Wood Trade in Greece: The Impact Of Economic Crisis And The Use Of New Technologies

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Abstract. In wood trade, the supplier is the forest and the product is round wood. The quality, the quantity and value of wood depend heavily on the practices that are applied in the early stages of the supply chain. Current methods of the the productive capacity of forests, the annual consumption of wood and wood products, both from natural and technical forests and also from imports are presented. The aim of the paper is to aggregate data on timber trade in Greece and also to study how the economic crisis has affected the forest, its products and how it has affected trade (imports and exports). We will present the characteristics and elements for timber products gathered and present the results in tables and diagrams. Finally, we will present the use and utilization of new information technologies, such as databases, digital timber traceability systems, sustainable timber and wood products, in collaboration with the traditional methods used in timber trade.

Keywords: wood trade; supply chain; technologies; economic crisis; wood products

1 Introduction

In the field forests exploitation, plenty has been achieved to this point, and this is due to the development of the science of Forestry and consequently, to the scientific management of forests. The basic principle of forest management is the sustainability of profit from the forests. This principle ensures on the one hand the continuous supply of forest products and services and on the other, the preservation, maintenance and improvement of forests. While in forest ecosystem management and governance, the essence of governance is its focus on governing mechanisms which do not rest in recourse to the authority and sanctions of government.

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Governance has been reformed in order to achieve transparency, efficiency, and accountability and to end with sustainable economic development. The Internet provides a new prospective with the provision of quality services within the social, financial and cultural regional forest development (Andreopoulou et.al. 2012).The rapid development and global spread of modern information and communication technology (ICT) allows the developing world to leapfrog the infrastructure constrains to access and utilize information vital to forest research and development. Stronger emphasis is given to the analysis of the entire forest-agronomic production systems to support the need to design agro-eco-systems that increasingly have to fulfil multiple objectives. Such interdisciplinary analyses need input from a wide variety of disciplines, which, in turn, are used to better define and understand the complete agronomic production system. Provision in agricultural governance can be implemented through ICT focusing on informing, directing, managing and monitoring agricultural and environmental activities toward the achievement of sustainable agriculture (Andreopoulou, et al. 2011).

Environmental and agricultural governance can be enhanced through IT applications and techniques, ICT and e-services adoption, GIS employ, supply chain management use and database exploitation. When properly stored, forest and wood data can be easily retrieved and they can be processed in many ways from end users. ICT's give the integrated organization the opportunity to access to a large amount of forest and wood information with a set of online services (e-services). The ability to access huge amounts of data, effortlessly and quickly, is the incentive for better communication, scientific growth and technology development, thus, the adoption of ICT in public administrations as it is combined with organizational and structural change aiming to improve public services and sustainable development (Tzoulis, et al. 2013). Additionally, a web-based environmental database is a collection of organized environmental data that serves multiple applications. The organization of data in a database online, results in program data independence, data redundancy, enhanced data consistency, improved data sharing, increased productivity, better data accessibility and responsiveness and reduced program maintenance, as in simple database systems.

Wood produces in appropriate and specific processes, thousands of products, many of which are basic necessities (eg paper, wood furniture, matches, etc.) (Voulgaridis 1996). Forests occupy 1/3 of the land surface (FAO, 2000) and play an important role at several levels. From an economic perspective, the forestry sector is an important source of income, as timber is used in a variety of construction, household and industrial operations. Today, forests contribute 14% of the global energy supply and have the ability to reach up to 50% in energy requirements worldwide during this century (Hall, 2002). About 55% of the amount of wood used worldwide (CRES, 2010) (which reaches 4 billion m3), is used as a wood or charcoal for daily energy requirements that concerns heating and cooking in developing countries. In our country, until the 1950s, 15% of energy was coming from the forest (Kompelitou & Koskina, 2004), in the form of firewood and charcoal. In recent years, new and innovative digital solutions and technologies play an important role within strategic planning and decision support in wood entreneurship sector. The study and analysis of the current situation of trade in wood products in the European Union is an important tool in decision-making by the industries of wood. The

information on the supply and demand of various wood products and the forecast for the future is sufficient by itself to reduce the risk of business (Tzoulis, et al. 2014a). The ability to perform and track the whole follow-up of products in industries has been doable with the implementation of information systems, of automatic identification, which are capable to create a link between the product, the database of the product and of process. Traceability information systems consist of processes to maintain records that expose the trace of a particular input from suppliers to customers. Wood traceability information systems make sure that wood derives from sustainable sources and supply a successful technique to fight illegal logging. These Information systems cover data on the source and movement of wood throughout harvesting area until its final destination. It is important to achieve detailed tracking of the log production and movement of timber and wood products aiming to guarantee the legality of the product (Tzoulis, et al. 2014).

