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Project-oriented work in Slovenian manufacturing companies

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Abstract

This paper deals with the characteristics of project-oriented work in Slovenian manufacturing companies. First part of the paper focuses on the use of project management in manufacturing environment. This is followed by the presentation of the results of the largest European manufacturing survey, conducted in years 2009 and 2012. Slovenian questionnaire partly consists of questions that explore the characteristics of project-oriented work in Slovenian manufacturing companies. The results indicate that the project-oriented work is widely used in Slovenian manufacturing companies, which implemented different project types in their environment in the period from 2007 to 2012. We have compared several production characteristics between those companies which have introduced project-oriented work with those, which decided not to introduce it. One of the most important findings is the fact that the share of companies, which implement different project types dropped heavily between 2007-2009 and 2010-2012 period.

Key words: *project management, project success, project-oriented work, manufacturing company*

1. INTRODUCTION

Professor Rodney Turner gives a very eye-catching definition of project management in the latest edition (third) of his world-wide most recognised book *The Handbook of Project-Based Management* [1]:

“Project management is about converting vision into reality. We have a vision of some future state we would like to achieve. It may be a new computer system, a new production process, a new product, a new organisation structure, or more competent managers. We foresee that the operation of that new state will help us improve performance of our business, by solving a problem or exploiting an opportunity, and so provide us with benefit that will repay the cost of achieving it. Project-based management is the structured process by which we successfully deliver that future state.”

The importance of project management continues to grow and can be found nowadays in all types of organisations and environments. Our paper focuses on one specific environment, namely manufacturing companies. The authors of the paper conducted an extensive research that examines to what extent project management is used in manufacturing companies and what are the basic characteristics of the companies that use its methods, tools and techniques.

This paper is organised as follows. We will follow introductory chapter with the chapter on the project

management importance and its use in manufacturing environment. The third chapter presents European Manufacturing Survey (EMS) and used research methodology. Results and findings are presented for the manufacturing companies with the use of descriptive statistics and simple correlation tests. In the end we discuss our results and present some implications.

2. PROJECT MANAGEMENT IN MANUFACTURING ENVIRONMENT

Project management as a management discipline underpins many economic activities. In industries as diverse as manufacturing, projects drive businesses [2]. Project management, therefore, is defined as the planning, organising, directing, and controlling of company resources for a relatively short-term objective that has been established to complete specific goals and objectives [3]. Kerzner [3] continues his thoughts on project management with its importance as he argues that project management has evolved from a management philosophy restricted to a few functional areas to an enterprise project management system affecting every functional unit of the company. He claims that project management has evolved into a business process rather than merely a project management process and that more and more

companies are now regarding project management as being mandatory for the survival of the company.

Lock [4] claims that the purpose of project management is to foresee or predict as many of the dangers and problems as possible and to plan, organise and control activities so that projects are completed successfully in spite of the risks. According to Bender [5] projects and project management add value to an organisation and this is the only reason to engage in a project or in project management. Project management must also add value as with all activities organisation undertakes project management must reduce the cost and time for completing projects. There are some other goals for project management: with project management we make clients happy, we make money or are being fiscally responsible, we achieve our strategic objectives, we optimise our resource usage and we are making things better.

Considering the manufacturing industry, its process consists in creating a product by transforming raw materials, usually the production of a specific item of equipment built for a customer, or initiated and funded within the organization for the design and development of a new product, aiming for the subsequent manufacture and sale in quantity. This process encompasses several functions that must be strategically planned, organised, programmed and completed. Functions such as facility layout, stock control, cost analysis, production planning and a series of others, fall within the processes of planning, organizing, scheduling and control cycles of project management [4, 6-10].

