

DOCUMENT TITLE:

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# GOOD PRACTICE REPORT FOR SERBIA

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

**Acronym: Smart Factory Hub**

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

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# 1 INTRODUCTION

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

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

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

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

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

UTC-N collected the following good practices cases:

No.	Name of the Good Practice	Classification <sup>1</sup>
1	OSICE - OPTIMIZATION AS A SERVICE IN CLOUD ENVIRONMENT	Optimization, Cloud processing
2	EcoTherm - a set of coatings for thermal insulation of wood hive	Smart materials
3	CNC robotic packing, palletizing and welding	Smart, fast, and easy programming of welding robots
4	Production of disinfectant at the place of consumption	Smart solutions for automatic disinfectant production
5	Individual orthopedic cartridges, CAD / CAM technology	Design for X

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<sup>1</sup> According GOOD PRACTICE GUIDELINES

# 1 GP1: OSICE - OPTIMIZATION AS A SERVICE IN CLOUD ENVIRONMENT

## Vodéna

Vodena d.o.o.

Contact person:

**Boban Stojanović**

Address:

**Kralja Milana IV 19b/5**

**34.000 Kragujevac, Serbia**

e-mail: [office@vodena.rs](mailto:office@vodena.rs)

tel: **+381 69 1154375**

website: [www.vodena.rs](http://www.vodena.rs)

**Keywords:** OSICE - Optimization as a Service in Cloud environment

*Good practice applied in: (NACE code):* Software Development Services (NACE code 62.0)

*OSICE is a Cloud service intended for solving complex optimization problems in the distributed computing environment. It provides all interested third parties, especially low resources stakeholders like SMEs, with the effective tool for the problem solving and decision making. This goal is achieved through the implementation of the optimization procedures based on evolutionary algorithms (EA) in Cloud computing environment and through the development of simple and intuitive application programming interface (API).*

## 1.1 GOOD PRACTICE DESCRIPTION

Vodena is an innovative ICT company established as a research spin-off from the Faculty of Science, University of Kragujevac, Serbia. Our enterprise offers university-strength research, modeling, simulation and data analysis, all integrated through flexible and efficient software applications. After years of experience in solving various optimization problems we have developed a web service for solving optimization problems on supercomputers using evolutionary algorithms. Finally, we have decided to offer the service to the market as a Cloud service.

OSICE is an innovative ICT concept which will disrupt existing markets of optimization software and create new ones by enabling SMEs to utilize immense computational power of the Cloud for optimization problem solving and decision making, regardless their financial, technological and knowledge level.

Technical solutions and innovations of the good practice are:

- Service Oriented Architecture (SOA) approach to the optimization software, which allows the optimization methods to be exposed as an Internet service.
- Fully automatic allocation of the computing resources on HPC or Cloud infrastructure, which provides enough computing power hiding the implementation details from the user.

- Frugal utilization of the computing resources in accordance with the current service load, resulting in financial savings and minimal energy consumption.

According to company's best knowledge, direct competition in the field of cloud-based optimization service does not exist at the moment. Currently, commercially available solutions available on the market (IBM, SAS, Lindo Systems Inc., AIMMS B.V., AMPL Optimization Inc., ...), although robust and reliable, are often very expensive and do not offer proper HPC support. On the other hand, open source solutions such as jMetal, OptaPlanner, Scilab, HeuristicLab HIVE, and others are publicly available, but their application requires significant expertise in the field of software development and optimization. Nevertheless, these solutions are still not comprehensive enough. For instance, OptaPlanner does not support multi-core execution, while HeuristicLab HIVE requires that the user establishes computing infrastructure on his own. The necessity of possessing expertise can be partially overcome by employing a consulting company specialized in solving certain types of optimization problems. Unfortunately, the services offered by these companies are often very expensive and unavailable to SMEs, due to engagement of highly qualified and scarce experts.

