SCIENTIFIC RESEARCH IN THE LABORATORY OF MANAGEMENT ACCOUNTING AND CONTROLLING SYSTEMS AT THE FACULTY OF MANAGEMENT AND POSSIBILITIES OF USING ITS RESULTS FOR STUDENTS' EDUCATION*

Justyna ŚPIEWAK, Arkadiusz JANUSZEWSKI

*Article was developed using equipment of the Laboratory of Management Accounting and Controlling Systems in the project 'Stage 2 of the Regional Centre of Innovativeness' co-financed by the European Regional Development Fund under the Regional Operational Programme for Kujawsko-Pomorskie Province for the years 2007-2013.

Abstract: The paper presents a project implemented at the University of Technology and Life Sciences in Bydgoszcz 'Stage 2 of the Regional Centre of Innovativeness', which aims at enhancing the transfer of knowledge and innovative solutions from the world of research and development to the world of enterprises. A special attention has been paid to the demonstration of research in the Laboratory of Management Accounting and Controlling Systems at the Faculty of Management. The lab is equipped with innovative computer hardware and software for operational budgeting, strategy management, and management of costs and profitability. As a result of cooperation with students, there has been created a business database of case studies, illustrating the practical use of innovative computer-aided management methods. Finally the paper demonstrates a potential of using the research results for the education of students.

Key words: transfer of knowledge, cooperation between science and business, research in the education of students, Regional Centre of Innovativeness, The Laboratory of Management Accounting and Controlling Systems.

1. Introduction

One of the main goals of the operation of an enterprise is building a high competitive position which is a reflection of its success. Maintaining this position is not an easy task, especially in the conditions of turbulent surroundings, in which current economic organizations operate. One of the most significant factors determining an enterprise competitive position is innovativeness [6,p.109]. On the other hand, the barriers which considerably limit the enterprise potential of developing and implementing innovative solutions on its own include a lack of appropriate resources, both human and financial, [6, p.109], [5, p.495]. The obstacles can be overcome by cooperation with academic centres. An essential role of research and development centres in building enterprise innovativeness is emphasized by several authors; Kielec and Patalas, [5, p.494-495], calling for cooperation between science and business in order to achieve a sustained competitive position. The transfer of knowledge from science to business is also considered one of the biggest challenges faced by the scientific environment [4, p.111]. Bearing that in mind,

providing business with support from scientific and research centres is becoming essential for the enterprise development and a great chance for innovations without high financial costs borne by enterprises.

Importantly, the research carried out by schools of higher education and the education provided; both at the basic and specialist level, are considered two out of the six key components of the model of innovativeness transfer from universities to enterprises [4, p.138]. Additionally, the student involvement in solving problems in business practice gives them a chance to enhance their academic knowledge and skills [4, p. 138]. It is also important to educate graduates not only with theoretical knowledge in their respective majors but also with skills and competence to take up innovative activities in their professional life.

Once Poland joined the European Union, it has become possible to seek co-financing as part of the cohesion policy, mostly from two funds: the European Fund of Regional Development and the European Social Fund [2]. Financial support has facilitated many projects, including establishing cooperation between the academic and business worlds. The project 'Realization of II Stage of Regional Centre of Innovativeness' is a positive example of such cooperation, being a follow-up of the project 'Regional Centre of Innovativeness' (RCI II) implemented by the University of Technology and Life Sciences in Bydgoszcz. The Project RCI II was initiated in 2009 and it has been co-financed from the European Regional Development Fund within the Regional Operational Program (Table1).

Table 1. Information on the project 'Regional Centre of Innovativeness'

Subject of the project	Regional Research Laboratories
Area of operation	Sciences of Technology and Agriculture
Priority axis 5	Enhancement of competitiveness of enterprises
Activity 5.4	Enhancement of the regional potential of technological research and development
Operational program	Regional Operational Program for the Kujawsko-Pomorskie Province for the years 2007-2013
European Fund	Regional Development Fund
Source of financing	European Regional Development Fund
Beneficiary	University of Technology and Life Sciences
Value of the project at the UTP, including	over PLN 57m (including PLN 40m from EFRR)
European Fund of Regional Development	PLN 40 263 443.29 (70%)
Own contribution	PLN 17 255 761.42 PLN (30%)
Project type	Investment
Number of the laboratories established	25 laboratories in a total of 9 UTP units
Project time	October 1, 2009 to December 31, 2013

Source: own research based on [11].