Project management is often associated with manufacturing industry especially in the field of new product development (NPD). There are numerous papers that deal this topic from different perspectives [11]. NPD projects have all the characteristics of other types of projects. They are temporary endeavours undertaken to create a unique product or service. Every project has a definite beginning and a definite end (temporary means), and the products or services developed are different in some distinguishing way from all other products or services (unique means) [12]. Pons [13] argues that there is a need for project management methods that can handle NPD. The problem of course is that some forms of NPD, especially those involving a high degree of innovation, are notoriously difficult to manage. Many NPD projects use project management tools, at least elements thereof. Based on that, Pons [13] examines the intersection of the project management body of knowledge with NPD. He claims that in general, the project management method, with its structured task definition and software tools, is useful for managing NPD projects. However, in some areas, project management incompletely meets the needs of NPD. Kim and Kim [14] argue that for successful NPD, a firm must be able to develop an innovative product that appeals to the customer and manufacture it in large quantity in order to reap profit from the mass market. Firm's ability to manage the ramp-up production effectively, i.e., manufacturability, is essential to the eventual success of NPD. Manufacturability is a quality of new product development that ensures the product

can be produced efficiently and reliably in the manufacturing process. As seen, a major link between developing a new product and manufacturing lies in the ability to restore the production system to high productivity and low yield loss as quickly as possible following the new product's introduction.

Most production controls are based on mass production or job shop manufacturing. In mass production, a production line produces a massive amount of units from a certain product. However, some manufacturers provide sets of unique products. They require a separate manufacturing method known as project manufacturing or engineer-to-order (ETO) manufacturing. For ETO manufacturing, every product is the ultimate result of a project. Although ETO products are created in a manufacturing environment, they meet the definition of the project of being temporary and unique [15].

Belassi et al. argue that several studies have addressed the determinants of general project performance [16-18]. However, the performance of a specific type of project has not gained the same level of attention and investigation. Therefore, our paper investigates the characteristics of manufacturing companies related to the use of different project management tools and methods and the implementation of different project types.

3. EUROPEAN MANUFACTURING SURVEY

Our research is based on the Slovenian sub-sample of EMS described briefly in the followings. The EMS, coordinated by the Fraunhofer Institute for Systems and Innovation Research – ISI, is the largest European survey of manufacturing activities. EMS questionnaire is very extensive with almost 8 pages. The survey's questions concern manufacturing strategies, the application of innovative organisational and technological concepts in production, cooperation issues, production off-shoring, servitisation, and questions of personnel deployment and qualification. In addition, data on performance indicators such as productivity, flexibility, quality and returns is collected. The responding companies present a cross-section of the main manufacturing industries. Included are producers of rubber and plastics, metal works, mechanical engineering, electrical engineering, textile and others. The survey is conducted among manufacturing companies (NACE codes from 15 to 37) having at least 20 employees. The main objectives of EMS project are to find out more about the use of production and information technologies, new organisational approaches in manufacturing and the implementation of best management practices.

The EMS was conducted in 2003/2004 as a pilot survey in nine European countries. The survey covered Austria, Croatia, France, Germany, United Kingdom, Italy, Slovenia, Switzerland and Turkey. In the year 2006/2007 a new survey was conducted in even more European countries, where Greece, Netherlands and Spain joined the project. We received around 4000 answers from nine countries.

The next edition of the EMS was carried out in 2009. The survey was becoming global as China and Russia joined the project team as well as Denmark and Finland. The Slovenian questionnaire also included questions on project management in Slovenian manufacturing companies as the basis of our study. The fourth edition of EMS started in 2012 and continues in 2013. Our family comprises 17 countries as Czech Republic, Sweden and Brazil joined the survey. Italy, France and United Kingdom changed project partner within their country. Slovenian EMS 2012 was finished in November 2012.

Our research is based on EMS data from Slovenian subsample from the years 2009 and 2012. Slovenia has always been a partner with one of the highest response rate. In 2009 we sent 665 questionnaires and received 71 answers (10,67% response rate). In 2012 we sent 791 questionnaires and 89 were returned (11,25% response rate).

The focus of project management questions in the EMS questionnaire is on the usage frequency of specific project management methods, tools and techniques, project management organisation and implementation of specific project types. These questions have been analysed with the use of descriptive statistics and simple correlation tests. Besides that we have classified Slovenian manufacturing companies based on different characteristics in regards to their project work orientation. To classify the companies we have used the following criteria:

1. Type of industry (NACE);
2. Company size;
3. Company return-on-sales (ROS);
4. Company competitive criteria;
5. Company production type;
6. Product development;
7. Product complexity;
8. Company organisational structure.