OSICE is a modular system that consists of:

- **WoBinGO** - the framework for parallel execution of the evolutionary algorithms
  - **JARE** - evolutionary algorithms library
  - **Work Binder** - the component in charge of elastic allocation of the distributed HPC/Cloud resources
- **JARE Service** - the optimization service which exposes functionalities of JARE library.
- **JARE Manager** - user exposed web application for optimization management and monitoring. Intended for both experts and users.

**Binder Manager** - web application for administration, monitoring and management of Work Binder service. Intended for HPC/laaS admins.

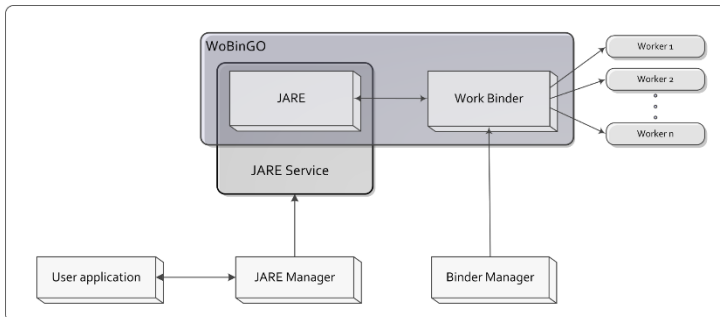


Fig 1 - Logical architecture of OSICE - component view



Fig. 2 - JARE Manager, user view. Monitoring the objectives in real time

## 1.2 OBJECTIVE AND TARGET AUDIENCE

Company's greatest achievement so far is the development and deployment of comprehensive data analysis and optimization solution employed at "Iron Gate" hydropower plant on Danube river. The solution uses OSICE as an underlying optimization engine.

The key segment of our identified users are European SMEs, with 50-250 employees, in high-tech manufacturing sector and high-tech knowledge-intensive services sector, especially telecommunications, computer programming, consultancy and related activities, information service activities and scientific research and development. These companies are already familiar with the benefits of business processes optimization, or optimization in design of products and services, and they are in the need for comprehensive, cost-effective and easy-to use optimization solution, or cost-effective alternative to existing in-house optimization solutions.

## 1.3 METHODOLOGICAL APPROACH

Implementation of our cloud-based optimization solution eliminates need for initial investment in HPC equipment, which ranges from 100,000 to 500,000 EUR. Development of HPC based optimization solutions demands interdisciplinary team, which include domain expert, optimization expert, expert for parallel programming and system administrator. Cost of this team is 200,000 EUR annually. Usage of our product require only domain expert, thus reducing the personnel costs up to 80%.

A crucial business novelty that OSICE brings to the global market is the offer of the optimization in the form of service that can be accessed over Internet. It is achieved through the technological innovation that combines state-of-the-art distributed evolutionary algorithms, cloud-based computational environment and easy-to-use universal API. This combination overcomes two main obstacles for broader usage of optimization, knowledge gap and technology gap.

Due to different internal and external factors, there is a risk of delay in different phases of the project, which can lead to insufficient funding for project completion or market takeover by the competition. Measures to mitigate these risks involve timely assessment of complexity of every activity and provision of sufficient human resources.

In spite of invested effort to expose optimization methods as easy-to-use API, there is a standing risk that resulting interface will still be too complex for the user who is not sufficiently familiar with the optimization techniques. This risk will be diminished by increased understanding of technological level and needs of our potential users.

There is also commercial risk that we will not succeed to reach our key customers. Mitigation measures will involve increased marketing activities.

By accessing **JARE Manager** instance, the expert defines the optimization problem, including the number and types of decision variables, their ranges, optimization goal(s), the algorithm to be used, etc. Moreover, the expert has to supply the evaluator whose role is to assess quality of the potential solution. The evaluator is given in the form of Docker/LXD container or ordinary ZIP that contains the executable(s) and necessary data for the solution fitness evaluation. The evaluator package has to comply to the standardized interface.

