5th International Conference on Industrial Engineering and Industrial Management
XV Congreso de Ingeniería de Organización
Cartagena, 7 a 9 de Septiembre de 2011

Final Year Projects as a means of University-Industry relationship measurement

N. Errasti [1], J.I. Igartua, N. Zabaleta

[1] Polytechnic School – University of Mondragon, Loramendi 4, 20600 Arrasate-Mondragon, Guipuzcoa (Spain), nerrasti@eps.mondragon.edu)

Palabras clave:

1. Introduction

There have been numerous calls for effective collaboration and more meaningful engagement between universities and industry. University-industry partnerships have long been realized as critical component for the successful development of a good university. Over the last few decades the university-industry partnership has been on the increase. A university-industry partnership enables especially effective communication with those "customers", thereby promoting means for continuing improvements in University quality (Baharom et al., 2009, Zunaira, 2005). This interaction has been developed incrementally over the years and the factors that affect it include the firms, the faculty, universities and the government as well as the individuals. However, the interactions between these components yield a system that is highly dynamic (Al-Fares et al., 2005).

This relationship has gained considerable more attention in the recent years realizing that these ties are highly beneficial especially after it became apparent to researchers on both sides that this relationship is yielding significant pay-offs to the nation, to the firms and to the academia. Nevertheless, although there are several studies that research into the conflict between the teaching and research missions of universities, there are some studies that suggest that these activities are not so misaligned after all, stressing the importance of students in university industry relations, as an agent that increases the appeal of university scientists to industry agents seeking research partners in academe (Leonidov Ponomariov, 2006).

The focus of this study is a major yet understudied component of university-industry relations: students, and their final year project (FYP onwards) as a means of measuring the university-industry interactions.

This paper presents observations from the last 10 years of experience during which 992 projects were performed within 145 production and service organizations, involving students in industrial engineering and industrial management degrees.

2. The FYP approach at EPS-MU

The FYP is the culmination of engineering studies (Jawitz et al., 2002, Ortiz-Marcos et al., 2010), where the students develop a project in line with their professional future and it is an opportunity to have their first tutored professional experience as an engineer (Martinez et al., 2010), while gain knowledge concerning aspects such us teambuilding or managerial skills that are very difficult to obtain in the classroom (Bikfalvi et al., 2007, Bovea and Gallardo, 2006).

The FYP can be done at the university or in any other company or institution, but always with a clear industry involvement. Its aim is to establish a student-company relationship in line with the characteristics of their professional profile (Vaezi-Nejad, 1993), i.e. it aims to show students what an engineer's work actually consists of (Ortiz-Marcos et al., 2010)

The aim at EPS-MU is that every student has the experience of spending a whole year in a company or institution developing a project, enhancing final year students' hands-on learning experience through final year project in industry (Hasan, 2009). This project is always asked by the company, which has clearly defined the objectives it is looking for. During the project year, two people are aware of its development; one from the own company, which has direct touch with the student and supervises the student's work, ensuring the correct achievement of the objectives defined, and the other one from university, who is directly related to the subject matter to be dealt with during the FYP and mainly looks after its academic development.

Every year, more than 300 students carry out FYPs in around 200 companies and both students and companies clearly benefit from this experience (Bovea and Gallardo, 2006, Magleby et al., 2001), and as it happens in other universities, e.g. Universitat Jaume I in Castellon (Bovea and Gallardo, 2006), carrying out the FYP in an organization outside the university is rated very positively both by students (8,2[1] out of 10) and organizations (9,1[2] out of 10).

The percentage of FYPs that are carried out with involvement of industry is nearby 100%. It means that even there is a percentage of projects that is developed at university, every project is developed within a research project where the customer is a company, so that even in those cases, there is a clear involvement of industry. Around 81% of the projects are developed outside university, and this percentage is even higher when referring to the titles of mechanical engineering (production systems specialty) or industrial management engineering degrees. In these cases, almost every student develops its FYP in a company (

Table 1).

