

CHANGES IN THE EUROPEAN WOOD SCIENCE EDUCATION

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Abstract:

The wood industry has once again changed and distanced the poles of raw material acquisition, processing and markets. After the political reforms of 1989 in Eastern Europe and Russia, the biggest capacities for the panel production moved from Western and Central Europe to the East including also Turkey. Also the furniture production followed the same transfer direction. The large research centers and higher education institutions of Eastern Europe were reintegrated and reformed during these decades in order to be able to survive the economic and political changes. At the same time, pressure from Western countries on the new European countries and members of the EU was high and resulted in a decline of the wood processing industries and massive closures of the state companies. The massive immigration of high qualified personnel from East to West and the transfer of the production capacities from Western to Eastern part of Europe in order to avoid higher salaries, high environmental requirements and expensive round wood had a major impact on the quality and number of higher education institution and of course, the no. of students in both regions. The effects of these developments during the past two decades have been dramatic for wood-based industries in Europe. Imports from multinational corporations, combined to lower exports of own products and furniture at low margins impacted the industry. The number of students reduces while the no. of new universities of applied sciences with wood technology, furniture design and building program increased especially in the German speaking countries. The (sometimes local) governmental support of the new universities of applied sciences and established older faculties declined. The impact of the Bologna agreement drastically reformed the state institutions by leveling the differences between classical faculties and universities of applied sciences in the bachelor and master courses. The expansion of the EC to the East improved the situation, as foreign companies invested modern processing facilities and created new jobs in Eastern Europe including Russia and Turkey. A dramatic situation after the start of the economic crisis has to face the last years North America, especially USA, due to the low processing of round wood, massive closures of wood processing companies and low request from the national market for forest products. Also, higher education faculties are forced to change the names of the institutions to avoid using "wood processing" due to the pressure from environmental protection side. South-East Asia is continuing to dynamically increase the capacities for modern wood processing and no. of higher education centers. China became the absolute leader in the round, sawn wood and chips importation and also, for the panel, paper and furniture production reaching the no.1 worldwide. South America is on a positive course by continuing the successfully rapid growing trees plantation forest programs and specializing the processing industry on this raw material. The traditional trade markets of North America changed for Asia, especially China, Japan, South. Russia stopped the free exportation of logs to Europe but is continuing to support exportation to China. This has made the start of companies with foreign capital easier and concentrated industries for the European part market. The higher education and research in wood science seems to be in a crisis due to the competition of other study programs but also the decrease of the no. of students. An interesting and successful development from the industry and higher education point of view in between the two continents is in Turkey. A short presentation of each main high educational center for wood science and technology in Europe will be given in this paper.

Key words: wood science; wood technology; wood processing; higher education.

AUSTRIA

Institute for Wood Science and Technology, Department of Material Science and Process Engineering at the University of Natural Resources and Life Sciences Vienna (www.boku.ac.at)

According to Bologna process, the diploma-studies were changed to the bachelor and master system in 2003 by including the idea of renewables based technologies (in general) in the new curricula of "Wood and Bio-based Fibre Technology" (Bachelor) and "Wood Technology and Management" (Master). This process was accompanied by the establishment of two new chairs, one for natural fibre technology and the other for cellulose fibre and wood chemistry. As an average, there are currently about 40 per year in the Bachelor program "Wood and Bio-based Fibre Technology" and yearly less than 20 in the Master program "Wood Technology and Management". BOKU has two general PhD programs (Natural Sciences & Technology and Social Sciences) which are not linked to any of the master programs (disciplines). Currently about 25 to 30 registered PhD studies can be assigned to Wood Science and Technology (according to the topic and/or the expertise of the supervisor). E-learning has been well established since 2009. In 2001, BOKU becomes a share holder of the newly established Competence Centre for Wood Composites and Wood Chemistry (Wood Kplus), which is seen as one of the top research programs. Based on a model of public-private-partnership (PPP) of the ministry of science and the Austrian wood industries a PhD program on wood technology, pulp and paper and timber engineering has been established by the end of 2013 and supports 12 PhD projects in collaboration with the Universities of Technologies in Vienna and Graz. The number of staff is about 40 with about 15 financed in co-operation with the competence centre Wood K plus. The institute is also involved in lecturing in the curricula of "Forestry" (Bachelor), "Forest Science" (Master) and "Renewables-based Technologies/NAWARO" (Master).

Study program for Wood Technology and Construction in Kuchl, Salzburg University of Applied Sciences (www.fh-salzburg.ac.at)

The implementation of Bologna for the Wood based Study Program process was possible in 2007, and the new branded Bachelor program "Wood Technology and Wood construction" (3 years about 60 places) offers the students competence on processing technologies, economical analyses and design of wood products, furniture and construction. Also a parallel bachelor and master program is available in Kuchl specializing the students in "Design and Product Management". Since 2010, the Master program "Forest Products Technology and Management" (2 years and about 25 places) started successfully and involves also graduated specialists from industry wishing to stay up-to-date or to add knowledge on wood technology and economics and since 2013, also in wood construction. The master degree of FHS directly allows further doctoral studies without exams. The permanent staff at Kuchl site reached 25 persons. 2013 started new specializations "Furniture and Interior Design" in the bachelor and "Wood Construction and Economics" in the master study program

BULGARIA

Faculty of Forest Industry, University of Forestry, Sofia (www.ltu.bg)

