

Greek timber industries and wood product markets over the last century: development constraints and future directions

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Abstract. This paper examines the Greek forestry sector after 1930. According to the past literature, the sector was entirely degraded and reliable data are not available. The study analyses critical historical data about timber sector and timber companies; the main objective is the specification of the factors that kept the Greek forest sector underdevelopment. The factors and the development constraints, including the indigenous characteristics of the Greek forests, the inhibitory policy for timber production investments, especially in the state industries, lack of market research, unorthodox procedures for sale of the wood, bad quality and high cost of production and periods of general economic recession are analyzed farther. Conclusively, the need for producing official forest maps, forest data recording, rapid adaptation to EU specifications, investments, deep changes in to the managership of the state industries, permanent and specialized personnel and promotion of national programs for the development of the small-scale wood elaboration and wood selling industrial units are some of the solutions for the above problems that could be suggested.

Keywords Greek timber industry, constraints, trends, timber sale.

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Introduction

Greek policy-makers intend to increase timber and industrial wood production during the next several years. This intention could be achieved by implementing national forest development

programs that have been designed from 1973 until 2010 (Papastavrou 2006). Some data about the Greek forest sector, published by the Food and Agriculture Organization outline the profile of the sector. FAO (2001) reported that most Greek forests can be used for wood

supply and that more than three-quarters of the forest and other wooded land is publicly owned, with the remainder being owned by private individuals and institutions. In addition, the collection of fuelwood, honey, resin and other non-wood products is important for the livelihood of the local population (FAO 2001). FAO (2005) also investigated important forest sector characteristics and reported historical trends and forecasts about European countries, including Greece.

There are no significant studies published on the Greek forestry industry development. There are some studies about the wood products that consumed or produced in Greece. Arabatzis & Klonaris (2009) emphasize that the study of wood and wood product imports, consequently, is important to the national economy and can be a useful guide for the forest farms, wood industries and wood firms.

Klonaris and Arabatzis (2009) refer too that in Greece and internationally, the roundwood is one of the most important forest products, as it is used widely in construction and building sector. In this study the process of wholesale long-length roundwood (>2 m) price determination is depicted in the form of an inverse demand system. Finally, Koulelis (2010) using linear regression examined a possible method to forecast the timber forest products in the Mediterranean European countries using socio-economics factors.

The review of forest industry development could be an effective method for the extraction of valuable conclusions about the expectations, the transformations and policy strategies about the sector for the future. Roche (1990) examined the changing place and status of the timber industry in New Zealand during the 100 years following European colonization. He also described a significant transformation that occurred after 1900 because of a timber deficit, which led to state control of the industry.

Stanturf et al. (2003) investigated innovations that occurred within the timber industry in the southern United States from 1920 to 1999.

They reported that companies that spent the most on forestry research also did the best job implementing innovative practices. Also, they suggested that the emerging trends in industry structure and the support for research indicated a new role for public research institutions in the South, calling into question the need for silviculture research cooperatives. Brodrechtova (2007) examined how Slovakian forestry companies determined their marketing strategies over the years in the context of transition. She suggested that it is generally the physical resources and domestic institutions that have the most influence on export marketing strategies. In addition, company history reveals that practices developed during transition are still important today. Also, Glavonjic & Vlosky (2008) investigated the sale of timber in the Balkan region (Albania, Bosnia and Herzegovina, Bulgaria, Croatia, FYROM, Romania and Serbia Montenegro). The article presented research on wood sale systems and suggested several improvements, and also recommended cooperation between Balkan governments and industry, accelerated changes in legislation, and the promotion of sale compatibility with the European Union.

A historical overview of the forest sector can be highly useful for policy-makers and other stakeholders because it could provide critical answers to research questions like what went wrong in the past. This historical account may be important to many activities within the forest sector, including sustainable forest management and timber harvesting. Also the inferences derived from this historical account can be used as basic tools for making future decisions and constructing policy frames.

Main scope of this study is to specify all the several factors that kept the Greek forest sector away from the progress and development. According to the main purpose is presented an analysis of historical data about the forest sector in Greece mainly using techniques as the literature reviewing and the direct observation of the activities over the years of three repre-

sentatives (two state and one private) Greek timber industries. The theoretical framework of this paper is based on the hypothesis that the historical data of the forest sector and the timber industries should help to identify some of the special characteristics that worked as constraints to the development of the Greek timber sector.