The execution of the optimization task itself is left to the **WoBinGO** framework, which hides the complexities of the optimization method and underlying computing infrastructure. The user has

the ability to follow the progress of the optimization process within **JARE Manager**, through its common numerical and graphical elements expressing the current status.

The web application **Binder Manager** is aimed at computing infrastructure administrators. Its main purpose is to enable fine-grain control of the distributed evaluation process. It plays a role of a bridge between the evaluation requests posed by **JARE** and underlying HPC/laaS infrastructure controlled by **Work Binder**. The **Binder Manager** largely facilitates a number of common admin tasks like monitoring laaS instances, cleanup, specifying users' Quality of Service (QoS) requests, etc.

We offer the solution for two, not necessarily distinct, user categories: experts and users. **Experts** encounter optimization problems in their domain (i.e. in production, computer science or hydrology) and try to get a viable solution. For them, OSICE provides tools for specifying optimization parameters, goals, algorithm to be applied, evaluator, etc. **Users** of the optimization service are not as familiar with the problem domain as experts are. They only use the provided optimization scenario of the service. Since typical optimization tasks take hours to days, users need control to start, pause, resume and stop such runs.

## 1.4 VALIDATION PROCESS

The solution has been validated as an underlying engine of several decision support software in hydrology, power production, finance, etc. The most comprehensive and demanding software that uses OSICE is the power production optimization tool employed at "Iron Gate" hydropower plant on Danube river.

## 1.5 RESULTS / IMPACT

OSICE provides a comprehensive solution comparable to in-house optimization solutions **without need for investment in HPC infrastructure** and **reducing the costs of expert stuff by 80%**. In addition, it provides ease-of-use of available commercial solutions, but with possibility to optimize large real-world problems in Cloud-based environment.

## 1.6 SUCCESS FACTORS AND CONSTRAINTS

In spite of invested effort to expose optimization methods as easy-to-use API, there is a standing risk that resulting interface will still be too complex for the user who is not sufficiently familiar with the optimization techniques. This risk will be diminished by increased understanding of technological level and needs of our potential users.

	No initial investment	No need for expert knowledge	Ease of use	Generality	Distributed computation	Price
In-house solutions	X	X	✓	✓	✓	High
Commercial solutions	✓	✓	✓	X	X	Low
OSICE	✓	✓	✓	✓	✓	Low

- **Better laaS support.** In its current incarnation, OSICE is fully tested within a pure HPC and HPC-in-the-Cloud infrastructure. Although the first alpha version, which uses cloud laaS, has been built, this approach needs more thorough testing.
- **Accounting and Billing.** Although OSICE logs all events, the accounting and billing feature has to be implemented more seriously. The service has also to provide an easy to use cost estimator.
- **Service Level Agreements (SLAs).** Since users may have versatile QoS requirements, service level agreements play an important role for the optimization service.

- **Implementation of security standards and data governing procedures** in relation to administering data transfer, storage and backup. Trust and confidentiality can be critical factors in deciding whether to use the services of an HPC/Cloud provider.
- Further improvements of user and admin front ends.

## 1.7 LESSON LEARNED & SUSTAINABILITY

According to INFORMS, winners of Franz Edelman Award for Achievements in Operations Research and Management Science made a cumulative financial impact of \$240 billion in last 40 years through optimization of business processes. Some of these companies are Syngenta, TNT Express, MISO, HP, GM etc. However, SMEs, which contribute two-thirds of total employment and 57% of value added in the EU, **rarely use large scale optimization of real-world problems**, due to the following obstacles:

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

Mentioned gaps drive away the potential users from investment in the optimization tools, and consequently reduces their potential to compete in today's markets.

## 1.8 REPLICABILITY AND UP SCALING

OSICE is an innovative ICT concept which will disrupt existing markets of optimization software and create new ones by enabling SMEs to utilize immense computational power of the Cloud for problem solving and decision making, regardless their financial, technological and knowledge level. It will provide comprehensive, cost-effective and easy-to-use HPC-Cloud-based optimization service.