Over 700 students can enrol in three degrees (B.Sc., M.Sc., Ph.D.) in two different types of study: 85% of the students take the regular classes whereas 15% attend in correspondence courses. The two offered B.Sc. programs (4 years), Mechanical Wood Technology (410 students) and Interior and Furniture Design (230 students), achieved the highest ranking from the National Agency for Rating and Accreditation of the Republic of Bulgaria. The M.Sc. studies (1.5 years) in Mechanical Wood Technology (6 programs) and Interior and Furniture Design (4 programs) has over 60 students. Also there are two 3 years Ph.D. programs to continue the highest education for 15 graduate students (M.Sc.). Six departments (Wood Mechanical Technology; Furniture Production; Interior and Furniture Design; Woodworking Machines; Mechanization and Automation of Production; Mathematics and Physics) with 58 professors, assistant professors and assistants with unlimited employment contracts, two visiting professors and 12 lecturers with short-term employment contracts conduct education. The FFI owns specialized facilities to theoretically and practically conduct the education programs, such as a teaching and production center for wood processing and laboratories for wood modification, wood processing and wood-based composites with laser cutting equipment and for the manufacture of wood-based products.

CROATIA

Faculty of Forestry, University of Zagreb (www.sumfak.hr)

The Faculty of Forestry offers many undergraduate study programs: Forestry; Urban Forestry, Nature Conservation and Environmental Protection and Wood Technology. Upon completion of an undergraduate study program Wood Technology to B.Eng. during of 3 years, students have the option of continuing training in postgraduate specialist study program Wood Working Processes or Design of Wood Products to M.Eng. of 4 semesters or in postgraduate doctoral study program in Wood Technology for 3 years. A postgraduate study for Wood Materials Technologies and Organisation of Production of 2 years is also available.

Enrollment quotas in undergraduate study are 270 students, and in graduate studies 40 students. The Wood Technology Department focuses the development and improvement in the field of wood technology and process quality based on the specialized laboratories for furniture, wood panels and construction. The department involves for education and research 26 professors and associate professors and 17 assistants (partially in doctoral studies). For the faculty currently consists of 20 full professors, 24 associate professors, 18 assistant professors and 53 assistants. The faculty is intensively developing scientific-professional activities through numerous domestic and international scientific and professional projects. Furthermore, the FF is a publisher of two internationally recognized scientific journals (ISI): Wood Industry and Croatian Journal of Forest Engineering. It is also a member of the prestigious European associations and has a significant international collaboration with similar faculties from EU and other countries.

CZECH REPUBLIC

Faculty of Forestry and Wood Sciences, Czech University of Life Sciences Prague (www.fld.czu.cz)

The Faculty of Forestry and Wood Sciences is providing bachelor study program "Wood Technology", master study program "Wood Engineering". The study programs provide comprehensive education covering wood industry, including wood structure and properties, wood-based materials, sawmilling, wood construction as well as furniture making and design. A doctoral study program in Wood Science and Technology is also available for students. A new bachelor study program "Business in Wood Processing Industry" was introduced in 2013. On average, 50 to 60 students per year attend the bachelor program and 30 to 40 students the master program. About 20 to 30 students are involved in Ph.D. studies currently. Two departments dealing with wood science and technologies comprise permanent staff of about 20 persons, supported by external staff of about 15 teachers from another universities and research institutes.

Faculty of Forestry and Wood Technology Brno, Mendel University (www.mendelu.cz)

Wood Technology is taught at the departments for wood sciences and furniture fabrication at the Faculty of Forestry and Wood Technology. There are four undergraduate (B.Sc.) and graduate (M.Sc.) study programs in Forestry, Wood Technology and Timber Management, Landscape Design and Furniture Design and Furniture Technology. Bachelor study programs have been taught in English ("European Forestry") and in Czech (Wood Technology since 1993) for 3 years including defense of bachelor thesis and state final examination. New study programs are the Furniture Fabrication Processes (100 students at start) and Wood Constructions which are continued also as master study programs (about 40 student at start). 2012 started also the 4 years new bachelor program "Furniture Design" (20 students enrolled). For Wood Technology, there are 60 students starting the bachelor program and continuing about 30 to 40 in the master. In addition, FFWT MUAF Brno has been working on immediate opening one Double Diploma with Finland and one with France. The faculty shares on four Czech Ministry of Education programs for the conceptual development of international relations. Recently, it has opened a standard "guest professor" program where both travel and living expenses demands are fully covered. The research is oriented above all to the branches for which the Faculty provides 13 PhD programs. The scope of research reflects the multi-disciplinary character of the study. The PhD programs related to wood are: Wood Technology and Wood Science and Forest Processes Mechanization, and the newest one for Furniture Fabrication Process. The regular duration of the PhD study programs is 3 years. The above mentioned PhD programs have about 50 to 60 students involved.

