



IF4TM

Institutional framework for development
of the third mission of universities in Serbia

**Report on collected examples
of good practices of technology
transfer and innovation**



IF4TM

D7.5 Report on collected examples of good practices of technology transfer and innovation

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TABLE OF CONTENT

DOCUMENT CONTROL SHEET (Use Style IF4TM_Header)	2
TABLE OF CONTENT	3
EXECUTIVE SUMMARY	4
1. Introduction	5
2. Questionnaire	6
3. Collected questionnaires	10
4. List of collected examples of good practice	12
4.1 UNIVERSITY OF BELGRADE	13
4.1.1 AccuRate	13
4.1.2 Work and Earn website	18
4.1.3 Trusted	21
4.2 UNIVERSITY OF NOVI SAD	26
4.2.1 Customized (individualized) maxillofacial implants	26
4.2.2 Smart Egg	30
4.3 UNIVERSITY OF KRAGUJEVAC	34
4.3.1 Intelligent system for predicting fruit yields	34
4.3.2 DESC – Double exposure, flat-plate solar collector	39
4.4 BELGRADE METROPOLITAN UNIVERSITY	43
4.4.1 ISUM	43
4.4.2 mDita Editor	48
4.5 UNIVERSITY OF NIŠ	52
4.5.1 Press for automatic balling of metal scrap	52
4.5.2 Baker’s planetary mixer	59



EXECUTIVE SUMMARY



1. Introduction

The presentation of good practices from Serbian HEIs in the areas of technology transfer and development of innovations is in the focus of this activity. This was realized during the third project year. Report on these good practices is presented as short public reports. It consists of non-confidential information about developed technologies and realized innovations. The Report will be available at the project and partners' websites and promoted at various project events.

The present report is based on the data about examples of good practices of technology transfer and innovation collected from Serbian higher education institution. All teams whose examples of good practices of technology transfer and innovation are presented here have given their consent for this report to be published on the project website



2. Questionnaire

The questionnaire sent to research teams consisted of three parts filled in by the leader of the research team whose good practice was promoted. The first part provides information about the technology/innovation, the second part offers information about the research team and institution where the technology/innovation was developed and third part gives the data about the technology/research result user as shown below:

PART 1

DESCRIPTION OF TECHNOLOGY/RESEARCH RESULT/INNOVATION

Please describe the expected contribution of the technology/innovation or give a short description of the problem it solves; name also the targeted group of users.

<i>Max 1000 characters</i>

Please describe the competitive advantages of the technology

<i>Max 500 characters</i>

What is innovative in the technology?

<i>Max 500 karaktera</i>

Please describe how the issues of intellectual property are regulated.

<i>Max 300 characters</i>



PART 2

INFORMATION ABOUT THE RESEARCH TEAM AND INSTITUTION

Please give the data about the research team, their competences and the previous research results relevant for the present technology.

Max 1000 characters

Name the most important capacities of the institution where the technology has been developed.

Max 500 characters

Please give a short description of the research process starting with the data collecting and ending with the successfully realized technology.

Max 500 characters

Describe how the technology transfer activities were financed (e.g. national or international projects, companies, own funds, etc.) and in case of several sources of financing, give their shares.

Max 500 characters



PART 3

INFORMATION ABOUT THE USER

Please give a brief description of how the technology user (a company or an innovator) uses the technology

<i>Max 500 characters</i>

Please give a short history of the cooperation with the user, i.e. of the technology transfer

<i>Max 300 karaktera</i>

Name the (short-term) benefits enabled by the technology and the (long-term) expectations

<i>Max 500 characters</i>

Briefly describe how the company's competitiveness and innovativeness were improved as well as its marketing positioning

<i>Max 300 characters</i>



PART 4

ATTACHMENTS/PHOTOGRAPHS

Please provide attachments or photographs which illustrate the technology and resources such as the photographs of researchers, institution, company, etc., or any other material which may be used for designing the promotional material (flyers) of the examples of good practice or a website. If photographs are provided, please write a caption with their titles or explanations (document name jpg).



3. Collected questionnaires

The examples of good practices of technology transfer and innovation were all collected using the same questionnaire (as shown above) presented in D.7.1 Questionnaire for the collection of data about examples of good practices of technology transfer and innovation at Serbian higher education institutions.

Five Serbian higher education institutions out of seven which participate in the project reported eleven examples of good practice, namely:

1. University of Belgrade:

- **AccuRate**, on 26th June 2018 by Centre for Investments and Finances (CIF)
- **Work and Earn website**, on 15th October 2018 by Work and Earn (Uradi-zaradi), a startup company established by Jelena Joksimović, Dušan Cernović and Dragana Jovčić
- **Trusteed**, on 16th October 2018 by Trusteed, a startup company established by Nikola Ćurčić, Jovan Milovanović, Dijana Janošević, Stefan Petričević, Bojan Vasiljević, Marko Petričić and Marko Jovanović

University of Belgrade also reported another example – **Smarting**. It was reported on 10th July 2018 by mBrainTrain, a startup company established by Bogdan Mijović i Ivan Gligorijević. This example is not included in the present report because the procedure defined by the project quality standards required every team to send the signed approval for publishing in the overall report, which this team could not send in the given deadline.

2. University of Novi Sad:

- **Customized (individualized) maxillofacial implants**, by the research team Dr. Igor Budak, Associate Professor at the Faculty of Technical Sciences in Novi Sad; Dr Dominic Egbeer from the International Centre for Design and Research of the Cardiff Metropolitan University; Mario Šokac, Assistant, MSc in Mechanical Engineering at the Faculty of Technical Sciences in Novi Sad; Željko Santoši, Assistant, MSc in Mechanical Engineering at the Faculty of Technical Sciences in Novi Sad; Dr Aleksandar Kiralj from the Faculty of Medicine in Novi Sad
- **Smart Egg (Pametno jaje)**, by the Faculty of Technical Sciences in Novi Sad and the Scientific Institute of Food Technology from Novi Sad

both reported on 10th July 2018



3. University of Kragujevac:

- **Intelligent system for predicting fruit yields**, on 26th July 2018 by Marija Blagojević, Assistant Professor at Faculty of Technical sciences Čačak, University of Kragujevac
- **DESC**, on 13th September 2018 by Nebojša Lukić, Professor, and Novak Nikolić, Assistant Professor, both from the Faculty of Engineering, University of Kragujevac

4. Belgrade Metropolitan University:

- **ISUM**, by the research team of BMU teachers and students receiving scholarship from the company Innovative Software Technologies
- **mDita Editor**, by the research team of BMU teachers, graduate students and students

both reported on 23th July 2018.

5. University of Niš

- **Press for automatic balling of metal scrap**, by the Institute for Mechanical Engineering of the Mechanical Faculty of Niš
- **Baker's planetary mixer**, by the research team of the Innovation Centre at the University of Niš

both reported on 14th September 2018

The collected data will be used to prepare and print brochures/flyers for each example of good practice as a promotional material.



4. List of collected examples of good practice

The examples of good practice of technology transfer and innovation are listed hereafter:



4.1 UNIVERSITY OF BELGRADE

4.1.1 AccuRate

PART 1

DESCRIPTION OF TECHNOLOGY/RESEARCH RESULT/INNOVATION

Please describe the expected contribution of the technology/innovation or give a short description of the problem it solves; name also the targeted group of users.

AccuRate* is software developed as a set of tools for calibration, validation and automated selection based on Probability of Default estimates. It is primarily meant for professional risk managers in banks, but it may also be used by other advanced users not necessarily in financial institutions. As a result, AccuRate* provides PD and the assessment of the rating model for each individual or financial instrument in the portfolio. The models are subject to a detailed check of statistical significance and out-of-sample validation tests. The automated selection is implemented through statistical significance and information criteria.

PD modelling is fully aligned with regulatory requirements and may be used for transition from standardized to internal ratings based approach under Basel III framework as well as for Through-the-Cycle estimations under MSFI 9

Please describe the competitive advantages of the technology

AccuRate* enables the users:

- to create custom factors based on raw data;
- to use expert opinion in factor selecting process in order to capture specific local conditions;
- to opt for multiple competitive models which meet the criteria of statistical significance and are subject to validation tests;
- to have almost unlimited flexibility for parameter selection which are possible risk factors;
- to select multiple stratification method based on a large number of various criteria (sector, region, period, etc.)
- to use highly intuitive user interface which provides progress bar monitoring and reversibility to previous steps option;
- to use all advantages of relational database and built-in tool for data import;
- to archive all relevant intra-steps and results and to export them into xls[x] format;
- to monitor all steps using a detailed methodology instruction based on contemporary relevant references.

What is innovative in the technology?

AccuRate* uses a parallel multiple core calculation and Smart brute force algorithm for globally optimal model search based on model predictive power.



The selection of rating categories is based on K-means clustering method in order to achieve an optimal number of rating categories and their intervals based on every given model.

AccuRate* utilizes advanced methodologies of machine learning for optimization of validation function in model calibration. Combined with *Weight-of-Evidence* (WoE) approach and Firth's bias reducing regression to bypass some of common problems of standard probit and logit models, such as multicollinearity, extreme factor values, missing values, non-linear relationship between log odds and factor itself. The process of extreme values in WoE transformation follows CHAID algorithm (Chi-square Automatic Interaction Detector).

Please describe how the issues of intellectual property are regulated.

AccuRate* is protected in accordance with the laws of the Republic of Serbia on intellectual property rights. Being the owner of this intellectual property, CIF transfers the limited, non-exclusive and non-transferable license rights to use AccuRate* and accompanying services in the licensing agreement. A licensee has the right to use AccuRate* and accompanying services in accordance with his needs and for the purposes defined in the agreement. The license includes creation of 10 user accounts.



PART 2

INFORMATION ABOUT THE RESEARCH TEAM AND INSTITUTION

Please give the data about the research team, their competences and the previous research results relevant for the present technology.

Centre for Investments and Finance (CIF) is a company specialized in research, software development and consulting in risk management. The company was established in 2003 by university teachers from various research fields: economics, finance and physics. Our business is more than a decade long which has enabled us to gain broad experience, develop high levels of professional competence and to understand core needs of our clients.

We have gained much experience in development of software solutions for risk management while implementing a large number of different projects comprising scientific researches, banks, insurance companies, pension and investment funds and other institutions. Our key expertise comprises regulatory standards based on risk, development of quantitative models for risk measure, stress tests, internal rating and scoring systems, risk management and collateral optimization.

We work in a team of fifteen competent and highly motivated professionals of different areas of expertise who are experienced in economics, finance, information technologies, banking, accounting, business administration and financial regulations.

Name the most important capacities of the institution where the technology has been developed.

Beside the University of Belgrade and foreign scientific and research organizations where the authors of AccuRate* developed the concept of the product within their research work, CIF also uses the premises of 200m² with usual equipment necessary for development of software solutions and consulting during implementation of the solutions (4 servers, 18 PCs, accompanying peripheral devices, a scanner, a fax machine, telephones, Smart mobile phones, a projector, etc.), as well as accompanying commercial software tools (licensed operation systems and over 20 types of software applications)

The Ministry of Education, Science and Technological Development of the Republic of Serbia certified CIF as a centre for development and production in 2011.

Please give a short description of the research process starting with the data collecting and ending with the successfully realized technology.

N/A

Describe how the technology transfer activities were financed (e.g. national or international projects, companies, own funds, etc.) and in case of several sources of financing, give their shares.

The activities of development are partly financed with the company funds while in the initial phase they were financed partly through realization of the innovation project "System for advancement of credit



risk control in banking“ of the Ministry of Education, Science and Technological Development of the Republic of Serbia.

PART 3

INFORMATION ABOUT THE USER

Please give a brief description of how the technology user (a company or an innovator) uses the technology

Krajnji korisnici primenjuju AccuRate* kao samostalnu programsku aplikaciju na svom ličnom računaru, uz mogućnost povezivanja aplikacije sa bazama podataka na serverima koji su unutar lokalne mreže korisnika ili dostupni putem virtuelne privatne veze (VPN).

The end users utilize AccuRate* as an independent software application on their PCs. It is possible to connect the application with databases in servers within the local network of users or they may be available via virtual private network (VPN).

Please give a short history of the cooperation with the user, i.e. of the technology transfer

Key knowledge transfer from CIF to users is through workshops where a detailed methodological framework is presented to users along with all technical aspects of solutions.

A standard AccuRate* maintenance tool provides the following:

- regular service version (computer bug removal);
- technical support;
- consulting about methodology.

Name the (short-term) benefits enabled by the technology and the (long-term) expectations

Key improvements relevant for AccuRate* users are an adequate estimation of credit ratings of borrowers, predicting probability of debt default, application of obtained models in the credit granting process in banks, and finally, the use of results of models in defining credit premium.