The main goal of RCI II project is 'spreading information of scientific character as well as taking up and tightening cooperation between scientific centres and economy' [8, p.148]. The goal is pursued by creating conditions for facilitating the transfer of knowledge and experience from the research and development domain to business, supporting innovative development of the enterprises with no adequate research and development facilities and sufficient scientific potential and enhancing the cooperation between the world of science and entrepreneurs [11]. Research laboratories, founded step by step, in various University units are to facilitate cooperation between the academic world and entrepreneurs to support the innovativeness of small- and medium-sized enterprises of the Kujawsko-Pomorskie Region (More information: www.rci-2etap.utp.edu.pl).

At the Faculty of Management there were founded 4 computer business laboratories which involved the allocation of PLN 3.5m. The laboratories are equipped with computer hardware and integrated IT systems, business models creation tools with the use of innovative management methods and knowledge management tools (Figure 2). The value added is made up by the databases and reference models, demonstrating, with specific examples, the possibilities of using innovative methods implemented in the solutions.

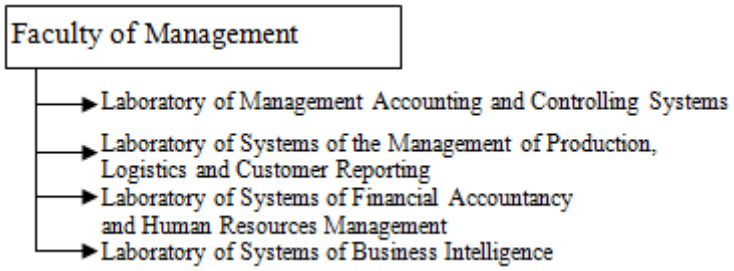

Fig. 1.Structure of laboratories founded at the Faculty of Management, UTP
Source: authors' own research based on [11]

One shall note that the main task of the laboratories is not to promote specific IT products but state-of-the-art innovative methods and operation methods with the use of high performance IT tools and systems supporting management in different areas of operation of economic organizations.

The laboratories provide a possibility to implement practical solutions developed in cooperation with business into the education program. Following a given course, it is possible to present the research results and to engage the student in research itself.

This article aims at demonstrating the research performed in the laboratory of Management Accounting and Controlling Systems in cooperation with students and enterprises and at highlighting the potential of applying the solutions to education.

1.1 Characteristics of the Laboratory of Management Accounting and Controlling Systems

This article covers the research performed in the Laboratory of Management Accounting and Controlling Systems. The analysis of the source materials covered the lab operation documentation. The following were analysed: the service offer addressed for entrepreneurs, cooperation contracts, installed systems documentation as well as the results of research performed by students as part of their research work on MSc and BSc theses,

applying the laboratory software. Additionally, there were investigated the education programs offered for the management major, especially the courses and problems where laboratory research results can be applied.

The Laboratory of Management Accounting and Controlling Systems is the response to the needs of enterprises in terms of the application of innovative methods for management accounting and controlling. The research includes computer-aided applications of Activity Based Costing (ABC), Balanced Scorecard (BSC) and the operational budgeting method. The laboratory is equipped with state-of-the-art IT systems and tools Business Intelligence BI class, using the technology of data warehouse and the multidimensional tool (On-line Analytical Processing (OLAP)).

Research on data warehouses has been developed since the 1970s [7, p. 436]. BI systems are a response to the growing demand for detailed analyses of the constantly increasing amount of data; historical, current and planned. The development and the availability of those systems results in an increasing interest among managers who understand the need of their implementation mainly for customer relationship management (analytical systems of the Customer Relationship Management (CRM) class) and for support controlling and management accounting [3, p. 181-213].

