



## Steering Committee meeting

7<sup>th</sup> October 2010, Rijeka

# Overall WBC-VMnet project achievements

*Prof. Dr Vesna Mandic*

*Prof. Dr Vesna Mandic*

This project has been funded with support from the European Commission



## Outline

- ❖ Overall achievements
- ❖ Project implementation timeframe
- ❖ Key project results, per Outcomes
- ❖ Conclusions

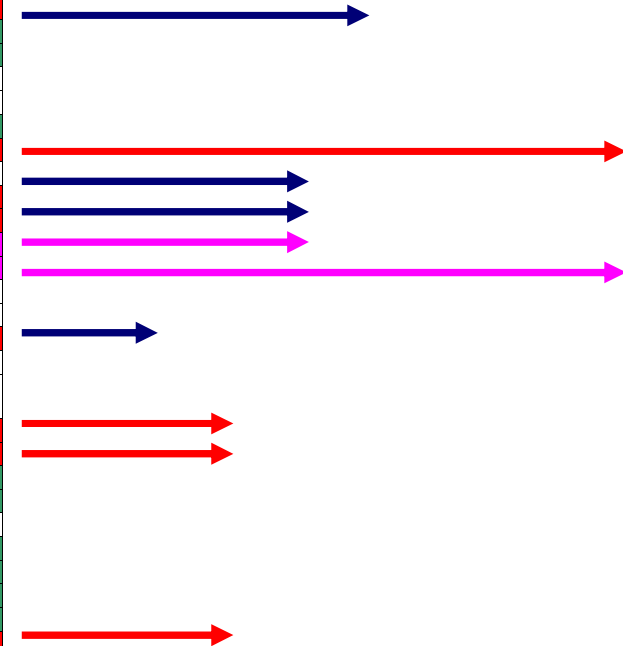


## Overall achievements

- ❖ Four CTCs are functional in Kragujevac, Rijeka, Banja Luka and Podgorica
- ❖ CTC centres are equipped as it was planned in AF: 35 PC, 4 projectors, internet network, 6 VM software, CMM Werth machine, RP ALARIS 3D printer
- ❖ VMnet network has 870 members in total (during the project implementation there are 400 new members, so far)
- ❖ Comprehensive TSNA analysis in the WBC region (800 questionnaires)
- ❖ WBC Regional model for University-enterprise cooperation was developed; Publication in English was published in June 2010 after two-month public debate;
- ❖ Project WEB site is regularly updated with all important results and news
- ❖ Development of Practical Placement programme was finished in June 2010
- ❖ Development of Industrial Fellowship programme was finished in July 2010
- ❖ Syllabuses for 11 vocational trainings were developed; available on web site
- ❖ Trainings for WBC staff in Serbia, Slovenia, Denmark, Italy (20 days, 14 persons)
- ❖ 7 info days have been organized – 242 participants in the WBC region

## Project implementation timeframe

Ref.N°	Activities Title	M4 Y2	M5 Y2	M6 Y2	M7 Y2	M8 Y2	M9 Y2	
<b>1.</b>	<b>Four Collaborative Training Centres (CTC) are established ...</b>							
1.1	Found and equip four CTC and define Action plan			F				6m
1.2	Re-training for staff						F	
1.3	Market and marketing activities							
<b>2.</b>	<b>VMnet network is enlarged throughout the WBC region ...</b>							
2.1	Develop collaborative web tools and communication strategy	F						
2.2	Bring new VMnet members and experts for multidisciplinary approach							
2.3	Update existing systematization knowledge e-base with new topics							10m
<b>3.</b>	<b>Model for university-enterprise cooperation developed ...</b>							
3.1	Analyze the EU models for cooperation in the knowledge triangle	F						5m
3.2	Develop, assess and adopt the new regional model of cooperation			F				5m
3.3	Set up joint structures of SMEs							5m
3.4	Case studies – benchmarking best practice							12m
<b>4.</b>	<b>Training/service needs identified and trainers/service providers...</b>							
4.1	Training/service needs analysis (TSNA)							
4.2	Selection and re-training of trainers and service providers						F	
4.3	Quality monitoring of training/services							
<b>5.</b>	<b>Programme of vocational training, industrial fellowship and student practical placement developed and carry out ...</b>							
5.1	Develop and delivery vocational trainings for SME, unemp. graduates ...							4m
5.2	Develop and redesign instructional material for e-learning							4m
5.3	Develop and conduct Industrial Fellowship Progr. (IFP) for graduates...				F			
5.4	Develop and conduct Practical Placement Programme for students			F				
<b>6.</b>	<b>Dissemination</b>							
6.1	Prepare Programme for public information, dissemi. and raising awareness							
6.2	Printing and publishing of brochures, leaflets and other material							
6.3	Information days and public appearances							
6.4	Organize three motivational seminars	F						
6.5	Organize three workshops							4m
6.6	Organize three brokerage events							
<b>7.</b>	<b>Sustainability</b>							
7.1	Institutional sustainability							
7.2	Financial sustainability							
<b>8.</b>	<b>Quality control and monitoring</b>							
8.1	Develop quality control and monitoring strategy							
8.2	Internal monitoring and interviews of target groups							
8.3	External monitoring and inter-Tempus coaching							
<b>9.</b>	<b>Management of the project</b>							
9.1	Overall project management and administration							
9.2	Local management on the level of WBC partners							
9.3	Local management on the level of EU partners							



	Period of implementation
	In time
	Delay
	Delay, but not critical
F	Finished



## Key project results – Outcome 1

- ❖ Four regional Collaborative Training Centres (CTC) are functional – Kragujevac, Rijeka, Banja Luka and Podgorica
- ❖ CTCs are equipped as planned in AF: 35 PC, 4 projectors, internet network, 6 VM software, CMM Werth machine, RP ALARIS 3D printer
- ❖ CTC brochure was designed and printed in 2000 copies, in September 2010
- ❖ UKG has designed and partially developed CTC web site, in September 2010





## Key project results – Outcome 1

### ❖ CTC brochure

**...AND OFFER**

**Vocational trainings**

**CTC Kragujevac:**

1. CAD/CAM modelling - CATIA
2. Tool design
3. Modelling and optimization of production processes using the FE / FV simulation
4. Project management

**CTC Rijeka:**

1. Simulation of machining processes and rapid prototyping techniques (SolidWorks, SolidCam, RP) - introductory course
2. Product design and development with CATIA
3. Process Quality Improvement Methods

**CTC Banja Luka:**

1. Advanced CAD modelling using Solid Works
2. NC programming and the basics of CAM modelling

**CTC Podgorica:**

1. CAD - ProEngineer
2. Office informatics

**Practical Placement Programme**

In order to improve and acquire new knowledge of students, CTC centers have developed and coordinate a new Practical Placement Programme (PPP) which provides students the opportunity to gain practical experience in industry, in an area that relates to their academic studies, and to further develop their professional, technical and interpersonal skills.

Placement programs have the important role of creating a bridge between education and employment. They help students to optimize their education and subsequently work choice and to better position themselves in the work world. Then the objective of PPP is to facilitate the incorporation of students into the workforce while supplying them with professional experience and skills in addition to theoretical knowledge.

**Industrial Fellowship Programme**

IFP program is intended for the establishment of sustainable partnership between university and industry through hosting industrial fellows (graduates and engineers from industry) in research and academic centers, with the aim to realize advanced targeted trainings of industrial fellows and joint research according to the needs of industrial sponsor.

Flexible IFP duration, organized several times during the year, enables the hiring of industrial fellow on development and innovation projects of mutual interest for academic and industrial partner. The IFP program is an excellent opportunity for technology transfer and involvement of young people in innovative projects that contribute to the exchange of experience, ideas, knowledge, and increase of innovative potential and competitiveness of enterprises.

**CTC Kragujevac:**  
 Prof. Dr Vesna Mandić,  
 Coordinator of CTC Kragujevac  
 Sestre Janjic 6  
 34000 Kragujevac  
 Tel. +381 34 501 201  
 Fax. +381 34 501 901  
 E-mail. mandic@kg.ac.rs  
 Url. www.ctc.kg.ac.rs

**CTC Banja Luka:**  
 Prof. Dr Živko Babić,  
 Coordinator of CTC Banja Luka  
 Vojvode Stepe Stepanovića 71  
 78000 Banja Luka  
 Tel. +387 51 462 321  
 Fax. +387 51 465 085  
 E-mail. ctcc@unibl.rs  
 Url. www.ctc.unibl.rs

**CTC Rijeka:**  
 Prof. Dr Zoran Jurković,  
 Coordinator of CTC Rijeka  
 Vukovarska 58  
 51000 Rijeka  
 Tel. +385 51 651 466  
 Fax. +385 51 651 468  
 E-mail. ctcc@riteh.uniri.hr  
 Url. www.ctc.riteh.uniri.hr

**CTC Podgorica:**  
 Prof. Dr Mileta Janjić,  
 Coordinator of CTC Podgorica  
 Džordža Vašingtona bb  
 81000 Pogorica  
 Tel. +382 78 107 285  
 Fax. +382 20 245 116  
 E-mail. ctcc@ac.me  
 Url. www.ctc.ac.me

Network of Collaborative Training Centres in the Western Balkans

Map showing locations: Rijeka, Banja Luka, Kragujevac, Podgorica.

Tempus Project University of Kragujevac  
**WBCVMnet**  
 WBC Virtual Manufacturing Network  
 Fostering an Integration of the Knowledge Triangle  
 www.wbc-vmnet.rs

European Commission  
**TEMPUS**

This publication has been funded by the European Commission. The publication reflects only the views of the authors. The European Commission cannot be held responsible for any use which may be made of the information contained therein.

Prof. Dr Vesna Mandić


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## Key project results – Outcome 1

### ❖ CTC brochure



**Vision**  
To become a strong cooperative center that will initiate, mediate and sustain mutually beneficial partnership between University, that is its members, students and graduates on one hand and enterprises and other partners that support SME sector on the other hand.

**Mission**  
To develop efficient and effective mechanisms for cooperation between University and enterprises, through the projects' implementation, vocational trainings for enterprises and the unemployed, fellowship programs (Industrial Fellowship Programme - IFP) and student practice (Practical Placement Programme - PPP).





**Objectives**

- To establish sustainable links between University and enterprises through the implementation of a the WBC Regional model of university-enterprise cooperation;
- To provide services for improvement of existing and development of new products, technological processes and tools for small and medium-sized enterprises;
- To provide quality and useful R&D result, which will launch funding and regular implementation of innovations in enterprises;
- To develop new and modernize existing vocational training programs in accordance with the needs of enterprises and labor market;
- To play an active role in the spreading WBC Vmnet network;
- To enable students to gain practical knowledge and skills in the industry;
- To facilitate IFP programme;
- To create opportunities for involvement in a number of international projects.