We have analysed companies according to NACE classification. In the EMS 2012 the majority of companies comes from NACE 25 (manufacture of fabricated metal products, except machinery and equipment – 27%), NACE 22 (manufacture of rubber and plastic products – 17%), NACE 28 (manufacture of machinery and equipment – 16%), followed by NACE 27 (manufacture of electrical equipment – 10%) and NACE 29 (manufacture of motor vehicles, trailers and semi-trailers – 10%).

The second classification was based on the company size, where the number of employees was the classifying criterion. As already mentioned we have included in our survey only companies with 20 employees and more. Still, it was a bit surprising that the largest share of respondents is from middle sized companies (46%) and that the share of large companies (25%) was almost the same as for the small companies (29%).

4. RESULTS

We will present three groups of results from EMS. First, we will present the use of project-oriented work in Slovenian manufacturing companies. Second, we will

focus on selected project types and present the frequency of these projects in companies with a special focus on comparison of EMS 2009 and EMS 2012. The last group presents general characteristics of manufacturing companies in regard to the use and no use of specific project management tools and techniques.

4.1 The use of project-oriented work in Slovenian manufacturing companies

Table 1 presents 8 questions about the characteristics of project-oriented work (POW) in Slovenian manufacturing companies.

Table 1. 8 questions about the characteristics of project-oriented work

POW1	Are you treating your orders as projects (order-based production)?
POW2	Have you introduced project-based work in your company?
POW3	Have you introduced any project based methodologies (IPMA, PMI, Prince, APQP or own methodology)?
POW4	Do you have IT support for project management?
POW5	Are you organised for project-based work (teams, project organisation)?
POW6	Are you educating and training yourself in project management area (seminars, consulting)?
POW7	Are you using official rule-book for project management and do you have a system for rewarding?
POW8	Are you fostering teamwork when planning and executing projects?

First we wanted to find out what percentage of manufacturing companies introduced project-based work and any specific project-based methodologies (IPMA, PMI, Prince, APQP) or even their own methodology. We also compared both questions in 2009 and 2012.

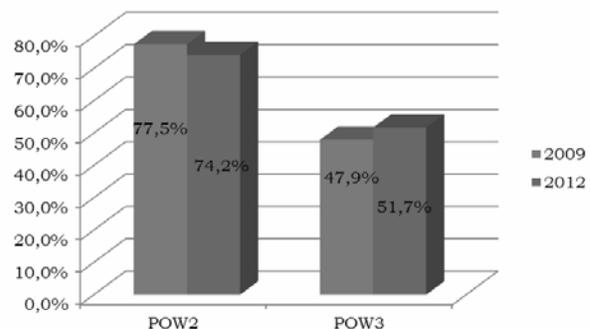


Figure 1. Introduction of project-oriented work

As seen from Figure 1 three quarters of Slovenian manufacturing companies have introduced project-oriented work in their organisation (POW2). On top of that half of them use a specific project-based methodology (POW3). EMS 2012 shows that among companies that introduced project-oriented work approximately two thirds of them admitted that they use one of the project-based methodologies. Only 2% of

companies use a specific project-based methodology without introducing project-oriented work. There is a moderate-strong positive correlation between introduction of project-oriented work and decision to treat each order as a project (Pearson coefficient $r = +0,54$). For example in 2012 survey 80% of companies that introduced project-oriented work treated

each new order as a project. In general 2 out of 3 companies treat each order as a project. Table 2 presents correlation matrix between project-oriented work characteristics in Slovenian manufacturing companies. In general, a moderate-strong positive correlation exists between the majority of POW characteristics (measured by Pearson coefficient).