Briefly describe how the company's competitiveness and innovativeness were improved as well as its marketing positioning

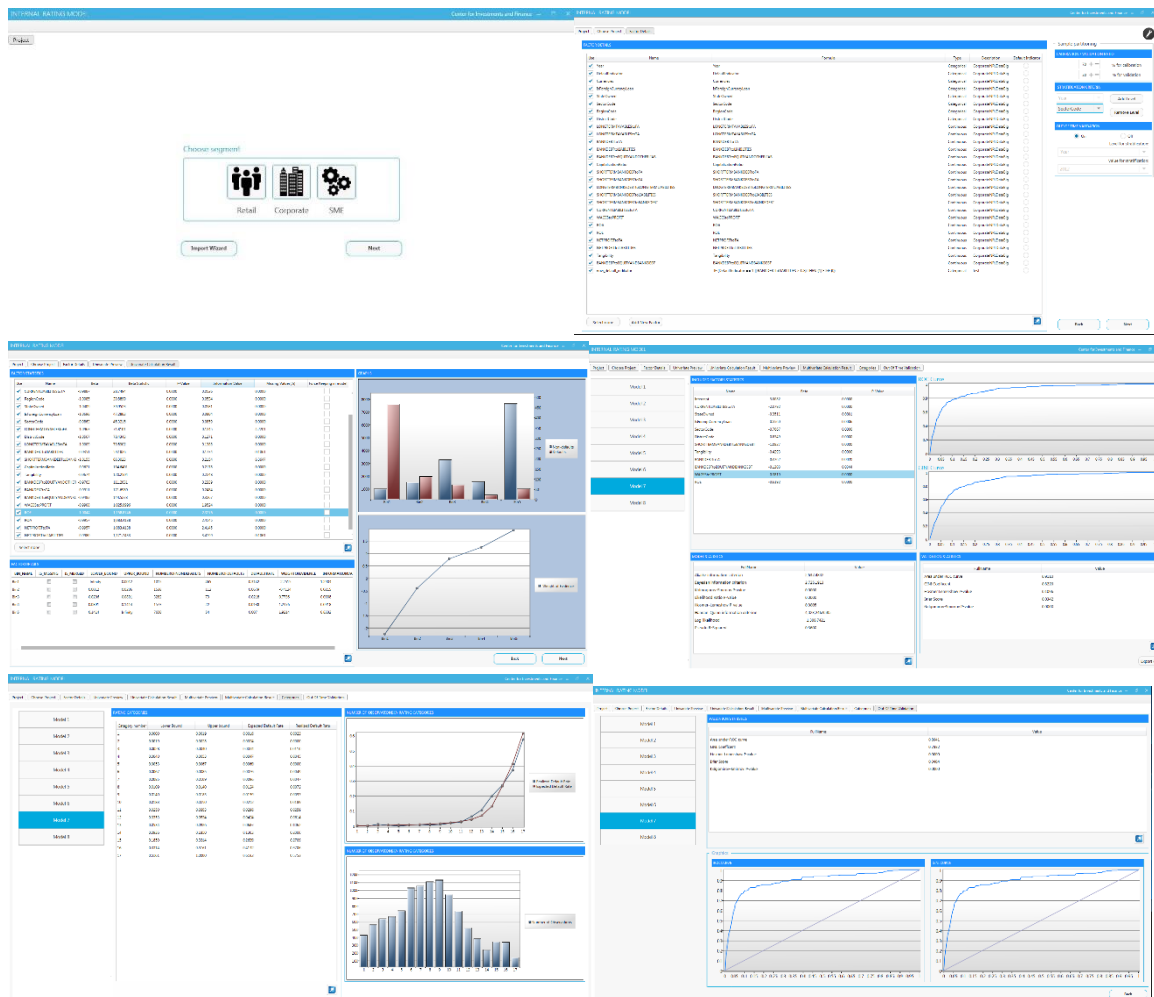
AccuRate* is a product which is in synergy with the basic line of software products – CIF Suite which comprises tools for risk management and regulatory reporting compliant with Basel III standards (RiskGuard*) and tools for provision estimates according to MSFI 9 standards (Select 9). CIF Suite project implementation is currently dominating on the revenue side of CIF, but in the last 12 months CIF has implemented three projects of development of internal creding rating method in domestic banks which used AccuRate* technology.



PART 4

ATTACHMENTS/PHOTOGRAPHS

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4.1.2 Work and Earn website

PART 1

DESCRIPTION OF TECHNOLOGY/RESEARCH RESULT/INNOVATION

Please describe the expected contribution of the technology/innovation or give a short description of the problem it solves; name also the targeted group of users.

Work and earn platform allows people who do not have enough time (entrepreneurs, mothers with children, pregnant women) to delegate household chores to people who can and know how to carry them out.

People who usually work are students, housewives, and unemployed. Innovation is reflected in the process of ordering the service, connecting with candidates, speed and ease of that process and online payment for service. We offer solution that allows finding household help quick, easy and without cash.

The problem we are dealing with is lack of free time. People do not have time for themselves, for friends and family, so we offer them personalized help based on a personalized announcement. On the other hand we enable people who are looking for extra income to earn it by helping someone in their neighbourhood.

We have two target groups:

1. Mothers with small children, pregnant women and entrepreneurs - they order our services most often
2. Students, housewives, workmen and unemployed - they are interested in cooperation with us and finding job

Please describe the competitive advantages of the technology

Our website provides easy way for finding right person who will offer you needed help just by going through few steps. First - you need to fill in the form with information for announcement, then to choose person based on her profile and after work is done – both sides leave comment and ratings about whole process. The advantage is transparent procedure - from posting the ad to candidate selection and writing review. Service is personalized, simple, fast and high-quality.

What is innovative in the technology?

N/A

Please describe how the issues of intellectual property are regulated.

We are in the research process of finding out how we can protect our intellectual property.



PART 2

INFORMATION ABOUT THE RESEARCH TEAM AND INSTITUTION

Please give the data about the research team, their competences and the previous research results relevant for the present technology.

Team

1. Jelena Joksimović - graduated from the Faculty of Mathematics in Belgrade, department of Probability and Mathematical Statistics . Work experience: "eFront" - Customer Service Consultant - one year and six months; "Banca Intesa" - BI Analyst, position in IT sector - one year.
2. Dušan Cemović - graduated from the Faculty of Mathematics in Belgrade, department of Informatics and Computer Science . Work experience: "Qodes themes" - Senior developer, creating custom sites - five years.
3. Dragana Jovčić - graduated from the Faculty of Political Science, department of Political Science. Work experience: Direct Sales Representative - 2 years

Three of us had started to work on the technical part about four years ago, but the idea turned into a business at the beginning of 2016. We applied for the Founder Institute, a global accelerator that have started the first semester of its program in Serbia. We are proud to say that we were one of seven companies that completed this program in May 2016. Next step was entering the Startup Center Accelerator on Faculty of Economics where we, with the help of a mentor, set the basics of business by analyzing everything through data and took further steps relying on that data.

Name the most important capacities of the institution where the technology has been developed.

We have a mentor that guides us through the whole business process and helps us on many levels. Community support, learning, progressing, basing everything on research and testing is always present.

Please give a short description of the research process starting with the data collecting and ending with the successfully realized technology.

We are already on the market with the minimum viable product that we tested for our market. We tested several things - what categories of services are needed by people, how they would like the services to be realized, how they want to pay, what is the best way to connect two sides in cooperation. Research started with interviewing people about which services they needed in the past (for a period of one year) and then we put those categories on the site. After that, we started with marketing and attracting customers to test process itself. So we came to 1500 clients who were looking for some kind of service, 3500 executives and positive comments about the process itself and our work.

Describe how the technology transfer activities were financed (e.g. national or international projects, companies, own funds, etc.) and in case of several sources of financing, give their shares.

The whole project is financed from the founders personal funds. At this point we are trying to find an investment, smart money, an investor who can help with our development.



PART 3

INFORMATION ABOUT THE USER

Please give a brief description of how the technology user (a company or an innovator) uses the technology

Used technologies are programming languages (Javascript, Codeigniter etc.) and frameworks necessary for website development. We also have modern design in line with new trends and user experience.

Please give a short history of the cooperation with the user, i.e. of the technology transfer

N/A

Name the (short-term) benefits enabled by the technology and the (long-term) expectations

Short-term improvements are better user experience, friendly design, modern user testing and constant learning about our clients. Long-term improvements - high quality service, better quality of life for users and centralized platform for all types of household chores.

Briefly describe how the company's competitiveness and innovativeness were improved as well as its marketing positioning

N/A

PART 4

ATTACHMENTS/PHOTOGRAPHS

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4.1.3 Trusted

PART 1

DESCRIPTION OF TECHNOLOGY/RESEARCH RESULT/INNOVATION

Please describe the expected contribution of the technology/innovation or give a short description of the problem it solves; name also the targeted group of users.

Trusted is a B2B SaaS for Instagram analytics which utilizes our machine learning and data science algorithms in order to provide:

1. User personas and segmentation of their followers
2. Actionable advices in order to increase their reach
3. Targeting the specific customer segment
4. Content creation assistance
5. Exporting modular insightful reports.

The product solves problems of marketing agencies and in house marketing teams specifically about understanding their audience and giving them insights about how to create more engaging campaigns and content.

Please describe the competitive advantages of the technology

Advantages are our machine learning algorithms that can provide deep insights from data.

What is innovative in the technology?

Innovative is that we use our algorithms of ML and AI in a very innovative way on a large set of data available to us.

Please describe how the issues of intellectual property are regulated.

N/A



PART 2

INFORMATION ABOUT THE RESEARCH TEAM AND INSTITUTION

Please give the data about the research team, their competences and the previous research results relevant for the present technology.

All team members are students of University of Belgrade.

Nikola Ćurčić and Jovan Milovanović are students of Faculty of Political Science, in charge of managing and communication. Dijana Janošević and Stefan Petričević are from Faculty of Economics and are in charge of finance and marketing. Bojan Vasiljević, Marko Petričić and Marko Jovanović are students of Faculty of Mathematics and are in charge of tech development.

Name the most important capacities of the institution where the technology has been developed.

N/A

Please give a short description of the research process starting with the data collecting and ending with the successfully realized technology.

Thanks to the program of Srtartup center at the Faculty of Economics University of Belgrade we have pivoted from initial idea through our communication with customers and our market research which lead us to this product.

Describe how the technology transfer activities were financed (e.g. national or international projects, companies, own funds, etc.) and in case of several sources of financing, give their shares.

N/A



PART 3

INFORMATION ABOUT THE USER

Please give a brief description of how the technology user (a company or an innovator) uses the technology

User uses our product to analyse their Instagram account in order to increase the visibility and form better communication with customers at Instagram.

Please give a short history of the cooperation with the user, i.e. of the technology transfer

Cooperation was made by contacting marketing agencies and presenting the product by our sales team

Name the (short-term) benefits enabled by the technology and the (long-term) expectations

With this technology they can better understand their target audience and customers on Instagram compared to plain usage of Instagram. Long term goal is for them to increase brand awareness and increase sales.

Briefly describe how the company's competitiveness and innovativeness were improved as well as its marketing positioning

Position of the company is improved because they can now better understand their customers and followers.



PART 4

ATTACHMENTS/PHOTOGRAPHS

Please provide attachments or photographs which illustrate the technology and resources such as the photographs of researchers, institution, company, etc., or any other material which may be used for designing the promotional material (flyers) of the examples of good practice or a website. If photographs are provided, please write a caption with their titles or explanations (document name jpg).