Optimization as a service in HPC-Cloud based environment is a new concept, and there is no developed market for it. However it is closely related to the cloud computing market, Platform as a Service (PaaS) market, and operational analytics market. Increasing adoption of cloud-based services and IoT technology among SMEs, growing demand of application development platforms, and technological improvement in PaaS services are the major driving factor for PaaS market. Hence the market for PaaS is expected to grow at US \$12 billion with CAGR of 26% between the years 2016 to 2022. Globally the market for operational analytics is valued at €3.3 billion in 2016, with CAGR of 18% and it is expected to reach €9 billion by 2022.

The key driver for the growth of this market is the increasing number of IoT-enabled smart connected devices and sensors, which releases a large amount of heterogeneous data simultaneously. Furthermore, the shifting interests towards cloud deployment, predictive analytics for business, end-to-end automation, and consumer-friendly IoT analytics platform are additional



factors driving this market and creating value in the market. Global cloud service market is expected to reach €249 billion by 2022, at 4% of CAGR between 2016 and 2022.

## **1.9 FINAL REMARKS**

Most of real-world optimization problems require computing resources that largely exceed the capacity of modern personal computers. Solving such optimization problems has so far been a privilege of large companies and research institutions, which can afford specialized expert teams and necessary computing infrastructure. Due to inability to provide adequate human and hardware resources, smaller companies and institutions are forced to avoid optimization of their business procedures, or to rely on commercially available solutions.

OSICE is an innovative ICT concept which will disrupt existing markets of optimization software and create new ones by enabling SMEs to utilize immense computational power of the Cloud for problem solving and decision making, regardless their financial, technological and knowledge level. It will provide comprehensive, cost-effective and easy-to-use HPC-Cloud-based optimization service.

### **Disclaimer / Acknowledgements**

The company describing this good practice doesn't guarantee the successfulness of the solution and can't be held liable for its failure in application.

We agree with on-line and printed dissemination of the information from this questionnaire.

## 2 GP2: ECOTHERM - A SET OF COATINGS FOR THERMAL INSULATION OF WOOD HIVE

***EkoLak***

**EkoLak d.o.o.**

Contact person:

**Nebojša Petrović**

Address:

**Vučić bb.**

**34.210 Rača, Serbia**

e-mail: [ekolaknatur@gmail.com](mailto:ekolaknatur@gmail.com)

tel: +381 34 355 339

website: [www.ekolak.rs](http://www.ekolak.rs)

**Keywords** : Thermal insulation protection of wooden hives  
*Good practice applied in: (NACE code) : Beekeeping*

*EcoTherm is a coating with a very low thermal conductivity coefficient ( $\lambda = 0.0016 \text{ W / (mk)}$ ) making it an exceptional isolator in very thin coatings of 0.7-1.0 mm. When applied on a hive, it very favorably affects the microclimate within the hive, prevents the decline of societies due to great cold or heat, bees consume less energy, they are healthier (no crop formation) and bring more honey.*

### 2.1 GOOD PRACTICE DESCRIPTION

Three years ago, the company won the production of thermal insulation coatings based on the microsphere, which is used in construction. At the Belgrade Building Fair in 2016, the product was awarded with a special award.

Our family has been in contact with beekeeping for a long time and are aware of the negative effects of extreme temperatures on the escape of society. So we came up with the idea to customize our product for that purpose and help solve this problem.

All of our products are ecological - water based. We have done health tests.

The mechanism is based on the most modern raw materials in the form of microspheres with exceptional thermal insulation characteristics.

The main thing is to keep the wood as a natural habitat of bees and to insulate from the outside significantly the thermal insulation properties of the hive. The coating is applied in a thickness of 1 mm and does not affect the dimensions and weight of the hives. This is very important because hives are transported and must be manipulated often with them.