Historical development of the sector

Until 1930, the Greek forestry sector was entirely underdeveloped. The demand of timber covered from the wood exploitation that had been done mostly with hands and water saws in the forest producing small quantities of wood (Papastavrou 2006). The lack of a forest-road network prevented extensive exploitation of the Greek mountainous forests. In 1937, the first sawmill in Greece was founded for educational purposes as part of the School of Forestry in Aristotle University of Thessaloniki (Figure 1). During the following years,

the state founded a number of sawmills near or inside Greek forests. Those sawmills were equipped with expensive and modern equipment taking into account the period of time. A forest road network was developed at the same time as these sawmill, with the support from the Greek Forest Service.

These circumstances also provided opportunities for private citizens to create small-scale wood enterprises marking the beginning of the Greek forestry sector history.

From 1954 to 1963 a number of wood companies began to produce sawnwood and panels. The concurrent development of the wood exploitation methods (mainly the installation of expensive and modern equipment) created the conditions for modern forest exploitation in countries with small wood stocks like Greece (Papastavrou 2006).

While these conditions existed, the Greek forestry sector did not become financially viable, because of the lack of implementation of efficient policies (critical decisions for

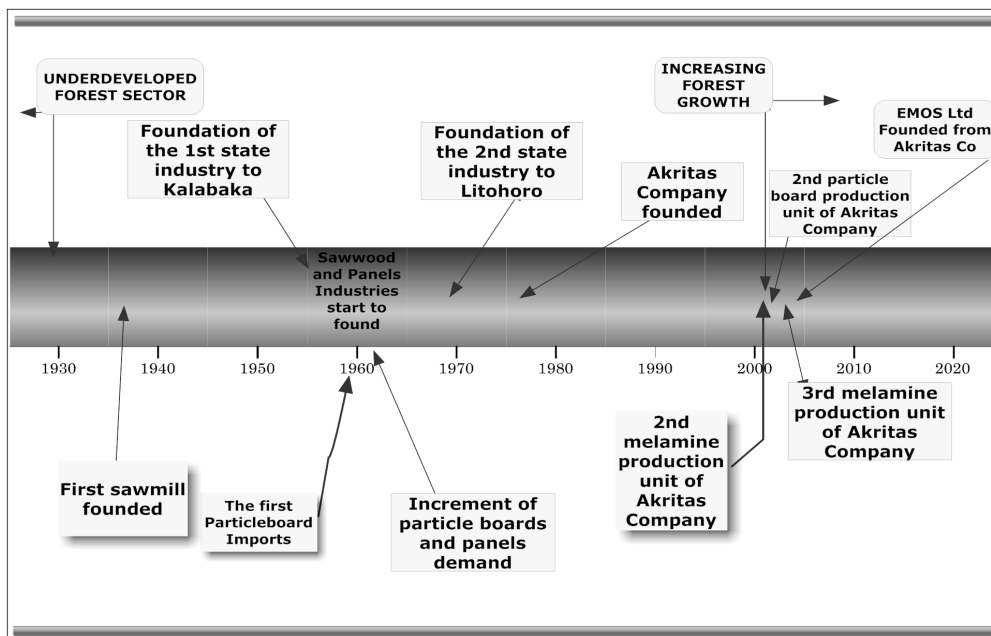


Figure 1 The Greek forest sector over the last 80 years

scientific help from the state, financing and entrepreneurship support) and the individual characteristics of indigenous forests. First, Greek forests cannot produce large amounts of roundwood from either conifers or non-conifers. Second, the mountainous topography of forest land, the lack of specialized labor, and the low level of automation within the wood harvesting process led to high production costs for wood products. Third, there were always technical and mechanical problems with the quality of timber. Moreover, there was always applied inhibitory policy for the development of timber industries owing to roundwood imports high-cost tariffs that discourage the domestic industry. Finally, the imports of final products including particle board and fibre board did not support of course the enlargement of the domestic forestry sector.

One of the most important problems for the development of the Greek forest industries was the system followed for the disposal of the timber for sale. The timber is moved following sale by auctions take place on forest roads. This procedure did not ensure stable prices for the primary wood removals (Papastavrou 2006), because it does not give the opportunities to wood-based industries to plan their expenses for the production of wood products. Even the same traders who supply them with roundwood did not know in advance what quantities and at what price to buy the wood in order to sell it to industry. In conclusion, the wood industries owners did not help to improve and enlarge their enterprises because this situation did not encourage them to supply their industries with Greek wood.