Figure 1: Trusted team.jpg

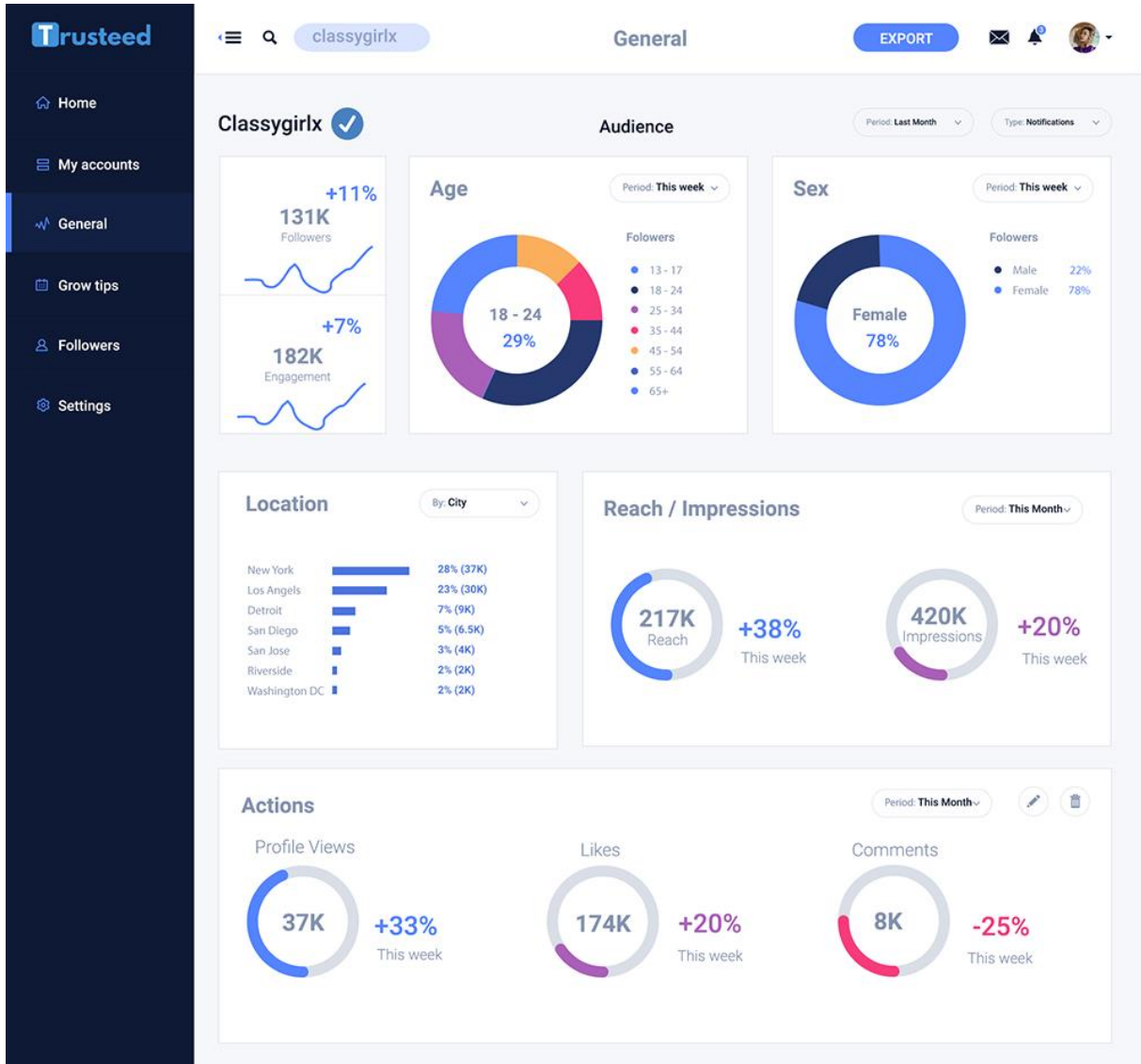


Figure 2: Tool.jpg



4.2 UNIVERSITY OF NOVI SAD

4.2.1 Customized (individualized) maxillofacial implants

PART 1

DESCRIPTION OF TECHNOLOGY/RESEARCH RESULT/INNOVATION

Please describe the expected contribution of the technology/innovation or give a short description of the problem it solves; name also the targeted group of users.

The rising number of bone fractures in car accidents, the more frequent appearance of bone defects caused by tumors, and the increased demand for reconstructive aesthetic procedures, often associated with facial areas, show the serious need for maxillofacial implants. The use of such implants has great potential for improving medical services and hence the quality of life for a large number of patients. Implant design, while meeting technical and aesthetic needs, also requires deep knowledge and collaboration between multiple disciplines. Adjustment of implants to each patient individually provides significantly better comfort, more efficient and accurate work of doctors-surgeons, reduced risks of infection and shorter recovery periods. In the past few years, lower costs of 3D design systems with medical imaging software and additive technologies, i.e. 3D printing technologies have opened up wider possibilities for designing and constructing such implants.

Please describe the competitive advantages of the technology

With the advancement of CAD / AM technology, their application in all areas of science and technology has been considerably improved. This will open possibilities to integrate these technologies into other areas of application such as the field of medicine, specifically in the field of maxillofacial region. This integration has led to faster and better medical care for patients.

What is innovative in the technology?

Customized (individualized) implants used for reconstructive surgery in the maxillofacial region get slowly to increase their use due to the better performance they provide. The reason for this is their precise adaptations in the field of installation, time reduction for surgical procedures, as well as better aesthetic characteristics. Application of the CAD / AM system allows the design and manufacture of customized crystallized implants at an affordable price, and in a shorter period of time. Different 3D printing technologies also allow the development of complex anatomical structures without any design restrictions, which are made from biocompatible materials. The produced implants obtained using 3D printing technology have good mechanical characteristics, which correspond to the properties of bone structures at the place of their installation.

Please describe how the issues of intellectual property are regulated.

These aspects will be devoted to attention in the coming period.



PART 2

INFORMATION ABOUT THE RESEARCH TEAM AND INSTITUTION

Please give the data about the research team, their competences and the previous research results relevant for the present technology.

The research team that participated in the development, design and implementation of this technology consists of the following members:

Design team:

Prof. Igor Budak, UNS, FTS, RS

Dr Dominic Egbeer, PDR, CMU, UK

MSc Mario Šokac, UNS, FTS, RS

MSc. Željko Santoši, UNS, FTS, RS

Surgical team:

Dr Aleksandar Kiralj, UNS, MF, RS

Name the most important capacities of the institution where the technology has been developed.

In the framework of the Faculty of Technical Sciences, specialized software was used for the design and modification of the implant, in cooperation with the International Center for Design Research, Cardiff Metropolitan University, PDR - International Center for Design and Research, headed by Dr Dominic Egbirom. Surgical implementation was carried out at the Clinical Center of Vojvodina, Faculty of Medicine in Novi Sad.

Please give a short description of the research process starting with the data collecting and ending with the successfully realized technology.

The use of a customized implant and guide enabled the surgeon to take a procedure with a higher degree of safety. Within the development path, the implant has implemented specific design principles and decisions that have contributed to the greater safety and efficiency of the implementation of such an implant. This should be considered in the context of progress in 3D printing and the application of biocompatible materials, the need for efficient multidisciplinary and the changing regulatory framework. It is clear that the hybrid approach of medicine and engineering design begins to give rise to the approach to which medicine is practiced and provides exciting new opportunities.

Describe how the technology transfer activities were financed (e.g. national or international projects, companies, own funds, etc.) and in case of several sources of financing, give their shares.

Usually national / provincial projects as well as personal funds.



PART 3

INFORMATION ABOUT THE USER

Please give a brief description of how the technology user (a company or an innovator) uses the technology

The specificity of the project is reflected in cooperation with the Faculty of Technical Sciences in Novi Sad, where the team of associate professor Dr. Igor Budak designed the 3D model of the implant based on the previously submitted CT images of the patient. Based on the 3D model, it was produced by 3D printing technology, a titanium implant, which was subsequently surgically incorporated into the body of the patient. The realization of the project is facilitated thanks to the cooperation with Dr. Dominic Eggbeer from the International Center for Design Research, Metropolitan University of Cardiff (Cardiff Metropolitan University, PDR - International Center for Design and Research).

Please give a short history of the cooperation with the user, i.e. of the technology transfer

Multidisciplinary cooperation between the Clinical Center of Vojvodina, the Medical Faculty and the Faculty of Technical Sciences of the University of Novi Sad was realized with the support of the Metropolitan University of Cardiff. Thanks to this, in the Clinical Center of Vojvodina for the first time successfully applied individualized titanium implant in the reconstruction of the facial part. The applied approach includes the analysis of all parameters (on the basis of the CT footage that is the basis), based on which 3D planning is done, and then the 3D simulation of defect reconstruction and final design of the implant is carried out. After analyzing all relevant data and in agreement with the patient, it switches to the production of an individualized implant, and its surgical implantation.

Name the (short-term) benefits enabled by the technology and the (long-term) expectations

Multidisciplinary collaboration has made it possible to achieve a successful outcome when using CAD / AM technologies. Such a case requires the application of complex computer software for planning and design with a detailed understanding of the design process and the production process. This should all be connected with detailed knowledge of the clinical condition and surgical techniques. It is rare to have each of these complex disciplines available in one environment. The importance of creating a high quality specification for design and manufacturing becomes critical to ensure patient safety and reduce the number of iterations needed to create the final product. Considering the importance of working together in such cases, a high accent is put on the effectiveness of specific communication tools.

Briefly describe how the company's competitiveness and innovativeness were improved as well as its marketing positioning

The advantages of such an advanced approach are multiple because in one practical surgical intervention, the problem of reconstruction can be solved, which is aesthetically and functionally most suitable for the patient, with minimal complications. The significance of the new approach, based on digital planning and production, is reflected in simplifying the surgical process and significantly reducing its duration with much less risk.



PART 4

ATTACHMENTS/PHOTOGRAPHS

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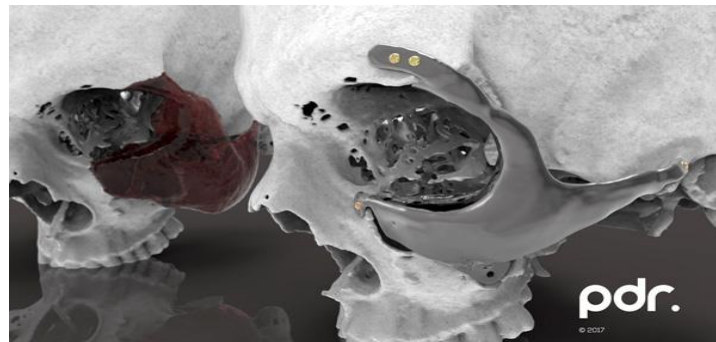


Figure 1: Rendering of the designed implant



Figure 2: A 3D printed model of a skull with a tumor and a set of handbags

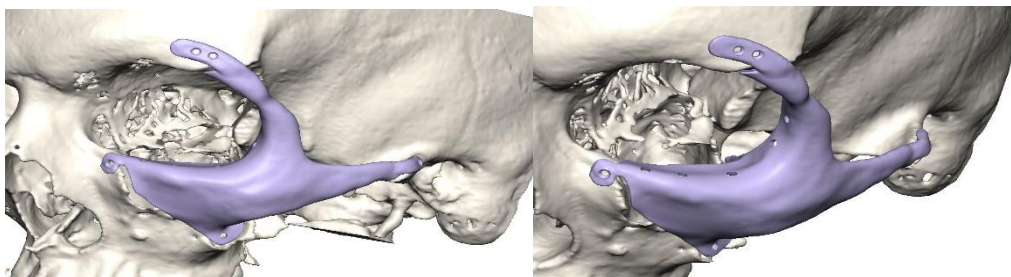


Figure 3: A 3D model of designed implant



4.2.2 Smart Egg

PART 1

DESCRIPTION OF TECHNOLOGY/RESEARCH RESULT/INNOVATION

Please describe the expected contribution of the technology/innovation or give a short description of the problem it solves; name also the targeted group of users.

"Smart Egg" improves the quality of everyday life of people by determining the life span of perishable foods by measuring temperature and humidity, at certain time intervals, in a place where food is stored. The data obtained by measuring are used to determine its useful life on the basis of the lifecycle model of each individual foodstuff.

The primary goal is that "Smart Egg" becomes part of every household, but also provides the basis for the development of other products that can be used in restaurants, bakeries, grocery stores, in order to reduce food throwing. In this way, besides material savings, environmental protection is achieved as the quantity of food waste decreases, as it enables the food to be used during the time period when they are correct for eating.

Please describe the competitive advantages of the technology

The greatest advantage in terms of competitiveness was achieved through the development and implementation of its own technology, which has greatly contributed to the innovation of the "Smart Egg" product. Functionally, the advantage of the "Smart Egg" is that it is an autonomous and mobile device that determines the shelf life of the food in the place where they are stored. The competitive advantage of "Smart Eggs", which has integrated Internet Technology, is the price that is extremely affordable for a product with such characteristics.

What is innovative in the technology?

A smart egg is a typical product that has a label of the Internet of Things. The main purpose is to measure the temperature and humidity in the area where it is located, determining the lifespan of perishable foods that are located in that area. The "Smart Egg" user uses a special application on the smartphone to obtain information about the condition of the food, where he receives all necessary notifications about the status of stored foods and the status of "Smart Eggs".

Please describe how the issues of intellectual property are regulated.

With regard to the protection of intellectual property rights, the first steps are taken regarding patent application. At the moment, the necessary documentation for patent application is collected at the Intellectual Property Office of the Republic of Serbia.



PART 2

INFORMATION ABOUT THE RESEARCH TEAM AND INSTITUTION

Please give the data about the research team, their competences and the previous research results relevant for the present technology.

Part of the team from the Faculty of Technical Sciences, the University of Novi Sad, has a long-standing experience in the field of Internet of Things, Artificial Intelligence and Information and Communication Technologies, which resulted in a large number of scientific and research papers published in both domestic and international journals. Team members participated in the implementation of a number of domestic and international projects.

Collaborators from the Scientific Institute of Food Technology in Novi Sad are licensed process designers, consulting and food safety audit, consulting for quality systems, consulting and auditing for accredited laboratories. Also, they have published a large number of scientific papers and participated in the realization of dozens of scientific-research projects.

Name the most important capacities of the institution where the technology has been developed.

The Faculty of Technical Sciences in Novi Sad is a scientific-educational institution composed of 13 departments, 33 scientific and professional centers and 14 professional services. The Faculty is located in the center of the campus of the University of Novi Sad. It consists of 7 buildings on over 30,000 m² of space. The Faculty has more than 1,200 employees and more than 14,000 students.