In the Laboratory of Management Accounting and Controlling Systems, launched in the early 2012, there were installed systems and tools which use the database Microsoft SQL Server with MS Analysis Services as a technological platform for multidimensional interactive analytical processing (OLAP). The systems are integrated with MS Office Package; hence a possibility to transfer data to e.g. MS-Excel for additional analyses (e.g. the graphic ones).

The research performed in the laboratory aims at developing models to support management accounting and controlling and adjusting them to the specific needs of various enterprises. The laboratory has been equipped with the adequate software [10], (for more information visit http://wz.utp.edu.pl/index.php/o-wydziale/struktura-wydzialu/katedra-inzynierii-zarzadzania/507-laboratorium-systemow-rachunkowosci-zarzadczej-i-controllingu.html):

- Profit Management Systems – software provided by of ABC Akademia for cost and profitability management with ABC Explorer modules (used for building the ABC model and calculation), ABC/M Analyzer® and ABC Reports® (analytic and reporting module with the library of model reports supporting the ABC account concept), [1];
- Optico – software for budgeting and BI class analyses provided by BMM,
- Result Scorecard v.1.0 – corporate strategy management supporting software provided by OTTIMA plus;
- Prophix – software for budgeting and BI class analyses with workflow mechanisms provided by Prophix Software from Canada.

The laboratory offers the business worlds with the following services:

1. Presentation of the potential and the methods of the use of specialist software for the development of budget models and budgets themselves (developing budget versions, developing budgets drawing on historical data, etc.), developing activity based costing models and profitability assessment as well as the development of strategic scorecard models.

2. Presentation, using the developed examples of reference models, of the application methods of OLAP tools and the tools for visualization, reporting and analyzing operational and strategic controlling data.
3. The elaboration of reference models of activity based costing, budgets, strategic scorecard for hypothetical enterprises from different business sectors and branches.
4. The development of the 'zero' model (activity based costing, budget, strategic scorecard), for a specific enterprise, closely cooperating with that enterprise.
5. Computer implementation of the model (developed together or provided by the enterprise), including the performance of calculations having received the data required.
6. The development of decision-making models for management accounting and controlling in the spreadsheet environment.

1.2 Students' Research

The research performed in the Laboratory of Management Accounting and Controlling Systems can be broken down into two groups:

- the research conducted for a company pursuant to the contract signed; the result is the 'zero' model (of the budget, activity based costing, strategic scorecard), which can provide the springboard for the development and implementation of the target model;
- the research carried out as part of the research work of MSc and BSc students; the result is a reference model illustrating the application of a given method (budgeting, activity based costing, strategic scorecard), built for a hypothetical enterprise representing a specific branch.

By the end of October 2012 three cooperation agreements were signed between the Faculty of Management and small- and medium-sized enterprise sector. The research projects are in progress. The projects aim at developing the model of activity based costing for an enterprise and its implementation in environment of the ABC Explorer system installed in the laboratory. The enterprise will receive a 'zero' model of cost calculation according to the ABC methodology and, having delivered the data necessary for cost calculations; the cost calculation results can be used to assessment the product and customer profitability.

The research results are expected to encourage enterprises to implement and to use the system of activity bases costing on everyday basis to facilitate making the right decisions on developing the product portfolio and the cooperation with customers.

One of the ways of using the laboratory for education purposes is the presentation of its application potential for management at seminars and facilitating the students own diploma research. Using the lab software, two diploma papers have been developed, defended in 2012. Two research projects are at their final stage; the projects will be included in MSc theses.

The first defended MSc thesis 'Computer Model of Activity Based Costing for Fruit and Vegetable Freezer' has been developed based on the data provided by small- and medium-sized enterprise sector. The research has given rise to the model of activity based costing implemented in ABC Explorer® system. The model has a relatively complex structure and

covers 119 cost accounts, including 29 resources cost accounts, 27 activities cost accounts and 63 cost accounts for cost objects (4 customer groups and 59 products) (Figure 2).

