the efficient quality management and awareness of all

Element	Guiding questions	Answers
		employees striving to develop the best possible product and service.
	Risk management aspects, if applicable	Risk management aspects such as the strengths, weaknesses, opportunities and threats regarding the future development are incorporated into managerial decisions.
Implementation guidelines	How can the Good practice be implemented?	It can be implemented if all necessary resources are available, however it can depend on the environment (i.e. if the environment is productive and all necessary suppliers are nearby, it can be a very positive start).
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	The resources necessary for implementation are: highly qualified and educated personnel, finance, infrastructure (production plant, top quality production machinery, devices and ICT system, adequate software tools), and timespan of ca. 1 year.
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	The good practice has been validated by every satisfied customer. The customer satisfaction survey is being continuously monitored, which is one of the main starting points where products and services are being improved. All products and services are monitored even after the delivery, using the Product Lifecycle Management. Thus they are able to witness the lifespan of products as well as some possible aspects of the product needed to be improved.
RESULTS / IMPACT		

Element	Guiding questions	Answers
Solution impact	What has been the impact (positive or negative) of this good practice on the beneficiaries	Satisfied customers, product improvement, taking part in development of future smart factories by improving their product according to guidelines of Industry 4.0 strategy. Their employees are continuously improving their skills and knowledge, the company's employment rate is continuously rising which is being positively affected on the development of the Zadar County.
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	Limitations are mainly in the ability to find skilled professionals who are willing to work in small towns. The educational system needs to be up-grated so the company continuously invests time and money to improve the level of knowledge of its employees. Limitations are found in the local area, where there is a minor percentage of suppliers, almost all suppliers are located at least 300 km from the company location (which negatively affects the time management and transportation costs).
	Selling points – list the real or perceived benefit of a good practice that differentiates it from the competing brands and gives its client a logical reason to prefer it over other brands	Their products and services are made according to customer requests and are mainly prototypes. The company's know-how is a great sales point, where they consult their customers on what solution to choose. Their ability to produce only one prototype product for a reasonable price differentiates them from the competing brands that only sell standard products. The company differentiates from other companies in having

Element	Guiding questions	Answers
		all the necessary departments on the same location: development and design department, production and assembly department, quality control department, product testing department, logistics department, after sales, service department etc. and thus is able to offer a competitive solution incorporating knowledge, high-quality product, product monitoring and servicing.
Need assessment	What else would be needed in order to improve the impact of the Good practice	More highly qualified and trained personnel, an improved industrial environment where most suppliers would be located and thus easily connected with the company.
LESSON LEARNED		
Lessons learned	What are the key messages and lessons learned to take away from the good practice experience	Always strive to be ahead of your competitors by knowledge and quality. Work continuously on improvement of your business processes, resources, personnel, products and services.
SUSTAINABILITY		
Sustainability of Good Practice	Describe aspects related to sustainability of the Good Practice, if applicable	As mentioned above: *Always strive to be ahead of the competitors by knowledge and quality; Continuous work on improvement of business processes, resources, personnel and products and services.*
REPLICABILITY AND UP SCALING		
Replicability and further application	How can the solution / good practice be useful for other SMEs?	A good practice can be useful for other SMEs in regard to implementing the solutions for energy efficiency, production efficiency, production process automation by incorporation of digital and ICT systems, HR management and continuous investment