**Activities**

- Development and implementation of vocational trainings, seminars and workshops;
- Coordination of Industrial Fellowship Programme (IFP);
- Coordination of Practical Placement Programme (PPP);
- Rapid prototyping and reverse engineering applications in integrated product and process development;
- Virtual manufacturing applications by applying up-to-date FE/FV software;
- Quality control and measuring (optical, laser and contact techniques);
- Training of staff and external experts of CTC Centre;
- Projects' implementation;
- Spreading the WBC Vmnet network.

**CTC offices in Kragujevac, Rijeka, Banja Luka and Podgorica**

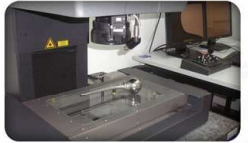

WE USE MODERN APPROACH



**Integrated product and process development**

**Resources**

- Multisensor coordinate measuring machine - **WERTH Video-check IP250** (determination of 2D and 3D geometries of parts with very small features with integrated optical, laser and patented fiber contact techniques)
- 3D printer (Rapid Prototyping) - **OBJET Alaris 30** (based on PolyJet technology creates smooth surfaces with complex geometries, small moving elements and fine details of plastic prototypes)

**Software:**

CAD/CAM software (3D CAD modelling, CAM modelling with powerful new toolpaths and techniques, NC programming)

- SolidWorks
- ProEngineer
- CATIA
- Mastercam

CAE software (advanced FE/FV software for all bulk and sheet metal forming applications, independent from process temperature, machine used or material processed):

- Stampack
- Simufact

Software for tool design (design and optimization of progressive die from 3D solid model, as SolidWorks add-on)

- 3DQuickPress

Virtual reality software (software for design of interactive 3D content and rapid prototyping for virtual reality applications).

- Vizard

Network of Collaborative Training Centres in the Western Balkans Kragujevac, Rijeka, Banja Luka and Podgorica

## Key project results – Outcome 1

- ❖ CTC web site is designed and launched, but it is still in developing phase; until the end of October it will be ready for delivery to other CTCs in the WBC region



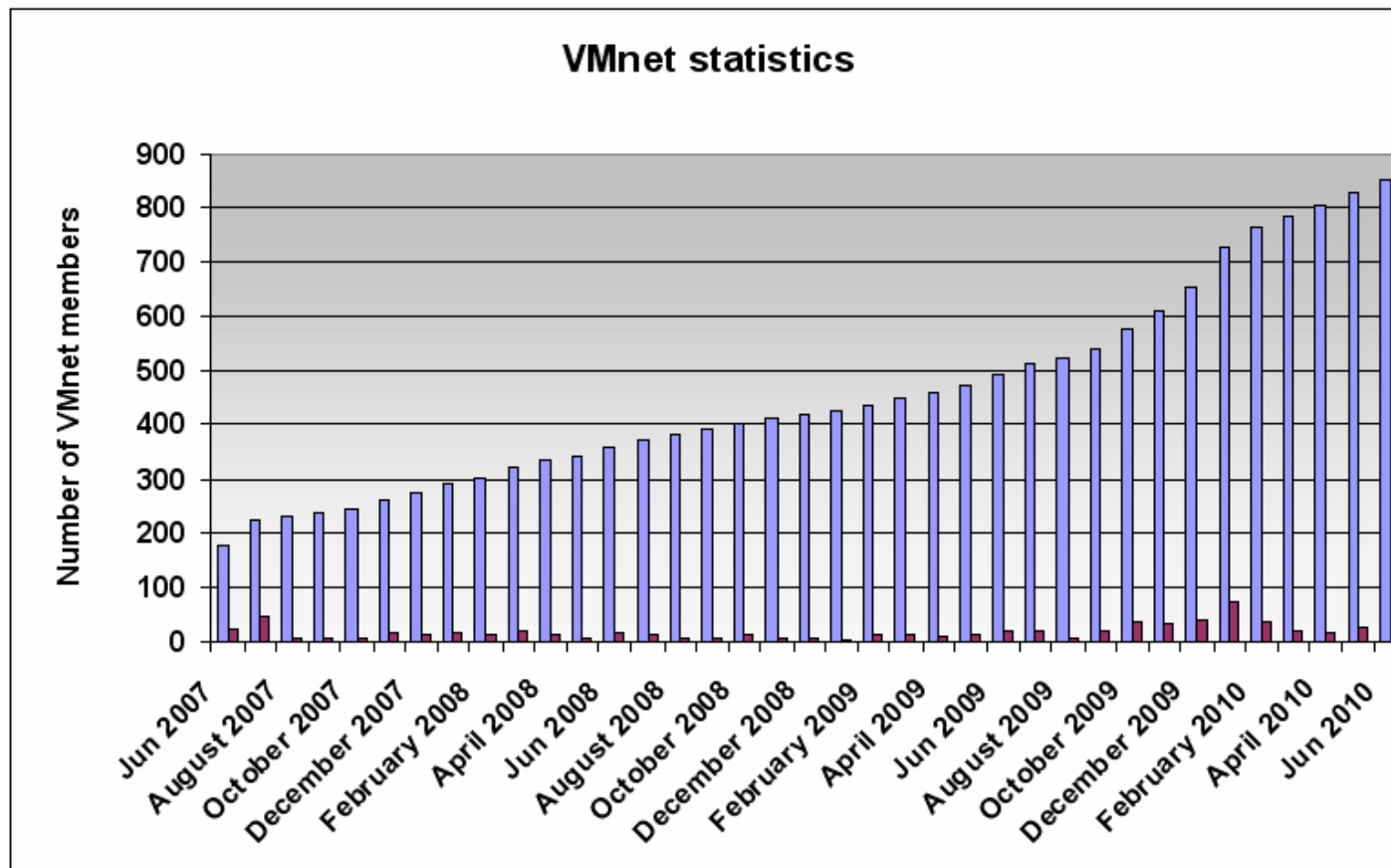
The screenshot shows the website for the Cooperative Training Center (CTC) in Kragujevac. The header includes logos for the European Commission TEMPUS, the University of Kragujevac, and the CTC itself. A navigation menu is visible with options like 'NASLOVNA', 'O CENTRU', 'RESURSI', 'USLUGE', 'OBUIKE', 'PSP PROGRAM', 'ISP PROGRAM', 'PONUDA/POTRAZNAJA', and 'KONTAKT'. The main content area features a banner for 'Mreža Kooperativnih trening centara u zemljama Zapadnog Balkana' with a map of the region. Below the banner, there is a section titled 'Kooperativni Trening Centar Kragujevac' with a date '15. SEPTEMBER 2010 10:00'. A login form is present on the left side. The footer contains 'AKTUELNO' with a list of centers, 'CTC' details, and 'JOIN AND BENEFIT FROM VMNET' information.





## Key project results – Outcome 2

- ❖ VMnet is enlarged with 435 new members from WBC region, in 2009 and 2010, so far (870 members in total)



## Key project results – Outcome 2

❖ VMnet is enlarged with 435 new members from WBC region, in 2009 and 2010, so far (870 members in total)

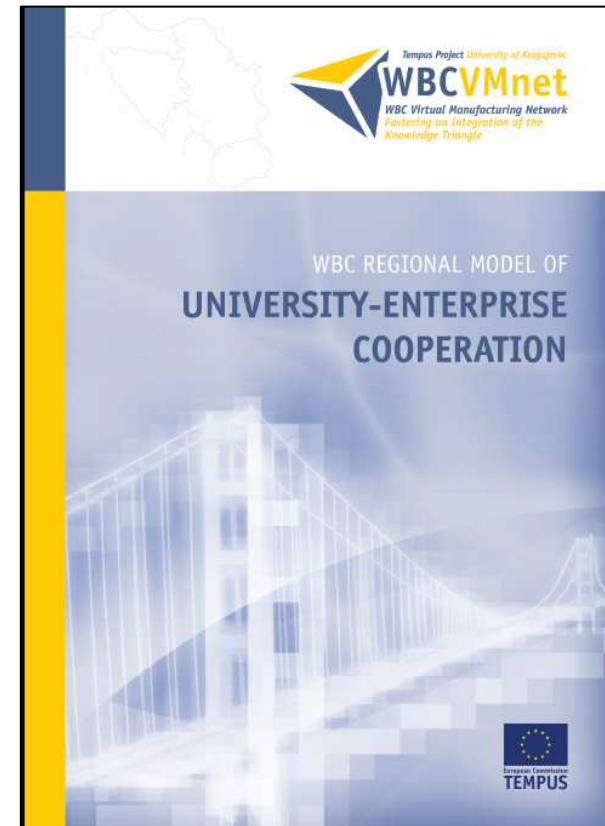
Number of new VMnet members in 2009-2010		Planned number, WBC-Vmnet project	Balance
Provided by partner	Number of VMnet members		
UKG, Serbia	226	300	74
UP, Montenegro	53	100	47
UR, Croatia	89	100	11
UBL, Bosnia & Herzegovina	67	100	33
<b>TOTAL in 2009/2010</b>	<b>435</b>	<b>600</b>	<b>165</b>

<b>TOTAL number of VMnet members</b>	<b>870</b>
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## Key project results – Outcome 3

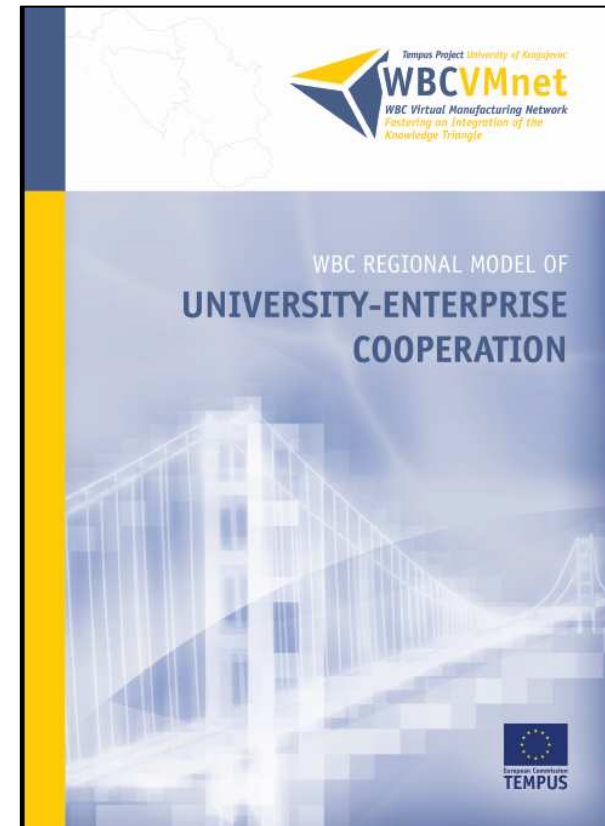
- ❖ New WBC regional model for university-enterprise cooperation has been developed
- ❖ Based on 15 EU good practices and regional specialities
- ❖ Public debate from April until June 2010 - in order to achieve national and regional consensus
- ❖ Publication (125 pages) was printed in 500 copies, in English
- ❖ 200 copies delivered so far throughout the WBC
- ❖ 7 info days were devoted to discussion and promotion of new WBC model, as well as efficient tool for public debate



## Key project results – Outcome 3

Proposes following activities and measures:

1. Establishment **Science and Technology parks** in regional university centers;
2. Organization of **WBC regional industrial clusters**
3. Forming **University-enterprises consortia** for joint projects;
4. Establishment of **Collaborative-training and/or long-life learning centres**;
5. Setting up of **Open Innovation Networks with SME**;
6. **Practical placements** for students in industry;
7. **Industrial fellowship programme** for graduates and/or employees from enterprises





## Key project results – Outcome 3

- ❖ CTC Kragujevac is actively involved in the set up joint structure of SME, activity 3.3, via offering trainings and services to existing clusters
  - [www.embedded.rs](http://www.embedded.rs),
  - [www.ssc.rs](http://www.ssc.rs),
  - <http://acserbia.org.rs/sr>) and the planned inclusion as a member.
- ❖ The initiative of establishing ICT cluster in Serbia was supported by CTC Kragujevac, where CTC will be included as a member in the future.
- ❖ SCGM, partner on the project, joined the auto components cluster in 2009 (AC cluster Serbia).