All the accounts have been connected via network showing the directions of costing from resources through activities on cost objects. In total there have been defined as many as 738 of such connections. Cost computing has been performed with the use of 12 accounting keys (including 5 resource cost drivers and 7 activity cost drivers).

The second defended MSc thesis deals with the model of activity based costing developed for a hypothetical confectionary enterprise producing cakes and layer cakes. First of all, the author, drawing from her own experience in the field, has made the adequate assumptions defining the enterprise resources with their costs, technological processes and the products. Next she built a cost calculation model according to the ABC methodology. Having implemented the model in the IT environment, she performed cost calculation. The model *m* has a less complicated structure than the model described above. It comprises 65 cost accounts, including 26 for resources, 33 for activities and 6 for cost objects (Figure 3).

Seven different resource cost drives and 9 activities cost drives have been used for cost accounting. In total 233 cost accounting paths have been defined: 109 paths between resources and activities and 125 paths between activities and cost objects. The calculations provided information on product costs, established which resources are most expensive and which activities generate the highest costs, thus consume most resource costs.

All the students performing laboratory research stress that it is only their own work on developing the ABC model which allows for a thorough understanding of that costing method and for getting familiar with the problems which occur while defining the model structure and collecting data for calculations. Similarly all of them emphasize the importance of dedicated software in the process of ABC modelling. Earlier students' experience could only rely on the theoretical calculations; very simple models evaluated by the teacher.

1.3 Potential of the application of the research results for students' education

Enjoying access to hardware-software facilities, BSc and MSc students can also use the research results their education.

First of all, the diversification of the knowledge transfer forms and the introduction of all kinds of methods based on specific examples can be of great importance for students. The focus on presenting practical applications enhances the attractiveness of the information. According to Wereda [9, p.3], a method based on the case study is more and more commonly applied in education, mainly due to the fact that hat the students are becoming aware of specific correlations and encouraged to be more open-minded, which involves the development of critical thinking.

Discussing and analyzing the business models developed in the laboratory with students is definitely more attractive than traditional lectures with theoretical presentations, especially that the students majoring in marketing are considered to be active participants in the teaching process and they are critical about any such lectures which provide them only with what they can find in books.

The scientific research performed in the Laboratory of Management Accounting and Controlling has generated a database; the study of cases discussed during tutorials. Demonstrating specific practical examples of the innovative methods applications for controlling and management accounting facilitates the process of learning. It also offers an insight into the advantages and disadvantages of selected methods and tools as well as

different problems to be encountered by design-implementation teams who adjust the methods applications to the conditions of the operation of a given organization.

As for adjusting the teaching process to fast changing market demand, the authors of this article, being actively involved in the operation of the Laboratory of Management Accounting and Controlling Systems, are fully aware of the need for the presentation of practical applications of particular methods and solutions in the process of students' education at universities.