Please give a short description of the research process starting with the data collecting and ending with the successfully realized technology.

The idea for this project came from previous research by team members in the field of Internet of Things, artificial intelligence and product tracking in their life cycle. In this research, a large number of researchers from different departments and departments of the Faculty of Technical Sciences in Novi Sad and the Scientific Institute of Food Technology in Novi Sad took part.

Research and development activities lasted 12 months, within which several prototypes were developed, within which various advanced technologies were implemented.

Describe how the technology transfer activities were financed (e.g. national or international projects, companies, own funds, etc.) and in case of several sources of financing, give their shares.

Financing of research areas was provided by the Ministry of Education, Science and Technological Development of the Republic of Serbia, the Provincial Secretariat for Higher Education and Scientific Research Activities of the Autonomous Province of Vojvodina. Within the framework of the international project, through the process of crowd funding campaigns, funds were provided for further research and development. In addition, significant own funds have been invested.



PART 3

INFORMATION ABOUT THE USER

Please give a brief description of how the technology user (a company or an innovator) uses the technology

Long-standing knowledge and experience gained through research in the field of electronics, information systems, the Internet of Things, artificial intelligence and food technologies have been implemented in the development of an innovative product.

Please give a short history of the cooperation with the user, i.e. of the technology transfer

The product was transferred through a spin-off company of the Faculty of Technical Sciences which enabled its commercialization on the market.

Name the (short-term) benefits enabled by the technology and the (long-term) expectations

In addition to material savings, the use of "Smart Eggs" also helps to protect the environment by reducing the amount of food waste. With a very affordable price, it is possible to add any smart place to any storage room. Bearing in mind the trend of technology development, it is expected that this product will enable further development of new products in the field of Internet of Things.

Briefly describe how the company's competitiveness and innovativeness were improved as well as its marketing positioning

By developing the "Smart Egg" product, the company achieved significant market recognition and positioned itself as a leader in the development of technologies in the field of Internet of Things. Thanks to the success of an innovative product on the market through its placement, interest in all products and services of the company is growing.



PART 4

ATTACHMENTS/PHOTOGRAPHS

Please provide attachments or photographs which illustrate the technology and resources such as the photographs of researchers, institution, company, etc., or any other material which may be used for designing the promotional material (flyers) of the examples of good practice or a website. If photographs are provided, please write a caption with their titles or explanations (document name jpg).

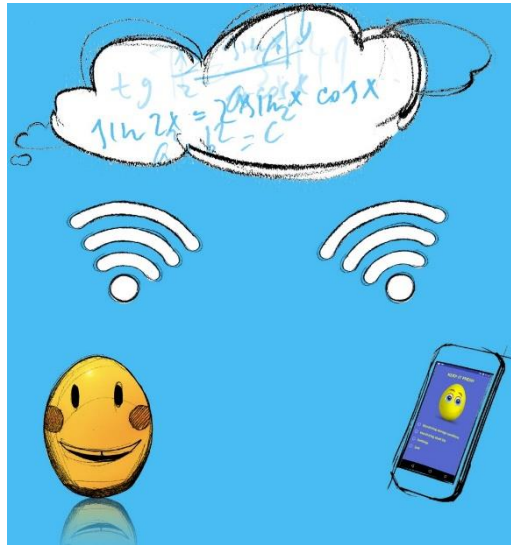


Figure 1: Display of the communication infrastructure for "Smart Egg"



4.3 UNIVERSITY OF KRAGUJEVAC

4.3.1 Intelligent system for predicting fruit yields

PART 1

DESCRIPTION OF TECHNOLOGY/RESEARCH RESULT/INNOVATION

Please describe the expected contribution of the technology/innovation or give a short description of the problem it solves; name also the targeted group of users.

This invention shows the use of artificial neural for predicting the apricot yield per hectare. Invention could be applied in other fields of agriculture, for predicting yield of other fruits or vegetables, or other parameter(s). The goal of this invention is to determine possibilities for using artificial neural networks for predicting the apricot yield per hectare if the following items are used as input parameters: fertilizer, date of harvest, irrigation system, number of treatments with pesticides, pruning type, hail protection, maintenance of the land, average annual temperature, average annual precipitation, and early frost. The goal of this invention also includes the creation of an application that displays final research results, received through neural networks. The results point to the possibility of successful application of the above mentioned methods. Advantages of the created system are: simple to use, possible to predict apricot yield, possible to include other models for data mining, possibility for predict yield of other fruit cultures.

Please describe the competitive advantages of the technology

Advantages of the created system are:

- Simple to use
- Possible to predict apricot and apple yield
- Possible to include other queries to get knowledge
- Possible to include other models for data mining
- Possible to include other areas which are interesting for industrial partner.

Special advantages which are important for agricultural domain are related to basic characteristics of created system. It enables end users (agricultural producers) to see the results of predictions of apricot yield via neural networks, without requiring them to possess special knowledge and skills that relate to work with artificial neural networks, but only basic knowledge from information technologies. The importance in agricultural domain relates to the possibility of planning future work and influence of certain input parameters in order to create a desired yield.

What is innovative in the technology?

In this invention approach is innovative. Artificial neural network is used for predicting yield with specific input parameter choosed with agricultural producers.

Please describe how the issues of intellectual property are regulated.

Invention is software so it is not patentable in Serbia. But, software is protected with registered trademark. Also, with every interested customer is signed licence agreement.



PART 2

INFORMATION ABOUT THE RESEARCH TEAM AND INSTITUTION

Please give the data about the research team, their competences and the previous research results relevant for the present technology.

Marija Blagojević is assistant professor at Faculty of Technical sciences Čačak, University of Kragujevac. She obtained PhD degree from University of Niš, Faculty of Electrical engineering. PhD thesis is related to appliance of data mining techniques with purpose of improvement learning management systems. Her area of interest is artificial neural network appliance in agriculture. She wrote several articles with the mentioned subjects. Proposed project leader is reviewer for journals and conferences and active participant in national and international projects. She participates in several Erasmus+ mobilities to get valuable knowledge from other universities.

The competencies of this researcher is available at: www.ftn.kg.ac.rs/marija.blagojevic

Name the most important capacities of the institution where the technology has been developed.

Faculty of Technical Sciences Čačak is a higher education and scientific research institution, established in 1975. The faculty is a member of University of Kragujevac. The mission of the Faculty is to educate future engineers in the field of Electrical and Computer engineering, Information technology and Management, and master professors in the field of Technics and Informatics, as well as to contribute to scientific research and development of the economy by transferring the acquired knowledge.

Detailed information about Faculty could be find at: <http://www.ftn.kg.ac.rs>

Please give a short description of the research process starting with the data collecting and ending with the successfully realized technology.

The invention started from problem definition and research which is published in international scientific journal. After publication, the idea was further developed and improved. Through IPA and Innovation fund Serbia the innovation is developed and published. Also, during project first interested company has shown (Agrivi doo).

Describe how the technology transfer activities were financed (e.g. national or international projects, companies, own funds, etc.) and in case of several sources of financing, give their shares.

The technology transfer is financed through project of Innovation fond Serbia:

1. "Intelligent system for predicting fruit yields", project from the Innovation Fund technology transfer fund program financed by EU funds 2013 IPA funds, from 3 May 2017 until 3 November 2017 the registration number of the project: 2014 / 354-899



PART 3

INFORMATION ABOUT THE USER

Please give a brief description of how the technology user (a company or an innovator) uses the technology

The interested company (Agrivi from Croatia) implemented solution as service which they offer to their customers.

Please give a short history of the cooperation with the user, i.e. of the technology transfer

During developing project idea interested company proposed collaboration. Within TTF project collaboration has been implemented.

Name the (short-term) benefits enabled by the technology and the (long-term) expectations

In the short term: Invention enables end users (agricultural producers) to see the results of predictions of apricot yield via neural networks.

In the long term: The importance in agricultural domain relates to the possibility of planning future work and influence of certain input parameters in order to create a desired yield.

Briefly describe how the company's competitiveness and innovativeness were improved as well as its marketing positioning

The competitiveness of company which adopted proposed solution is increased with including academic knowledge in existing offer. Also, beside standard set of tools which interested company offer, this module is advanced, for predicting fruit yield.



PART 4

ATTACHMENTS/PHOTOGRAPHS

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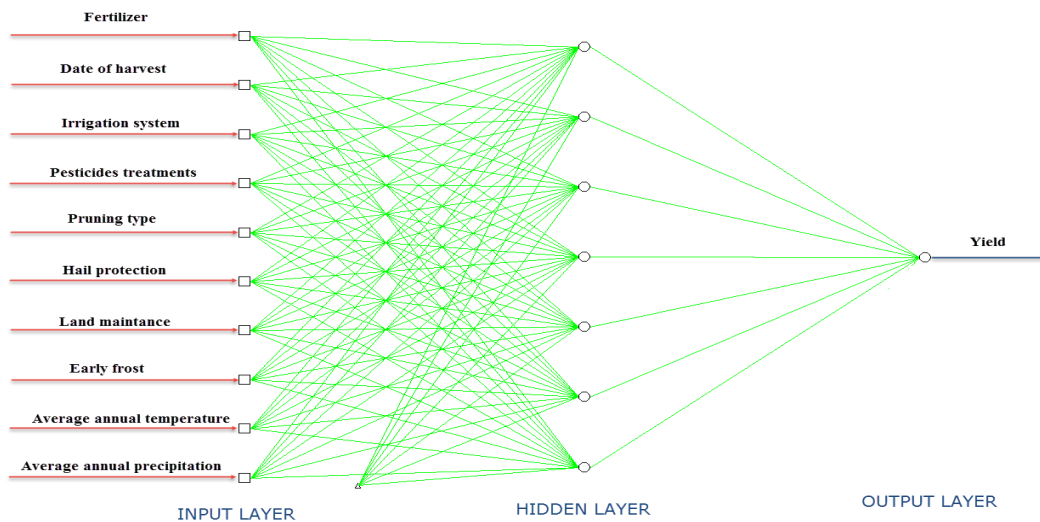


Figure 1: Neural network model

Figure 2: Calculator for predicting yield within Agrivi platform



Figure 3: Faculty of Technical Sciences Čačak



4.3.2 DESC – Double exposure, flat-plate solar collector

PART 1

DESCRIPTION OF TECHNOLOGY/RESEARCH RESULT/INNOVATION

Please describe the expected contribution of the technology/innovation or give a short description of the problem it solves; name also the targeted group of users.

The most common thermal solar systems are flat-plate (water) solar collectors. The mentioned collectors transform solar energy into heat energy through an absorber plate with high thermal conductivity placed in an insulated box with a flat glass cover. The main carrier of heat energy is a working fluid (water or antifreeze liquid) that passes through the absorber or absorber tubes integrated or attached to the same. The proposed thermal solar system is a double exposure, flat-plate solar collector with a flat-plate reflective surface (DESC). The main role of the reflector, which is placed below and parallel to the collector, is the reflection of solar radiation on the lower absorber surface. To enable absorption from the lower absorber surface, it is necessary for the insulation mounted on the lower part of the collector box to be removed and the lower box surface replaced by a glass cover. Performance of the proposed model can be significantly higher than a conventional solar collector.

Please describe the competitive advantages of the technology

The main advantages of the proposed collector-reflector system are: parallelism between the reflector and the collector, mirror reflective surface and mobility of the reflector in all three possible orthogonal directions, relatively simple and cheap construction and significantly higher thermal power.

What is innovative in the technology?

The materialized DESC prototype is different from the previously described similar systems in many ways. First, the reflector is placed in parallel below the collector. In this way, the incident angle of the solar beam falling on the upper absorber surface is the same as the incident angle of the reflected solar beam. The second difference is that reflective surface in this system is a Plexiglas mirror with a specular reflection, which means that the incident and reflected angles are the same. The reflector is movable in all three possible orthogonal directions. The reflector dimensions are approximately the same as those of the collector.

Please describe how the issues of intellectual property are regulated.

The described DESC model is theoretical and experimental investigated and the results are published in highly rated scientific journals. DESC prototype is effective only with precised moving of the reflector. Appropriate moving of the reflector is controlled by software developed in the laboratory, thus IP is protected in this way (software as copyright).



PART 2

INFORMATION ABOUT THE RESEARCH TEAM AND INSTITUTION

Please give the data about the research team, their competences and the previous research results relevant for the present technology.

Nebojša Lukić is a professor at Faculty of Engineering, Kragujevac. His scientific topics are Thermodynamics, Heat and mass transfer, Energy in buildings, Solar energy. He carried out the several scientific investigations abroad, at Erlangen-Nuremberg University (LSTM and LTT institutes).

Novak Nikolić is an assistant professor at Faculty of Engineering, Kragujevac. He was pronounced as the best graduated student at University of Kragujevac (2008). His scientific topics are Thermodynamics, Energy in buildings, Heating and refrigeration, Solar energy. Defined DESC model presents a part of his PhD work.

Name the most important capacities of the institution where the technology has been developed.