## Key project results – Outcome 4

Selection and re-training  
 of CTC staff and service providers

- ❖ **CEVIP, Serbia, May 2010**  
 (1p UR, 1p UBL, 1p UP)
- ❖ **UL+C3M, Slovenia, June 2010**  
 (4p UKG, 4p UR, 1p UBL, 1p UP)
- ❖ **IPU, Denmark, August 2010**  
 (5p UKG, 1p UR, 1p UBL, 1p UP)
- ❖ **DIMEG, Italy, September 2010**  
 (5p UKG, 1p UR, 1p UBL, 1p UP)

Training provider	List of offered trainings	Duration (days)
<b>DIMEG</b>	Metal forming (integrated design)	1.0
<b>5 days max.</b>	Geometrical metrology	1.0
	Concurrent engineering lab.	1.0
	New advances in micro-manufacturing	1.0
	Rapidprototyping and Reverse engineering	0.5
	Surface engineering	0.5
Total days DIMEG		<b>5 days</b>
<b>IPU</b>	Tribology (Bulk metal forming)	0.5
<b>5 days max.</b>	Measurement of heat transfer coefficient	0.5
	Metrology (dimensional)	1.0
	Metrology (surface characterisation)	1.0
	Laser technology	1.0
	Micro technology	1.0
Total days IPU		<b>5 days</b>
<b>UL</b>	Thermomechanical testing of materials	0.5
<b>3 days max.</b>	Microstructural changes	0.5
	Superplastic Al alloys	0.5
	Microscopy (SEM, optical)	0.5
	Industrial tours	1.0
Total at UL		<b>3 days</b>
<b>C3M</b>	Introduction to FEM (half day)	0.5
<b>2 days max.</b>	Symbolic approach to FEM (half day)	0.5
	M5 modelling (half day)	1.0
Total at C3M		<b>2 days</b>
<b>CEVIP</b>	VM software (2 days)	2.0
<b>5 days max.</b>	VE technologies - integration	0.5
	Rapid prototyping (OBJET, ALARIS 30)	1.0
	CMM Werth VideoCheck IP250	1.0
	Industrial tour	0.5
Total at CEVIP		<b>5 days</b>

## Key project results – Outcome 4

## CEVIP, RS

Date	Trainers	Name of training	Trainees
24th May	Prof. Dr Vesna Mandić Vladan Luković	Training for the use of CMM machine Werth VC-IP 250 3D CNC and Win Werth software	1.Dr. Zivko Babic 2.Dr. Mileta Janjic 3.Marko Pantic 4.Sasa Randjelovic
25th May	Prof. Dr Vesna Mandić	Integration of virtual engineering technology	1.Dr. Zivko Babic 2.Dr. Mileta Janjic 3.Vladan Lukovic 4.Marko Pantic 5.Sasa Randjelovic
	Prof. Dr Vesna Mandić	Control and calibration of CNC machines by using of Renishaw QC10 ballbar device,	
	Dir. Goran Matović	Industrial tour – SCGM, Kragujevac, Multicomponent plastic injection, practical demonstration of CNC machine testing	
26th May	Prof. Dr Vesna Mandić	Rapid prototyping	1.Dr. Zoran Jurkovic 2.Dr. Zivko Babic 3.Dr. Mileta Janjic 4.Vladan Lukovic 5.Sasa Randjelovic
	Marko Pantić	Training for the use of RP 3D Printer ALARIS 30 and Objet Studio software	
	Dir. Dragiša Barać	Industrial tour – UNIOR Formingtools, Kragujevac, design and development of tools for sheet metal, stepping tools	
27th May	Prof. Dr Vesna Mandić	Virtual production, training for FV modeling and simulation of production processes in Simufact.forming software	1.Dr. Zoran Jurkovic 2.Dr. Zivko Babic 3.Dr. Mileta Janjic 4.Vladan Lukovic 5.Marko Pantic 6.Sasa Randjelovic
	Representatives of National Instruments	Seminar dedicated to innovative technologies and products	
28th May	Prof. Dr Vesna Mandić	Virtual production, training for FV modeling and simulation of production processes in Simufact.forming software	1.Dr. Zoran Jurkovic 2.Dr. Zivko Babic 3.Vladan Lukovic 4.Marko Pantic 5.Sasa Randjelovic

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## Key project results – Outcome 4

**CEVIP, RS**



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## Key project results – Outcome 4

**UL, C3M, SI**

Date	Trainers	Name of training	Trainees
7th June	Prof. Dr. Tomaž Rodič	“Introduction and training overview”	1.Dr. Vesna Mandic 2.Dr. Zoran Jurkovic 3.Dr. Zivko Babic 4.Dr. Mileta Janjic 5.Dr. Duško Pavletić ** 6.Vladan Lukovic 7.Marko Pantic 8.Sasa Randjelovic 9.Sven Maričić * 10.Hrvoje Radelja *
	Janez Languz	“Introduction FEM” , “FEM Worked example – 2D Heat Flow”	
8th June	Dr. Tomaz Šuštar	“Symbolic approach to FEM”	
	Dr. Martin Lamut	“FEM Worked example – 2D Heat Flow”	
9th June	Prof. Dr. Goran Kugler	“Methods for recrystallization and grain growth simulation on mesoscopic spatial scale”	
	David Bompac	“Atomistic Simulations in Materials Science: Kinetic Method Monte Carlo ”	
10th June	Dir. Edvard Slaček	“Production of aluminium and aluminium-alloy products by casting, rolling, extruding, and drawing”	
	Dir. Matjaž Milfelner	“Laser Beam Hardening; Laser Engineered Net Shaping (LENS); Rapid Prototyping, Tooling & Manufacturing”	
11th June	Aleš Nagode	“Electronic Mikroskopy - Scanning Electron Microscope – JSM5610”	
	Prof. Dr. Anton Smole	“Superplastic Aluminium alloys”	

\* Participates at Trainings on 7th and 10th June

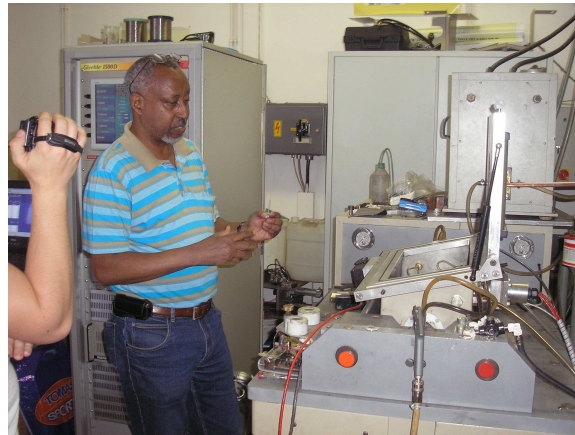
\*\* Participates at Trainings on 10th June

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# Key project results – Outcome 4

UL, C3M, SI



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## Key project results – Outcome 4

**IPU, DK**

Date	Trainers	Name of training	Trainees
<b>30th August</b>	Rene Sobiecki	“Metrology introduction – Demo of simple measuring instruments”	1.Dr. Vesna Mandic 2.Dr. Milentije Stevanovic 3.Dr. Zoran Jurkovic 4.Dr. Zivko Babic 5.Dr. Mileta Janjic 6.Vladan Lukovic 7.Marko Pantic 8.Sasa Randjelovic
	Rene Sobiecki, Erik Larsen, Jakob Rasmussen	“Visit to metrology lab, skener room and CMM room”, “Calibration of micrometer”, “Calibration of inductive probe”, “Roundness”, “CMM, OMC”	
<b>31th August</b>	Prof. Dr Flemming Olsen	“Industrial laser technology”, “Laser for material processing”, “Charasteristic of laser beam”, “Visit to laser lab”, “Laser/materials interaction”, “Laser cutting”, “Laser welding”, “New development in laser cutting and welding”	
<b>1st September</b>	Prof. Dr Leonardo De Chiffre	“Introduction, surface charakterisation metrology”, “3D roughnes”	
	Rene Sobiecki	“Roughnes presentation”, “Visit to metrology lab”, “Calibration of small roughness testers”, “2D/3D roughness demonstration”	
<b>2nd September</b>	Claus Schutt Hansen	“Measurement of heat transfer coefficient”	
	Dr Mogens Arentoft, Nikolas Aulin Paldan	“Tribology”, “Visit to tribology lab”, “Double can extrusion test - demonstration”, “Ring test - demonstration”	
<b>3rd September</b>	Dr Rasmus Eriksen	“Process technology”, “Tooling technology for bulk forming of micro components”, “Visit to microforming lab”	
	David Bue Pedersen, Jakob Nielsen	“Rapid prototyping”, “Visit to rapid prototyping lab”	



# Key project results – Outcome 4

**IPU, DK**



*Prof. Dr Vesna Mandic*

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## Key project results – Outcome 4

## DIMEG, I

Date	Trainers	Name of training	Trainees
13th September	Prof. dr Enrico Savio	“Geometrical and industrial metrology”, “Coordinate metrology”	1.Dr. Vesna Mandić 2.Dr. Dragan Adamović 3.Dr. Zoran Jurković 4.Dr. Mladen Perinić 5.Dr. Duško Pavletić * 6.Dr. Zivko Babić * 7.Dr. Mileta Janjić 8.Vladan Luković 9.Marko Pantić 10.Sasa Randjelović
	Manuel Balcon	“Calibration of touch probe”, “Calibration of CMM using stepcage” “WERTH VC IP 400 demonstration”	
14th September	Prof. dr Simone Carmignato	“Reverse engineering”, “Optical measurement methods” “Computer tomography metrology”	
	Prof. dr Francesco Marinello	“Geometrical characterisation of microcomponents” “Demonstration of Rapid prototyping equipment”	
15th September	Prof. dr Giovanni Lucchetta	“Concurrent engineering”, “Design for assembly”, “Design for assembly software presentation”, “Design for injection molding”, “Design for manufacture software presentation”, “Design for X”	
16th September	Daniele Pelegrini, Paolo Regazzo	“Sheet metal forming devices”	
	Dario Scarabello, Francesko Sgarabotto, Daniele Pellegrini	“Compression test - demonstration”, “Torsion test - demonstration”, “Strip test - demonstration”, “Nakazima test - demonstration”	
17th September	Gianluca Tristo	“Micro electrical discharge machinig”	
	Prof. dr Giovanni Lucchetta	“Micro injection molding”	

