Postgraduate Education on Pulp and Paper Engineering in Spain

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Abstract - **The Spanish Ministry of Education and Science with its Resolution of June 22nd 2006 (BOE nº 157, July 3rd 2006), published the list of official postgraduate programs and their corresponding master titles. This list includes the "Master in Textile, Paper and Graphic Engineering" with two intensifications: 1) Textile Engineering and 2) Paper and Graphic Engineering. This interuniversity master in Paper and Graphic Engineering has its origin in the interuniversity PhD program that received a "Quality Mention" during the last two years between Technical University of Catalonia (UPC) and Universitat de Girona (UdG). It gives a good education and training for the pulp, paper and graphic industries, mainly orientated to lifelong learning to all of those people that are working in related industries. The design of this Master is mainly orientated to Engineering Practice for the Pulp, Paper and Graphic industries under the auspicious of Bologna Process. It includes a wide vision of the related processes, practices, visits to modern installations and with an important future extension to other Spanish Universities and South American ones.**

Index Terms – Bologna Process, Future extensions, Official Post-graduate programs, Pulp, Paper and Graphic Engineering.

INTRODUCTION

Formation in pulp and paper engineering at a University level begins in Spain in the middle of the last century. Effectively, we can found precedents in the teaching of paper industry in the syllabus of the School of Textile Engineers of Terrassa in the late forties [1].

In the decade of 1960 there are two important landmarks concerning the paper studies in Spain: the foundation of the Paper School of Tolosa in the Basque Country (three academic years, equivalent to bachelor) and the creation of a Chair of Paper Science within the syllabus of Industrial Engineering (Terrassa) of the year of 1964.

The Paper School of Tolosa was inaugurated in 1965 [2]. The degree awarded in this School was Technical Engineer in Paper Industry (equivalent to Bachelor degree). Unfortunately, these studies disappeared in 1997 [3].

The School of Textile Engineers of Terrassa changed its name in 1957 [4] to *Escuela Técnica Superior de Ingenieros Industriales de Terrassa, ETSIIT* (the highest degree in studies of Industrial Engineering in Spain).

Since 1964 the studies of Industrial Engineering consisted of 5 academic years. It has to be remarked that these studies of Industrial Engineering entail a general but at the same time an in depth academic education with a specialization in the lasts years. At that time the different Specializations were: Mechanical, Textile, Chemistry, Electricity, Metallurgy and Industrial scheduling.

Concerning the Pulp and Paper studies, they were included in the Textile Specialization of the School of Terrassa and consisted of 5 different subjects (Raw Materials, Paper Chemistry, Paper Technology, Paper Physics and Printing and Converting). The lectures were given by the professors of the chair of Paper Science and the total number of hours was 600.

In 1978 the Spanish Ministry of Education and Science approves [5] a new Speciality within the curriculum of Industrial Engineering: Paper and Graphic Sciences. In this Curriculum, the students, besides the scientific education of the industrial engineering acquire a formation at University level in Paper and Graphic Sciences. The students that followed those curricula were very welcomed by the industry both in Spain and in Latin America.

CURRENT PAPER AND GRAPHIC FORMATION IN THE STUDIES OF ENGINEERING

The evolution and the change of the University Curricula have led to the modification of the Specialities. In the School of Terrassa, belonging to the Technical University of Catalonia (UPC), with the current name of *Escuela Técnica Superior de Ingenierías Industrial y Aeronáutica de Terrassa* (ETSIIAT), these modifications have conducted to the "Technical Curricula" (ICT) within the degree of Industrial Engineer (five academic courses studies), one of which is the Paper and Graphic ICT [6].

The Paper and Graphic ICT consists of 11 different matters or subjects with a total of 67.5 credits (675 teaching hours). Students have to follow 51 credits. The different subjects of the Paper and Graphic ICT are [7]:

- Unit operations in Engineering
- Paper raw materials and pulping
- Paper physics
- Physicochemical aspects of papermaking
- Paper technology
- Graphic technology
- Packaging
- Prepress
- Paper Converting
- Chemical analysis and Environment
- Industrial Projects

During this long period of experience from the side of Terrassa, in Girona University (UdG) during 1993, a research group started its activity in paper engineering. The name of this group is LEPAMAP. Different collaborations were established between both centres. The first was a revitalising network of technology transfer to Spanish paper industry (DGR 1998XT 00031) financed by autonomic government and renewed during 2000 (CIRIT 2000XT 00058). The total amount of these networks summed around 10800 €. The responsible was Prof. J.F. Colom.

The good relations and collaborations between both groups lead to a proposal of an Interuniversity Doctoral Programme

INTERUNIVERSITY DOCTORAL PROGRAM

On 13 of May 2003 the Girona University (UdG) and the Technical University of Catalonia (UPC) signed an agreement according to carry out an Interuniversity Doctoral Programme in Paper Sciences.

The lectures of this program were given both in Terrassa (ETSIIAT) and in Girona (UdG-EPS).

Concerning this Doctoral Program, it has two main phases, an educational part and a research part.

Included in the educational part, students had different matters to conform their curricula with a total of 20 credits (200 teaching hours). Lectures were given by the academic staff of both universities (UPC and UdG) and were classified as obligatory (OB) or optional (OP), and also were classified as methodological (M) or fundamental (F). Some examples of the lectures: i) Fibres, pulps and paper characterization (OB+F); ii) Instrumental analysis applied to textile, paper and environment (OP+F); iii) Chemistry and technology of bleaching cellulosic fibres (OP+F); iv) Chemistry and technology of cellulosic fibres processing (OB+F) or v) Instrumental methodology in the evaluation of structure and properties of paper (OP+M).