Coatings of other manufacturers do not have thermal insulation properties and can not be compared with our coatings. There are beehives made of styrofoam and plastic that have insulation, but it is not a natural habitat of bees and as such is not widely accepted.



## 2.2 OBJECTIVE AND TARGET AUDIENCE

In the previous period, we tested the product in Serbia and countries in the region (Bosnia and Herzegovina, Montenegro, Croatia, Slovenia, Macedonia, Romania). The test results are excellent and the beekeepers are very satisfied.

In October, we successfully presented the product at the international fair for bee-keeping - Apimondia in Istanbul. There is a lot of interest from around the world, so now we send samples to twenty countries for various tests.

Target group are beekeepers from around the world! Our product positively affects bee companies in all climate zones. The coating has several positive factors on the beehive and bee company and there is no negative factor.

## 2.3 METHODOLOGICAL APPROACH

The investment of beekeepers in our product is not high and it is very fast to pay off. There is no deterioration of societies, healthier and stronger societies and as a result higher honey production.

The application of our products to beeswax all over the world can significantly improve beekeeping.

The product is environmentally friendly, very easy to use and does not require any expensive equipment and training.

## **2.4 VALIDATION PROCESS**

The thermal conductivity coefficient was tested at -IMS-Belgrade  $\lambda = 0.0016 \text{ W / (m.k)}$ .

It is examined according to health safety by Jugoinspekt - Belgrade

A large number of beekeepers with comparative tests confirmed the positive effects of the coating.

## **2.5 RESULTS / IMPACT**

We did not have negative observations.

Positive are numerous:

- Prevent the decline of the bee's society due to extreme temperatures and in winter and flying
  - Prevent the occurrence of mould due to condensation on the walls of the hive
  - It facilitates the maintenance of microclimate in the hive
  - Reduces the disorder of bees because they provide a healthier environment
  - Reduces the consumption of food needed to maintain microclimate
  - We get a stronger and more numerous society
  - Bees can spend more time in collecting pollen ...
  - The length of the wooden hive is prolonged because the coating has a positive effect on the wood. It prevents rapid spread and shrinkage due to sudden changes in temperature and hence the cracking of wood.
- INCREASES HONEY PREDUCTION

## **2.6 SUCCESS FACTORS AND CONSTRAINTS**

The product must be applied at a temperature of 14-30 C. The product must not freeze and should not be in direct sunlight.

Our product is unique on the market. There are no similar products for this purpose. A large number of positive factors and no negative. The product is environmentally friendly, health-minded, easy to apply.

We enable the bee's society to maintain the necessary microclimate in a wooden hive as a natural habitat.

In order for EcoTherm to have the right results, it is necessary to follow the instructions for use and apply it to a standard hive.

## **2.7 LESSON LEARNED & SUSTAINABILITY**

Experience has shown that the best results are achieved when the finishes are of a lighter shade of colors.

Increasing demand and production would probably result in a reduction in product and its massive use.

## **2.8 REPLICABILITY AND UP SCALING**

This type of thermal insulation coating based on microspheres already has application in construction.

Products are perfected every day and we believe that we can find even more useful applications.

## 2.9 FINAL REMARKS

EcoTherm - a set of coatings for thermal insulation of wooden hives is a very useful innovation for beekeeping. By its application, the following positive effects on the wooden hive as a natural habitat are achieved:

- Prevent the decline of the bee's society due to extreme temperatures and in winter and flying
- Prevent the occurrence of mold due to condensation on the walls of the hive
- It facilitates the maintenance of microclimate in the hive
- Reduces the disorder of bees because they provide a healthier environment
- Reduces the consumption of food needed to maintain microclimate
- We get a stronger and more numerous society
- Bees can spend more time in collecting pollen ...
- The length of the wooden hive is prolonged because the coating has a positive effect on the wood. It prevents rapid spread and shrinkage due to sudden changes in temperature and hence the cracking of wood.
- INCREASES HONEY PRODUCTION

### Disclaimer / Acknowledgements

There are no legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed.