Table 2. Correlation matrix between project-oriented work characteristics

		POW1	POW2	POW3	POW4	POW5	POW6	POW7	POW8
POW1	Pear. Corr.	1	,540**	,217*	,151	,331**	,265*	,208	,348**
	Sig. (2-tailed)		,000	,042	,159	,002	,012	,050	,001
	N	89	89	89	89	89	89	89	89
POW2	Pear. Corr.	,540**	1	,508**	,433**	,482**	,456**	,366**	,431**
	Sig. (2-tailed)	,000		,000	,000	,000	,000	,000	,000
	N	89	89	89	89	89	89	89	89
POW3	Pear. Corr.	,217*	,508**	1	,550**	,449**	,460**	,537**	,331**
	Sig. (2-tailed)	,042	,000		,000	,000	,000	,000	,002
	N	89	89	89	89	89	89	89	89
POW4	Pear. Corr.	,151	,433**	,550**	1	,421**	,415**	,316**	,411**
	Sig. (2-tailed)	,159	,000	,000		,000	,000	,003	,000
	N	89	89	89	89	89	89	89	89
POW5	Pear. Corr.	,331**	,482**	,449**	,421**	1	,449**	,421**	,492**
	Sig. (2-tailed)	,002	,000	,000	,000		,000	,000	,000
	N	89	89	89	89	89	89	89	89
POW6	Pear. Corr.	,265*	,456**	,460**	,415**	,449**	1	,491**	,503**
	Sig. (2-tailed)	,012	,000	,000	,000	,000		,000	,000
	N	89	89	89	89	89	89	89	89
POW7	Pear. Corr.	,208	,366**	,537**	,316**	,421**	,491**	1	,372**
	Sig. (2-tailed)	,050	,000	,000	,003	,000	,000		,000
	N	89	89	89	89	89	89	89	89
POW8	Pear. Corr.	,348**	,431**	,331**	,411**	,492**	,503**	,372**	1
	Sig. (2-tailed)	,001	,000	,002	,000	,000	,000	,000	
	N	89	89	89	89	89	89	89	89

** Correlation is significant at the 0.01 level (2-tailed).
 * Correlation is significant at the 0.05 level (2-tailed).

We also tested relationship between the introduction of project-oriented work (POW2) and company size and one of the financial indicators – ROS. We found out that there is a weak positive correlation between introduction of POW and the number of employees (Pearson coefficient $r = +0,259$). On the other hand (unfortunately) we found no statistical significance between introduction of POW and ROS.

4.2 Project types in Slovenian manufacturing companies

We have asked Slovenian manufacturing companies about the same project types in EMS 2009 and EMS

2012. Both times we wanted to know which projects types have companies implemented in the period from 2006-2009 and from 2009-2012.

The responses we got show a significant percentage drop between EMS 2009 and EMS 2012. The only exception is NPD projects. 63,4% of manufacturing companies implemented NPD between the years 2006 and 2009. This number was higher by 14% in the period between the years 2009 and 2012.

Table 3 presents 8 projects types (PT), that we were asking about in Slovenian manufacturing companies.

Table 3. 8 project types in Slovenian manufacturing companies

PT1	NPD project (design, technology, production, sales, market analysis ...)
PT2	New production service development project
PT3	Project of acquiring and introducing new technology (external technology)
PT4	Project of development and introduction of own technology
PT5	Project of introducing new information system in a company
PT6	Project of acquiring a quality standard, environmental or any other certificate
PT7	Joint R&D project with partners (other companies, R&D institutions)
PT8	Investment project (buildings, acquisition projects)

The first big change in numbers between both survey periods is evident from the percentage of new production service projects: 77,5% in 2009 and only 30% in 2012. We were asking about product-related services, but we allow that these projects were badly interpreted as the number in 2009 is unexplainably high.

Numbers in Figure 2 and Figure 3 are concerning. First we present several types of investment projects. There are two possibilities how to introduce a new technology (equipment) in manufacturing company: acquisition of technology from selected supplier (PT3) or development of its own technology (PT4). In both cases we observe a decrease in percentage of such projects from 2009 to 2012; especially for project where companies develop their own technologies. What is even more evident is the change in implementation of investment projects in new buildings, shop floors, acquisition of other companies etc. We can observe a 250% drop in implementation of these projects between 2009 and 2012.