[1] Data are referred to the average level of student's and organization's satisfaction respectively, for projects developed during the 2008-2009 academic course.

Table 1. % of F YP developed outside the university (data correspond to period 2004-2010)

Technical Engineering degrees	**%**	**Engineering degrees**	**%**
Mechanical Engineering		Automatics	65,13
. Desing	88,35	**Industrial management**	**98,00**
. Manufacturing processes	77,11	Industrial engineering	87,40
. Production systems	**99,06**	Informatic engineering	70,58
. Welding systems	92,31	Telecommunications engineering	60,77
Industrial Desing	64,55		
Computer Engineering	87,13		
Electronic Engineering	85,70		
Telecommunications engineering	86,65		
First cycle	**85,11**	**Second cycle**	**76,38**
TOTAL			**80,74**

3. The FYP approach at EPS-MU

The objective of this research work is to analyze the evolution and typologies of FYP developed by engineering students from the Polytechnic School at MU, and verify their evolution according to the organizations needs. The analysis has centered in two engineering specialties; production systems mechanical engineering (first cycle degree) and industrial management engineering (second cycle degree). The time scope used for the analysis is 10 years, referring to FYPs developed from 2000 to 2010. During this period, a total amount of 992 FYP has been developed in 147 organizations. Data for the analysis is content in the data base used for FYP management.

In order to prepare the information for the analysis, a first activity has been developed, named categorization of the projects. Without wishing to set boundaries, in order to carry out this study, the projects have been categorized according to these areas of knowledge:

Operations management	*Innovation management*	*Management*	*Others*
Maintenance	New product/activity	Management systems	Methology
Manufacturing process	development	Strategy	development
Simulation	Project management		Web 2.0
Improvement and quality	Prospective		
Lean manufacturing	Industrialisation		
Logistics			
Purchasing			

Some research works, as the ones presented by (Vitner and Rozenes, 2009, Bovea and Gallardo, 2006), consider the industrial sector or the organizational type where the FYP is developed as a research factor. In this case, we have used the National Classification of Economic Activities to define the main activity of the organization where the FYP is carried out, and to analyze the FYP's impact according to the organization type.

Once all the projects have been categorized, a descriptive statistic tools, the bar chart is used for the analysis, similarly to what was used in the analysis of the FYP at the Universidad Politécnica de Madrid or the research made at the Universidad de Murcia (Ortiz-Marcos et al., 2010, Martinez Muneta et al.).

4. Results of the study

In this section, the results obtained from the research work made are presented in graphic form. In some cases, segmented data are used (mechanical production systems and industrial management), but in other cases, data are shown as unique.

The following figure shows the global evolution of the FYP proposals received by the Polytechnic School, and segmentation by academic cycle.

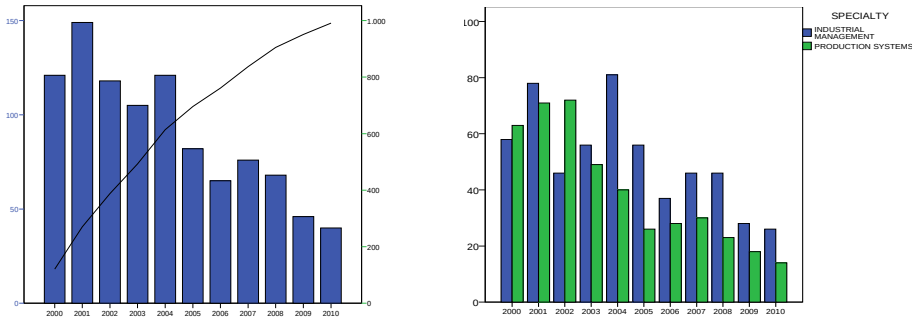

Fig. 4.1 **Total amount of FYPs by call and academic cycle**

Fig. 4.1 shows the continuous decrease in the number of project proposals received and developed every year, and this decrease is repeated in both cycles, going from an average of 100 projects per year during the period from 2000 to 2005, to an average next to 50 projects during last five years. This decrease is explained by the gradual decrease suffered by the number of students at university.