FINLAND

Department of Forest Products Technology, School of Chemical Technology, Aalto University, Espoo (puu.aalto.fi)

The Department of Forest Products Technology is a leading unit in the higher education of the forest products technology sector in Europe and globally, producing on average 70 M.Sc. and B.Sc. degrees graduates annually. Duration of bachelor is three year and for masters two years. There are approximately 120 Bachelor, 180 Masters and 55 PhD students. The department consists of 13 professors, 11 post doc researchers, 4 post docs, 2 research fellow (senior scientists). The 9 research and teaching groups are structured in bio-based materials technology, bioproduct chemistry, biorefineries, clean technologies, forest products surface chemistry, paper converting and packaging, printing technology, wood chemistry and wood material technology. Historically the department has trained paper and wood scientists and engineers for the Finnish industry but nowadays has a much wider international perspective and offers a Master's level degree program through the medium of English. The program attracts students from Europe and internationally. Classes in wood science now forms part of the Bioproduct Technology degree program which is being continually developed to ensure that students are given the most up-to-date education. As such, the teaching carried out very much reflects the research activities of the department. As part of "Aalto Wood", a collaboration between the departments of Architecture, Civil Engineering and Forest Products Technology, the department contributes to the multi-disciplinary education of students of architecture, civil and structural engineering, believing that there is huge potential for wood to contribute to a more sustainable future.

Faculty of Technology, Lahti University of Applied Sciences (www.lamk.fi)

Bachelor's level education in Wood Technology has been given in Lahti since 1960. Every year 30 students are enrolled for this study program and the total number of students for the four-years bachelor study counts 100. The teaching staff includes three senior lecturers in wood technology, a laboratory engineer and a project engineer. The Wood Technology Bachelor program provides comprehensive education in production and materials, covering sawmilling, wood-based panels, furniture and joinery industries, as well as the wood construction industry. The studies also focus on high-tech expertise and sustainable development. Studies take the form of lectures, practical assignments and project work. Periods of practical training and projects are done in cooperation with partners, both in Finland and abroad. The education provides the graduated engineer with versatile qualifications to work in industry or marketing. Typical job descriptions are development and management positions, as well as design and marketing positions in Finland and abroad. The graduated engineer can also work in planning factory layouts or in production or design tasks in the wood house and wood construction industries.

FRANCE

National Higher School for Technologies and Industries of Wood, University Henri Poincaré -Nancy 1, Epinal (www.enstib.uhp-nancy.fr)

Presently Ecole Nationale Supérieure des Technologies et Industries du Bois (ENSTIB) has 32 lecturers and professors, and 23 supporting and administrative staff. The entrance of student is possible only after two years of university preparation studies. A total of nearly 400 students are present on the site and in allied laboratories, of which about 50 in the last year of 2 BSc courses in Furniture/Production and in construction/building. The bulk of the students is concentrated in the three years of engineers classes leading to a Masters Degree in Wood Engineering where there are at present about 260 students for the three years. To these are added several specialized Masters degrees, one for architects wanting to specialize in timber construction (1 year), one for graduates coming from different programs joining the timber industry (2 years) , and a third one held in Paris with the Centre of High Structural Studies (1 year). The Masters students vary between 30 and 40 every year. To these figures can be added the PhD students, at present over 40. ENSTIB issued 200 international refereed publications, several books and patents during the last 5 years. 70 to 90 timber engineers are graduating yearly. Four optional lines are available to students in the last two years of their 5 years course, namely in Materials, in Environmental science, in Production and Manufacturing Technology and in Construction/Building Technology. These are not specialization, but just preferred orientations in the total course. Exchanges during the last year of study with foreign universities abroad are active and encouraged. The double Master degree in Wood and in Forestry in collaboration with the School of Forestry in Nancy –ESB is obtained by just adding one more year of study.

Groupe Ecole Supérieure du Bois, Atlanpôle, Nantes (www.ecoledubois.fr)

The 3 years diploma of engineers is based on wood science and technology as a whole, but management, business, law, marketing, foreign languages and communication also play an important part in the education given at the ESB. Students get specialized as well as practical training in companies in France and abroad enabling them to become high level professionals in the wood sector. Evolving in a Group dimension, its aim is to train various types of professionals throughout their careers. With approximately 350 students from 3 levels - HND, bachelor degree and engineer -, the school has a dynamic, open spirit which facilitates both the students' integration and their contacts with the wood sector professionals.. The School's research is targeted in that the focus of research is on wood-based composite materials. The internationalization policy of the ESB started 16 years ago and in the last few years has developed extensively with regards to student and teacher mobility and also research projects led by partners from various countries, as well as international conferences and exhibitions. The school launched a six-months long course called "International Wood Trade".

GERMANY

Chair of Wood and Fibre Material Technology, Institute of Wood and Paper Technology, Faculty of Mechanical Science and Engineering, Technische Universität Dresden (tu-dresden.de/hft)

Since more than 50 years the Studying Course of Wood and Fibre Material Technology at Technische Universität Dresden offers the only engineering and technical study of wood science at a German university. The Main Course of Wood and Fibre Material Technology is based on the Diploma Course of Process Engineering and Natural Materials Technology at the Faculty of Mechanical Science and Engineering. There is a 4 semester basic study. The following main study of 6 semesters focuses on wood technology related subjects. An including practical semester and the final diploma work complete this study. Furthermore, together with the Faculty of Environmental Sciences there is a common four semester Master Program "Wood Science and Technology". All in all in 2012, there were 93 students of wood engineering at the Chair. Currently 16 graduates work on their doctoral degree. The local cooperation with the University of

Cooperative Education Dresden and with the Institut für Holztechnologie Dresden (IHD) gives the chance for exchange of students and teaching staff and for usage of the labs and other facilities.