### List of attachments:

Attachment 1: video presentation: [https://www.youtube.com/watch?v=qphwXjKN\\_I8](https://www.youtube.com/watch?v=qphwXjKN_I8)

Attachment 2: video presentation: <https://www.youtube.com/watch?v=HOwINxoyLBM>

Attachment 3: video presentation: <https://www.youtube.com/watch?v=Q8uApz-mjV4>

Attachment 4: video presentation: <https://www.youtube.com/watch?v=R0bpln6lheU>

Attachment 5: declaration of conformity:



Declaration of  
Conformity - EcoTher

## 3 GP3: CNC ROBOTIC PACKING, PALLETIZING AND WELDING



ICM Electronics d.o.o.

Contact person:

**Nenad Mičić**

Address:

**Vase Miskina Crnog 2  
21.000 Novi Sad, Serbia**

e-mail: [office@icm.rs](mailto:office@icm.rs)

tel: **+381 21 518 458**

website: [www.icm.rs](http://www.icm.rs)

**Keywords** : Smart, fast, and easy programming of welding robots

*Good practice applied in: (NACE code) :*

*We made a robotic welding system that is programmed through the PC and software for 3D modelling of parts. The traditional way of programming robots is with the help of a cone with which the robot learns how to move. Robot programming software reduced the programming time of the robot from several hours to a few minutes and made a robot suitable for companies that produce small series.*

### 3.1 GOOD PRACTICE DESCRIPTION

Through conversation with customers, we realized that robotics does not pay off to many domestic companies because no one has a big series. While the robot is programmed, a person can wipe half of the parts manually. For this reason, we started developing an application that will enable the robot to be profitable and to companies that do not have a series.

This is a new technology that improves production processes in small-scale companies that can not provide welders or have problems with them.

In the computer software, the 3D model of the work to be welded is inserted. With a few clicks, the positions are marked where they need to be protected. The software automatically generates a robot program. The operator should just insert a piece on the table and load the program of robots that generated the software.

The solution is quite different because it accelerates and facilitates the robot programming process and makes the product more applicable to many customers.

### **3.2 OBJECTIVE AND TARGET AUDIENCE**

The good practice has been used Republic of Serbia.

The solution is globally applicable, and so we will perform on the market.

Target group of customers are: SME's, large companies, end customers...

### **3.3 METHODOLOGICAL APPROACH**

The robot, on average, replaces 9 welders. Companies that need 9 welders can return investments within a year.

It can be applied in any company that has a welding process.

Staff and finance are resources are necessary for implementation.

### **3.4 RESULTS / IMPACT**

So far, the system has been tested only in our production.

### **3.5 SUCCESS FACTORS AND CONSTRAINTS**

It is necessary to have 1 man who knows how to draw in 3D software.

The machine that has so far been used in companies that have a large series can also be used in companies that have small series.

### **3.6 REPLICABILITY AND UP SCALING**

All companies that have the welding process can use this solution and solve many problems related to MHR, improve quality and speed up the production process.

### **3.7 FINAL REMARKS**

All companies that have the welding process can use this solution and solve many problems related to MHR, improve quality and speed up the production process.

#### **Disclaimer / Acknowledgements**

There are no legal loose ends or limitations for dissemination, certify the use of this information for dissemination, online and printed

## 4 GP4: PRODUCTION OF DISINFECTANT AT THE PLACE OF CONSUMPTION



**SIGMA d.o.o.**

Address:

**Marsala Tita 248/b  
25.230 Kula, Serbia**

e-mail: [office@hlorogen.com](mailto:office@hlorogen.com)

tel: **+381 25 731 805**

website: [www.hlorogen.com](http://www.hlorogen.com)

**Keywords** : Ecologically sustainable, safe disinfection, no hazardous substances, at the place of consumption, automatically, in site...