\* Participates at Trainings on 14th and 15th September

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## Key project results – Outcome 4

**DIMEG, I**



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## Key project results – Outcome 5

Based on TSNA analysis and discussion with enterprises during Motivational seminars in Serbia and Croatia, following trainings have been developed:

### CTC Kragujevac:

1. CAD/CAM modelling - CATIA (40 hours)
2. Tool design (40 hours)
3. Modelling and optimization of production processes using FE/FV simulation (40h)
4. Project management (20 hours)

### CTC Rijeka:

1. Simulation of machining processes and rapid prototyping techniques (40 hours) (SolidWorks, SolidCam, RP) - introductory course
2. Product design and development with CATIA (20 hours)
3. Process Quality Improvement Methods (20 hours)

### CTC Banja Luka:

1. Advanced CAD modelling using Solid Works (40 hours)
2. NC programming and the basics of CAM modelling (40 hours)

### CTC Podgorica:

1. CAD – ProEngineer (40 hours)
2. Office informatics (40 hours)

## Key project results – Outcome 5

- ❖ Syllabuses are available at the project web site, with CVs of lecturers

 <a href="http://www.wbcvmnet.rs">www.wbcvmnet.rs</a> <a href="mailto:info@wbcvmnet.rs">info@wbcvmnet.rs</a> tel.: +381 34 501 201 fax: +381 34 501 501			
<b>Name</b>	Modeling and optimization of production processes using the FE/FV simulation		
<b>Code</b>	CTC+IG-03		
<b>ECTS</b>	4		
<b>Location</b>	CTC Kragujevac, University of Kragujevac, Faculty of Mechanical Engineering, Serbije Jantić 6, 34000 Kragujevac, Serbia		
<b>Trial name</b>	Prof. Dr Vesna Mandić (v.m@in.kragujevac.rs)		
<b>Purpose</b>	New market demands in terms of price and quality of products call for the implementation of more efficient ways to design products and tools, which involves application of new CAD-technologies, modeling and FE simulation. The research and analysis of processes, their virtualization through virtual models obtained from FE simulation is proven way to increase the efficiency of design and to increase the quality of the final product. Participants of this training will have the opportunity to learn and train themselves for the application of innovative VE technologies in product development, tools development and optimization of multi-body processes.		
<b>Recommended entry level</b>	2 <sup>nd</sup> level of professional qualification, mechanical engineering		
<b>Special requirements</b>	Basic knowledge of CAD modeling and design of tools		
<b>Duration</b>	40 hours		
<b>General objectives</b>	Trainees should be able to: <ul style="list-style-type: none"> <li>explain the principles of concurrent engineering</li> <li>explain the importance of modeling and simulation in the design of products and processes</li> <li>use a modern software tools for FE/FV simulation process</li> <li>identify the relevant parameters for the optimization process</li> <li>provide quality input for the FE simulation of the process (flow curves, contact friction, thermal conditions...)</li> <li>interpret the results and transform them to the real processes</li> <li>explain ways to optimize products and processes through use of relevant parameters</li> </ul>		
<b>Topics</b>	1. Engineering design 2. Virtual engineering technologies and their integration 3. Importance and role of modeling and numerical simulation in engineering design 4. Role of virtual rapid prototyping of products, tools and processes in the concurrent engineering, practical demonstration 5. Finite element structure method 6. Input parameters for modeling and simulation process (preprocessing), exercises 7. Modeling of deformation processing, principles, examples, exercises 8. Interpretation of the results of modeling and simulation (post processing), exercises 9. Optimization process, the large function 10. Optimization of processes and tools, exercises		
<b>Specific learning outcomes in topics</b>	<b>Topic 1: Engineering design</b> Trainees should be able to: <ul style="list-style-type: none"> <li>Describe the stages in the development cycle of products and processes, especially in the engineering design</li> <li>Apply the recommendations for successful engineering design</li> <li>Apply the principles of concurrent engineering design</li> </ul>	Number of hours	2
	<b>Topic 2: Virtual engineering technologies and their integration</b> Trainees should be able to: <ul style="list-style-type: none"> <li>Description of contemporary trends in the application of innovative VE technologies</li> <li>Demonstrate the application and integration of different VE technologies in product development and related technological processes</li> </ul>	Number of hours	2
	<b>Topic 3: Importance and role of modeling and numerical simulation in engineering design</b> Trainees should be able to:	Number of hours	2
	<ul style="list-style-type: none"> <li>Select the method of modeling processes and „jobs“ for numerical simulation</li> <li>Determine the relevant process parameters</li> <li>Highlight the advantages of modeling and simulation in engineering design</li> </ul>	Number of hours	4
	<b>Topic 4: Role of virtual rapid prototyping of products, tools and processes in the concurrent engineering, practical demonstration</b> Trainees should be able to: <ul style="list-style-type: none"> <li>Select the method for making prototypes</li> <li>Select the method for reverse engineering</li> <li>Describe the principles of concurrent engineering</li> </ul>	Number of hours	2
	<b>Topic 5: Finite element/volume method</b> Trainees should be able to: <ul style="list-style-type: none"> <li>Understand the principles of finite element and finite volume methods</li> <li>Choose the type of FE analysis and finite element</li> <li>Interpret the results of FE/FV analysis</li> </ul>	Number of hours	8
	<b>Topic 6: Input parameters for modeling and simulation process (preprocessing), exercise</b> Trainees should be able to: <ul style="list-style-type: none"> <li>Use CAD packages, standard formats for the transfer of geometry</li> <li>Define relevant input for the FE process simulation</li> <li>Understand the concept of flow curves, mesh handling, experimental demonstration</li> <li>Understand the conditions in the contact of tool and workpiece, mathematical description of the contact friction and determine the friction parameters</li> <li>Describe the thermal conditions of the process</li> <li>Successfully use of FE/FV software post processor for the entry of input data</li> </ul>	Number of hours	8
	<b>Topic 7: Modeling of deformation processing, principles, examples, exercise</b> Trainees should be able to: <ul style="list-style-type: none"> <li>Model different processes of deformation using FE/FV software</li> <li>Define relevant process parameters, which should be modified in the course of numerical analysis</li> <li>Successfully use VIM software for numerical simulation</li> </ul>	Number of hours	4
	<b>Topic 8: Interpretation of the results of modeling and simulation (post processing), exercise</b> Trainees should be able to: <ul style="list-style-type: none"> <li>Interpret the results of FE/FV analysis process and transform them to the real processes</li> <li>Do a detailed analysis of the results of simulation and suggest corrective measures</li> <li>Successfully use post processor in FE/FV software for overview of results</li> </ul>	Number of hours	2
	<b>Topic 9: Optimization process, the target function</b> Trainees should be able to: <ul style="list-style-type: none"> <li>Optimize designs of tool through numerical FE/FV simulation</li> <li>Identify critical parameters of the process, define a plan of numerical experiment</li> <li>Understand the concept of large function optimization, making the right choice</li> </ul>	Number of hours	8
	<b>Topic 10: Optimization of processes and tools, exercise</b> Trainees should be able to: <ul style="list-style-type: none"> <li>Independently optimize processes of deformation using FE/FV simulations</li> <li>Conduct geometrical parameters of tools and process parameters to meet the target function optimization</li> <li>Find ways to use VIM technologies in domains of environment</li> </ul>	Number of hours	8
<b>Portfolio assessment</b>	Trainer evaluates level of success in overcoming the training objectives, through assessment exercises and testing. Rating exercise: Exercise trainer defined on the basis of which can be implemented to assess the degree of learning outcomes. The exercises can be performed individually or in team, in groups of 2-5 trainees. Examination: Test is defined by trainer on basis of examination which can assess the cognitive skills and their application. For this purpose it is necessary to respond to a range of questions. Answers to questions are provided in writing and orally, in a conversation with		



## Key project results – Outcome 5

- ❖ Practical Placement programme was developed until June 2010
- ❖ Action and work programme was accepted and applied by working team members
- ❖ PPP programme with all annexes is available at web site
- ❖ PPP flyer is designed

Responsible partner	Country	Responsible person
<b>DIMEG</b>	Italy	Stefania Bruschi
<b>UKG</b>	Serbia	Vesna Mandić
<b>REDASP</b>	Serbia	Marijana Božić
<b>UR</b>	Croatia	Zoran Jurkovic
<b>UBL</b>	Bosnia and Herzegovina	Živko Babić
<b>UP</b>	Montenegro	Mileta Janjić



## Key project results – Outcome 5

Structure of Practical Placement Programme includes:

1. Executive summary
2. Introduction (**2.1** Purpose and objectives of PPP; **2.2** Structure of PPP guide; **2.3** Benefits for students and hosting companies/institutions)
3. Management of PPP and procedures (**3.1** Basic principles of organizing practical placements; **3.2** Database models for establishing sustainable and efficient PPP, defined list of offered hosting institutions and list of courses/student needs/; **3.3** Workplace requirements and safety conditions; **3.4** Principles of review and monitoring of practical placement implementation)
4. Supporting documents and guidelines (**4.1** Information guideline to students; **4.2** Information guideline to prospective hosting enterprise/institution; **4.3** Guidelines for mentors; **4.4** Application forms; **4.5** Template letters; **4.6** Model of agreement between faculty and hosting enterprise/institution; **4.7** Accident report form; **4.8** PPP monitoring form; **4.9** PPP report by student; **4.10** Evaluation form by mentors)



## Key project results – Outcome 5

**CTC Practical Placement Programme**  
 Collaborative Training Centre

In order to improve and acquire new knowledge of students, CTC centers have developed and coordinate a new Practical Placement Programme (PPP) which provides students the opportunity to gain practical experience in industry, in an area that relates to their academic studies, and to further develop their professional, technical and interpersonal skills.

Placement programs have the important role of creating a bridge between education and employment. They help students to optimize their education and subsequently work choice and to better position themselves in the work world. Then the objective of PPP is to facilitate the incorporation of students into the workforce while supplying them with professional experience and skills in addition to theoretical knowledge.