Wood Technology Department, University of Applied Sciences Eberswalde (www.hnee.de)

In the bachelor degree course in the field of Wood Technology, the students (totally over 360) are prepared for sectoral, directive and executive activities in industry, research, trade and craft under the aspects of sustainability. The master education of the HNEE is oriented on the needs of research and development in the wood branch as well as in the industry-sector-specific engine construction and building sector. The main aim of the course is to enable the graduates to work on research and development objectives in companies of the afore-mentioned and possibly related branches independently. Furthermore the students (about 10 start places) will be supported and promoted in their personal development. With the practise oriented research at the department, the overall concept of the university of applied sciences is realised by the 13 staff in the fields of production, design and processing of materials based on natural products.

Department of Wood Science, Faculty for Mathematics, Informatics and Natural Sciences, Hamburg University (www.holzwirtschaft.org)

The Department of Wood Sciences (University of Hamburg) consists of about 33 staff member enclosed 12 permanent scientists, 28 PhD students thereof 13 from abroad. Furthermore the close partner (former BFH), the Thünen-Institut (TI), employs at the location approx. 165 staff members (enclosed 30 permanent scientists and 36 non-permanent scientists). Within the Department of Wood Sciences, there are the following working groups and research topics: Wood Biology (formation, structure and quality, biodeterioration, protection), Wood Chemistry and Chemical Technology of Wood (pulp and paper, bio-refinery processes, polysaccharide and lignin chemistry), Wood Physics and Mechanical Technology of Wood (technology, processing, timber engineering), Wood Economics (forest products markets and marketing, resources monitoring and flow analyses) and World Forestry (ecosystems, development and monitoring, management). In 2005 in Hamburg, the Diploma program changed first to the Bachelor and in 2008 the Master program started. The "Bachelor of Wood Science and Economics" lasts three years and gives a general and detailed overview over the whole field of Wood Science and Technology (50 students starting). Afterwards there is the possibility to continue with two years lasting graduate study program for the title "Master of Wood Science and Economics". Right now over 40 students per year are inscribed for the BSc and approx. 25 students per year for the MSc. 10-15% of each age-group decides to continue for a doctorate study (approx. 3 years).

Course of Studies Wood Technology, Hochschule Ostwestfalen-Lippe, University of Applied Sciences, Lemgo, Germany (www.hs-owl.de/holztechnik)

Five professors, 12 employees and several assistant lecturers are engaged in the field of wood technology and assure a close contact between practice, research and education. The Bachelor course Wood Technology consists of seven semesters. It provides four semesters of basic studies. An internship semester is mandatory in the fifth semester, in which the students are supposed to put their skills they have already obtained into practice. In the sixth semester the students have to choose two of the four offered different major fields (Industrial Production, Furniture Construction and Development, Interior Finishing and Products and Production of Timber Constructions). The seventh semester should be mainly used for the bachelor thesis (beside three courses). Currently, there are about 160 students being enrolled in the bachelor course Wood Technology. Every year, another 60 to 80 start the course in Lemgo. After finishing the bachelor course, graduates can either start their working life or decide to continue their studies in one of three different master courses particularly suitable: Master of Science Wood Technology (mainly in German, partly in English language), Master of Engineering Production and Management (in German language) and Master of Science Production Engineering and Management. The latter master course is conceived as international double degree program in cooperation with the University of Trieste and is carried out entirely in English language.

Wood Research Institute, Technical University of Munich (www.holz.wzw.tum.de)

The total staff number of the Technical University of Munich (TUM) chairs and Institute for Wood Research Munich (HFM) fluctuates between approximately 55 and 60 persons (40% academic degree, 55% technicians, 5% administration). The HFM personnel perform research and development projects, service work, and testing, inspection and certification activities for the wood and building industries. Teaching is predominately presented at the Faculty of Forest Science and Resource Management in Weihenstephan by Munich, where at present 260 bachelor students are enrolled. In the master courses, 90 students are enrolled in the program "Forest and Wood Science", and 130 students in the program "Sustainable Resource Management". Approximately 40-60 students are enrolled in the elective wood related courses on

processing, conversion to energy quality, utilization etc. In addition, teaching is offered at the Bachelor and Master courses "Renewable resources" managed at the Science Centre in Straubing. On average, 5 to 10 theses in the Bachelor, Master and PhD courses are directed and supervised yearly by the chairs of Wood science, and Technology, respectively. As a specific activity, HFM is operating the editorial office of the wood research journals "Wood Science and Technology" and "European Journal of Wood and Wood Products".

Faculty for Wood Technology and Construction, University of Applied Science Rosenheim (www.fh-rosenheim.de)

The Faculty for Wood Technology and Construction counts about 900 students for the three Bachelor and two Master courses, 29 professors, about one dozen visiting lecturers and 28 technical and administrative staff. After the Bologna Declaration, the three diploma studies merged in a Bachelor of Engineering (B.Eng.) in Wood Technology, Wood Construction and in Interior Engineering all with a duration of 3.5 years, a Master of Science (M.Sc.) in Wood Technology in cooperation with Bern University of Applied Sciences in Biel (CH) and a Master in Wood Construction for architects. All Bachelor graduates are also entitled to bear the title "Engineer". PhD studies are possible in cooperation only with other universities. Students come from more than 20 countries worldwide. The faculty has about 70 cooperations with other universities and research institutes worldwide. The Faculty for Wood Technology and Construction runs a wide range of modern technical facilities and laboratories covering the whole value chain of the wood processing and wood working industry. This also includes also laboratories for material testing, furniture testing, testing of full size building elements, chemistry labs, labs for electronic data processing, wood protection, wood anatomy and others.