*Good practice applied in: (NACE code):*

C27.9.0 - manufacture of other electrical equipment

C28.9.0 - manufacture of other special - purpose machinery

*Production of disinfectant (1% sodium hypochlorite solution; and a mixed disinfectant - a mixture of sodium hypochlorite and chlorine dioxide) users expel hazardous chemicals from use in the process of disinfection of drinking and process water.*

### 4.1 GOOD PRACTICE DESCRIPTION

First plant for the production of 1% solution of sodium hypochlorite at the place of consumption (in situ) HLOOROGEN® was manufactured and installed in 1996. Since then, over 120 HLOOROGEN and OksiHLOOROGEN plants have been installed on the territory of Serbia and Montenegro.

HLOOROGEN and OksiHLOOROGEN technologies are smart solutions for automatic disinfectant production at the place of consumption that fully disclose the possibility of human error in the process of water disinfection and completely replace the use hazardous chemicals (primarily gas chlorine that is hazardous to human health and life) in water disinfection.

Technological equipment HLOOROGEN at the place of consumption produces 1% solution of sodium hypochlorite in the process of electrolysing of aqueous solution of kitchen salt. To obtain a 1% solution of sodium hypochlorite, only salt, water and electricity are used.

Technological equipment OksiHLOOROGEN at the place of consumption produces a mixed disinfectant - a mixture of sodium hypochlorite and chlorine dioxide it the electrolysis process of water solution of salt uses only salt, water and electricity.

Less energy consumption more cost-effective due to the use of common unheated kitchen salt, it is safer because it produces dilution solutions that are classified as safe chemicals, a complete



solution that combines the production of disinfectant at the place of consumption, automatic dosing administrated by flow and / or residual user training and service.

All awards are available on [www.hlorogen.com](http://www.hlorogen.com) as well as all technical data.

## **4.2 OBJECTIVE AND TARGET AUDIENCE**

Serbia, Montenegro, Romania, Bulgaria, Croatia, Bosnia and Herzegovina, Slovenia.

Water supply companies, meat industry, food industry, hospitals and spas, swimming pools.

## **4.3 METHODOLOGICAL APPROACH**

The use of HLOOROGEN and OksiHLOOROGEN technology reduces the cost of water disinfection from 3 to 5 times.

The user of HLOOROGEN an OksiHLOOROGEN technology receives a modern plant for its own production of disinfectant, which becomes independent from the supplier of strategic chemicals for water disinfection and simultaneously throws away from the use of dangerous chemicals for the health and life of people and the environment.

The documentation of the site is necessary and it is done by our professional team of the manufacturers of technological equipment HLOOROGEN and OksiHLOOROGEN in the order to determine the necessary equipment capacities, space for the installation and configuration of technological equipment .After the technological equipment is produced especially for the known customer, after which it is installed and put into operation.

Necessary resources are: trained rersonnel for the basic management of the technology of SCADA software, this training is provided by the manufacturer of technological equipment, finance and existing infrastructure.

## **4.4 VALIDATION PROCESS**

Validation is done through regular bacteriological and physico-chemical analyses of water.

## **4.5 RESULTS / IMPACT**

Application of technological equipment HLOOROGEN an OksiHLOOROGEN reduces the costs of water disinfection increases the independence of user.

## **4.6 SUCCESS FACTORS AND CONSTRAINTS**

The only limitation is the poor information of potential users about the benefits of this technology for their business process.

Use of easily available raw materials for the production of disinfectant at the place of consumption - kitchen salt, water and electricity. This eliminates the use of hazardous substances and chemicals from the process of water disinfection and ensures greater environmental safety of the water treatment plant. Using this technology users' independence from chemical suppliers for disinfectants is achieved.

Better inform potential users and more emphasis on their education in order to get acquainted with the availability of modern technologies in the field of water disinfection.

#### **4.7 LESSON LEARNED & SUSTAINABILITY**

The use of technological equipment HLOOROGEN and OksiHLOOROGEN prevents the use of hazardous chemicals and materials in the working environment and the contact of employees with them. The presence of hazardous materials from the production process and the environment in which a large number of people lives or works.