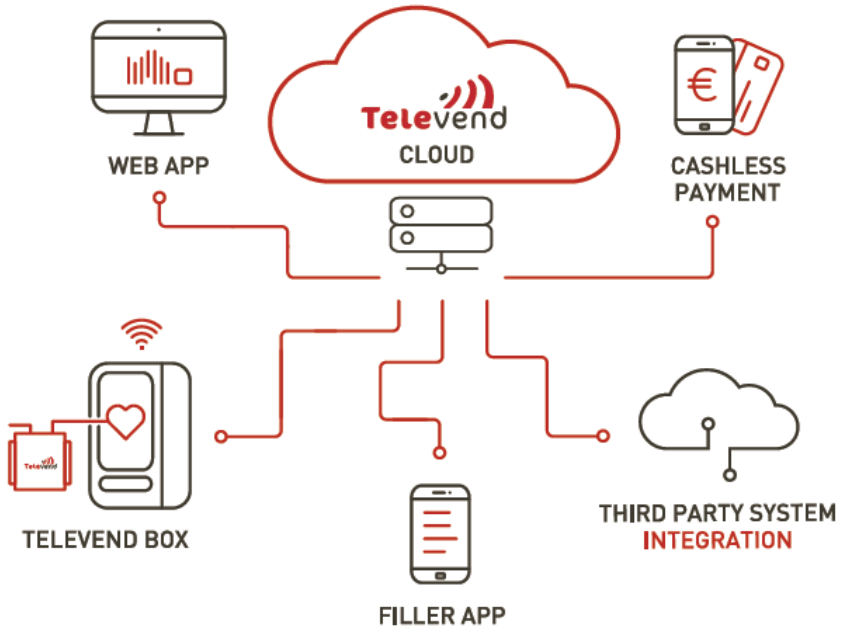
Element	Guiding questions	Answers
		in education of employees, risk management that is efficient and prospective and process organization according to lean management principles and guidelines.
	What are the possibilities of extending the good practice more widely?	Opportunities are in growth of companies that have the best practice or merging several companies and thus lead to an increase and spread of the good practice.
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	The impact is global and irreversible: future demands are based not only on automation of processes and products, but also on digitalisation and implementation of monitoring sensors in order to communicate throughout the network of production machines and between several smart factories.
Disclaimer / Acknowledgements	Address any legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed (Yes/No)	This information can be disseminated by printing material and online release.

4 TEMPLATE FOR GOOD PRACTICE DOCUMENTATION

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

Element	Guiding questions	Answers
		 Televend logo - the IoT product of INTIS for online monitoring of vending machines.
Name and brief description.	Name or acronym: what is the name that captures the essence of the good practice	**Televend Smart Vending**
	Provide a concise description of the good practice being addressed	Televend Smart Vending platform is a unique combination of Hardware and Software products which organize and optimize daily business in vending operator company. It is the most important and most useful technical improvement in the last ten years in vending industry. There is no need for investment in huge software modules and there is no need for internal IT specialists: powerful platform is in the Cloud. It is real proof that 4th Industrial revolution hasstarted. Platform consists of:

Element	Guiding questions	Answers
		10. Televend Box which is inserted in the vending machine and communicates via GSM with the Cloud 11. Televend Cloud which supports vending operator's daily business using real time data 12. Televend Mobil App which supports fillers and technicians on their daily tasks 13. Televend Virtual bank which allows consumers to close loop payment and marketing actions 14. T- Wallet Mobil App – consumers application for cashless payment via Smartphone

Element	Guiding questions	Answers
		 The company's goal is to have complete centralization of production and development since their IoT product Televend consists of complex hardware and software components that are closely related. In the schematics of their system it is visible that every development on a hardware installed into the vending machine is connected to the cloud solutions. By keeping the production and design of their hardware and software development both in house, they are:

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

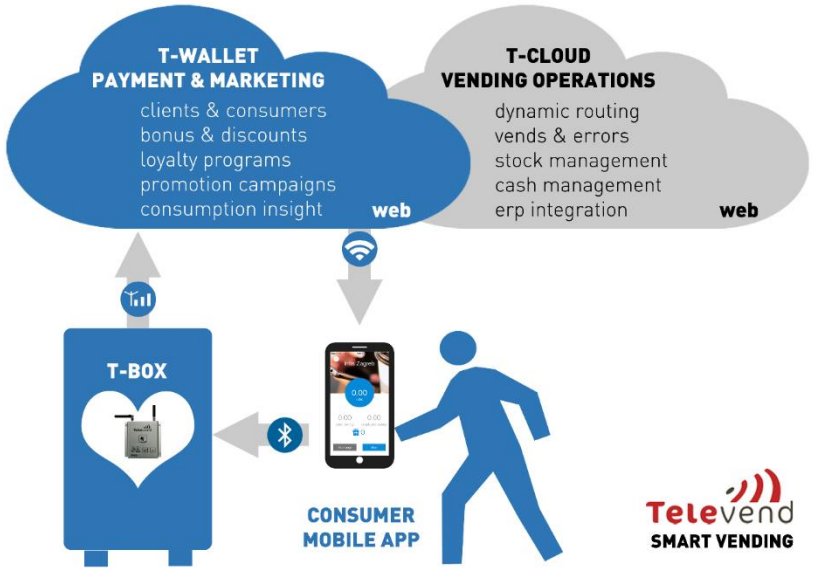
Element	Guiding questions	Answers
		the development in house in order to quickly react to new requirements from various customers as there are many vending machine types and many different requests to tackle in the industry.
	What is the relationship to SFH approach: novel technology, production processes,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

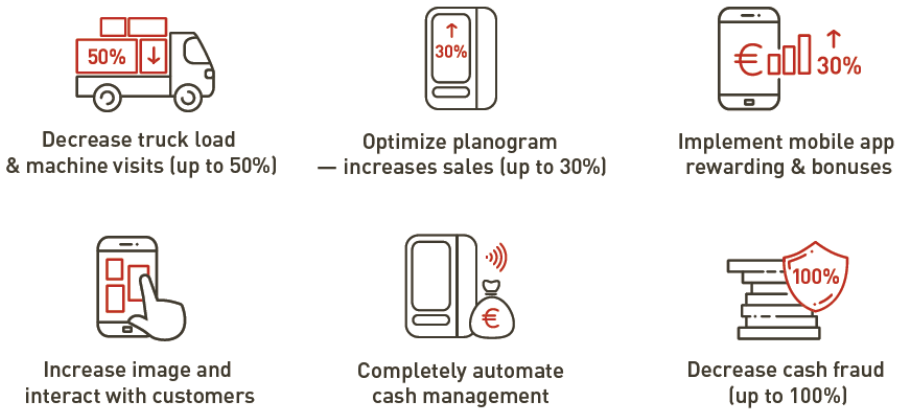
Element	Guiding questions	Answers
	Describe what are the technical solutions and innovations: of the good practice	 T-BOX is a small device installed into old and new vending machines. It collects all useful data from the machine and payment systems including sales, cash details and errors, and sends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

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

Element	Guiding questions	Answers
		CASH CONFORMITY Televend Cloud is connected to the counting machine enabling cash conformity analysis and complete automation of cash handing. Fillers scan the barcode on the cash bag using Televend Mobile App. Cash bags are brought to the counting machine.
	Highlights (or keywords) of the Best Practice	Smart Vending, IoT Showcase, State of the art Industry 4.0. product, Real time vends & events • Real time cash Planogram analysis • Pre-kitting • Live routing Geo routing • Cash conformity • Machine urgency Rewarding schemes • Rule editor • Customer mobile app Service mobile app • Loyalty programs • Vending academy Prediction algorithm • Expiry date management Report builder • Erp integration api • Virtual eva dts Age verification • Offline machine management
	Good practice applied in : (NACE code)	J62 - Computer programming, consultancy and related activities J62.0 - Computer programming, consultancy and related activities J62.0.1 - Computer programming activities J62.0.2 - Computer consultancy activities J63 - Information service activities J63.1 - Data processing, hosting and related activities; web portals J63.1.1 - Data processing, hosting and related activities J63.1.2 - Web portals J58.2 - Software publishing C26 - Manufacture of computer, electronic and optical products C27.3.2 - Manufacture of other electronic and electric wires and cables