A new bachelor study "Applied Wood Technology" (3.5 years) started 2007 successfully at the University of Applied Forest Sciences Rottenburg (HFR) with about 40 students each year (www.hs-rottenburg.net).

GREECE

Dept. of Harvesting and Technology of Forest Products, School of Forestry, at the Aristotelian University of Thessaloniki (AUTH) (www.auth.gr/en/for)

The Department of Harvesting & Technology of Forest Products at AUTH is the oldest one in Greece. It belongs to the Forestry School and the 5-year diploma degree awarded is in Forestry. It has also two different MSc and PhD programs focusing on wood science- and wood products technology- related topics.

Department of Wood and Furniture Design and Technology (WFDT), at the Technological Educational Institution (TEI) of Thessaly (former Larissa), in Karditsa (www.wfdt.teilar.gr)

The Department of Wood & Furniture Design and Technology is a new department first fully run in year 2002 and offers only a B.Sc. degree (7 terms + 1 term of practical exercise). The curriculum covers the areas of wood technology, furniture design and manufacturing technology of furniture - wooden constructions. Offered degree at bachelor level is a technological engineering degree (3.5 years) and is unique in Greece. The WFDT although new in the area, has developed a good name in the Greek market of wood and furniture enterprises, expanding numerous mini-projects having close ties with the industries and SMEs. It offers up to date no Master's program. WFDT has a new laboratory facilities; today 14 faculty members and 4 so-called technical teaching staff have full-time employment in this department. It has almost 300 undergraduate students attending the Greek-language B.Sc. program, while the WFDT is divided academically in the laboratories of: wood technology, furniture manufacturing technology, wooden constructions technology, quality control, wood machinery and processing, CAD lab, furniture industrial design, CAD-CAM lab, and applied economy and marketing.

HUNGARY

Faculty of Wood Sciences, West Hungarian University, Sopron (www.uniwest.hu)

The Wood Engineering program at the Faculty of Wood Sciences is the only one in the country. During their studies, students complete projects involving planning, design, manufacturing technology and economical aspects of wood and wood based products. They gain complex technical and business skills to use in the wood industry. Around 1,000 students attend B.Sc. (3.5 years) and M.Sc. (2 years) courses in the Faculty of Wood Sciences. The programs can either be conducted through direct attendance of the students or as long distance courses. Offered degrees at Bachelor level for Wood Engineering and Industrial Design study are an engineering degree (7 semesters), and for Applied Arts study at the university level (6 semesters) is an arts degree available. English language M.Sc. program in Wood Science and Technology started in 2008. There are 3 programs for 130 graduate M.Sc. students, Wood Industrial Engineering (also in English), Industrial Design Engineering and Light Industrial Engineering. Other postgraduate degrees, programs: Energy management, Engineer-manager, Wood product designer, Wood product manager. The Faculty for Wood Sciences is divided into 8 institutes as well as independent units with 20 full professors, 24

associate professors and 15 assistant professors. A new Natural Resources Research Center and a Visitor Center for Forestry and Wood Industry started to operate at site 2012 on 2,944m² laboratories and workshops after an investment of 7.7 mil.€ Furthermore the university holds the right to award Ph.D. degrees. The highest level of education is provided by the Cziráki József Doctoral School of Wood Science and Technology (3 years). It includes 35 graduate students in 6 programs: Wood Science, Wood Processing, Wooden Structures, Fiber Science, Information Technology and Management. The publication of research results is facilitated by the scientific journals "Faipar" ("Wood Industry") and Acta Silvatica et Lignaria Hungarica either in English or in German..

ITALY

Department of Forest Environmental Sciences and Technologies, Università degli Studi di Firenze
(www.unifi.it)

In Italy presently no specific higher education curriculum specifically dealing with the wood industry is offered. Educational curricula in Forestry have always included course units dealing with Wood Science and Wood Technology. In some cases, other higher education curricula such as civil engineering, architecture, industrial design, conservation of cultural heritage, economics, include course units dealing with wood technology, supporting the education of professionals who might be involved with wood during their activity. At the Universities of Firenze, Viterbo, Torino, some PhD were specifically awarded on subjects dealing with wood, within PhD schools of the forestry sector. Globally in Italy the professors and researchers belonging to the scientific sector of wood technology and forest operations are approximately 16. The number of students graduating yearly in forestry sciences or related fields can be very roughly estimated as 100-150 (Bachelor) and 30-40 (Master); approximately 15-20% of these carry out their final graduation work in subjects related to wood technology. Historically, during several years Wood Technology was taught only at University of Florence 2013 within GESAAF (Department for Management of Agricultural, Food and Forestry Systems) the Wood Technology and Forest Operations sector includes 4 professors, 1 researcher, 2 technicians, plus 6 researchers with limited contract and 5 PhD students; among the on average 60 students graduating yearly in Forestry Sciences (45 Bachelor, 15 Master), approximately 10-15 carry out their final graduation work in subjects related to wood. Similar activities are carried out at faculties of forestry of other Italian universities, including Bari, Padova, Torino, Viterbo, with some differences and specific interests which are dealt with lesser or greater depth.

KOSOVO

Department of Wood Design and Technology, Faculty of Applied Sciences in Ferizaj, University of Prishtina (www.unu-pr.edu)

The Faculty of Applied Sciences in Ferizaj has currently 20 full time faculty members (10 professors, 10 assistant professor), who serve in three departments of the faculty (Mechanical Engineering, Wood Design and Technology and Management department) for around 293 students (undergraduates only since the faculty hasn't yet started with Master programs). The Department of Wood Design and Technology has in the undergraduate program (B.Sc. – 3 years) 66 students. A total of seven teaching staff (2 professors, 5 assistant professors) are teaching and researching in this department.