Faculty of Mechanical Engineering from Kragujevac (established in 1960) belongs to the group of the most distinguished and the most prestigious educational institutions in the field of technical sciences. The role of the Faculty of Mechanical Engineering is to rationalize, test and develop innovations in the field of engineering or technical sciences, as well as to help the development of the region and wider, through scientific and technical support. Vision of the Faculty is to evolve into a modern European academic institution recognized by its scientific and scientific-research achievements and by achievements of former students and after graduates in the field engineering techniques.

Please give a short description of the research process starting with the data collecting and ending with the successfully realized technology.

This investigation and materialized model of DESC are a part of project TR 33015 of the Technological Development of the Republic of Serbia. Investigation was carried out within PhD thesis

Describe how the technology transfer activities were financed (e.g. national or international projects, companies, own funds, etc.) and in case of several sources of financing, give their shares.

The financial support of the described investigation was obtained by Ministry of Education, Science and Technological Development of the Republic of Serbia (scientific project TR 33015).



PART 3

INFORMATION ABOUT THE USER

Please give a brief description of how the technology user (a company or an innovator) uses the technology

Construction Company OBI Kragujevac is user of prototype and results of investigations.

Please give a short history of the cooperation with the user, i.e. of the technology transfer

OBI Company is the participant within the scientific project TR 33015.

Name the (short-term) benefits enabled by the technology and the (long-term) expectations

The experimental and theoretical results show that performance of a double exposure, flat-plate solar collector can be significantly higher than a conventional solar collector. The experimentally obtained relative difference of thermal power of these collectors is in the range of 41.79 to 66.44%, the highest achieved value of this difference in the reviewed literature is 48%.

Briefly describe how the company's competitiveness and innovativeness were improved as well as its marketing positioning

Market of the solar collectors in Serbia is not fully developed. With the materialized technology and prototype, the Company, user of technology will be in a better position in the rising market.



PART 4

ATTACHMENTS/PHOTOGRAPHS

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Figure 1: Prototype of a double exposure, flat-plate solar collector (perspective 1)

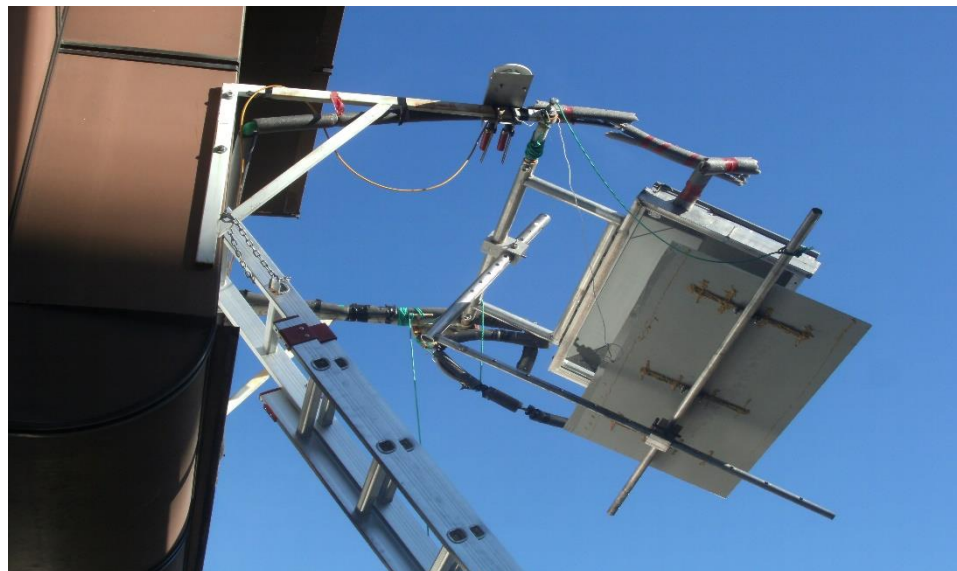


Figure 2: Prototype of a double exposure, flat-plate solar collector (perspective 2)



4.4 BELGRADE METROPOLITAN UNIVERSITY

4.4.1 ISUM

PART 1

DESCRIPTION OF TECHNOLOGY/RESEARCH RESULT/INNOVATION

Please describe the expected contribution of the technology/innovation or give a short description of the problem it solves; name also the targeted group of users.

ISUM (Information System of the University of Metropolitan) provide support to the business processes essential for the operation of universities (1) the process of preparing the teaching at the University: recording curricula, engaging teachers by school years, and thanks to integration with the e-learning system (ISAM), ISUM provides tracking the review process teaching materials in order to improve the process of teaching (2) monitoring the realization of teaching at the University: monitoring attendance at classes, pre-examination obligations, passing exams, etc. (3) financial management of the University: financial obligations and student payments, salaries and other income teachers, university cash, financial obligations to suppliers, etc.

Please describe the competitive advantages of the technology

Considering that it involves the automation of a large number of business processes supported by different systems that are interconnected, provides quick information acquisition at different levels of management and quick response to changes in the environment or in the way the University operates.

What is innovative in the technology?

Possibility of complete automation of the University's activities through integration with systems of different purposes (e-learning system, CMS) and continuous upgrade of system integration with new sw modules; It can be easily customized and modified for use in similar environments. Using state-of-the-art technology in making sure that technology is easy to maintain and change.

Please describe how the issues of intellectual property are regulated.

The Statute of the Metropolitan University stipulates that the holder of the intellectual property right has been realized by the University projects, Metropolitan University. The Rulebook on Intellectual Property is being drafted which will regulate these rights in more detail.



PART 2

INFORMATION ABOUT THE RESEARCH TEAM AND INSTITUTION

Please give the data about the research team, their competences and the previous research results relevant for the present technology.

The research team is represented by the IST scholarship students who are studying at the University of Metropolitan who, in addition to their teaching activities, represent the main bearers of the development and design team. In addition to the final year students, new students who show the best results during their studies are included each year and receive IST scholarship. In addition to the students, professors and assistants of the University are actively involved, who through their experience and mentoring work direct students and help them in realization.

Name the most important capacities of the institution where the technology has been developed.

Metropolitan University has about 1200 students enrolled at the Faculty of Management, Faculty of Information Technologies and the Faculty of Digital Arts. 300-350 new students are enrolled annually at all levels of education. It is technically very well equipped to use the most advanced servers with client computers as well as the modern software platform. The university has about 150 employees 107 of teaching staff in full or part-time employment.

Please give a short description of the research process starting with the data collecting and ending with the successfully realized technology.

The research team consists of teachers, assistants and associates of the Metropolitan University, and a significant part is made by students of the Metropolitan University who are in the dual education regime. In addition to studying, they work for IST (Innovative Software Technologies), through which they pay scholarship earnings, after deducting the amount of scholarship. In this way, they can cover the costs of the elementary school, earn scholarships, and also acquire practical experience in software development.

The research team's development path usually begins with the definition of doing free study and earning a process that needs to be supported by collecting requests from users who participate in the process itself. On the basis of the collected requests, the analysis and modeling of the module that is being developed and accessed is only afterwards access to the realization of the module. Every idea of an innovation team goes through the same process before the realization itself. ISUM is for the time being the internal information system of the university, and it is not offered, as such, on the market.

Describe how the technology transfer activities were financed (e.g. national or international projects, companies, own funds, etc.) and in case of several sources of financing, give their shares.

By agreement with the University of Metropolitan, the IST regulates its commitment to the university, and also the obligations of universities towards IST. With each student who is on a dual program, a contract is made that defines the rights and obligations, and payments to students go through the Youth Cooperative. The university funds its development of its information system - ISUM.



PART 3

INFORMATION ABOUT THE USER

Please give a brief description of how the technology user (a company or an innovator) uses the technology

ISUM users are students and university employees. They apply it daily in their work, and they also represent active users in terms of proposing innovative modules that would facilitate work and contribute to the better business of the entire university.

Please give a short history of the cooperation with the user, i.e. of the technology transfer

For the purposes of system development, the University employs IST, which develops an information system to fund students through scholarship and scholarship payments, and teachers through additional work engagement. By agreement, Metropolitan-IST University defines the mutual rights and obligations in the development of ISUM.

Name the (short-term) benefits enabled by the technology and the (long-term) expectations

With the application of the proposed technology in all spheres of business, improvements have been achieved in all fields in the form of timely information and smooth operation of independent services, although they are active participants in the joint process. It is expected that the system will be able to integrate with new independent systems for which the need arises, and given that the system is now most often used at the operational level, it is expected to expand it in terms of providing information for a higher level of management using business intelligence.

Briefly describe how the company's competitiveness and innovativeness were improved as well as its marketing positioning

The number of students enrolled at the University of Metropolitan every year grows most thanks to the satisfaction of students and their parents, for which the information system is partially close to receiving fast and comprehensive information. Thanks to the application of innovative technologies and the improvement of business processes, the position of the University on the market has been improved. Unlike most universities that buy ready-made software solutions, the Metropolitan University independently develops its own system that fully corresponds to the University's specific requirements, and at the same time provides students with the opportunity to engage in the process of developing such a system before completing the studies.



PART 4

ATTACHMENTS/PHOTOGRAPHS

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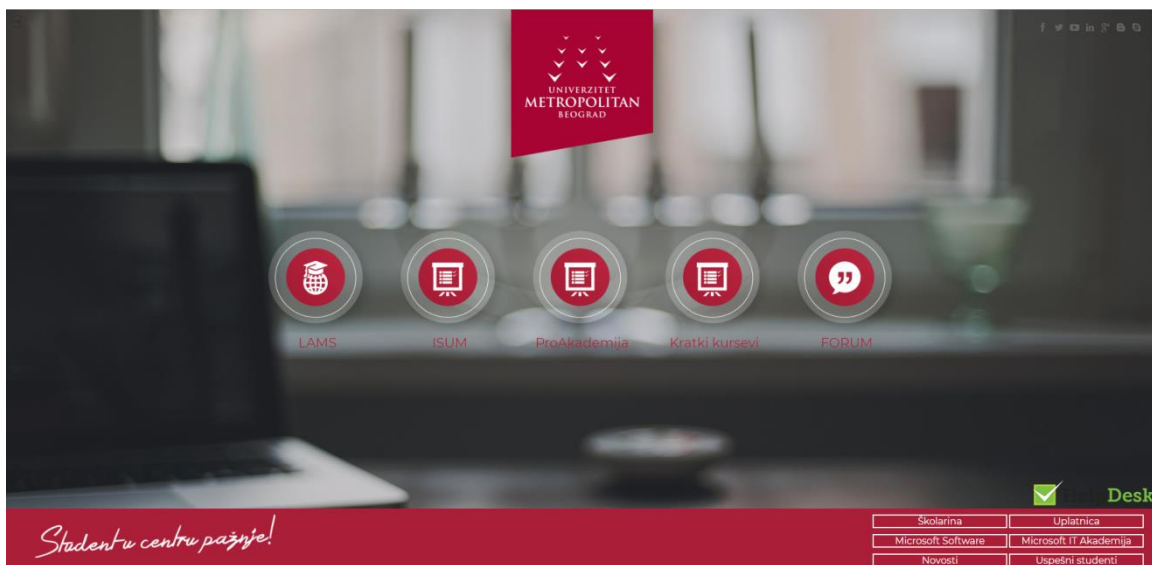