Use of easily available raw materials for the production of disinfectant at the place of consumption - kitchen salt, water and electricity. Using this technology users' independence from chemical suppliers for disinfectants is achieved.

#### **4.8 REPLICABILITY AND UP SCALING**

This technology can be implemented with a large number of users from different fields of production and services: water supply, food industry, hospitals and other health facilities, spas, swimming pools and bathing sites, etc.

In addition to the primary users in the field of treatment and distribution of drinking water and wastewater treatment plants, technological equipment HLOOROGEN and OksiHLOOROGEN is applied in the hospitals, food industry, swimming pools and wherever the sanitary safety of water is essential for the production process of service provision.

#### **4.9 FINAL REMARKS**

Use of easily available raw materials for the production of disinfectant at the place of consumption - kitchen salt, water and electricity. This eliminates the use of hazardous substances and chemicals from the process of water disinfection and ensures greater environmental safety of the water treatment plant.

#### **Disclaimer / Acknowledgements**

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## 5 GP5: INDIVIDUAL ORTHOPEDIC CARTRIDGES, CAD / CAM TECHNOLOGY

# ottobock.

Otto Bock Sava d.o.o

Contact person:

Ana Božović

Address:

Industrijska bb

34.000 Kragujevac, Serbia

e-mail: [info@ottobock.rs](mailto:info@ottobock.rs)

tel: +381 34 351 671

website: [www.ottobock.rs](http://www.ottobock.rs)

**Keywords** : 3D scanning of prints, CAD / CAM technology

*Good practice applied in: (NACE code) :*

*Taking footprint, 3D scanning of prints, computer preparation and correction, machine making*

### 5.1 GOOD PRACTICE DESCRIPTION

Based on good years of experience in the development of individual orthopedic cartridges and modernizing technology, CAD / CAM technology has been used in the production of our orthopedic cartridges.

CAD / CAM technology speeds up the production process and improves the quality of fabrication of products, with the help of high-quality materials.

Fingerprint imaging, 3D imaging scanning, computer preparation and correction, machine manufacturing.

The solution speeds up the production process and produces a high quality product.

Contour /  
Contour dečji

Comfort

Sport



CAD/CAM - Kompjuterska priprema  
i korekcije, mašinska izrada



Skenirana stopala ubacuju se u program za obradu

Ubacivanje korekcija

Gotovi model uložka



Projekcija obrade

Projekcija obrade

Projekcija gotovog modela

## **5.2 OBJECTIVE AND TARGET AUDIENCE**

Serbia, end users and companies.

## **5.3 METHODOLOGICAL APPROACH**

It can be applied in cooperation with other companies and end users.

## **5.4 RESULTS / IMPACT**

Positive impact on users.

## **5.5 SUCCESS FACTORS AND CONSTRAINTS**

Working in software, operator on CNC machine.

A faster production process, high-quality materials, Ottobock orthopedic cartridges reduce the effects of micro trauma and save the locomotors system.

Positive user experience, good marketing.

## **5.6 LESSON LEARNED & SUSTAINABILITY**

Positive experiences of the users who come to create more pairs of individual orthopaedic cartridges.

## **5.7 FINAL REMARKS**

Since the introduction of CAD / CAM technology in the production of individual orthopedic cartridges, we have three types of products that are selected in relation to the needs of users, high quality materials in application, faster process of production, which has a positive impact on both workers and users, a positive impact on end users.

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

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

### ***Lesson learned from the perspective of the partner***

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

This time we decided to select about ten companies through Chamber's network that meet our needs and focus on them, instead of sending hundreds of invitations. From 9 selected companies, 5 of them finally responded, although with some difficulties in understanding the questions and, in some cases, with our assistance. There were companies that have promised to fill in the questionnaire, but they failed due to some justified reasons, but this is something that we have to count on.

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