Element	Guiding questions	Answers
		J61 - Telecommunications J61.1 - Wired telecommunications activities J61.1.0 - Wired telecommunications activities J61.2 - Wireless telecommunications activities
Benchmarking	How does your solution related to others provided by competitors	The solution includes a highly versatile and rounded up product for Vending machines management including hardware, web application, staff mobile app, mobile app for end customers, cashless payment, ERP integration. Unsignificant number of competitors offer such flexibility as a product coming from a single source company.
Additional information's / materials	Provide additional information if existing such as case studies, datasheets, whitepapers, awards and other relevant information. Electronic sources (websites, social media, pictures, videos) are encouraged to be included in this section. Training manuals, guidelines, technical fact sheets, posters, pictures, video animations, audio documents, 3D files, and/or other material about the Good practice implementation (if existing).	https://televend.eu/ https://www.facebook.com/televend/ https://www.youtube.com/watch?v=sHUdQkwjSnc&t=190s Intis is a member of the biggest vending association in Europe – EVA. Televend is actively present and exists on the biggest EU vending fairs for already four consecutive years – EU Vend Koln, Venditalia Milano. Also they present on Evex, Vendiberica (spain), UK vending fair etc. Televend Wallet is mobile payment and marketing solution tailored for vending. End consumers use mobile application to pay or recharge with just simple tap of mobile on vending machine. Vending operators use web application to track consumer payments, feedbacks and activities in real time and create loyalty and rewarding programs. Operators can configure mobile application "look and feel" and that way create their own vending payment service. Solution is based on Televend Box hardware which provides vending operators with most advanced Smart Vending

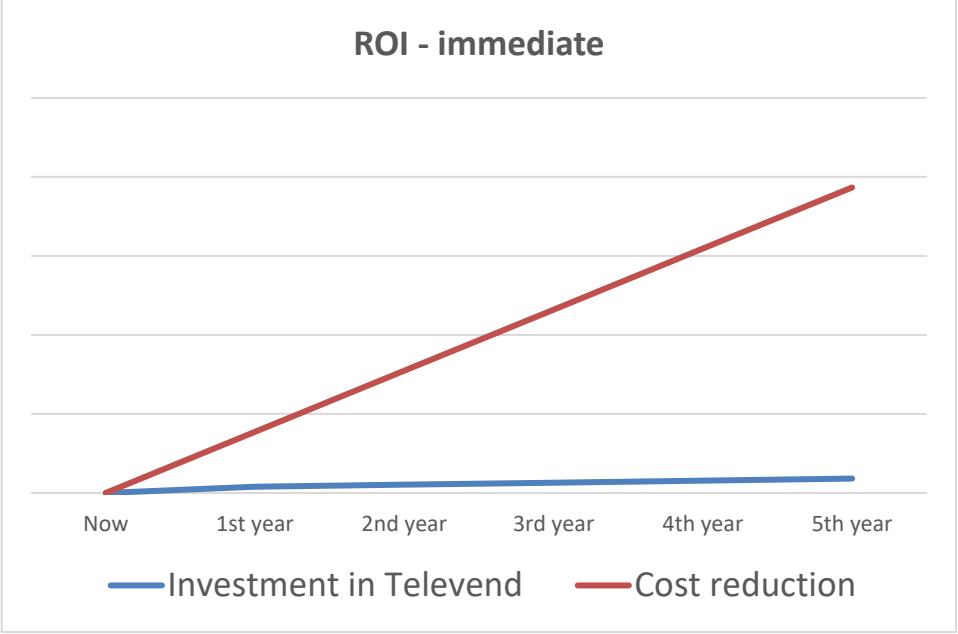
Element	Guiding questions	Answers
		Operations features to optimize and improve their daily business. One hardware, two solutions. 
OBJECTIVE AND TARGET AUDIENCE		
Geographical coverage and target audience	What is the geographical range where the good practice has been used / tested / validated: country, region, Danube Region if is relevant and possible	The product is designed and produced in our headquarters in Zagreb, Croatia. The product is sold in more than 40 countries in EU, and distributed by specialized partners from Germany, Austria, Spain, Portugal, UK, Slovenia, Hungary.