Figure 1: The home page of the ISUM system



Figure 2: E-professor home page

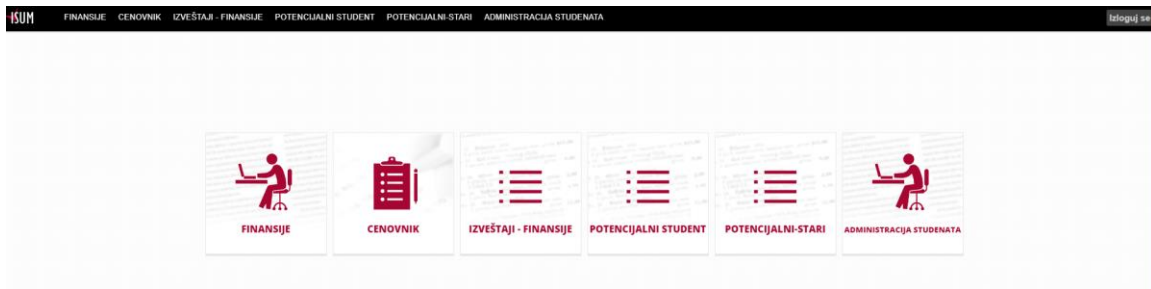


Figure 3: Financial office home page

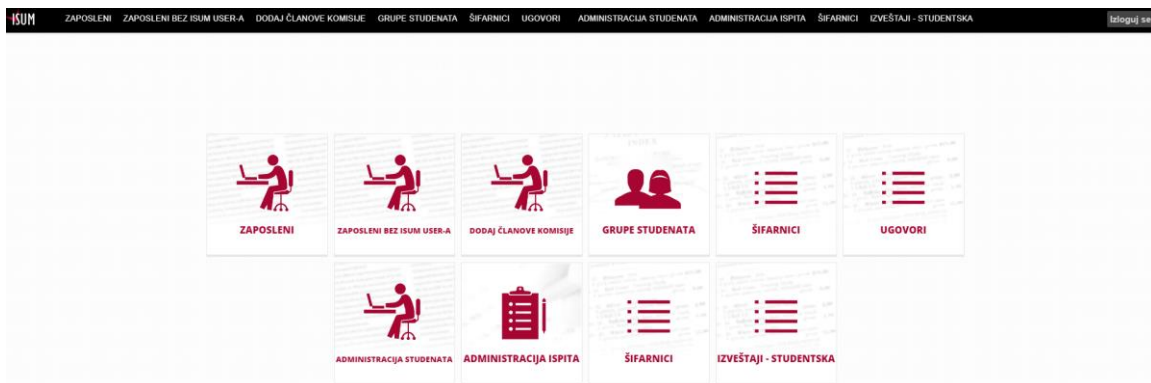


Figure 4: HR Home Service

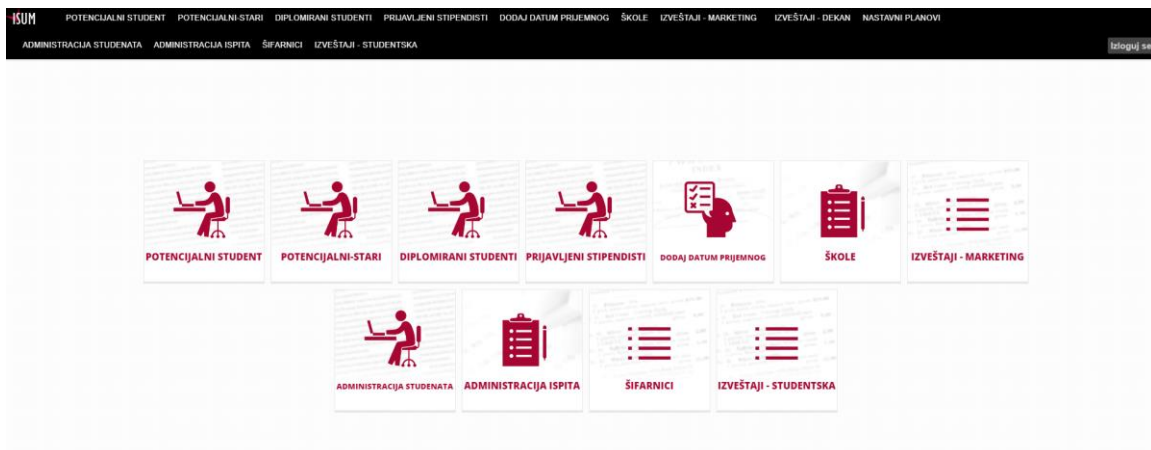


Figure 5: Student service home page



4.4.2 mDita Editor

PART 1

DESCRIPTION OF TECHNOLOGY/RESEARCH RESULT/INNOVATION

Please describe the expected contribution of the technology/innovation or give a short description of the problem it solves; name also the targeted group of users.

The tool for preparing teaching materials at the University of Metropolitan, mDita Editor, allows the creation of teaching materials in the form of learning objects in accordance with the DITA standard. In addition to creating teaching materials through mDita Editor, a server application has been developed that enables the processing of lessons (learning processes) and the preparation for installation on the distance learning system. Learning objects after the processing process are stored in a repository of learning objects (a directory containing all learning objects). The authors of the teaching material can search the repository by specific defined metadata (data describing the learning object) and use learning objects created by other authors without having to recreate the learning object on a subject that already exists in the repository. Writing teaching materials in the form of learning objects requires authors to be concise and to form learning objects as small entities (knowledge particles). The created learning objects allow the student who reads the teaching materials to understand the core of the topic he is reading in the lesson. The target group is students, teaching staff and administrators involved in the processing of teaching materials.

Please describe the competitive advantages of the technology

The advantage of developing one's own tools for the preparation of teaching materials is the ability to constantly improve and adapt to their own needs. Metropolitan University has a development team, software code and complete accompanying software documentation that does not depend on any other system or tools that exist on the market. Also, if needed, it is possible to adapt the tools for preparing teaching materials to other standards or distance learning systems.

What is innovative in the technology?

In addition to creating teaching materials, the author can use the mDita Editor to add additional activities (questions and answers, forum, shared resources, file sending, etc.) into the learning process. Learned learning processes are based on the LAMS Learning Management Activity System used at the Metropolitan University, which supports and displays the aforementioned additional activities. Additional activities serve to check the student's knowledge within the learning process.

Please describe how the issues of intellectual property are regulated.

The Statute of the Metropolitan University stipulates that the holder of the intellectual property right has been realized by the University projects, Metropolitan University. The Rulebook on Intellectual Property is being drafted which will regulate these rights in more detail.



PART 2

INFORMATION ABOUT THE RESEARCH TEAM AND INSTITUTION

Please give the data about the research team, their competences and the previous research results relevant for the present technology.

The members of the research team have changed through the development process, but the positions in the team have remained unchanged. The team of researchers should have a team leader who needs to record user requests, distribute work activities, perform mentoring, perform team work, modify project documentation, explore the area of tools for preparing teaching materials as well as distance learning systems, has published and publishes works on the topic of distance learning tools and systems. The team leader should have a master's degree in the field of software engineering. In addition to the team leader, the team includes a software engineer (graduate engineer of software engineering) who deals with programming and testing new tool modules, maintaining existing tool modules and modifying project documentation. In the team there should also be a programmer who participates in the programming of the tool module, tests their own code, and if necessary, tests the application based on the test plan defined by the manager. Also, in the team there may be a programmer - a student who participates in the programming of certain parts of the module.

Name the most important capacities of the institution where the technology has been developed.

Within the institution, three R & D teams were formed. One team deals with the development of tools for the preparation and processing of teaching materials (mDita editor and server application). The second team deals with the development and research of the distance learning system, while the third team deals with the development of the information system of the Metropolitan University (ISUM). Also, the institution has the most up-to-date equipment necessary for the smooth development and operation of applications and systems developed within these development teams. These include computers, development environments, applications and servers running applications and systems.

Please give a short description of the research process starting with the data collecting and ending with the successfully realized technology.

The first task accomplished by the research team was to study, understand and apply the DITA standard. In parallel with the study of standards, the team also dealt with the research of tools for creating teaching materials as well as distance learning systems. For the purposes of application of the standard, the prototype of the application that was used for testing has been developed. In the testing process, members of the research team and teaching staff participated as future users of the application. The first production version with basic functionalities was created after the testing phase and the change of the observed defects.

Describe how the technology transfer activities were financed (e.g. national or international projects, companies, own funds, etc.) and in case of several sources of financing, give their shares.

Transfer technology activities are partly financed by the national project of the Ministry of Education, Science and Technological Development of the Republic of Serbia and partially co-financed by the institution.



PART 3

INFORMATION ABOUT THE USER

Please give a brief description of how the technology user (a company or an innovator) uses the technology

The user (Metropolitan University) applies technology in the process of preparing teaching materials. Teaching staff, the authors of the teaching material, have the application mDita editor (in the form of a desktop application). Authors submit prepared lessons to remote-system administrators who perform further processing. System administrators use the mDita server application for final lesson editing before installing on a distance learning system.

Please give a short history of the cooperation with the user, i.e. of the technology transfer

Metropolitan University has hired and created a team that would develop the tools necessary for the University to improve the process of preparing teaching materials. It is defined that this software tool for preparing online teaching materials should satisfy and be interwoven with the LAMS teaching material management system. In addition to web content, mDita editor gives their PDF variant, so that other LMS systems can use its results.

Name the (short-term) benefits enabled by the technology and the (long-term) expectations

The process of preparation and processing of teaching materials have been improved, and the quality of the teaching material has been raised. The complete teaching material of the University is in the form of learning objects that are located in the repository of learning objects (a directory with all the facilities of the University's learning), which enables reuse in different lessons (learning processes). Long-term expectations are based on adapting teaching materials to the needs of each student using flexible (adaptive) learning processes.

Briefly describe how the company's competitiveness and innovativeness were improved as well as its marketing positioning

Innovation and competitiveness are reflected in the fact that other faculties are only users of the distance learning system while Metropolitan University develops its own tools for the preparation of teaching materials and adapts the distance learning system to their own needs. Continuous improvement of the process of creating teaching materials increases its quality.



PART 4

ATTACHMENTS/PHOTOGRAPHS

Please provide attachments or photographs which illustrate the technology and resources such as the photographs of researchers, institution, company, etc., or any other material which may be used for designing the promotional material (flyers) of the examples of good practice or a website. If photographs are provided, please write a caption with their titles or explanations (document name jpg).

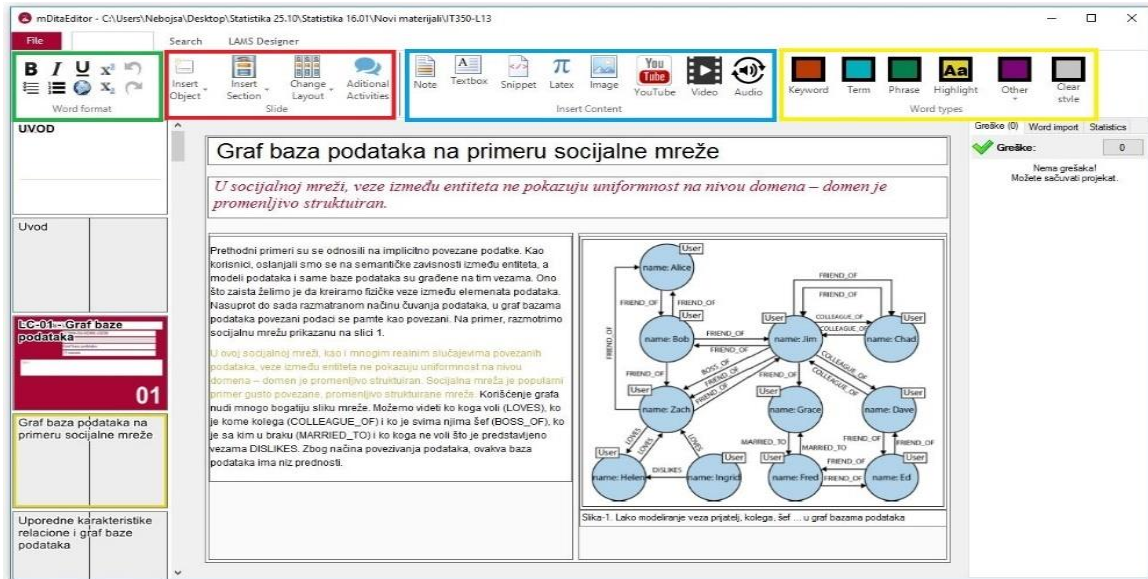


Figure 1: User interface of the mDita editor

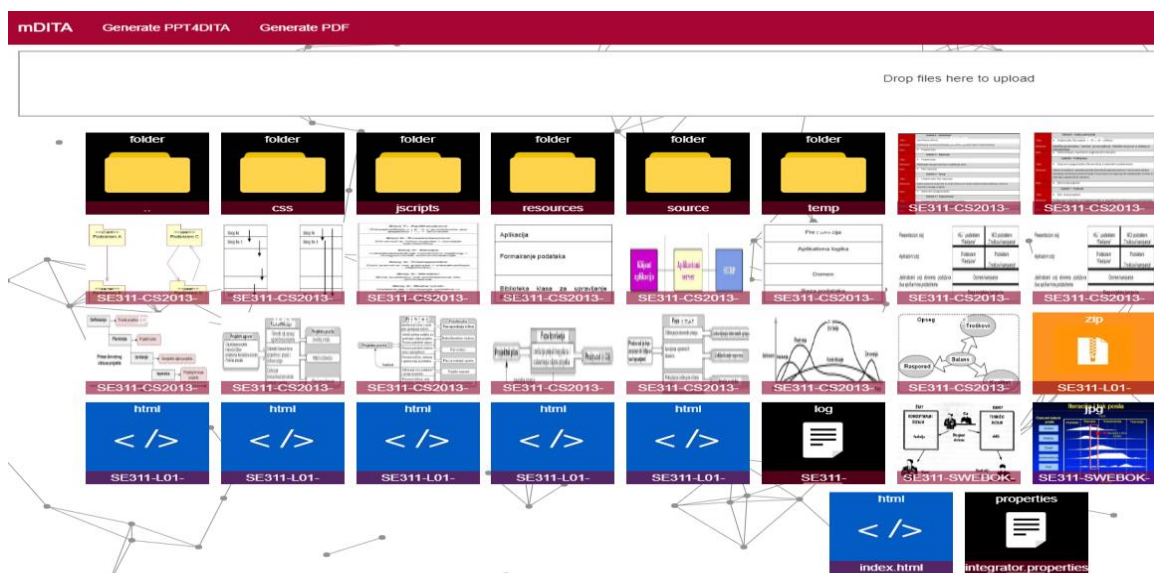


Figure 2: User interface of the mDita server application



4.5 UNIVERSITY OF NIŠ

4.5.1 Press for automatic balling of metal scrap

PART 1

DESCRIPTION OF TECHNOLOGY/RESEARCH RESULT/INNOVATION

Please describe the expected contribution of the technology/innovation or give a short description of the problem it solves; name also the targeted group of users.