**Benefits for students**

- Acquisition of practical knowledge and skills in the field of studies, often connected with solving real problems at workplace;
- The student can see how the teaching material covered within subjects of studies is applied and how relevant it is to the real situations in the business, which increases learning motivation;
- Making business contacts and increasing chances for future employment through gathering additional references in CV, by working at real jobs;
- Developing business communication skills and team work;
- Access to career development opportunities and proper decision making as regards the choice of future occupation;
- Broader understanding of domestic and international business environments and communications required for career development and business development;
- Sometimes practical placement can be a source of additional revenue, if the company that provides practical placement wishes and is able to finance part of the student's realized activities; it is defined by the contract.

**Benefits for enterprises**

- Students bring new ideas and different interpretations of the current problems of enterprise, which are up to date with modern trends and new technologies they learn during studies;
- Making closer connections with universities, and strengthening of development capacities;
- Longer practices may serve well to the evaluation and selection of new employees;
- The practical placement is an opportunity to influence the improvement of student education and their better preparation for inclusion in the work process when employed;
- Student involvement in the ongoing projects and reinforcing the team with fresh personnel;
- Employees involved in realization of practical placement strengthen their monitoring skills;
- Costs of training employees are reduced when employing graduates who have gone through the practical placement of that enterprise;
- Raising the reputation and publicity of enterprises through support and sponsorship of practical placement.

**CTC Practical Placement Programme**  
 Collaborative Training Centre

**Practical placement implementation procedure**

**1. Planning**

Database of enterprises	Matching student and enterprises	Workplace requirements	Negotiation and contracting
PPP coordinator, Representative of academic institution	PPP coordinator, Industrial mentor, Representative of enterprise	PPP coordinator, Representative of enterprise	Representative of academic institution, Representative of enterprise <i>annex 4.6*</i>

**2. Execution**

Application form	Referral/Confirmation form	PP Work programme	Diary on PP
Student <i>annex 4.4*</i>	Academic mentor and Industrial mentor <i>annex 4.5*</i>	Academic mentor, Industrial mentor and Student <i>annex 4.12*</i>	Student <i>annex 4.14*</i>

**3. Monitoring and reporting**

Industrial mentor's monitoring report	Academic mentor's monitoring report	Final report on PP	Accident report
Industrial mentor <i>annex 4.8*</i>	Academic mentor <i>annex 4.9*</i>	Student <i>annex 4.11*</i>	PPP coordinator, Industrial mentor <i>annex 4.7*</i>

**4. Evaluation**

Student's evaluation	Academic mentor's evaluation	Final mark
Student <i>annex 4.11*</i>	Academic mentor <i>annex 4.10*</i>	Academic mentor

*Detail description and supporting documents in form of annexes are available on CTC web sites*

**Contacts**

<p><b>Prof. Dr Vesna Mandić</b>                  Coordinator of CTC Kragujevac                  Sestre Janjic 6                  34000 Kragujevac                  Tel. +381 34 501 201                  Fax. +381 34 501 901                  E-mail. ctc@kg.ac.rs                  URL. www.ctc.kg.ac.rs</p>	<p><b>Prof. Dr Zinko Bahić</b>                  Coordinator of CTC Banja Luka                  Vojvode Stepe Stepanovića 71                  78000 Banja Luka                  Tel. +387 51 462 321                  Fax. +387 51 465 085                  E-mail. ctc@unibl.rs                  URL. www.ctc.unibl.rs</p>	<p><b>Prof. Dr Zoran Jurković</b>                  Coordinator of CTC Rijeka                  Vukovarska 58                  51000 Rijeka                  Tel. +385 51 651 466                  Fax. +385 51 651 468                  E-mail. ctc@irnh.hr                  URL. www.ctc.irnh.uniri.hr</p>	<p><b>Prof. Dr Mileta Janjić</b>                  Coordinator of CTC Podgorica                  Džordža Vasilingtona bb                  81000 Podgorica                  Tel. +382 78 107 285                  Fax. +382 20 245 116                  E-mail. ctc@ac.me                  URL. www.ctc.ac.me</p>
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Digitally signed by Vesna Mandic

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**WBCVMnet**  
 WBC Virtual Manufacturing Network  
 Fostering an Integration of the Knowledge Triangle

Prof. Dr Vesna Mandic

This project has been funded with support from the European Commission



## Key project results – Outcome 5

- ❖ Industrial Fellowship programme was developed until July 2010
- ❖ Action and work programme was accepted and applied by working team members
- ❖ IFPP programme with all annexes is available at web site
- ❖ IFP flyer is designed

Responsible partner	Country	Responsible person
<b>DIMEG</b>	Italy	Stefania Bruschi
<b>IPU</b>	Denmark	Mogens Arentoft
<b>UKG</b>	Serbia	Vesna Mandić
<b>UR</b>	Croatia	Zoran Jurkovic
<b>C3M</b>	Slovenia	Tomaž Šuštar
<b>Ind.exp.2</b>	Serbia	Goran Stojanovic
<b>SCGM</b>	Serbia	Goran Matović



## Key project results – Outcome 5

Structure of Industrial Fellowship Programme includes:

1. Executive summary
2. Introduction (**2.1** Purpose and aims of IFP; **2.2** Structure of IFP guide; **2.3** Benefits for graduates/industrial fellows, sponsoring enterprise and hosting R&D institution)
3. Management of IFP and procedures (**3.1** Basic principles of organizing Industrial fellowship programme; **3.2** Database models for establishing sustainable and efficient IFP; **3.3** Different types of IFP depending on discipline and duration; **3.4** Principles of career development for graduates/industrial fellows; **3.5** Principles of review and progress monitoring of IFP implementation; **3.6** Establishing a confidentiality of available information during IFP implementation; **3.7** Funding rules).
4. Supporting documents and guidelines (**4.1** Information guidelines for enterprise/industrial fellows; **4.2** Information guidelines for hosting R&D institution; **4.3** Guidelines for academic/research mentors; **4.4** Sworn statement form for industrial fellow; **4.5** Model of agreement between enterprise (sponsor), industrial fellow and hosting R&D institution; **4.6** Monthly IFP progress reporting form; **4.7** Certificate form by academic/research mentors; **4.8** Monthly time sheet form; **4.9** IFP monitoring form).

*Prof. Dr Vesna Mandić*

This project has been funded with support from the European Commission

## Key project results – Outcome 5



**CTC Industrial Fellowship Programme**  
 Collaborative Training Centres

**Purpose and aims of IFP**

IFP program is intended for the establishment of sustainable partnership between universities and industry through hosting industrial fellows (graduates and engineers from industry) in research and academic centers, with the aim to realize advanced targeted trainings of industrial fellows and joint research according to the needs of industrial sponsor.

Flexible IFP duration, organized several times during the year, enables the hiring of industrial fellow on development and innovation projects of mutual interest for academic and industrial partner. The IFP program is an excellent opportunity for technology transfer and involvement of young people in innovative projects that contribute to the exchange of experience, ideas, knowledge, and increase of innovative potential and competitiveness of enterprises.

The Industrial Fellowship Programme should focus on those sectors that have strategic importance for the WBC region, such as:

- manufacturing and production;
- micromanufacturing;
- nanotechnologies;
- energy and energy saving;
- advanced biotechnologies;
- ICT and embedded systems;
- other new and emerging sectors.

The main goals for the Industrial Fellowship programme will be:

- to establish and support research projects in strategic industrial sectors;
- to develop innovative solutions to industrial and societal challenges;
- to provide academics with the opportunity to learn about interesting and relevant problems and applications for future research directions;
- to transfer academic knowledge to industry;
- to facilitate long-term career success of highly qualified knowledge workers in academic organizations and industry;
- to encourage creation of R&D jobs in industry.

**Join and Benefit!**

**Motivation**

Several main reasons can motivate the industry to increase university-industry cooperation (including IFP). They are:

- access to manpower, including well-trained graduates and knowledgeable faculty;
- access to basic and applied research results from which new products and processes will evolve;
- solutions to specific problems or professional expertise, not usually found in an individual enterprise;
- access to university facilities, not available in the enterprise, for example some specific software tool or modern equipment;
- assistance in continuing education and training;
- obtaining prestige or enhancing the enterprise's image; and
- being good local citizens or fostering good community relations.

On the other hand, the reasons for universities to be interested in IFP are:

- industry provides a new source of money for university;
- industrially sponsored research provides student with exposure to real world research problems;
- industrially sponsored research provides university researchers a chance to work on an intellectually challenging research programs;
- some government funds are available for applied research, based upon a joint effort and cooperation between university and industry.



**CTC Industrial Fellowship Programme**  
 Collaborative Training Centres

**Benefits for industrial fellows**

An industrial fellowship is particularly valuable for graduates. The main benefits the fellows will experience can be summarized as follows:

- to be provided by an interesting working experience, developing an important contact with the university research environment;
- to enhance his/her own creative thinking, problem-solving, project management and team-building skills;
- to enhance his/her own ability to communicate with academy in order to identify solutions for problems and issues of interest;
- to be provided by a customized learning experience based on skills, talents, and developmental needs;
- to work in a collaborative environment with both academics and industrial people, forming long-term contacts and networks for future collaborations;
- to access to academic services (on-line databases, software, laboratory equipment, academic network) and the possibility of attending ongoing courses and seminars;
- to have the possibility of publishing papers and patent applications with the research team at the University.

**Benefits for the R&D institution**

Thanks to the activation of an industrial fellowship program, the hosting R&D institutions can:

- have fellows that will act for the knowledge and technology transfer from university to sponsor enterprises and provide excellent communication channels between them;
- provide a pipeline of up-to-date, experienced practitioners for innovation of internal audit products, tools, and services;
- reduce investment in overall staffing since the labor costs (salary and consumables) for fellows accepted into the program will be assumed by the sponsoring enterprise for the duration of the fellowship assignment;
- align the strategic directions of research to the real needs of industry;
- application and verification of fundamental research results through joint development and innovation projects with the sponsoring company within the IFP;
- development of a consortium for new projects (national and international).

**Benefits for the sponsor enterprise**

Sponsoring enterprises can gain great benefits from participation in Industrial Fellowship Programs. In particular the IFP:

- brings out technical expertise, research, and innovation from university experts (professors and researchers) to the industry;
- helps technological transfer from university to industry;
- fosters sustained competitive advantages through applying innovation;
- encourages to apply the scientific approach to industrial activities;
- promotes the development of new skills useful for the industry;
- gets opportunity to reduce rates at selected research facilities used in IFP;
- allows professional growth and reward opportunities for high-potential staff, integrating career goals with fellowship opportunities;
- creates an important communication channel with the university and R&D centres, helping knowledge transfer even in technological fields external to the specific research activity;
- generates customized assignments that are mutually beneficial to the employee, the organization, and the university;
- strengthens external relations;
- provides opportunities to impact the future research direction.