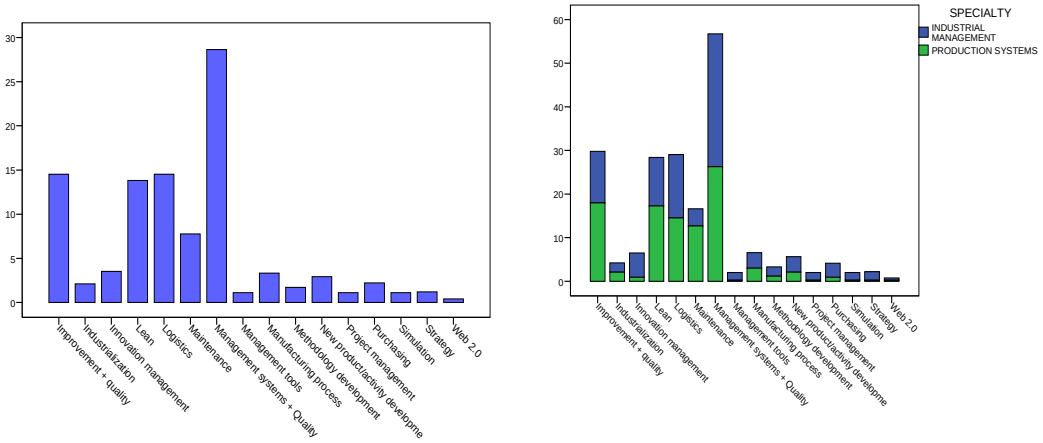

Fig. 4.2 **% of FYPs by area of knowledge and specialty**

When analyzing the projects by the area of knowledge they correspond to, a concentration of projects appears mainly in four areas of knowledge, named Management systems and quality, Logistics, Improvement and quality, and lastly Lean production (**Fig. 4.2**). If we have a look to the projects distribution by engineering cycle, we see that there is no variation from the global figures, and the same areas of knowledge keep on being the most popular ones.

Fig. 4.3 shows the evolution of FYP through ten years of analysis. In this case the same project concentration is repeated, so that the four major areas of knowledge are again, Management systems and quality, Logistics, Improvement and quality, and lastly Lean production.

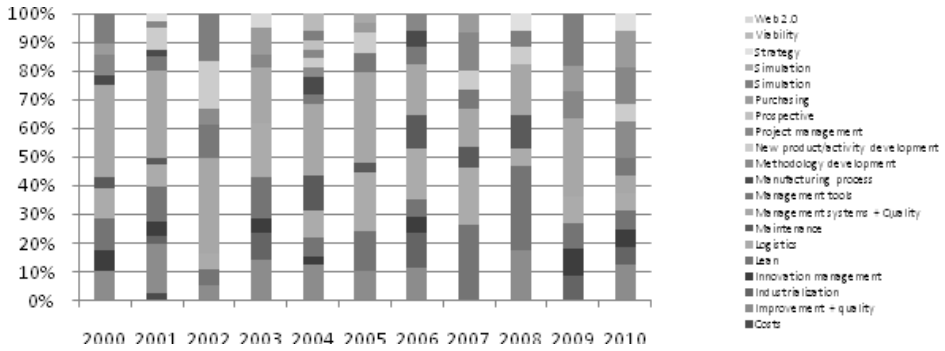

Fig. 4.3 **% of FYPS by area of knowledge and call**

Fig. 4.4 shows the rate of FYPs corresponding to the typology of organization where they are carried out. The organization typology is defined according to the economic activity it develops, similarly to what (Vitner and Rozenes, 2009, Bovea and Gallardo, 2006) did within their research works. According to the figure, more than 50% of the FYPs are developed in two types of organizations, metal products manufacturing (nº 25) and industry machinery construction (nº 28) organizations, that correspond to the type of activities that are the most common in the Basque Country.