Sawnwood. Until 1937, the sawing of wood was done with handsaws or water saws. During the following years, some sawmills began to use new technologies. Some of these mills faced problems including: (i) the storage of roundwood under suitable conditions in the sawmill stores, (ii) the natural and technical problems of wood desiccation, (iii) troubles with market practices about market research

and consumers preferences, (iv) sales network and finally, (v) the profitable selection of the sawmill site.

Fiber-particle boards. The first particle board imports arrived in Greece during 1960 and the use of these wood products increased rapidly. Since 1960 the demand for fibre board was low, due to low availability and high cost (Papastavrou 2006). Considering the infancy of these products, this pattern of demand was predictable.

Panels. Like other types of boards, the demand for panels also increased after 1960. The most important problem that the forestry sector confronted was how to use a variety of different wood panel products. The production of enchorial wood panels for decoration was most common and panels were not generally used in construction.

Paper and paperboard. During the 1960s the paper industry evolved and began to produce cellulose, paper and paperboard. During the following years, domestic production supplied 60% of the Greek consumers' demands for paper.

Figure 2 focuses on the production, import and export of technical wood products for Greece from 1980-2005. The import and production of technical wood exhibit similar trends. It is useful to mention that these quantities do not refer to the productive potential of the Greek forests, but rather to the quantities that were harvested. The Greek forests produced about 200-300 thousands m³ of technical wood until 1970. After 1970, the production rose to 800 000 m³ of technical wood, peaking in 1983 with 905 322 m³ of technical wood. From 1983, the amount of technical wood produced decreased slightly, and by 2005 the production reached 390 000 m³. At the same time, imports remained below 1 000 000 m³ until 1980. The trend until this year increased slowly. After 1986, imports varied between 1.1 M and 1.6 M m³, reaching 6.23 M m³ by the year 2000. This rapid increase continued during 2002, reaching 10 124 000 m³ of technical wood imports,