The value system is completed by the principles that forestry follows, among others, the principle of multiple use, the principle of sustainability, the principle of cost effectiveness and the principle of comprehensive and integrated approach management. These principles governing forest management and identify the key management rules and conduct on the implementation of any effort management objectives. The first principle, the effort to maintain and promote the multiple functions of forests derives from the fact that forests play a multiple role in the field of the environment, thanks to the multiple functions that characterizes it, and their ability to contribute decisively to maintaining nature and overall ecological balance. The multiple use one the hand preserves the multidimensional nature and biodiversity of the forest and on the other hand contributes more effectively / efficiently to the social welfare and development from single use. Sustainability, as a concept, is focusing at first on the ability of the forest to produce goods and service in accordance with the objectives of forestry. It constituted a basic principle for forest management from the first steps of Greek forestry, which in forced it, on the one hand forest conservation reasons and secondly the need for continuous coverage of annual requirements in forest products. The economic principle points the need that throughout the management of forests to constantly strive to shape a favorable relationship between the available instruments (expenses) and income (interest). The comprehensive and integrated approach stems from the nature of forest ecosystems, as a single and indivisible sets (ecosystems), as well as the need to preserve the unity and continuity of these in the conduct of forestry activities. Basic threat of degradation and destruction are mainly split and fragmented and unplanned intervention in forest ecosystems (Gkatzogiannis, S.2005). The purpose of this study is to record the effect of the economic crisis on timber trade in Greece and the use of new technologies.

2 Methodology

In this paper, will be presented aggregated wood trade data in Greece and further, will be discussed how the economic crisis has affected the forest, its products and how it has affected trade in imports and exports. Moreover, the use of new

technologies will be discussed. The study was conducted in 2015. Two main products categories of wood produced in the forest, construction timber and fragmentation wood, are presented along with the annual use of wood and wood products in Greece. We will also study the wood amount of production from public and non-public forests. Data of timber will be recorded and the results will be gathered in Tables. We will also examine the impact of economic crisis in wood trade sector in Greece, in Greek forests and the trade of firewood. The three main forest production stages are studied: the Primary (organic) Forest Production, The Secondary (mechanical) Forest Production and Tertiary (industries) Forest Production. Finally we present the use and utilization of new information technologies in wood trade certification, where various traceability systems are collected and studied in order to add flexibility and immediate feedback on the marketing of timber space, always in collaboration with the traditional methods used in timber trade.

The data of the Greek wood sector and therefore imports and exports in trade, were retrieved from the Centre for Renewable Energy Sources, the Reports of Greek Forest Services, Greek Ministry of Agriculture and FAO. Data were also collected by relative research books and studies (Tsoumis, 1983, Voulgaridis 1996, 1996a, Reuber και Fischer, 2011, Chaslidis, 2012, Tzoulis and Andreopoulou, 2013, Tzoulis et.al. 2013, Tzoulis et.al, 2014). Some of the keywords that were used in internet research are: wood trade, technologies, economic crisis, supply chain, ICT's and wood products.