An important percentage of these credits (25% i.e. 5 credits) would be obtained by assisting to external seminars or teachings related with the program.

In the research part of the program, the student had to pass 12 credits by means of one or two research works.

To pass all this parts, permitted to the student to obtain an Advanced Studies Diploma before to continue with a doctoral work.

This Doctoral program was awarded with the so called "Quality Mention" of the Spanish Ministry of Education MCD2005-00349 [8].

INTERUNIVERSITY MASTER PROGRAM

The Quality Mention awarded to the Doctoral Program encouraged the two Universities to prepare an Interuniversity Master Program dealing with Paper Science.

The Spanish Ministry of Education and Science divulged the relation of official postgraduate programs and their corresponding master titles, whose implantation was been authorised by autonomic communities [9]. This list included the "Master in Textile, Paper and Graphic Engineering" with two intensifications: in Textile Engineering on one hand and Paper and Graphic Engineering on the other hand. The last one is an interuniversity master that would accomplish with the regulated formation related with pulp and paper industry in all the Spanish country.

All Masters approved in Spanish Universities belongs to different Official Postgraduate Programs (POP). In the present case, UdG includes the master in a Technological POP and UPC includes the master in a Textile and Paper Engineering POP.

The Paper and Graphic Engineering intensification of the master gives a good education and training for the pulp, paper and graphic industries, also orientated to lifelong learning to all of those people that are working in related industries. The design of this Master is mainly orientated to Engineering Practice for the Pulp, Paper and Graphic industries under the directives of Bologna Process. It includes a wide vision of the related processes, practices, visits to modern installations and with an important future extension to other Spanish Universities and South American ones.

The Master is structured in a total of 120 credits, distributed as Figure 1 specifies. A total of 80 credits are specific, 20 credits are elective subjects and the last 20 credits include a final master project [10].

Semester	Type of matters	ECTS
S1	Specifics	55
S2		
	Optative	20
S3		
	Specifics	25
S4		
	Final master thesis	20

FIGURE 1
DISTRIBUTION OF CREDITS IN THE MASTER PROGRAM

With this curricular structure, contents that aim to give the specific knowledge in industrial areas of pulp and paper fabrication, paper conversion and printing processes are included. Competences that have to be achieved are [11]:

- Development of pulp, paper and graphic technologies.
- Design of processes and products applying new technologies.
- Research and innovation in all involved sectors.
- Development and management of industrial projects.
- Technical support in development and application of equipments and products for pulp and paper industry.
- Management of the production and logistics.
- Creation and innovation in processes and products.
- Decision making within the framework of a technological strategy of the companies.

And as well as the cross-sectional competences:

- Work in groups.
- Leadership of human groups in common projects.
- Continued capacity of learning.
- Management of the research, the resources and the projects.

Even though this Master is classified as a Professional and Research formation, it is clearly more centred in professional formation.

All students with 60 passed ECTS from a postgraduate official program (POP), and a total of 300 ECTS in their university student life can access to Doctorate program that also are included in the definition of POP's.

Taking into account the professional projection of these postgraduate students, it is important to keep in mind that pulp and paper engineering and graphic sectors are supported by a great amount of areas in which the diploma holders can exert their competitions. The areas involved in which the postgraduate students can choose as professional projection are: pulp and paper engineering, obviously, mechanical engineering, electrical engineering, electronic and computer science engineering, process automatization, energy management, environmental management, chemistry and chemical engineering, agro forest engineering and industrial microbiology, all of them applied to pulp and paper engineering and graphic applications.

THE EVOLUTION OF THE POSTGRADUATE EDUCATION ON PULP AND PAPER ENGINEERING IN SPAIN

The current curricular structure of the Interuniversity Master Program presented corresponds to a classical or historical formation. Pulp and Paper industry, as well as graphic sector, evolutes very quickly. An important aspect is that this evolution is related to geographical situation. Pulp and Paper Industry in Spain is relatively different from Latin America Industry. Thus for example pulp production in Latin America is much more important than in Europe, difference that would be increased after all predicted investments. On the other hand, in Europe, the increasing consumption of recovered papers as raw materials is in detriment of virgin pulp consumption. These changes have to be included in the Postgraduate Education related to Pulp and Paper Engineering. Also, other new subjects as the improvement the technology to process deinked fibres to increase their physical aptitude to high quality paper production, or new paper converting processes to facilitate certain properties than market demands, as for example: non-flammable paper, non-skid paper, special packaging, new hygienic paper applications, …

Combined with all these new applications, it has to be in mind that energy consumption and reductions of emissions will be the key processes in the future.

In order to mould all these requirements in a Postgraduate Education, more flexibility is required. Flexibility in choosing optative matters and also in choosing specific matters included that permits to draw different curricula.

Another important objective of this postgraduate education now centred in UdG (Girona) and UPC (Terrassa-Barcelona) is to extent it to all the Spanish territory in a next future. This objective would be accomplished by means of collaboration agreements between different Universities whose research activities turns around pulp and paper engineering. One important key to achieve this aim is to adequate the formation, via Bologna Process, to new semi presence methodologies that rules up with this postgraduate education.

In a perspective of two years minimum, the intention of the promoters of this Postgraduate Education is to extend this formation towards Latin America, adapting the contents of the matters to their own industry.

Perspectives are good. The Postgraduate Education on Pulp and Paper Engineering is alive, adapting their subjects to continuous modification of related Industry and with the capability to extend this formation to all related sectors.

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