**Contacts**

<b>Prof. Dr Vesna Mandić</b> Coordinator of CTC Kragujevac Sestre Janjić 6 34000 Kragujevac Tel. +381 34 501 201 Fax. +381 34 501 901 E-mail. mandic@kg.ac.rs Url. www.ctc.kg.ac.rs	<b>Prof. Dr Žilka Bahić</b> Coordinator of CTC Banja Luka Vojvođe Stepe Stepanovića 71 78000 Banja Luka Tel. +387 51 462 321 Fax. +387 51 465 085 E-mail. ctcc@unibl.rs Url. www.ctc.unibl.rs	<b>Prof. Dr Zoran Jurković</b> Coordinator of CTC Rijeka Vukovarska 58 51000 Rijeka Tel. +385 51 651 466 Fax. +385 51 651 468 E-mail. ctcc@rth.hr Url. www.ctc.rth.uniri.hr	<b>Prof. Dr Mileta Janjić</b> Coordinator of CTC Podgorica Džordžija Vašingtona bb 81000 Podgorica Tel. +382 78 107 285 Fax. +382 20 245 116 E-mail. ctcc@ac.me Url. www.ctc.ac.me
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## Key project results – Outcome 6

- ❖ Project web site are regularly updated by UKG, with intraproject communication tool for partners
- ❖ Different dissemination events are planned by the programme (8 info days, 3 motivational seminars, 3 workshops, 3 brokerage events). The following events have been realized so far:
  1. Motivational seminar, Kragujevac, Serbia, 25.12.2009, **30** participants,
  2. Motivational seminar, Rijeka, Croatia, 16.02.2010, **42** participants
  3. Motivational seminar, Banja Luka, BIH, 24.04.2010, **39** participants
  4. Info day, Kragujevac, Serbia, 15.04.2010, **50** participants,
  5. Info day, Belgrade, Serbia, 13.05.2010, **20** participants,
  6. Info day, Banja Luka, BIH, 17.05.2010, **34** participants,
  7. Info day, Rijeka, Croatia, 18.06.2010, **42** participants,
  8. Info day, Ulcinj, Montenegro, 24.06.2010, **27** participants,
  9. Info day, Novi Sad, Serbia, 24.06.2010, **29** participants,
  10. Info day, Zagreb, Croatia, 30.06.2010, **40** participants,



## Key project results – Outcome 6



355 participants

*Prof. Dr Vesna Mandic*

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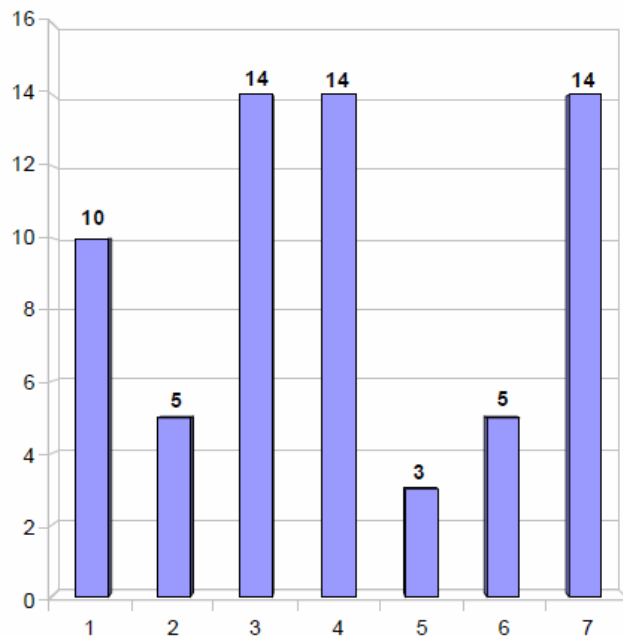




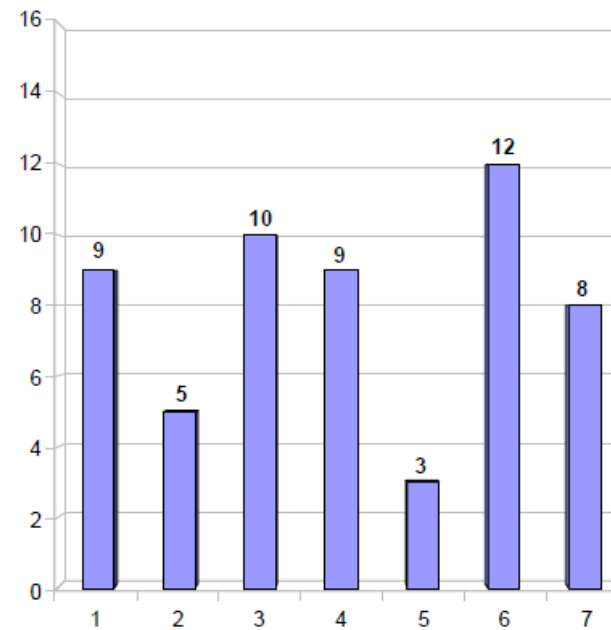
## Key project results – Outcome 6

Questionnaires` results – WBC Regional model of University-enterprise cooperation

- |   |                                       |
|---|---------------------------------------|
| 1. Scientific and technology parks in university centers, | 4. CTC and LLL centers;               |
| 2. Regional industrial clusters;                          | 5. Open innovation networks;          |
| 3. Consortium of universities and companies - EU projects | 6. Student practical placement - PPP; |
|   | 7. IFP for graduates and employees.   |



Info day – Kragujevac, RS, 4.38



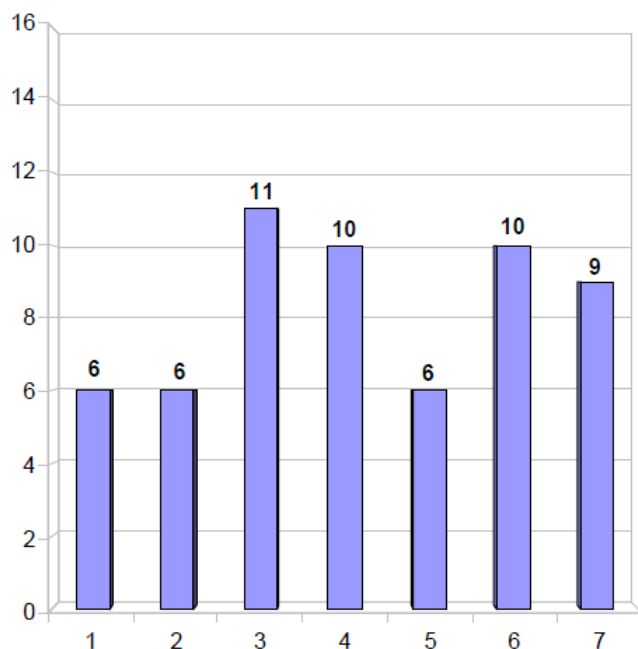
Info day – Belgrade, RS, 4.30



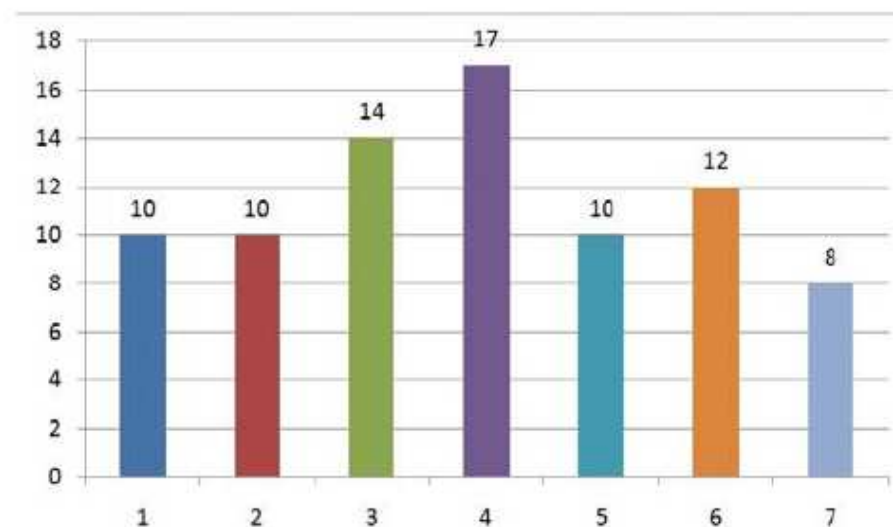
## Key project results – Outcome 6

Questionnaires` results – WBC Regional model of University-enterprise cooperation

1. Scientific and technology parks in university centers,
2. Regional industrial clusters;
3. Consortium of universities and companies - EU projects
4. CTC and LLL centers;
5. Open innovation networks;
6. Student practical placement - PPP;
7. IFP for graduates and employees.



Info day – Banja Luka, BIH, 4.24



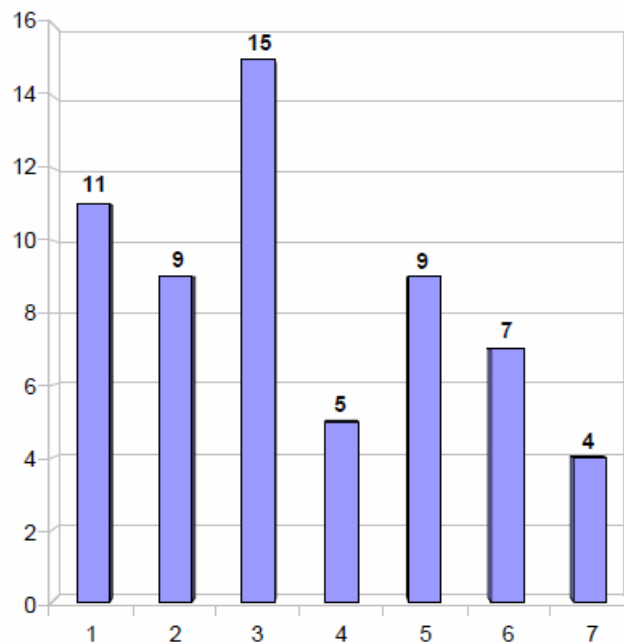
Info day – Rijeka, HR, 4.39



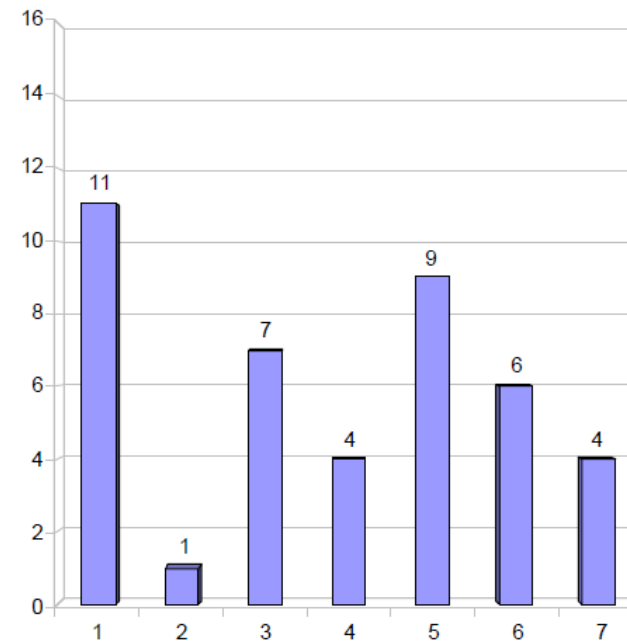
## Key project results – Outcome 6

Questionnaires` results – WBC Regional model of University-enterprise cooperation