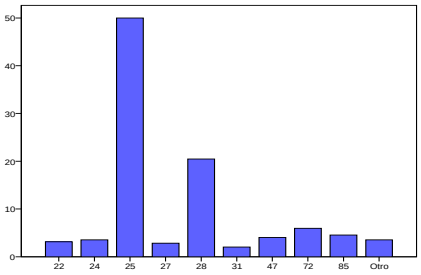

Fig. 4.4 % of FYPs according to the company's activity (numbers correspond to the **National Classification of Economic Activities)**

The analysis of the temporary evolution (**Fig. 4.5**) shows that year by year the type of organizations that develop more FYPs are those corresponding to the economic activities number 25 and 28.

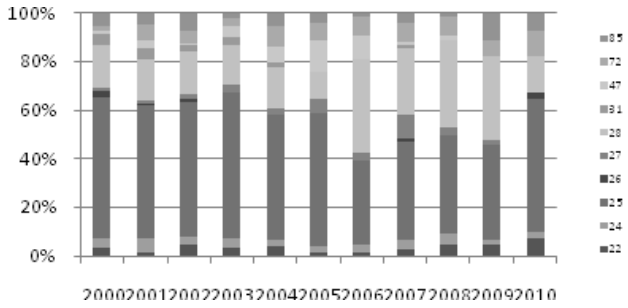

Fig. 4.5 % of FYPs according to the company's activity (numbers correspond to the **National Classification of Economic Activities) and call**

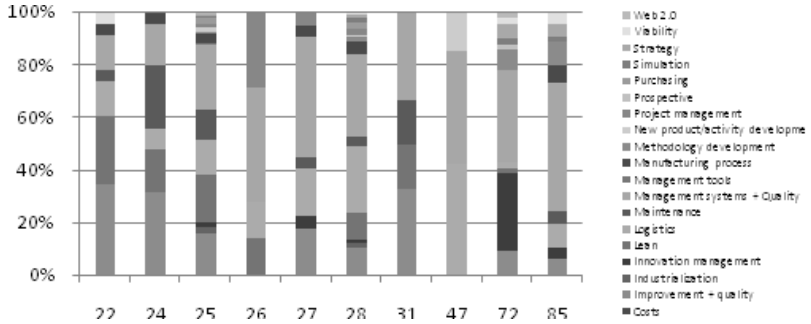

Fig. 4.6 % of FYPs according to the company's activity (numbers correspond to the **National Classification of Economic Activities) and corresponding area of knowledge**

Finally, Fig. 4.6 shows the relationship between the economic activity organizations belong to and the areas of knowledge where the project is categorized. In this case, the results are again repeated, and organizations belonging to economic activities number 25 and 28, develop their projects in the most repeated areas of knowledge (Management systems and quality, Logistics, Improvement and quality, and lastly Lean production). However, organizations working on other economic activities, such as education (nº 85) and research and development (nº 72), also have shown interest in developing FYPs in the cited areas of knowledge, mostly in Management systems and quality, and Lean production.

5. Discussion and conclusions

The analysis carried out shows how FYPs have evolved through the last decade at the Polytechnic School of Mondragon University. The first comment comes with the important decrease in the number of projects developed each academic year. The major decrease corresponds to the number of projects developed in the first cycle, decreasing to almost a fifth of the projects in 2000. The explanation to these figures comes from the general student decrease suffered by the Polytechnic School, and concretely in the production system specialization corresponding to the mechanical engineering degree.

When analyzing the FYP typology, both in general and year by year, the conclusion is the same. The areas of knowledge that compose the Operations Management and the Management areas are the most frequently developed themes in the FYPs. The analysis through the engineering cycles reaches the same conclusions, with a slight difference; there is no so large difference between areas of knowledge's intensity when referring the first cycle's production systems engineering degree.