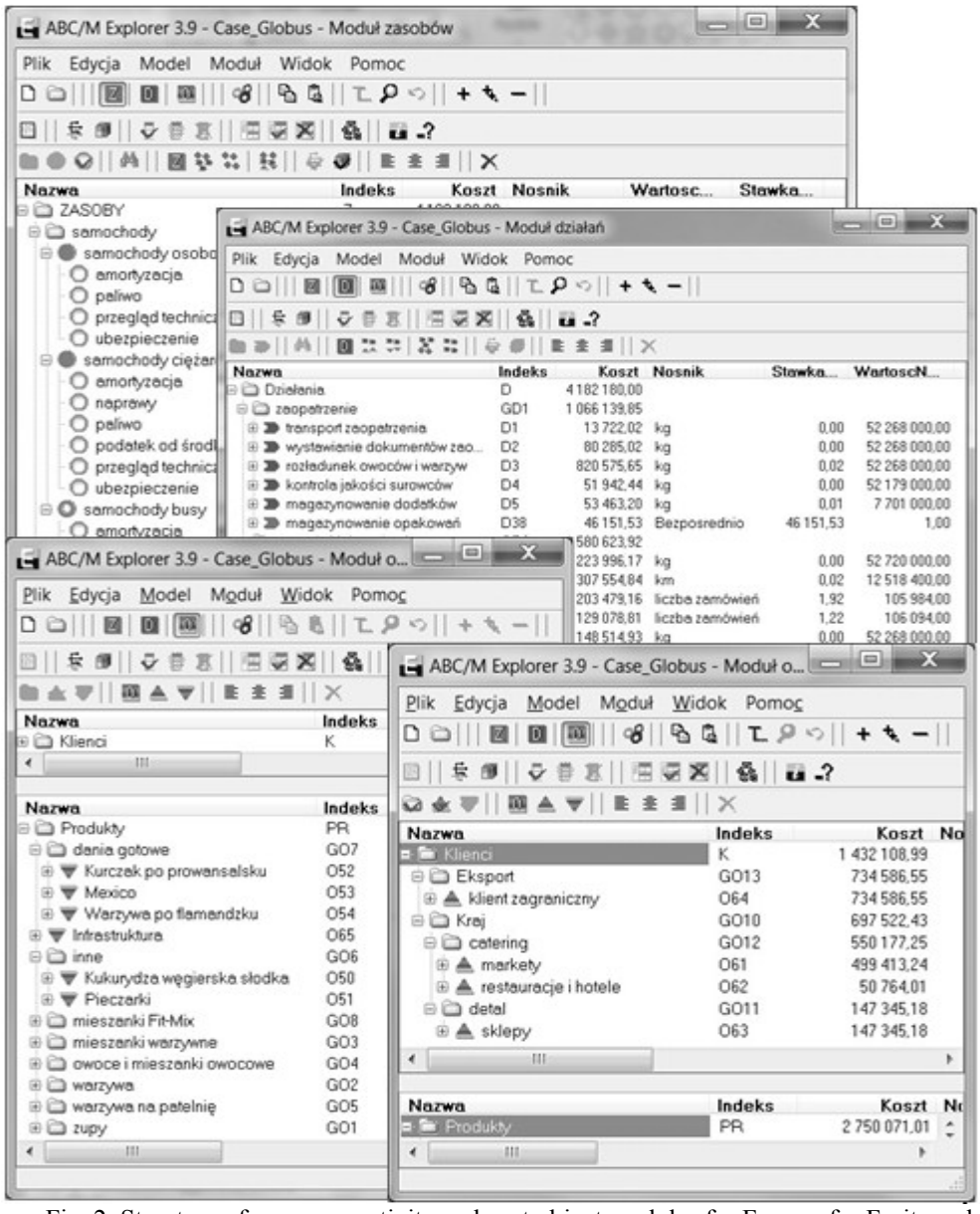

Fig. 2. Structure of resource, activity and cost object modules for Freezer for Fruits and Vegetables model. Source: author's own research