POLAND

Faculty of Wood Technology, University of Life Science, Warsaw (www.sggw.pl)

The Faculty of Wood Technology offers only one major characterized by technical and environmental approach – Wood Technology at 2 specializations: Mechanical Wood Technology and Conservation and Renovation of Historical Wood. All programs at engineering undergraduate (B.Sc., 3.5 years, 550 full time students) and graduate (M.Sc., 1.5 years, 100 students) level are offered in both regular and vocational schooling system for "Mechanical Wood Technology". The duration of Ph.D. (post-graduate, tertiary education) program is four years (25 graduates). There are departments at the faculty are for: Technology, Organization and Management in Wood Industry, Wood Science and Wood Protection, Mechanical Wood Processing and of Physics. The faculty staff includes 60 professors and assistants. At the moment the faculty has about 900 students.

Faculty of Wood Technology, University of Live Science, Poznan (en.puls.edu.pl)

The Faculty of Wood Technology provides the following departments existing in the wood-technological sector: Institute for chemical wood technology and the chairs for chemistry (wood chemistry, pulp and paper, wood protection), wood sciences, mechanical wood technology, wood-based composites, adhesives and surface coatings, engineering sciences, thermal processing, and life sciences. The scientific staff consists of 22 professors and associate professors, 56 doctors, 3 assistants and 44 engineers and technical assistants. The total number of students (full and part time is 750). Field of study "Wood

Technology" is available as well as undergraduate studies (1st cycle, B.Sc.) awarding an Engineer's degree after 3.5 years of studies in one of the four specializations (mechanical wood technology, chemical wood technology, furniture design, wood protection and modification) or graduate studies (2nd cycle, M.Sc.) after 1.5 years of studies following the same four specialization as for B.Sc. Also doctoral studies (3rd cycle, Dr.) are possible requesting a four years study and research period.

PORTUGAL

Wood Engineering Department, Highschool of Engineering and Management, Polytechnic Institute of Viseu (www.ipv.pt)

The Wood Engineering Department (DEMad), one of the 8 departments of School of Engineering and Management of the Viseu Polytechnic is the only Portuguese academic institution offering formations in the field of Wood Engineering (Bachelor and Master) and Furniture Design (Bachelor and CET). DEMad has 12 professors (4 full professors and 5 assistant professors) and has graduated more than 400 students (350 B.Sc., 50 M.Sc.). DEMad is installed at ESTGV campus and has several facilities specifically for wood engineering and furniture. These facilities include a full scale industrial plant (more than 2.500m²), several teaching laboratories (CAD-CAM, Wood Seasoning and Drying, Wood Finishing, Wood Physical-Mechanical testing, Wood-based Composites, Wood Chemistry) and a I&DT laboratory. DEMad being the only research and development institution focused only on wood and furniture industries as a very strong collaboration with the Portuguese industry and is partner for the major national industrial associations and guilds and is a partner of the Portuguese Standardization Institute.

ROMANIA

Faculty of Wood Engineering, „Transilvania“ University, Brasov (www.unitbv.ro)

The Faculty of Wood Engineering provides the License Domain Forestry Engineering in fulfilling the Bologna regulations with the following specializations (4 years of full-time study): Wood Processing / Furniture Design, Wood Engineering and Management. This undergraduate specialization trains 40 engineers yearly. Postgraduate courses include specializations in Master study (2 years): Innovative Technologies and Advanced Wooden Products and Furniture Eco-Design, Restoration and Certification. The teaching staff, acting within the Wood Technology Department and the Machines for Wood Industry Department, is formed by 11 professors, 5 assistant professors, 6 lecturers, 3 assistants and 5 consultant professors. The total number of students in the undergraduate studies – full time and low-frequency numbers 535 undergraduate students and 53 additional graduate students in the master studies. More than 10 graduated students specialized themselves in the doctorate study program.

RUSSIA

Today in Russia, forestry and wood technology is taught at about 20 universities. Herein the education is conducted in forestry (partially in combination with landscaping), mechanical wood technology (including wood sciences), chemical wood technology and automation technology in forest and wood industry. Especially in the field of forestry, the number of students is very high: Forestry 1,760, Mechanical wood technology 3,090, Chemical wood technology 390, and automation technology in forest and wood industry 350. Roughly one professor is employed for every eight students.

Nowadays in Russia there are federal research institutes and 20 private research institutes in the field of wood technology with a staff of 7-30 each. This picture is meaningfully characterized by the example of the Research Institute of the Wood Industry (WNIIdrew), Balabanowo. Until 1987, around 800 people were employed at this institute, 470 of which were scientists (two associated professors, 71 Ph.D.). Today only three Ph.D.'s work at this institute. Presumably it was one of the world's largest research institutes in the field of wood science.