3 Results

The annual production of wood from the forests globally to meet human needs is approaching 3.5-4 billion cubic meters, while forecasts show that wood consumption is increasing (Tsoumis 1983). Our country, Greece, is strong deficit in wood and wood products and imports significant quantities of round and sawn timber, wood pulp, etc. that are representing a total of 2,000,000 cubic meters of round wood equivalent per year. The forest cover rate (25.4%) of industrial forests is considered relatively small for a mountainous country. In the composition of our forests broadleaved species dominates having a percentage of 57% against the 43% of coniferous species. An additional percentage of 23.9% of the country's area is covered by non-industrial (non-productive wood) forests composed mainly of evergreen broadleaved (Ministry of Agriculture, 1992)

Two main categories of wood formed in the forest: a. Industrial timber includes: (1) The construction timber, which is called round wood and technical wood and (2) fragmentation wood (or industrial), which is used after the conversion into particles by crushing for particleboards, fiber and paper. b. Firewood that is pieces, round or slit, and are predestinated for household needs. From the total country's public forests 2.707 million cubic meters timber are produced annually (786,000 cubic meters of industrial timber and 1.921 million cubic meters firewood, ratio 29: 71). Those quantities estimated to be added another 400,000 cubic meters Industrial timber and

650,000 cubic meters firewood from private forests and plantations, community, monasteries and other non-public forests (Voulgaridis 1996a).

Overall, the annual consumption of wood and wood products in Greece is approximately 3,100,000 cubic meters equivalent round wood (not including amounts of produced firewood). The part thus of the domestic production from industrial timber is only 30-35% of the country's needs (Voulgaridis 1996). Other species that produce small quantities of wood are: cypress, birch, plane tree, maple, walnut, helm oak and other broad-leaved evergreen, etc. Natural forests of our country although they are growing satisfactorily in mountainous and hilly areas, remain in poor condition in terms of quality of the growing stock and the ability to produce technical wood. This is due to small and fragmented throughout the mountainous Greece production volumes, the unstable and often poor quality of the product, the constantly growing production costs, and the lack of industries producing finished products and powerful competition that exists on imported products. The result is either the distribution of the technical timber be done by loggers directly to small scale local crafts, and utilized in low value added products, whether it remains unsold and is offered at prices below production costs or compromising on firewood.

The evolution of the technical production of wood from the Greek forests is obvious that during the last thirty years has a drop in its production of 60%. Moreover, while imports in the early 80s covered only marginally the production, in the early 90s accounted for more than twice, and arrived in the early 00s to more than five times. Similar was the trend in terms of production of firewood (Forest Services Report 2009). Forests provide many benefits to society and the economy and play an important role in preserving biodiversity and mitigating the climate change, they also covering 177 million hectares (42% of the land area) of the 27 EU Member States. According to FAO, public sector holds 41% while private and other are holding 59%. In Greece covers about 20% of its surface. The Greek forests and woodlands are characterized by high ecological value and biodiversity. Of the total forest, 22% are conifers (pine, spruce, etc.), 30% broad-leaved deciduous forests-primarily oak and the remaining 48% are non-industrial forests. The wood-stock that forests are giving is: coniferous: 54 m3 / ha, deciduous broadleaf: 27,8 m3 / ha, total forest ecosystem: 21,2 m3 / ha. From the total timber produced quantity that serves, as firewood is 70 % of the timber, while in Europe the same category is 7-10%. The remaining 30% of the wood harvested, is used as construction wood and industrial wood. Their exploitation is made by their owners in accordance with the management studies, with their care, and approved by the local forest services. Regarding forest products produced therein, other than wood, they include Christmas trees, ornamental plants and herbs. Non-public forests constitute 36% of the Greek forests. In terms of composition and capacity these forests are not lacking at all against those from public, on the contrary too many outweigh (FAO, Global Forest Resources Assessment 2015).

But there are factors that greatly influence the rational exploitation of non-public forests and such are: small size in terms of surface, the capital investment reluctance infrastructure and culture and development of these forests. The capital investment reluctance is mainly because there is reduced and long-term performance of forests and the social character of forest ownership and the emergence of many co-owners

so there are discrepancies regarding the correct management. Following there are details on the development of imports and exports of wood products and paper in Greece during the decade 2004-2013, where in some categories the decline observed in recent years is vertical (Data source: FAO, Global Forest Resources Assessment 2015).