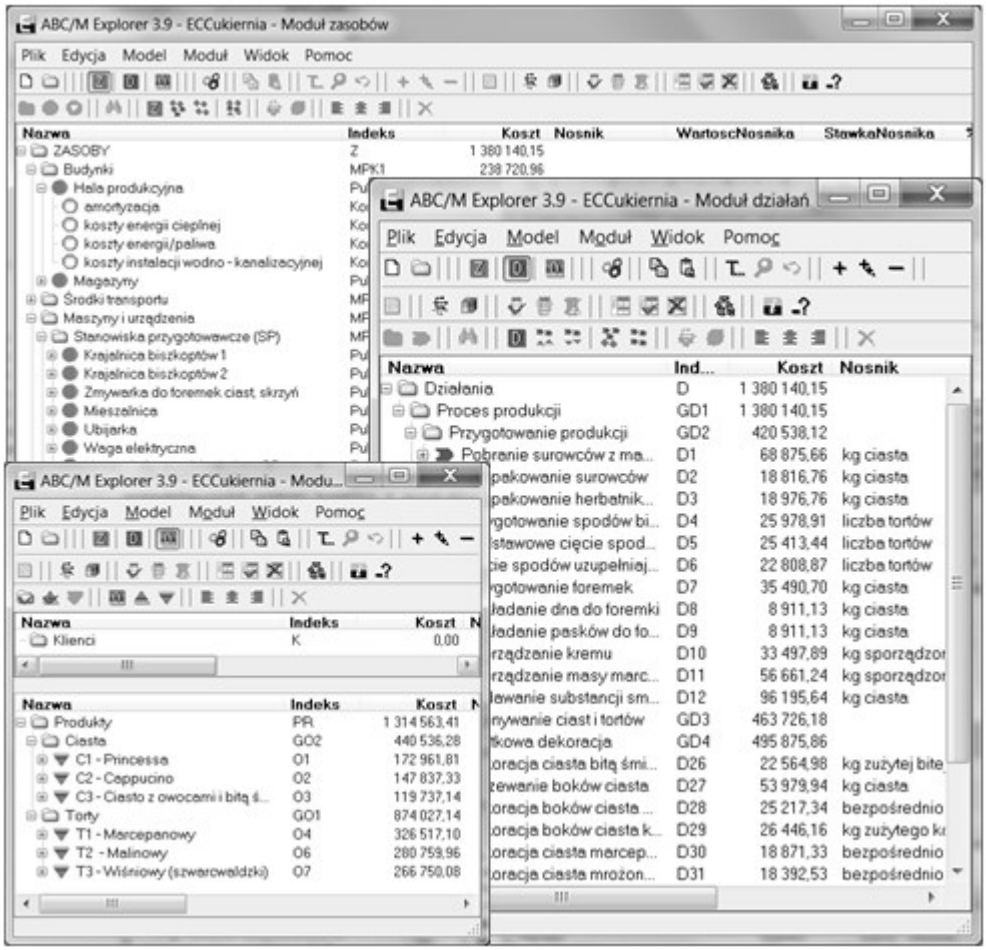

Fig.3. Structure of modules of cost objects and activity resources for a confectionary enterprise. Source: author's own research

The objectives and tasks which are pursued in the laboratories are a springboard for the application of the knowledge and experience in practice and sharing it with the students majoring in management as part of the following courses:

- operational controlling in a trading company (BSc studies)
- management accounting (BSc studies)
- process management (MSc studies)
- strategic management (MSc studies)
- Business Intelligence systems and data warehouses (MSc studies)

Table 1 provides specific problems which can be discussed using the laboratory systems, illustrated with the examples from the case study database being developed.

Table 2. Potential of using the applications in education

Course	Subjects	Application
Operational controlling in a trading company	Developing multidimensional budgets Multidimensional analysis of costs, income and profit Multi-step contribution margin analysis	PROFIX Optico
Management accounting	Cost calculation according to the ABC Multi-step contribution margin analysis according to the ABC Multidimensional analysis of costs, income and profit	Profit Management System
Strategic management	Development and analysis of the strategic scorecard	Balanced Scorecard
Business Intelligence Systems and data warehouses	Rules of OLAP systems development Multidimensional OLAP analyses Reports distribution through portal	Profit Management System PROFIX Optico
Process Management	Identification and measurement of efficiency of processes and activities according to the ABC/M Automation of the budgeting process (workflows)	Profit Management System PROFIX

Source: author's own research

2. Summary

This paper presents the resources and research carried out in the Laboratory of Management Accounting and Controlling Systems operating as part of the project 'Realization of Step II of Regional Centre of Innovativeness'. The purpose of the lab operation is to provide conditions facilitating the bidirectional transfer of knowledge; from science to business and from enterprises to the world of science. The flow of knowledge from science to business involves providing entrepreneurs with modern management methods aided by IT tools. Allowing the performance of research in a real object, the transfer of knowledge from business to science is immediate. The academics involved research; scholars and MSc and BSc students can learn about the ways of enterprise operation and acquire data needed for the calculations. The cooperation of students with the business environment makes it possible to get to know how an enterprise operates and enhances their chances on the job market. Developing an application of a selected management supporting method for a given organization and experience in its implementation, using innovative IT tools, facilitate getting an insight into its practical aspects and it is crucial for the development of the graduates' knowledge, skills and social competences.