REPUBLIC OF SERBIA

Faculty of Forestry, Belgrade University (www.sfb.rs)

The Faculty of Forestry of Belgrade University is the oldest and the highest educational and science institution in former Federal Republic of Yugoslavia. During the 1st level of undergraduate study (B.Sc., 4 years) students acquire the professional title of Engineer. The 2nd level of graduate study (M.Sc., 1 year) initiates a certain specialization for research work. This aspect is essential for the 3rd level, the doctorate study. In total, 135 scientific staff work and about 2,000 students study at this faculty (all 4 departments). The total of 100 students enlist in the first year of studies on the Department of Technology, Management and Design of Furniture and Wood Products (TMD). After the second year of studies on the TMD department, the bachelor students choose one of the 3 available specializations: Technology of Furniture and Wood Products; Design of Furniture and Wood Products and Management of Furniture and Wood Products Manufacturing. M.Sc. program (1 year) in Technology, Management and Design of Furniture and Wood Products is divided into 8 modules with total of 58 positions for graduate students. The doctoral school in

Wood Processing (3 years) counts over 20 students. International cooperation of the lecturers (37) on the Department for Wood Processing provides opportunities to postgraduate students for professional further education abroad as well.

SLOVAK REPUBLIC

Faculty of Wood Sciences and Technology, Technical University Zvolen (www.tuzvo.sk)

The Faculty of Wood Sciences and Technology currently consists of 11 departments and 130 staff. The present structure of accredited study programs is as follows: Bachelor in Wood Sciences, of Economy and Enterprise Management, of Design and of Protection of Persons and Property for 3 years for 870 full time and 430 part time students. Master of Wood Sciences, of Economy and Enterprise Management, of Design and of Protection of Persons and Property for 2 years and over 170 full time graduate students. Doctoral studies (3 years) in Wood Processing Technology, Wood Structure and Properties, Constructions and Processes of Wood Products Production and Fire Protection and Safety are offered for over 43 full time and 30 part time students.

SLOVENIA

Department of Wood Science and Technology, Biotechnical Faculty, University of Ljubljana (www.bf.uni-lj.si)

The Department of Wood Science & Technology consists of 45 employees, around 400 students. The B.Sc. Program in Wood Science lasts for 3 years At Master Study Program in Wood Science (M.Sc.) are enrolled 15 students, for 2 years. The dDoctorate in Wood Science has 5 graduate students and lasts for 3 years. The primary activity of the Department of Wood Science & Technology is education on higher/university level. At the same time, it is the only research and development institution in the field of wood science and technology. Organizational structure of the department consists of four Chairs (Wood Technology, Mechanical Woodworking Technologies, Adhesive Bonding, Wood Composites and Surface Finishing and Management and Economics of Woodworking Industry and Product Design & Development), two working groups (Wood Chemistry and Wood Pathology and Preservation) and the group of supporting staff (administration, library, and technical staff).

SPAIN

Forestry Engineering Department, Technical University of Madrid (www.montes.upm.es)

The objectives of degree in forestry engineering are very diverse within the forest sector and enables the students to participate direct in forest management projects and implement forestry engineering also in the field of forest products industries. The degree includes two itineraries aimed at the specialisation in Forest Management and Forest Products Industry. In 2013, the number of enrolled students for Bachelor was 295 in the old plan of studies and 460 in the new plan adapted to Bologna; 10 in the Master of Advanced Forestry Engineering; and 147 for PhD in 6 different programs. Total number of graduates is 66 (17 in the specialty of Forestry Industries, that includes studies in "wood").

SWEDEN

Division of Wood Science and Engineering, Luleå University of Technology (www.ltu.se)

The research and education has expanded and is now joined in the Division of Wood Science and Engineering. Research is within 3 fields of Wood Technology, Wood Physics and Wood Products Engineering. The staff consists of 6 professors, 7 associate professors, 3 senior research engineers and 15 PhD students. There are 15 Master students and 30 students on basic levels (bachelor). There are 3 research fields: wood technology, wood physics and wood products engineering. Cooperation with companies is strong within research projects. It also operates a large Industrial Research Center called Wood Center North. The Division of Wood Science and Engineering is a part of the Department of Engineering Sciences and Mathematics.

Department of Forestry and Wood Technology, Linnaeus University (www.lnu.se)

The Department of Forestry and Wood Technology started 1995 in Växjö. There are approximately 10 associate professors and 10 PhD students at this department. Target has been to have nine professors to cover the chain: silviculture, forest operation, forest products/wood properties, forest products/wood manufacturing, forest products/wood chemistry, forest products/marketing and forest products/economy. Today there are four professors at the department. The department provides 3 study programs as well as single courses and contract training with about 750 students. Several of the students study part time. Within individual courses, it is not uncommon with quarter speed: Forest and Wood Engineering Program with 50 full time students, Bachelor; Forest and Wood Engineering, Master program (taught in English), Master, Parts of the Master's program courses can be read as master courses and Forest Production and Wood utilization Program with 180 full time and 70 part time students.

SWITZERLAND

Department of Civil, Environmental and Geomatic Engineering, Swiss Federal Institute of Technology Zürich (www.ethz.ch)

The **Department of Civil, Environmental and Geomatic Engineering** is able after restructuration and developments to support the civil engineering program with the main topics related to wood science, technology and engineering. About 5-10 Bachelor students are finalizing within this working group their final works. Also Master final works, exchange students and visiting professors are yearly hosted by this group. It has 15 members (the half of are PhD-students financed by research projects. The main topics are focusing the wood physic, NDT, adhesion (2-3 PhD works/year)

Architecture, Wood and Civil Engineering Biel/Bienne, Bern University of Applied Sciences (www.bfh.ch)

Bachelors in Wood Engineering are specialists who have practical and theoretical skills in the production of semi-manufactured items (saw mills, wood material producers) and products (cabinet making, furniture industry, carpentry, engineering construction with wood). This course, the only one of its kind in Switzerland, is guided by the criteria and needs of the wood economy and its allied branches. The Master of Engineering in Wood Technology course of study prepares graduates for higher professional positions in the international environment of the wood industry. In addition to the solid fundamental knowledge acquired in the Bachelor of Science in Wood Technology course, graduates have the ability to tackle practice-related and scientific problems in all areas of wood and wood-based materials processing. As such, they are in a position to make business decisions swiftly and confidently in an increasingly globalised and competitive market. The degree program is carried out together with the University of Applied Sciences in Rosenheim.