Another complementary analysis has been developed in order to reach an interpretation of the typology of organizations that approach the university to start a relationship through the development of a FYP. Data reflect that organizations belonging to metal products manufacturing and industry machinery construction economic activities are the most active organizations in FYP development. These economic activities suppose nearby 70% of the industrial activity in Guipuzcoa (Ine, 2011). When analyzing the temporary evolution of the organizations approaching the university, even metal products manufacturers and industry

machinery constructors are the major consumers of FYPs, organizations belonging to economic activities such as education and research and development, have started their approach to university last years.

Another interesting approach is the one referred to the organizations typology and the type of FYPS developed by them. In this case, and once again, there is a clear correlation between the type of organization and the type of FYPs developed, so that the most popular themes within FYPs and organizations are those referred to Management systems and quality, Logistics, Improvement and quality, and lastly Lean manufacturing.

After this analysis it seems to be clear that even there is a great amount of FYPs developed in the last years, they could be summarized taken into account the reality of two types of organizations and four areas of knowledge. According to this, the needs of the organizations in the last ten years, and even nowadays, are related to Management systems and Quality, Logistics, Improvement and quality and Lean manufacturing. So, the Polytechnic School's researches should keep on working and deepening these areas of knowledge.

References

Al-Fares HK, Jaber A, Achoui M, Bubshait A, Al-Swailem O, Aaid SAM (2005) University-Industry/Business Interaction: KFUPM Experience. Conference of University-Private Sector Partnership in Research & Development. Riyadh, Saudi Arabia

Baharom MNR, Salleh R, Idrus H (2009) University-industry partnerships towards producing quality graduates. Conference of the International Journal of Arts and Sciences

Bikfalvi A, Pages JL, Kantola J, Gou PM, Fernandez NM (2007) Complementing education with competence development: an ICT-based application. Int. J. of Management in Education, 1, 231-50

Bovea MD, Gallardo A (2006) Work placements and the final year project: A joint experience in the industrial engineering degree. Int. J. of Engineering Education, 22, 1319-1324

EPS-MU (2010) Guía académico administrativa del proyecto final de carrera. In: EPS-MU (ed.)

Hasan Z (2009) Enhancing student's hands-on learning experience through final year project in industry: Implementations and challenges. 2009 International Conference on Engineering Education, ICEED2009 - Embracing New Challenges in Engineering Education, 29-33

INE (2011) Instituto nacional de Estadística [Online]. [Accessed 2011]

Jawitz J, Shay S, Moore R (2002) Management and assessment of final year projects in engineering. Int. J. of Engineering Education, 18, 472-478

Leonidov B (2006) Student centrality in university-industry interactions. Doctor of Philosophy in Public Policy Doctoral Dissertation, Georgia Institute of Technology

Magleby SP, Todd RH, Pugh DL, Sorensen CD Selecting appropriate industrial projects for capstone design programs. In: Mudd Design Workshop II, `Designing Design Education for the 21st Century', 19-21 May 1999, 2001 Ireland. Tempus House of Publishers, 400-5

Martinez ML, Carretero A, Romero G, Mera JM Evaluation and use of the standards in of the technical drawings in the final year project. In, 2010 Istanbul. 4239-4244

Martinez ML, Carretera A, Ortiz-Marcos I, Sánchez MJ Valoración del empleo de la ingeniería gráfica en los proyectos fin de carrera

Mondragon Unibertsitatea (2010) Report on the migration to an international campus of excellence (CEI): Mondragon Unibertsitatea-The university of knowledge transfer. Arrasate-Mondragon: Mondragon Unibertsitatea

Ortiz-Marcos I, Sánchez MJ, Cobo JR (2010) Evolution of final degree projects at the Universidad Politécnica de Madrid. Int. J. of Engineering Education, 26, 162-168

Vaezi-Nejad SM (1993) Final year project as an important component of the electrical and electronic engineering degree course at the university of Greenwich. Int. J. of Electrical Engineering Education, 30, 296-302.

Vitner G, Rozenes S (2009) Final-year projects as a major element in the IE curriculum. European Journal of Engineering Education, 34, 587-592

Zunaira M (2005) The Internet for value innovation. Proceedings of 2005 International Conference on Innovation & Management, 1301-130