Element	Guiding questions	Answers
	Specify also the target audience/potential customers and stakeholders (stakeholders can affect or be affected)	Their customers are the biggest vending operators in EU and vending machine producers.
Targeted customers and scale of use	Select the target group of customers: 13. SMEs (<250 employees) 14. Large companies 15. Public institutions 16. End customer (Business to Customer) Other, please specify	SMEs and Large companies Also, their product enables their customers to communicate with End Consumers (4) through Televend Wallet mobile application.
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	The key driver of the solution is exactly to increase logistical efficiency of the vending operator: 
	Quality assurance aspects, if applicable	All software and hardware components are tested by their QA team and product possess all quality certificates which ensures sales on the global market.

Element	Guiding questions	Answers
	Risk management aspects, if applicable	N/A
Implementation guidelines	How can the Good practice be implemented?	Solution is implemented by their key account managers who work closely with the clients, educating them on the software and hardware implementation, and they also have customer support in daily communication with the customers.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	The team for this project is consisted of 50 people working in following departments: • cloud development team • basic infrastructure development team • It system support • mobile app dev team • firmware development team • hardware development team • wallet dev team • testers team, • product management team , • customer support team, • production management • sales • procurement, • QA team • management
VALIDATION PROCESS		
Validation	Provide a brief description of the good practice validation process.	Every development is done according to the best development practice. After every development cycle, QA team is responsible that improvements and new developments are delivered to the customers.

<table>
<tr><th>Element</th><th>Guiding questions</th><th>Answers</th></tr>
<tr><td colspan="2">RESULTS / IMPACT</td><td></td></tr>
<tr><td>Solution impact</td><td>What has been the impact (positive or negative) of this good practice on the beneficiaries</td><td>Case studies show massive improvement in cost efficiency of vending operators in many areas.
Following table shows a measured case study with one customer who owns 3200 vending machines whit a solution for all mentioned areas which proved that following savings are possible.

Recalculation on 3200 machines during a 6-month period (230 snack & cold drink machines and 3 fillings)
<table><tr><th>Reason</th><th>Annual cost</th></tr><tr><td>Unnecessary visits</td><td>2.030.191,30 EUR</td></tr><tr><td>Expired products</td><td>85.176,57 EUR</td></tr><tr><td>Working capital cost</td><td>24.192,00 EUR</td></tr><tr><td>Failed vend</td><td>378.657,39 EUR</td></tr><tr><td>Price incorrect</td><td>10.685,22 EUR</td></tr><tr><td>Cashless malfunction</td><td>584.000,00 EUR</td></tr><tr><td>Coin changer fail</td><td>467.200,00 EUR</td></tr><tr><td>Planogram</td><td>583.680,00 EUR</td></tr><tr><td>Total:</td><td>4.163.781,91 EUR</td></tr></table></td></tr>
</table>

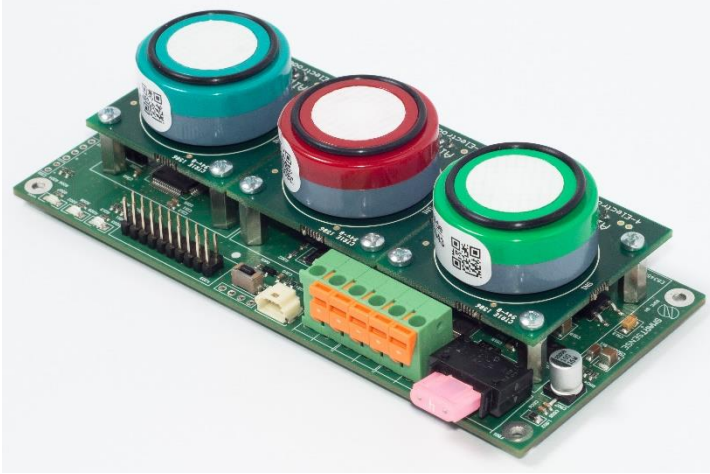
Element	Guiding questions	Answers
		
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	Compatibility is one of the main challenges on the market with almost thousand different machine types. Different communication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