Table 1. Imports of wood and paper products (2004-2013), (FAO, 2015)

UNITS x 1000		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Round wood	Cubic m	651	328	285	490	490	365	410	380	483	379
Industrial roundwood	Cubic m	280	282	216	170	170	165	140	154	93	93
Industrial coniferous	Cubic m	137	117	128	86	86	113	100	87	55	55
Industrial non-coniferous	Cubic m	143	165	88	84	84	52	40	68	38	38
Wood fuel	Cubic m	371	46	68	320	320	200	270	226	390	286
Wood chips & particles	Cubic m	193	358	429	24	429	3	26	49	8	14
Wood residues	Cubic m	1	3	6	9	9	6	11	27	97	55
Wood charcoal	Metric t	51	54	63	62	62	66	56	59	61	63
Sawnwood	Cubic m	918	874	898	928	670	446	370	289	227	223
Sawnwood coniferous	Cubic m	725	705	796	820	538	365	315	251	196	188
Sawnwood non-coniferous	Cubic m	193	170	102	109	132	81	55	38	31	35
Wood-based panels	Cubic m	482	427	506	417	413	328	274	235	146	195
Veneer sheets	Cubic m	23	27	24	29	29	39	31	24	11	11
Plywood	Cubic m	58	68	82	65	61	62	55	41	33	51
Particle board	Cubic m	133	134	180	142	142	94	92	79	74	103
Fibreboard	Cubic m	268	198	220	182	182	133	97	90	29	29
Wood pulp (chemical)	Metric t	113	102	76	80	80	124	162	128	130	152
Recovered paper	Metric t	6	10	8	4	4	11	6	9	19	12
Paper and paperboard	Metric t	597	710	1044	701	701	732	720	572	486	537

3.1 The impact of economic crisis on Greek forests, and trade of firewood

The economic crisis that our country faces has, or is expected to have, the following impact in wood trade on our country: 1) The total collapse of the presently weak demand for technical timber. 2) Increase in the demand for trade firewood, mainly oak and other hardwoods as well as beech. 3) Significant pressure from local mountainous populations to satisfy most of their heating needs from forests, which is obvious by the return on woodstoves and fireplaces that have been increased in mountainous areas 4) intensifying illegal-logging in mountainous areas, even in urban forests. 5) there is an increasing tendency in the number of seasonal dealing with logging and as well the working period in days. The final result is the increase

of pressure on the "productive" public forestry's to meet those needs, which ultimately supply firewood. 6) species that so far were considered unfit because of wood characteristics are now in demand for firewood because of the growing pressure for legal and illegal firewood 7) there is a huge pressure to meet production needs in biomass (crushing timber) in order to produce pellets, or by using logging residues either by direct mechanical collection of forest occupied by low shrubby vegetation. 8) seasonal increase in the price of firewood of beech and oak, which is expected to intensify in the future. 9) the distance from the place of wood production up to their final consumption areas causes explosive growth of prices. 10) the imports of firewood mainly from Bulgaria are continuously growing in quick rates,. 11) there is a significant increase in the number of firewood outlets in all areas in Greece is reported (Chaslidis, 2012).

Table 2. Exports of wood and paper products (2004-2013), (FAO, 2015)

UNITS x 1000		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Round wood	Cubic m	16	16	27	36	36	7	6	11	27	26
Industrial roundwood	Cubic m	1	0	21	30	30	5	5	8	21	22
Industrial coniferous	Cubic m	0	0	20	23	23	4	4	6	17	8
Industrial non-coniferous	Cubic m	1	0	1	7	7	1	1	1	4	14
Wood fuel	Cubic m	15	16	7	5	5	2	1	3	6	4
Wood chips & particles	Cubic m	0	0	0	0	0	0	0	0	0	0
Wood residues	Cubic m	0	0	7	0	0	17	12	12	4	13
Wood charcoal	Metric t	0	0	0	0	0	0	0	0	1	2
Sawnwood	Cubic m	18	13	9	14	11	17	19	25	26	19
Sawnwood coniferous	Cubic m	2	5	4	5	2	4	11	14	16	8
Sawnwood non-coniferous	Cubic m	16	8	5	9	8	13	8	10	11	11
Wood-based panels	Cubic m	201	200	81	82	80	150	155	232	257	178
Veneer sheets	Cubic m	1	1	1	2	2	2	1	1	1	1
Plywood	Cubic m	10	11	13	13	11	12	12	38	22	26
Particle board	Cubic m	167	155	30	34	34	81	77	96	127	74
Fibreboard	Cubic m	23	32	37	33	33	55	65	97	108	77
Wood pulp (chemical)	Metric t	7	5	1	1	1	1	2	0	0	2
Recovered paper	Metric t	104	141	154	195	195	364	315	238	321	269
Paper and paperboard	Metric t	73	72	68	119	119	82	89	92	86	87