TURKEY

Department of Forestry Industrial Engineering, Faculty of Forestry, Istanbul University (www.orman.istanbul.edu.tr)

The three main programs at the **Department of Forestry Industrial Engineering** are "Forest Engineering", "Forest Products Engineering" and "Landscape Architecture". It consists of 4 sub-departments with totally 30 faculty members (11 professors, five associate professors). Total number of graduated students from the division forest industrial engineering since 1982 is over 1,450. The number of new registered students in the last year was about 560 in all forms of education program. Some of students come from foreign countries.

Department of Forest Industrial Engineering, Faculty of Forestry, Karadeniz Technical University, Trabzon (www.orman.ktu.edu.tr)

The Faculty of Forestry has currently 69 faculty members (24 professors, 9 associate professors), who serve in 4 departments (Forest Engineering, Forest Industrial Engineering, Landscape Architecture and Wildlife Ecology and Management) for around 2,200 students (undergraduates – 800 of them are in the night time teaching program, graduates, Ph.D.). The department has in the undergraduate program (B.Sc. – 4 years) over 700 students (more than half in the day teaching). Other 30 graduate students (day teaching for 2 years) are further completing their higher education. 32 expert staff (13 professors, 3 associate professors and 5 assistant professor) are teaching and researching in this department.

Department of Forest Industrial Engineering, Faculty of Forestry, Kastamonu University (www.orman.kastamonu.edu.tr)

The Department of Forest Industry Engineering has 4 main branches: Forest Products Chemistry and Technology; Forest Biology and Wood Protection Technology; Wood Mechanics and Technology and Forest Industry Machinery and Administration. In 1999, Forestry Engineering master program began under the authority of Gazi University Science Institution. To date, 61 students have completed with the title of "Forest Engineer (MSc)", and 5 students have completed with the title of "Forest Industrial Engineer (MSc)". Kastamonu University began offering a master program in Forestry Engineering and Forest Industrial Engineering in 2008 and a PhD program in 2012.

Other new but important sites for the higher education in wood science and technology are:

- Department of Forestry Engineering, Faculty of Forestry, Bartın University (bof.bartın.edu.tr)
- Department of Forest Products Engineering, Faculty of Forestry, Düzce University (www.of.duzce.edu.tr)
- Department of Forest Industry Engineering, Faculty of Forestry, Kahramanmaraş Sütçü İmam University (www.ksu.edu.tr)
- Department of Forest Products Engineering, Faculty for Forestry, Süleyman Demirel University, Isparta (sablon.sdu.edu.tr)
- Department of Forest Industry Engineering, Faculty of Forestry, Artvin Coruh University (orman.artvin.edu.tr)

- Cankiri Karatekin University, Faculty of Forestry (of.karatekin.edu.tr)
- Suleyman Demirel University Faculty of Forestry (orman.sdu.edu.tr)
- Faculty of Forestry, Karabuk University (orman.karabuk.edu.tr)
- Faculty of Forestry, Bursa Technical University, (of.btu.edu.tr)

UCRAINA

Faculty of Wood Technology, Ukrainian National Forestry University, Lviv (biblos.com.ua)

Ukrainian National Forestry University (NFUU) is the only university in Ukraine fully specialized in forestry issues and graduates can receive Bachelor, Specialist or Master degrees and also a Doctoral degree. The university trains with 400 staff (including 34 professors and 225 associate professors) in 32 departments of the university, 6,000 undergraduate to become professionals for forestry and the economic forest industry Today 900 undergraduate students attend the TF. The education is organized by eight chairs with a teaching staff 87, with 11 professors and more than 50 assistant professors with an unlimited contract of employment. From 1992, the following programs are offered by the TF: Wood harvesting and Wood processing, Technology of Wood Processing, Chemical Technology and Engineering, Chemical Technology of Wood and Other Raw Materials and Art and design. Beginning with 2007 the three steps education (bachelor, specialist, master) were transformed to two steps (bachelor and master).

OTHER EUROPEAN COUNTRIES

Forest and Wood science education exists also in (no answer received from some of the responsible persons):

- Albania, located in Tirana at the Forestry Faculty
 - Belgium, located in Ghent as Laboratory of Wood Technology
 - Estonia, located in Tartu as Department of Forestry Industries, Estonian University of Life Sciences
 - Ireland, two located in Limarick as Faculty of Science and Engineering and in Mayo as Institute of Technology (Study course wood technology furniture production)
 - Latvia, located at Forest Faculty of Latvian University of Agriculture
 - Lithuania, located at Faculty of Forestry, Lithuanian University of Agriculture
 - Republic of Macedonia, located in Skopje as Faculty for Forestry at Cyril and Methodius University.
 - The Netherlands, located in Wageningen as DendroLab at Forest Ecology and Management Group
- There have also been some signs of new departments developing in Bosnia Herzegovina.

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