Executing successive research projects in the laboratory provides the case study database demonstrating the practical application of state-of-the-art methods of management accounting and controlling. The database covers reference models of Activity Based Costing, strategic models of the scorecard and budget models used both at meetings with entrepreneurs to demonstrate the benefits from applying computer-aided modern

management methods and tools and during tutorials with students to discuss specific application examples. The case study method has been common in education in the United States. More and more frequently its importance for education is also stressed in Poland.

To sum up, one can suggest that the research performed in the Laboratory of Management Accounting and Controlling at the Faculty of Management, the UTP, enhances not only the cooperation between the world of science and the world of business but also the effectiveness and the quality of student education.

Literature

1. ABC AKADEMIA (2012, wrzesień 01). Sieci [Online]. Dostępne: abcakademia.com.pl
2. Fundusze Europejskie (2012, wrzesień 01). Sieci [Online]. Dostępne: www.funduszeeuropejskie.gov.pl
3. Januszewski A. 2008. Funkcjonalność informatycznych systemów zarządzania. [w: Systemy Business Intelligence].T. 2. Wydawnictwo Naukowe PWN, Warszawa, s.181-213.
4. Kamińska A., Skonieczny J. 2012.Transfer technologii z uniwersytetu do biznesu [w: Komputerowo zintegrowane zarządzanie]. Red. R.Knosala. Wydawnictwo Polskie Towarzystwo Zarządzania Produkcją, Opole, s. 132-142.
5. Kielec R., Patalas J. 2009. Rola instytucji badawczo-rozwojowych w kształtowaniu innowacyjności firm [w: Komputerowo zintegrowane zarządzanie]. Red. R.Knosala. Wydawnictwo Polskie Towarzystwo Zarządzania Produkcją, Opole, s. 493-501.
6. Michna A., Męczyńska A., Kmieciak R. 2011. Małe i średnie przedsiębiorstwa wobec wyzwań współczesnej gospodarki [w: Komputerowo zintegrowane zarządzanie]. Red. R.Knosala. Wydawnictwo Polskie Towarzystwo Zarządzania Produkcja, Opole 2011, s. 108-116.
7. Rostek K. 2010. Projektowanie analitycznych baz danych [w: Informatyka gospodarcza]. T. 1. Wydawnictwo C.H. BECK, Warszawa, s. 433-462.
8. Wcześniak D., Wilmanowicz E. 2011. Formy wspomagania przedsiębiorczości akademickiej w województwie kujawsko-pomorskim. Jak z nich korzystać? [w: Dobre praktyki przedsiębiorczości akademickiej Kompendium wiedzy, studium przypadków]. Polskie Towarzystwo Ekonomiczne Oddział w Toruniu, Toruń.
9. Wereda W. (2012, październik 10). Wspieranie dydaktyki nauk zarządzania w aspekcie metody badawczej – studium przypadku, materiały konferencji „Organizacja procesu dydaktycznego oraz zarządzanie wiedzą w ekonomicznym szkolnictwie wyższym, Dostępne: http://www.fundacja.edu.pl/organizacja/_referaty/10.pdf
10. Wydział Zarządzania (2012, lipiec 01). Sieci [Online]. Dostępne: www.wz.utp.edu.pl
11. II Etap REGIONALNEGO CENTRUM INNOWACYJNOŚCI (2012, lipiec 01). Sieci [Online]. Dostępne: www.rci-2etap.utp.edu.pl.

mgr inż. Justyna Śpiewak
dr hab. Arkadiusz Januszewski
Katedra Inżynierii Zarządzania
Wydział Zarządzania
Uniwersytet Technologiczno-Przyrodniczy
85-790 Bydgoszcz, ul. Fordońska 430,
tel./fax: (0-52) 340 82 28
e-mail: justyna.spiewak@utp.edu.pl
arekj@utp.edu.pl