Metal waste in Serbia mainly comes from industrial plants or from used vehicles. Very important are the quantities of metal waste collected from the households, either as municipal waste or as secondary raw materials (stoves, refrigerators, dishes, etc.). Almost all metal waste, due to its dimensions, non-homogeneous and loose structure, is not suitable for transport after collection. It is therefore necessary to perform its compacting to enable more efficient transport to recycling centres and reduce transport costs. With approximately 270,000 tons of metal waste in the Republic of Serbia during one year, a logical conclusion is drawn that the transport of these quantities is an outstanding problem. The most efficient way to solve this problem are devices - hydraulic presses of various sizes, types and forces that successfully compress metal waste and reduces its volume, thereby transforming it into a form convenient for transportation.

Hydraulic presses for baling metal waste currently available in the market of Republic of Serbia have a defect that is reflected in inadequate dimensions of formed bale depending on the technological recycling process of metal waste companies engaged in this activity. The dimensions of the formed metal bale are larger than the dimensions of the jaws of the shredders which are installed in recycling centres. Because of this, bales must be partially disassembled to allow their entry into the jaw of the shredder, which results in a significant slowdown of the recycling process and a significant increase in its costs. Also, some press models require special permits for transportation between different locations where metal waste is collected, because the dimensions of the press are higher than those allowed for truck transport. A large number of press types also require that the transport of the frame of the press and associated propulsion and electrical equipment must be performed with multiple vehicles, since the mass of the complete equipment exceeds the load capacity of the truck transport.

Due to all of the above, it was necessary to develop a press for baling metal waste whose dimensions of formed metal bale are adapted to the technological capabilities of companies that deal with recycling of metal waste. Also, the developed press should have dimensions and mass suitable for truck transport in one vehicle without the need for transport in the special transport regime.

Please describe the competitive advantages of the technology

The developed press for baling metal waste allows users to:

- bale metal waste with bale dimensions suitable for continuing the recycling process;
- transport presses between different locations for collecting metal waste with one vehicle;
- transport presses between locations for collecting metal waste without the need for transport in the special transport regime;
- use presses at locations where electricity is not available;
- reduce the cost of maintenance and overhaul of the press, because it is made of wear-resistant materials.



What is innovative in the technology?

Kinematics of the motion of moving parts is carried out in such a way that by using standard hydraulic actuators, metal bales of the required dimensions can be formed, and that the total width of the trough in which metal bale is formed is less than 2.4 meters, which enables the transport of the press without the need for a freeway transport regime. The structural elements are made so that the press can be partially folded and prepared for transport on one vehicle together with the associated hydraulic and electrical equipment. The mass of the press structure has been significantly reduced.

Please describe how the issues of intellectual property are regulated.

By the terms of the contract between researchers and user of technology, all rights for production and placement of presses in all markets have been transferred.



PART 2

INFORMATION ABOUT THE RESEARCH TEAM AND INSTITUTION

Please give the data about the research team, their competences and the previous research results relevant for the present technology.

Distinguished by knowledge, as the most powerful creative force, the Faculty of Mechanical Engineering in Niš has been a true driving force of economic development for 55 years, not only in Niš, but also in a wider region. Namely, the beginning of the work of the Faculty relates to the year 1960 when the Technical Faculty in Nis was established. Soon after the opening of the Faculty, in 1962, the Institute for Mechanical Engineering was established with the aim of providing better connections with business organizations, primarily in Niš, but also in wider area. The constituted Department of Mechanics acted as a scientific and research unit of the Faculty of Mechanical Engineering. The Institute of Mechanical Engineering is the carrier of scientific work, knowledge transfer, the bridge between industry and the University, the connection between the production process, fundamental research and higher education.

The Institute of Mechanical Engineering is designated to enable all employees and associates of the faculty to solve scientific, professional and production problems, in the most convenient way. Despite the unfavourable economic environment, the Institute is capable of solving the most complicated tasks and achieves important cooperation with related institutions in the country.

Since the establishment of the Institute of Mechanical Engineering, there is intensive cooperation with companies and business organizations in the south of Serbia, and especially in the Nišava region. Activities of the Institute of Mechanical Engineering are basic, developmental and applied research in the field of mechanical engineering and its related fields. The Institute of Mechanical Engineering permanently provides significant scientific and research support to all forms of training at the Faculty of Mechanical Engineering.

The Institute of Mechanical Engineering is involved in the realization of various studies, elaborates, audits, monitoring, design and development of products, machines, equipment and devices for the industry and the needs of the economy, social and private enterprises.

Name the most important capacities of the institution where the technology has been developed.

The Institute of Mechanical Engineering consists of: Scientific and Research Centres, Laboratories for Testing and Calibration, Centre for Quality Assurance, Standardization and Metrology. The Institute has on its disposal all the human and material resources of the Faculty of Mechanical Engineering of the University of Niš, so it can employ over 100 researchers in technology transfer activities.

Laboratories of the Institute are equipped with modern equipment for testing in the field of mechanical engineering. In addition to the test equipment, the Institute also has large number of licences for engineering software used in product development, HPC cluster for calculations execution, and other equipment that is used in virtual product development and rapid prototyping (3D printers, 3D scanners, etc.).

Please give a short description of the research process starting with the data collecting and ending with the successfully realized technology.



Based on the preliminary request of technology users, the Institute of Mechanical Engineering formed an expert team composed of teachers and faculty associates with the necessary competences. The expert team of the Institute consisted of 10 people who worked on the preparation of the main project and technical documentation during the period of 6 months.

Describe how the technology transfer activities were financed (e.g. national or international projects, companies, own funds, etc.) and in case of several sources of financing, give their shares.

Development activities are financed by own funds of technology users and funds received from the Development Fund of the Republic of Serbia.



PART 3

INFORMATION ABOUT THE USER

Please give a brief description of how the technology user (a company or an innovator) uses the technology

The technology user has a plan to apply a developed press for baling metal waste in recycling centres that collect metal waste throughout the Republic of Serbia. By baling metal waste, significant savings are achieved on the transport of metal waste to processing stations. Due to the shortcomings of existing presses for baling metal waste on the Serbian and regional markets, as well as the high prices of import presses, the technology user saw a chance to develop a prototype of metal baling device, primarily intended for pressing used cars, and its placement on the regional market.

Please give a short history of the cooperation with the user, i.e. of the technology transfer

Based on the preliminary request of technology users, the Institute of Mechanical Engineering of the Faculty of Mechanical Engineering formed an expert team that, in cooperation with the user and after the preliminary market analysis, defined the development task. Based on the preliminary feasibility study, the user of the technology applied for the funds for the preparation of the main project of the press prototype at the Development Fund of the Republic of Serbia.

Based on the defined development task, the team of the Institute of Mechanical Engineering has developed the main project of the press for automatic baling of metal waste, which enables the production of press prototype. The main project includes: main mechanical and electrical project with automation part. In addition to the mechanical and electro-project, the main project also contains annexes on Safety at Work and Environmental Protection.

Name the (short-term) benefits enabled by the technology and the (long-term) expectations

Key improvements for the users of developed baling press are the dimensions of the metal bale that correspond to the technological process of metal waste recyclers in the Republic of Serbia. Also, the mass of the press is considerably reduced compared to competing solutions, which makes it easier to transport to the locations where metal waste is baled. The transport of the press is facilitated by an innovative constructive solution that allows transportation of the press with the associated hydraulic and electrical equipment within the scope of the regular truck transport. In process of producing the press, materials with increased wear resistance are used, significantly prolonging its lifespan. These improvements significantly reduce operational costs for technology users. The decrease in mass also results in a lower production cost of the press, which is reflected in larger customer revenue.

Briefly describe how the company's competitiveness and innovativeness were improved as well as its marketing positioning

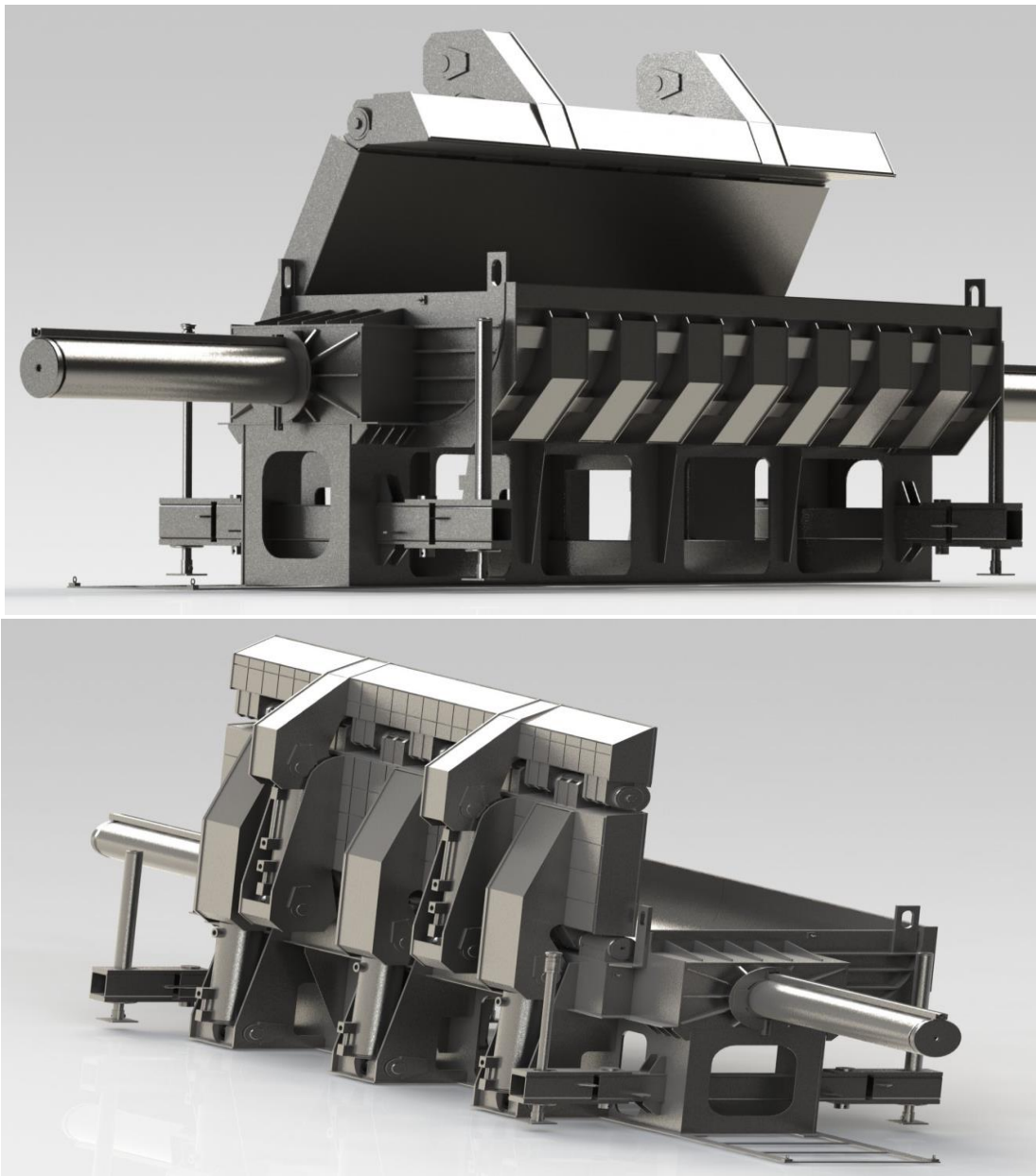
The use of developed presses by technology users significantly reduces its transport and operating costs. Also, the sale of the developed press to other companies that deal with recycling of metal waste increases the revenues of the companies - technology users.