- |   |                                       |
|---|---------------------------------------|
| 1. Scientific and technology parks in university centers, | 4. CTC and LLL centers;               |
| 2. Regional industrial clusters;                          | 5. Open innovation networks;          |
| 3. Consortium of universities and companies - EU projects | 6. Student practical placement - PPP; |
|   | 7. IFP for graduates and employees.   |



Info day – Novi Sad, RS, 4.64



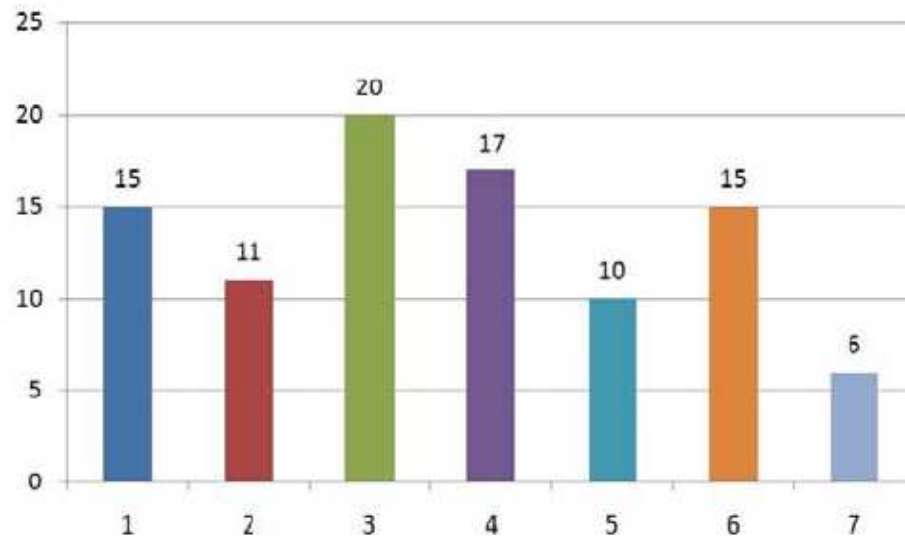
Info day – Ulcinj, MNE, 4.43



## Key project results – Outcome 6

Questionnaires` results – WBC Regional model of University-enterprise cooperation

1. Scientific and technology parks in university centers,
2. Regional industrial clusters;
3. Consortium of universities and companies - EU projects
4. CTC and LLL centers;
5. Open innovation networks;
6. Student practical placement - PPP;
7. IFP for graduates and employees.



Info day – Zagreb, HR, 4.1

Prof. Dr Vesna Mandić

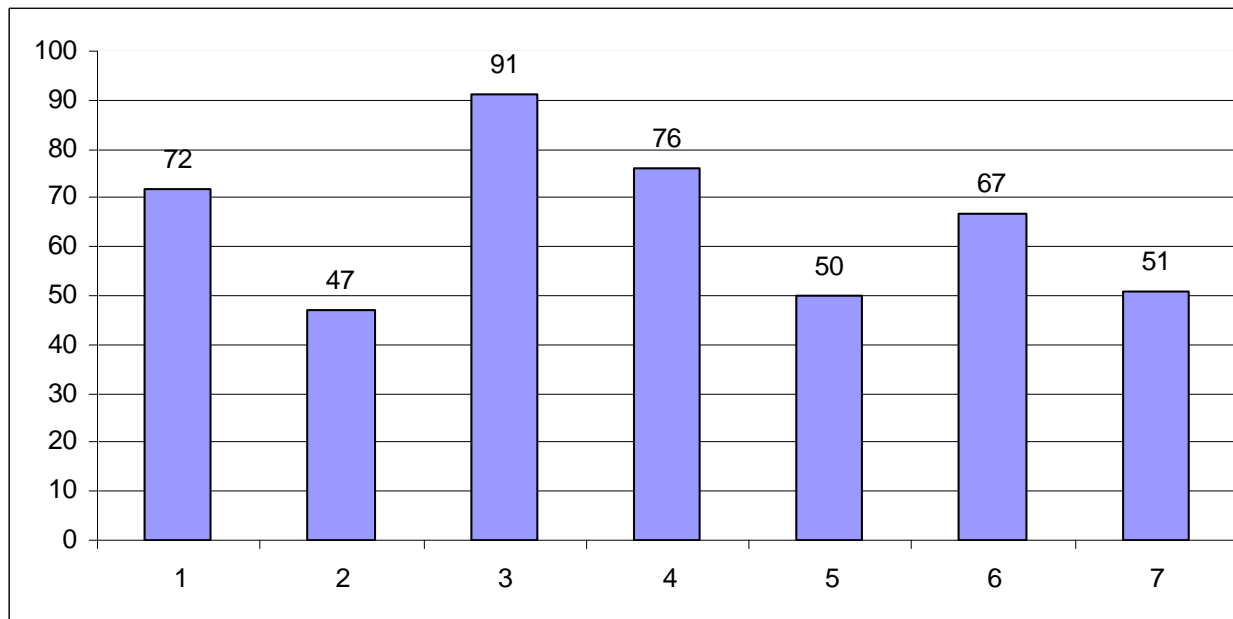
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## Key project results – Outcome 6

Questionnaires` results – WBC Regional model of University-enterprise cooperation

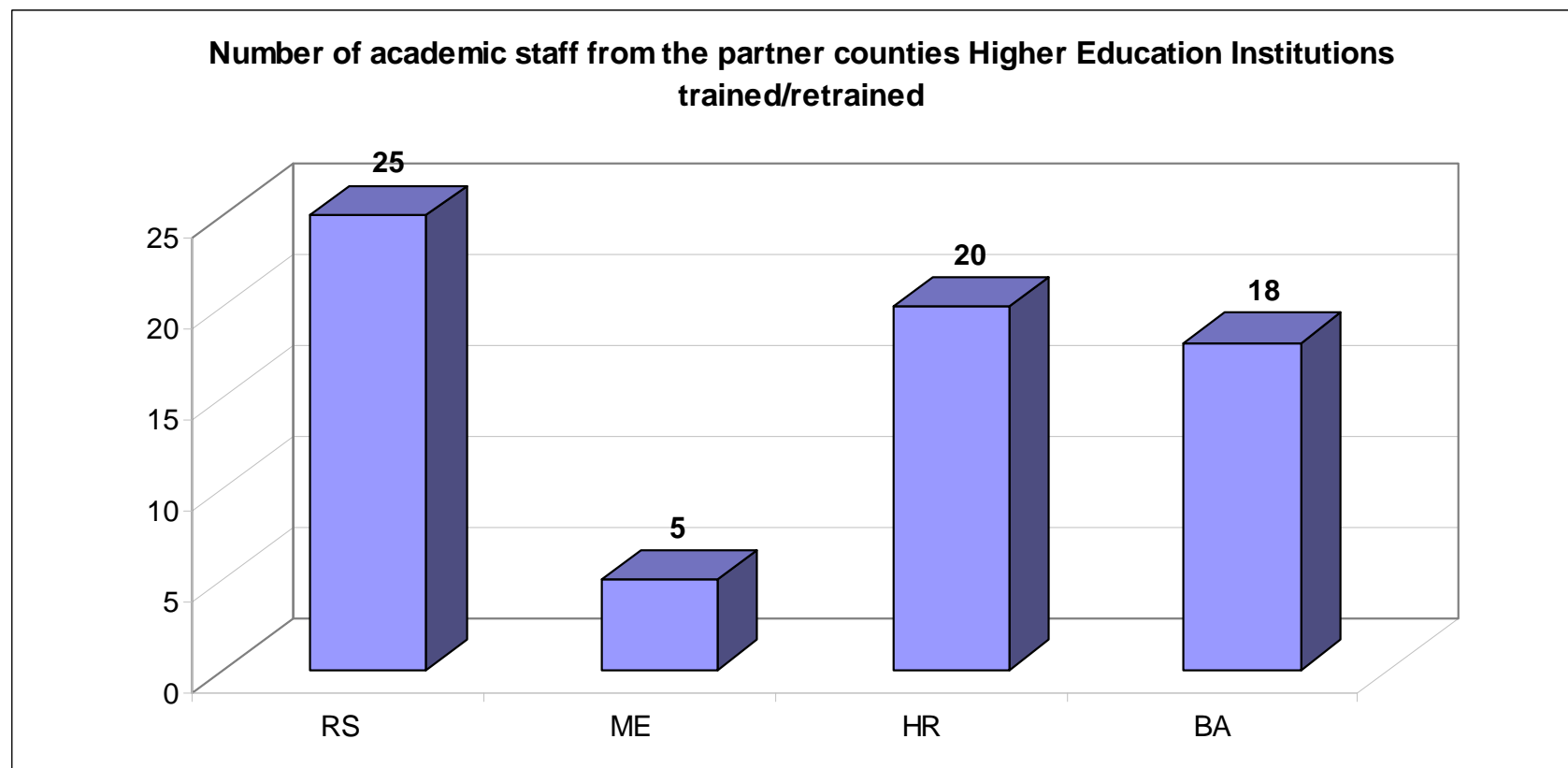
- |   |                                       |
|---|---------------------------------------|
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| 2. Regional industrial clusters;                          | 5. Open innovation networks;          |
| 3. Consortium of universities and companies - EU projects | 6. Student practical placement - PPP; |
|   | 7. IFP for graduates and employees.   |