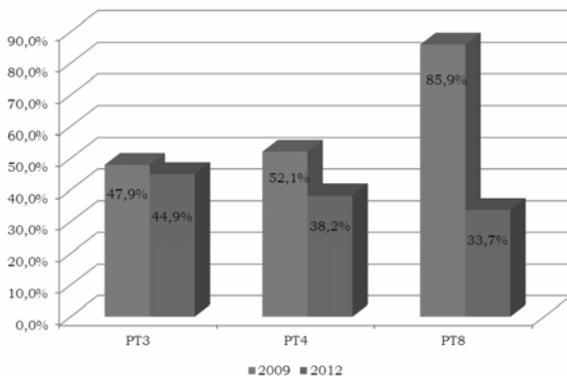


Figure 2. Investment projects in Slovenian manufacturing companies

Looking at selected three organisational projects, we can also see a substantial drop of projects (Figure 3). The biggest downsize in projects is in ICT projects, mostly projects of introducing new information system in a company. In the last period only 1 of 3 companies introduced a new or upgraded existing information system, while in the period from 2006 to 2009 84,5% of companies implemented these projects. It is also concerning that lately companies invest less finances

and engage less in projects of acquiring a quality standard, environmental or any other certificate. In the end, we expected a rise of joint R&D projects with specific partners (other companies, R&D institutions) where financial input and risks are better distributed. Unfortunately, the percentage of these projects also dropped.

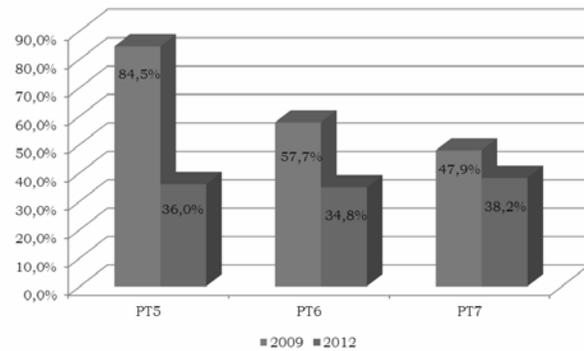


Figure 3. Organisational projects in Slovenian manufacturing companies

4.3 Some other characteristics of Slovenian manufacturing companies and project-oriented work

We have analysed selected characteristics of Slovenian manufacturing companies who have introduced project-oriented work in their organisation and those who have not. We will present and comment differences between both groups for the EMS 2012.

First analysis is based on the importance of company competitive criteria (product price, product quality, innovative products, customization to customers' demands, adherence to delivery times/short delivery times and service).

Table 4. Competitive criteria in manufacturing companies

Competitive criteria	Project-oriented companies	Non-project-oriented companies
Product price	2,75	2,65
Product quality	1,91	1,98
Innovative products	4,16	4,39
Customisation to buyers' demands	3,22	3,17
Adherence to delivery times	3,58	3,57
Services	5,38	5,24

The respondents had to classify all six competitive criteria based on their importance (1-the most important, 6-the least important competitive criteria). Table 4 shows that the most important competitive criterion is product quality, followed by product price and customisation to customers' demands. The least important competitive criterion is product related services. We can also see that there are no significant differences between all competitive criteria based on companies' project orientation.

The second analysis classifies manufacturing companies based on the four product development types:

- according to customer specification,
- as a standardised basic program into which customer specific options are implemented,
- for a standard program from which customer can select,
- product development does not exist in the company.

Table 5. Product development type in manufacturing companies

Product development type	Project-oriented companies [%]	Non-project-oriented companies [%]
Customer specification	57,6	47,8
Standard program / customisation	27,3	17,4
Standard program	9,1	21,8
Does not exist	6,0	13,0

Table 5 shows that there are some differences in product development types between both company groups. Project-oriented companies are much more focused on delivering product based on customer specifications. The percentage of standard programs, from which customers can select, is almost three times higher in non-project-oriented companies than in project-oriented companies. Similar is true for percentage of companies that do not have product development processes (only production and/or assembly). This clearly indicates that project-oriented companies focus more on meeting customer demands than others. This also shows that treating customers' orders as projects is a better option to be flexible to customer requirements.

The next analysis deals with company production type:

- make-to-order production,
- assembly-to-order production,
- make-to-stock production.

Table 6. Production type in manufacturing companies

Production type	Project-oriented companies [%]	Non-project-oriented companies [%]
Make-to-order	78,8	78,3
Assembly-to-order	16,7	13,0
Make-to-stock	4,5	8,7

As we can see from Table 6 there are no significant differences between both company groups. The majority of companies have order-based production. This is understandable as the majority of companies customise their products according to buyers' requirements. It is also no surprise that the percentage of make-to-stock production is higher for non-project-oriented companies.