3.2 Primary and secondary forest products

In forestry three main forest production stages exist: the Primary (organic) Forest Production: concerning the establishment, construction, farming, improvement and protection of forest stands, mostly studied and regulated by the Forestry measures sectors, the Forest Efficient, the Forest Management and Forest Protection. The Secondary (mechanical) Forest Production: concerning the opening-road construction, exploitation, harvesting, transportation and production of forest products. Tertiary (industries) Forest Production: is about the full refining and use all kinds of finished products (mainly wood, resins and biomass) by humans. Wood is

the raw material of various primary industrial processing products (sawn timber, plywood, etc.), which are materials for production of other secondary processing products (eg furniture, paper). Both the primary and secondary products can be produced by mechanical or chemical treatment (Voulgaridis, 1996a). For the main forest products we distinguish three phases or development stages, which are: Primary use: it begins immediately after the pre-labelling to the logging trees and ends with the production of raw feedstock products in the cutting area, the forest road or in the yard of the factory, the Forest Harvesting. Secondary use: it contains the use of raw forest products, such as heating with firewood and the production of semi-finished products, eg sawn timber, sleepers, piles, veneer etc. Tertiary use: includes full refining and use of forest products in perfected form in their final use, such as parquet, wood paneling, furniture, paper, packaging, wood etc.

3.3 The aspect of technologies in wood trade certification

The adoption of new technological developments and innovative management practices will offer flexibility and immediate feedback on the marketing of timber space (Tzoulis and Andreopoulou, 2013, Tzoulis et.al. 2013, Tzoulis et.al, 2014). Information and Communication Technologies (ICT) and innovative tools and services offer huge opportunities for everyone to advance and take advantage and new opportunities for economic development, better service, social and cultural developments (Tzoulis and Andreopoulou, 2013). Advances in information technology have been identified as drivers of entrepreneurship in the field of commercial timber (Reuber και Fischer, 2011). The internationally traded wood should come from sustainable-managed forests (FSC & PEFC). Two certification systems of sustainable forest management have been developed: a) FSC: Forest Stewardship Council and b) PEFC: Program for the Endorsement of Forest Certification schemes (ACE UK, 2012). Certification schemes have emerged in recent years to become a significant and innovative venue for standard setting and governance in the environmental realm. Using the FSC label requires chain-of-custody certification, which involves tracking the origin of forest products all through the supply chain and guaranteeing that products meet specific content requirements. Initially, only products with 100% FSC content had access to the label. The rules have since been revised, gradually reducing the percent thresholds, introducing new restrictions delineating acceptable non-FSC content, and developing an FSC label for 100% post-consumer recycled paper. In regard to reducing pressure for deforestation, researchers have also been skeptical about certification's potential impacts. Certification provides an inadequate counterbalance to larger economic incentives for land-use conversion. In 1998 and 1999, European forest owners' associations joined together to create the Pan-European Forest Certification (PEFC) scheme to facilitate the mutual recognition of national schemes and to provide them a common eco-label. The PEFC Council, composed of national governing bodies primarily representing forest owner associations and the broader forestry community, approves national schemes if they are developed in conformance with the criteria, indicators, and rules of the umbrella scheme. In 2003, PEFC restructured itself and went global, changing its official name to the Program for the Endorsement of Forest

Certification schemes while retaining the PEFC acronym. The certification model now exists in numerous sectors, covering an ever-expanding suite of production processes (Auld et al, 2008). The wood trade presents forest change, as it relates forest stock change to net trade of wood products by localizing the origin of wood consumed in a given nation (Kastner et al, 2011). Wood for trade should not come a) from illegal cuttings, b) areas of natural value, c) gene-modified trees, d) areas with social conflicts, e) natural forests transformed to other use (Korsnäs, 2012, Tzoulis et.al, 2014). This situation was the first indication of the necessity for developing and implementing systems of products follow-up (Stevens, J. et all 1998) and to increase the efficiency of the process and its technologies, (Töyrylä, 1999) highlights that it is possible to improve the logistics chain, the management, the supply and the optimization of raw material. Much remains to be determined regarding the application of international trade law to multicriteria environmental and social labels.