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

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

5 TEMPLATE FOR GOOD PRACTICE DOCUMENTATION

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

Element	Guiding questions	Answers
		 System enables remote control, monitoring and configuration of AirQ system and OTA software upgrades managed by Smart Sense server. Monitoring station uses very sensitive electrochemical gas sensors. Each gas sensor is factory calibrated and lasts for up to 24 months, depending on air pollution. Gas sensors can be easily exchanged on the field without a need for deinstallation of monitoring station. For monitoring particles, the laser optical sensing modules is used.
GOOD PRACTICE DESCRIPTION		

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

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

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

Element	Guiding questions	Answers
		Smart Sense is using service provider (Deutsche Telekom, Croatian Telekom, Nokia, Huawei, Ericsson, …) sales and marketing strength to sell Smart Sense – Smart City AirQ Environmental Monitoring System. Target audiences are Smart Cities and various city institutions using air quality data.
Targeted customers and scale of use	Select the target group of customers: 17. SMEs (<250 employees) 18. Large companies 19. Public institutions 20. End customer (Business to Customer) Other, please specify	Target group of customers are Public institutions through service provider sales channel.
METHODOLOGICAL APPROACH		
Managerial aspects	Cost efficiency of the good practice, if applicable	N/A
	Quality assurance aspects, if applicable	N/A
	Risk management aspects, if applicable	N/A
Implementation guidelines	How can the Good practice be implemented?	By making initial business research regarding market potential and product development, by using processes that have been effective in previous projects, using qualitative materials and components used in product development and reliable partners who can help them in development and production processes.
	What resources are necessary for implementation (personnel, finance, infrastructure and timespan)?	HW, SW and business experts, financial support, infrastructure, reliable production partners.
VALIDATION PROCESS		

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

Element	Guiding questions	Answers
		Places with good air quality can put this information on a display and make it available to citizens and tourists, especially on places like National parks, City centre, Beaches… Better overview of air quality enables better traffic management, e.g. redirect traffic in order to reduce air pollution on critical points, avoid closing whole City centre for cars because of the lack of relevant information on air quality. **Actions:** Real-time traffic surveillance and control – i.e. dynamically modifying speed limit, traffic light period or closing off critical areas for general traffic. Real time pollution incident detection and location, identification of safe evacuation routes, precise alarming. Conduct pollution characterization research – long term improvement actions.

Element	Guiding questions	Answers
		Comprehensive pollution maps, influence travel advice, weather forecasts for joggers, children and sensitive population. Parking management and pricing depending on air pollution; e.g. bigger prices for parking in the centre of town when pollution is rising.
SUCCESS FACTORS AND CONSTRAINTS		
Limitations and Strong points	Describe limitations, both from the technical and implementation point of view	Big development and production costs; limited number of suppliers who are critical for production process; no local presents outside of Croatia
	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	Smart Sense – Smart City AirQ Environmental Monitoring System best-selling points are: Collaboration with Andrija Stampar Teaching Institute of Public Health in Croatia in validating Smart Sense AirQ Monitoring Station data with professional environmental station data. Solutions is “white-label” conceived, so service providers could sell it as their own. Easy scaling and adjustments to customer requirements.
Need assessment	What else would be needed in order to improve the impact of the Good practice	Employee education, larger production series, more field tests in different environments.

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

Element	Guiding questions	Answers
		- Real time pollution incident detection and location - Conduct pollution characterization research - Comprehensive pollution maps - Parking management
	What are the possibilities of extending the good practice more widely?	Wider Smart City Initiatives and approach to other service provider in Smart City Initiatives worldwide
FINAL REMARKS		
Conclusion	Conclude specifying / explaining the impact and usefulness of the good practice.	Smart Sense – Smart City AirQ Environmental Monitoring System: - Promote City as a place to live in - Promote City as a tourist destination - Help in problems with traffic management and regulations - Ensures better model for Air Quality index in urban area
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