Info days in the WBC region – 242 participants, 4 countries

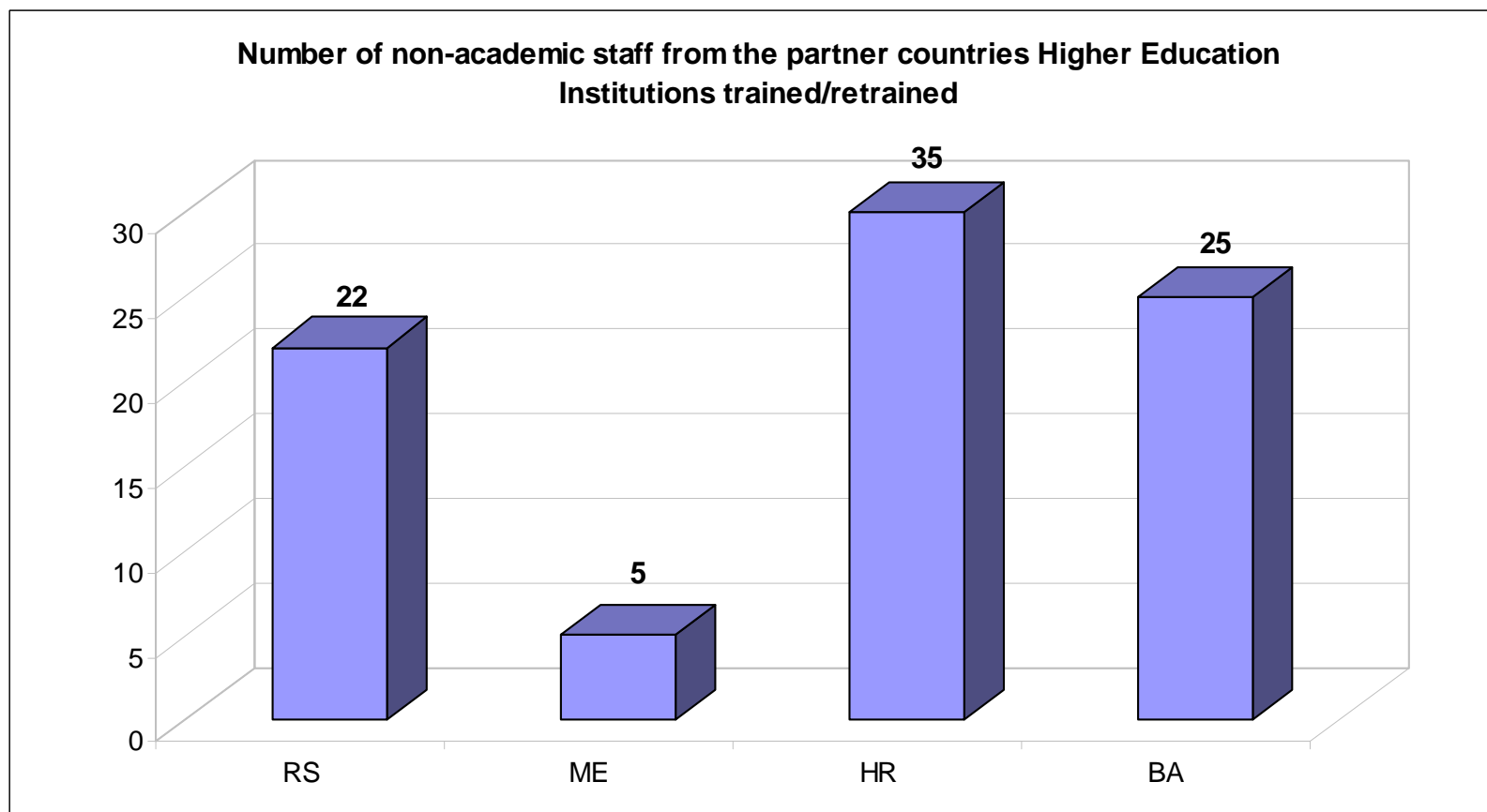


## Key project results – Outcome 6



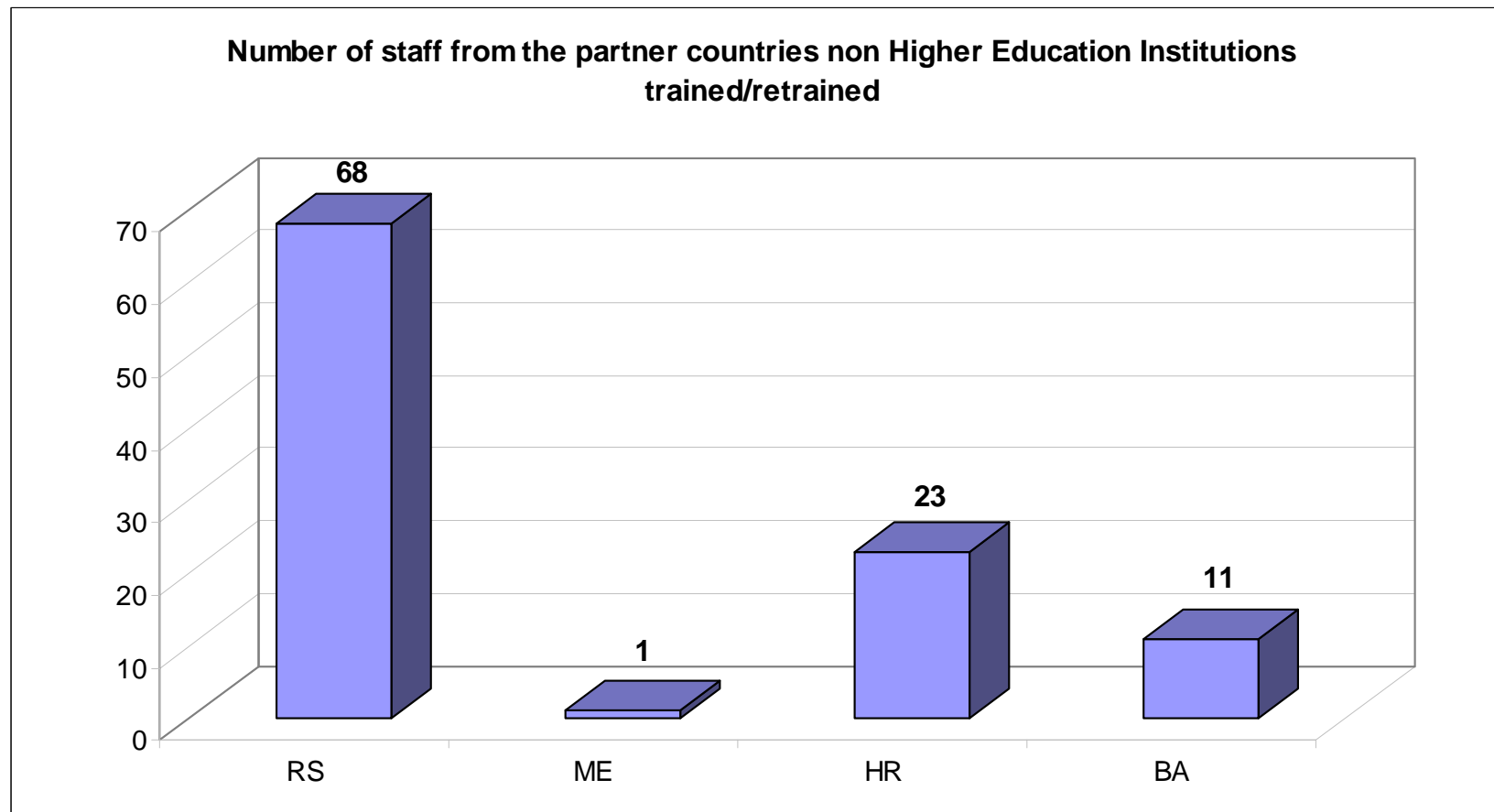


## Key project results – Outcome 6





## Key project results – Outcome 6







## Key project results – Outcome 8

- ❖ Three internal monitoring visits to UR, Elcon Geratebau and UBL, by Project Coordinator, have been realized in February and April 2010,
- ❖ Four external monitoring visits were performed by national TEMPUS offices:
  - UR - Rijeka, February 2010
  - UKG – Kragujevac, January 2010
  - UBL – Banja Luka, May 2010
  - UP – Podgorica, October 2010
- ❖ Each partner had their own internal quality control activities



## Key project results – Outcome 9

- ❖ 1<sup>st</sup> and 2<sup>nd</sup> instalments transferred to all partners who sent PP reports and spent more than 70% of previous instalment
- ❖ Project Coordinator was in charge of overall project management on the level of Consortium
- ❖ Communication channels have been established
- ❖ UKG has updated (on monthly base) financial tables, cash flow,
- ❖ All supporting documents are properly stored (their own and obtained from partners)
- ❖ Intermediate report was consolidated and sent to **EACEA** Brussels on 2<sup>nd</sup> July 2010. We are expecting next grant payment from EACEA.

## Key project results – Outcome 9

		<b>1. PROJECT COSTS €</b>
		Estimated Budget of the action (Annex II)
I	Staff costs (including replacement costs)	262370
II	Travel costs and Costs of Stay	194000
III	Equipment	200000
IV	Printing and publishing	12000
V	Other costs	5000
VI	Indirect Costs <sup>1</sup>	47000
<b>TOTAL ELIGIBLE COSTS (A.4) <sup>2</sup></b>		<b>720,370.00</b>

		<b>3. PROJECT FINANCE €</b>
A	Co-financing	33700
B+C	Total from Tempus	686670
<b>TOTAL PROJECT FINANCE (A.4)</b>		<b>720,370.00</b>

<b>2. PROJECT EXPENDITURE €</b>		
Declared Paid from Tempus	Declared Co-financed	Total Declared
62,299.44	10,066.22	72,365.66
33,980.52		33,980.52
182,610.72		182,610.72
6,304.14		6,304.14
3,948.29		3,948.29
10,646.15		10,646.15
<b>Total:</b>	<b>Total:</b>	<b>TOTAL:</b>
299,789.26	10,066.22	<b>309,855.48</b>

<b>BANK INTEREST €<sup>3</sup></b>	0.00
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## Key project results – Outcome 9

- ❖ 11 partners sent 2<sup>nd</sup> Partner Report until June 2010
- ❖ PST and QAPT team have done evaluation of reports - results are shown in table below

2nd Partners' reports assesment and acceptance		UP	UR	UBL	UPD	UL	REDASP	IPU	C3M	SCGM	ELCON Geratebau	TRIBEST	METALIK
<b>Partnership agreement signed</b>		x	x	x	x	x	x	x	x	x	x	x	x
<b>Technical Report:</b>	Technical report delivered in time	x	x	x	x	x	x		x		x	x	
	Technical report is quality completed (1 - poor, 5 - excelent)	4	4	4	4	4	4		4		4	2	
	Do described activities in technical report corespond to sent deliverables, as well as incurred staff and travel costs within finniacial report?	Yes	Yes	Yes	Yes	Yes	Yes		Yes		Yes	Yes	
	Expected indicators are achieved (1 - insufficient, 5 - completely)	4	4	4	4	3	4		3		4	3	
<b>Financial Report:</b>	Financial report is completed and signed by legal representative	x	x	x	x	x	x	x	x	x	x	x	x
	Cash flow staff table	x	x	x	x	x	x		x	x	x	x	x
	Cash flow travel table	x	x	x	x	x	x		x	x	x	x	x
<b>Supporting documents delivered as copies:</b>	Convention form for staff costs, signed by legal representative	x	x	x	x	x	x	x	x	x	x	x	x
	IRG report on travel, signed by traveler	x	x	x	x	x	x	x	x	x	x	x	x
	Travel invoices - copies, calculations by accountant	x	x	x		x	x	x	x	x	x		x
	Invoices of purchased equipment, copies	x	x	x	/	/	/	/	/	/	/	/	/
	Are there overspends (OS) or underspends (US) of TEMPUS budget?	US	US	US	US	US	US	OS	US	US	US	US	US
	Cofinancing are provided	x	x	x	x			x	x	x			x



## Thank you for your attention