The objective of traceability in timber is to prevent the circulation of illegal timber, and explore ways in which it can eliminate the export and import of illegally harvested timber. Businesses have a growing interest in wood as overall current trends in modern society, the timber and timber products, is the raw material for various industrial primary processing products such as poles, sawn wood, veneer, plywood, particleboard, fiberboard, wood pulp, etc, which are the materials for the production of other products, such as furniture and secondary processing paper (Tzoulis et.al., 2013). Modern innovative wood traceability systems certify the supplier and the buyer that wood comes from sustainable sources and is a successful way to fight illegal logging. Information systems include data on the origin and movement of wood throughout the collection area to its final destination, ie throughout the supply chain of wood. The most common traceability systems in timber trade is one of the traditional methods: stamping / punching, the color marking, barcodes (barcodes), the engraving dimensional code QR (quick response code), Micro Wave Sensor (Experimental), microchip RFID, innovative digital DNA of the cluster, etc. (Tzoulis and Andreopoulou, 2013, Tzoulis et.al., 2014) and finally the traditional labeling with a metal plate that is used now in Greece. Various innovative methods, such as satellite systems and remote sensing systems, have been proposed in international level and other are still under research (Brack et.al. 2002). The web-database technologies are also utilized in the marketing of wood, for example in a DB for European and tropical woods, which lists the species of wood, the physical and chemical properties and their characteristics and their potential uses (Tzoulis et.al. , 2014a). An online database is an effective tool for management and management in general, since it is a data set that has some logical structure and grouping. The database structure provides data independence, have more consistent data, thereby improving the exchange of data, increases productivity, improves the accessibility of data and reduces the maintenance and management of the program. Specifically, in the modern competitive timber business, especially SMEs in the region, integrated digital management and promotion systems utilize databases incorporated in governance and automated management systems. The business environment requires fast, efficient and reliable management of huge amounts of information on timber for products, suppliers, customers, materials, machinery, facilities, financial-accounting firm, office support and many more items. Many organizations have supported the idea of marketing using techniques segmentation,

identifying marketing strategies and creating special marketing departments (Tzoulis et.al, 2014a). The online databases have recently emerged as a fairly important component of any company; moreover a database supports the modern concept of marketing as it can gather all the necessary information.

4 Conclusions

Our country has a deficit in wood. Thus, the larger amounts of wood now imported from abroad. Most Greek forests nowadays are "unproductive" forests that mainly produce firewood and only small amounts of technical timber, timber with good quality and without errors. In trade, the species derived from the Greek forests are mostly fir, beech, black pine and poplar (plantation). Previously there was sufficient production amounts and from other wood species, e.g. chestnut, walnut, cypress, ash (ash, honey), elm (elm), pine vitiligo (robolo), juniper (cedar), maple (maple) and linden (lime).It is a fact that the social and economic environment of the era of the crisis and the scale of the threat, in principle generate pessimism about the future of forests in our country. Recent history also teaches us that in all times of crisis the forests had the same major disaster, but objectively helped the survival of people, and some bounced back after improving social and economic conditions. It is therefore expected that, despite the hopes and probably efforts of several national forests already suffer and will suffer a growing extent in the coming years the consequences of crisis. It is up to the individuals and collective associations to adopt the right strategy both to confront the threat and to highlight and capitalize on the opportunity. In the field of exploitation of forests a lot have been achieved so far, and this is due to the development of the science of Forestry and the scientific management of forests. The basic principle of this management is the sustainability of profit participation from the forests. This principle ensures on the one hand the continuous supply of forest products and services and on the other the preservation, maintenance and improvement of forests. Therefore, the adoption of new technological solutions and innovative digital management practices of all data is required, that will provide flexibility, immediate feedback and fast decision-making.

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