The fourth analysis deals with product complexity, where we distinguish between:

- simple products (e.g. cogwheels),
- products with medium complexity (e.g. pumps),
- complex products (e.g. machines or manufacturing systems).

Table 7. Product complexity in manufacturing companies

Product complexity	Project-oriented companies [%]	Non-project-oriented companies [%]
Simple product	6,1	31,8
Product with medium complexity	53,0	45,5
Complex product	40,9	22,7

This analysis offers the biggest differences between both company groups. As we can see the percentage of simple products in project-oriented companies is five times lower than in non-project-oriented companies, where one third of companies makes simple products. The percentage of complex products in these companies is also two times smaller than in project-oriented companies. Obviously it is easier for the project-oriented companies to cope with complexity in NPD than for other companies.

5. DISCUSSION

There are several general conclusions that can be made when analysing the use of project management methods, tools and techniques in Slovenian manufacturing companies.

We were surprised with the high level of manufacturing companies that claim that they have introduced project-oriented work in their organisation (around 75%). Half of all companies also claim they have introduced a systematic project-based methodology. These methodologies are in manufacturing companies often a prerequisite to even "play the game" as the OEMs require that their partners (e. g. suppliers) use a specific methodology in product development (e. g. APQP).

There is a weak positive correlation between introduction of project-oriented work and the number of employees and no statistical significance between introduction of project-oriented work and ROS.

The share of NPD projects has risen from 2009 to 2012, which is good. But on the other hand, the downfall of new product related service development project, all types of investment projects, ICT projects and R&D project with partners is evident.

There is a substantial difference between project-oriented and non-project-oriented manufacturing companies in some of the characteristics of the products they manufacture. Project-oriented companies are more flexible to customer requirements and they produce more complex products. The reasons for these findings can be partly assigned to the fact that they treat their orders as projects. With projects we can involve the customer into the conceptualisation and project planning phase and even later in execution phase. This enables higher customisation. On the other hand, projects are born to cope with complexity and uncertainty; therefore they are a better mean to engage in development of more complex products.

6. CONCLUSION

It is obvious that project-oriented work is present also in manufacturing companies. Based on the results of our survey it is evident that manufacturing companies are aware of the benefits the project management brings to day-to-day management of the company as well to strategic management of the company.

The most concerning finding in the research was the fact that the frequency of implementing new strategic projects in manufacturing companies has been drastically lowered. The main reason is probably global economic and financial crises, where companies lack money to invest in their development and growth. This is not very optimistic information, as development projects are one of the most important ways to break through the crises.

A further in-depth statistical analysis is necessary to further examine the impact of project-oriented work on specific manufacturing companies' characteristics. This analysis only scratched the surface of the influence of project-oriented work on manufacturing companies, but it clearly shows some interesting facts and reveals several reasons why we should be concerned about our economic recovery.

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Projektno orjentisani poslovi u Slovenačkim proizvodnim preduzećima

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Rezime

Predmetni rad se bavi karakteristikama projektno-orijentisanih poslova u proizvodnim preduzećima u Sloveniji. Prvi deo rada je fokusiran na upotrebu projektnog menadžmenta u proizvodnom okruženju. U drugom delu su predstavljeni rezultati najvećeg evropskog istraživanja u oblasti proizvodnje, sprovedenog u periodu od 2009. do 2012. godine. Slovenački upitnik je delimično sadržao pitanja koja istražuju karakteristike projektno-orijentisanih poslova u proizvodnim preduzećima u Sloveniji. Rezultati su pokazali da je projektno-orijentisani prilaz široko primenjen u slovenačkim proizvodnim preduzećima, koja su realizovala različite tipove projekata u njihovom okruženju u periodu od 2007. do 2012. godine. Za potrebe ovog rada poredili smo nekoliko proizvodnih karakteristika između onih preduzeća koja primenjuju projektno-orijentisan prilaz i onih koji to ne čine. Jedan od najvažnijih zaključaka je da je učešće preduzeća koja su realizovala različite tipove projekata značajno pao u posmatranim periodima između 2007-2009 i 2010-2012.

Key words: project management, project success, project-oriented work, manufacturing company