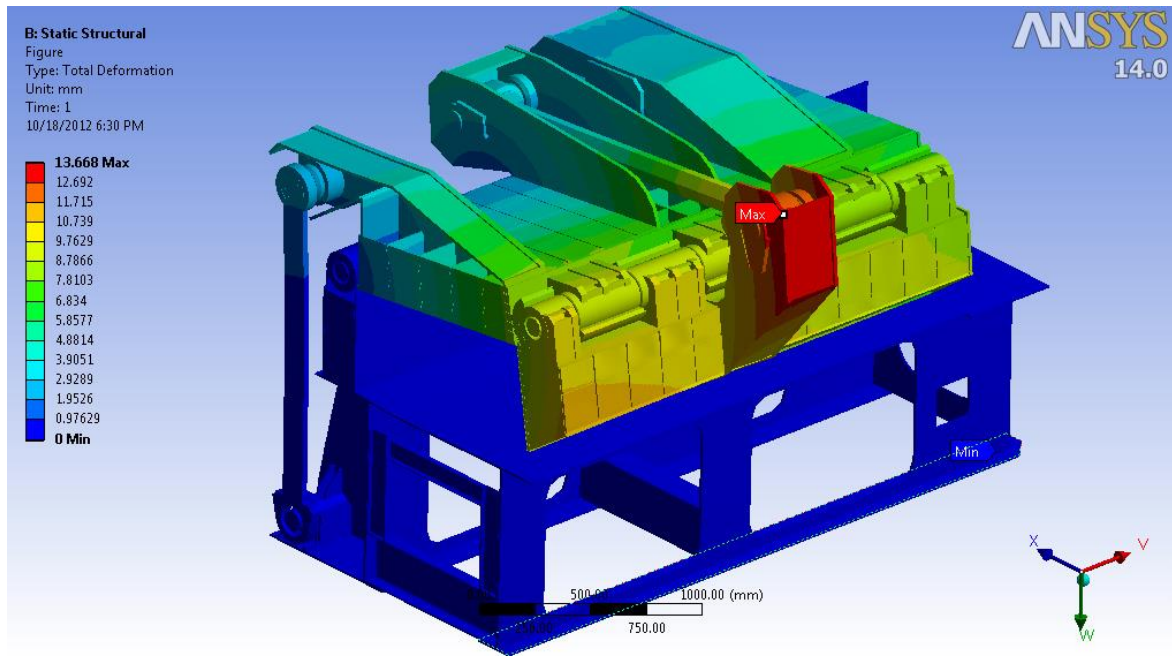


PART 4

ATTACHMENTS/PHOTOGRAPHS

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4.5.2 Baker's planetary mixer

PART 1

DESCRIPTION OF TECHNOLOGY/RESEARCH RESULT/INNOVATION

Please describe the expected contribution of the technology/innovation or give a short description of the problem it solves; name also the targeted group of users.

The company which uses the technology is a long-time manufacturer of machines used in the bakery industry. One of the machines from the product portfolio of the company is the planetary mixer used in the mixing process of the dough. The problem that arises with the current design of the machine is that during the mixing process, the executive tool (wire, hook) does not include the entire space in which the kneading dough is located, which extends the preparation time and reduces the quality of the pit.

Please describe the competitive advantages of the technology

- actuator in the mixer during the course of work includes each point of the space in which the kneading dough is located, thus obtaining the homogeneous structure of the dough
- shortening the time required to obtain the desired homogeneity
- reduction of noise and vibration during the work of the planetary mixer
- increase in the energy efficiency of the mixers
- automatic control of the machine operation during the preparation of dough

What is innovative in the technology?

In order to optimally fulfil the function of the planetary mixer, it is necessary that the entire space in which dough is located be treated equally by the executive organ of the mixer, which implies that the mixer occupies a different position at each turn.

This condition is provided by a redesigned planetary gearbox so that at each turn, different teeth of the coupled gears are coming into contact with each other. As a result, the dough mixing tool pathways always pass through the various points within the dough bowl working area. As the tool has multiple cutting edges, it is ensured that the entire space in which dough is placed is treated evenly.

Planetary mixer gearbox must be without backlash, enabling adequate precision of positioning, noise and vibration reduction and energy efficiency. This condition is also fulfilled by choosing the appropriate parameters related to the tolerances and making of planetary gear elements according to the technical possibilities of the company.

It should be also noted that the planetary gear solution is optimal from the aspect of the available resource of its vital elements. The degree of safety of the toothed pair of planetary gear units (pedestal, sides and deformation of the teeth) are within the allowed limits, but with the maximum utilization of the available load capacity.

Please describe how the issues of intellectual property are regulated.

The improvement of the existing product was carried out through the program of innovation vouchers of the Innovation Fund of the Republic of Serbia. According to the rules of the program, the user of the technology is the only owner of the intellectual property created on the project.



PART 2

INFORMATION ABOUT THE RESEARCH TEAM AND INSTITUTION

Please give the data about the research team, their competences and the previous research results relevant for the present technology.

The Innovation Center of the University of Niš was founded by members of the University of Niš. The founders and members of the Innovation Center are the following legal entities: University of Niš, Faculty of Civil Engineering and Architecture in Niš, Faculty of Mechanical Engineering in Niš, Medical Faculty in Niš, Faculty of Technology in Leskovac and Faculty of Occupational Safety in Niš.

The Innovation Center of the University of Niš is an organization devoted to original and systematic application of scientific results and modern technological processes in order to create innovations, develop prototypes, new products, processes and services or to improve existing products, technologies and services and at the same time, transfers knowledge and technologies into production and services of other economic entities, through the implementation of domestic

Name the most important capacities of the institution where the technology has been developed.

The Innovation Center of the University of Niš has on its disposal all the human and material resources of the members of the Innovation Center, which consists of 5 faculties and the university itself.

Please give a short description of the research process starting with the data collecting and ending with the successfully realized technology.

Based on the requirements of the technology users, the Innovation Centre of the University of Nis formed a team of experts that made the requested improvements of the existing product.

Describe how the technology transfer activities were financed (e.g. national or international projects, companies, own funds, etc.) and in case of several sources of financing, give their shares.

The improvement of the existing product was carried out through the program of innovation vouchers of the Innovation Fund of the Republic of Serbia.



PART 3

INFORMATION ABOUT THE USER

Please give a brief description of how the technology user (a company or an innovator) uses the technology

The company that is the user of technology has been producing machines for the bakery industry for the last 20 years. During this period, the company produced and sold over 2500 bakery machines on the European market. The upgraded planetary mixer is included in the regular offer of the company and it will continue to be distributed to the clients who are interested in purchasing planetary mixers.

Please give a short history of the cooperation with the user, i.e. of the technology transfer

On the basis of previous successful cooperation, the user of technology has asked the Innovation Centre of the University of Nis to bid on the basis of which the company has been granted an innovation voucher by the Innovation Fund of the Republic of Serbia.

Name the (short-term) benefits enabled by the technology and the (long-term) expectations

Technology transfer enhanced the existing product of the company as the following results were achieved:

- increased quality of the dough
- shorter time for preparation of the dough
- reduced noise and vibration of the machine
- increased competitiveness due to the higher quality of the planet mixer

Briefly describe how the company's competitiveness and innovativeness were improved as well as its marketing positioning

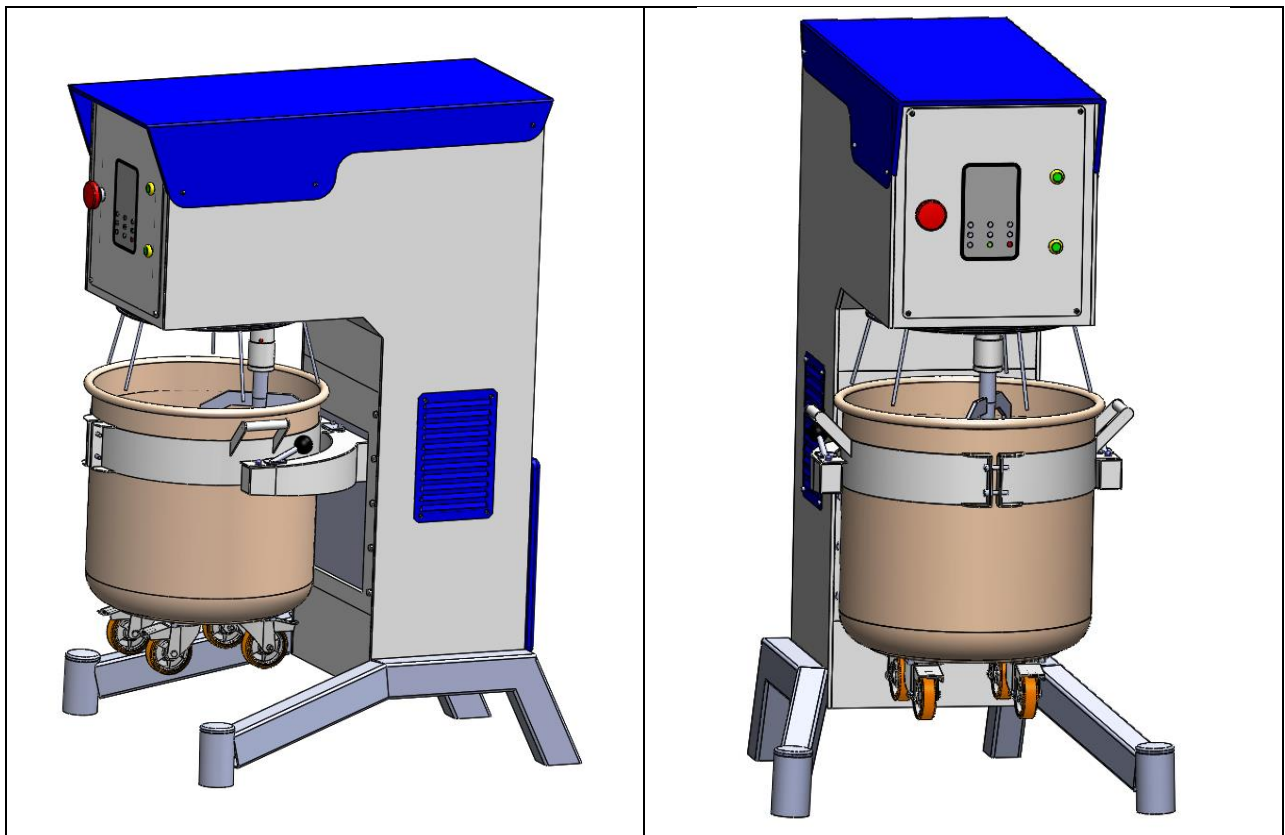
Increasing the quality of existing products raises the competitiveness of the company. Higher quality of the enhanced product leads to an increase in revenue and a rise in the productivity of technology user.

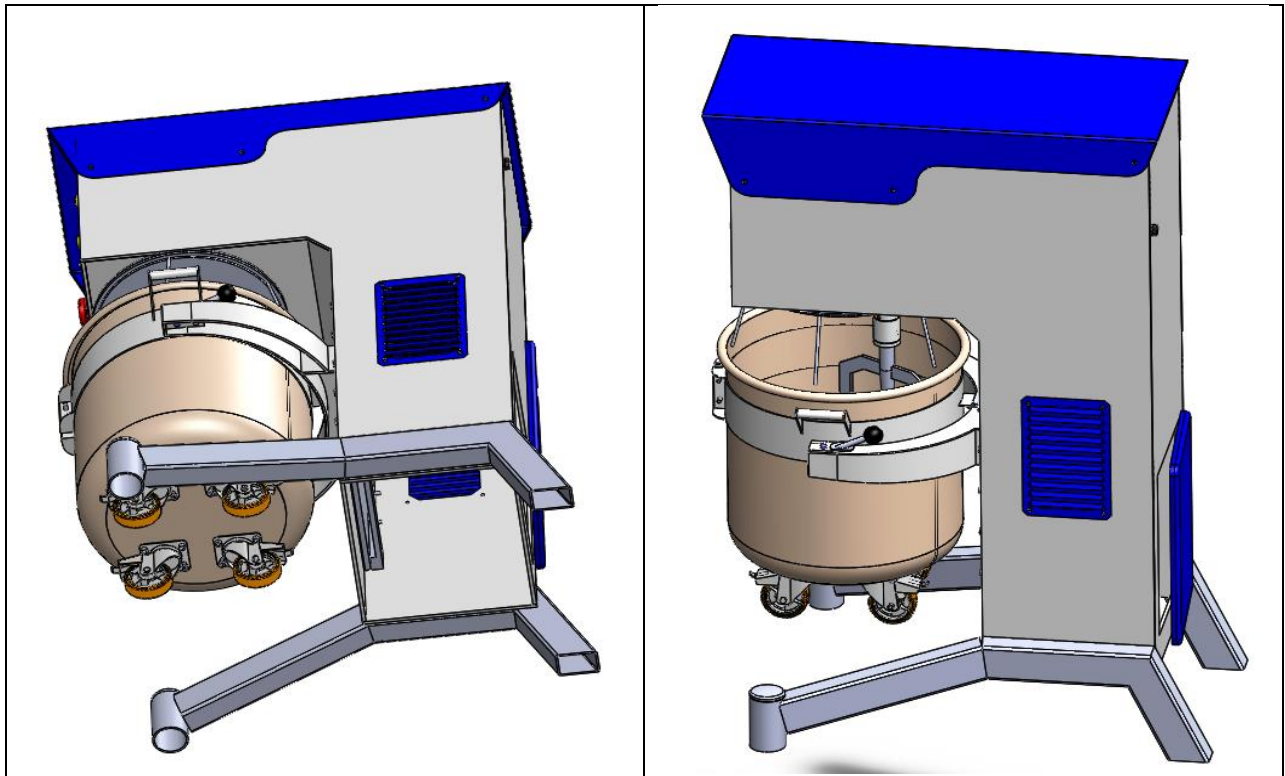


PART 4

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