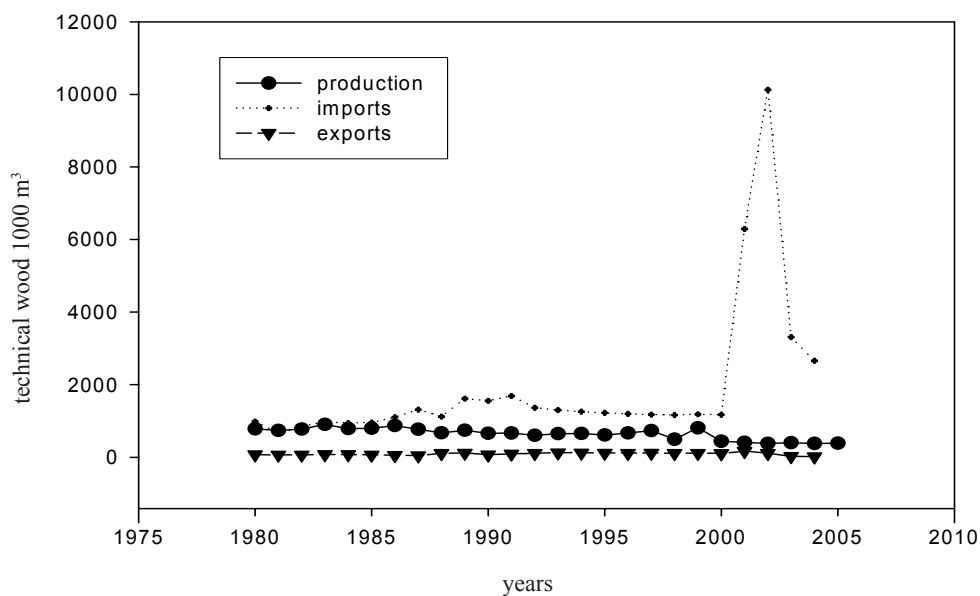


Figure 2 Trends of production, imports and exports of technical wood for Greece

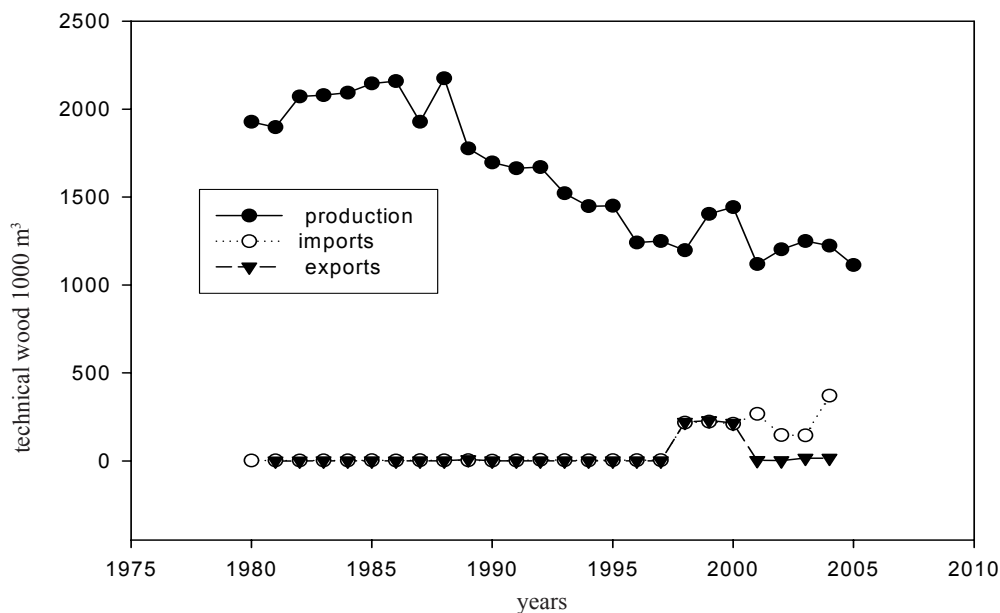


Figure 3 Trends of production, imports and exports of fuel wood for Greece

and was followed by a rapid decrease in imports to almost 2 500 000 m³ for 2004. During 2001 and 2002, the import of technical wood

increased almost tenfold. Data from the past two years show an economic recession in the forestry sector. This recession can only be as-

sociated with general economic issues, such as the purchasing power of the Greek currency, market problems or a reduction in timber demand for construction by consumers. A reduction in timber demand can be rejected because current studies forecast increased demand for wood and environmental services from Western (including Greece) European forests until 2020 (Kangas & Baudin 2003, Solberg et al. 2003). Thus, recession in the forestry sector is likely due to uncertainty in the Greek economy and market.

Exports of Greek technical wood began to increase after 1970 (54 000 m³ in 1975) and reached 108 000 m³ in 1988. Exports remained mostly stable with some fluctuations until 2000. Exports peaked in 2001 with 165 000 m³. In 2002, the exports retreated to previous levels of 111 000 m³ and from 2003-2004 were half the levels that were reached during the 1970s, falling back to 16 330 m³ for 2004. However, the production was not reduced for these two years. Thus, export reduction is also likely due to market problems.

At the same time, the GTM forecasts increasing forest growth, increasing sawn wood production and increasing forest industry profits in Western Europe until 2020. In addition, all recent studies predict that the future supply and demand for wood and the structure of trade in forest products will receive increased attention in Europe, due to EU enlargement and demands for sustainable forestry - e.g. concerns for industrial wood supply (Merlo 2003).

Figure 3 refers to the production, import and export of fuel wood over the years. Fuel wood production before 1980 was five times higher than subsequent periods. The Greek Forest Service reported 5 000 000 m³ of production in 1922 and 3 756 000 m³ of production in 1960. After 1975, production decreased from 1 927 000 m³ to 1 223 000 m³ in 2004 and to 1 112 000 m³ in 2005. This long-term reduction can be explained by changes in the quality of life, as well as changes in types of energies being produced and utilized. These changes mainly

stabilized fuel wood production between one and two million m³ per year until today. In addition, before 1970 the fuel wood harvests from the Greek forests was almost uncontrollable, a problem that continues today with illegal logging.

According to Greek Forest Service, for the 17 years following 1980 fuelwood imports were between 1 500 m³ and 5 000 m³. This changed in 1998, when reported fuel wood imports reached 217 000 m³. This quantity remained stable for the next 6 years, reaching 370 760 m³ in 2004. Similar patterns were observed with wood fuel exports for Greece over this time. Between 1997 and 1998, the fuel wood exports increased from 260 m³ to 220 000 m³ and remained stable for the next three years. After 2000, exports experienced big fluctuations, ranging from 1 760 m³ in 2002 to 15 330 m³ in 2004. Trends in exports were related to trends in imports during these years, with both increasing. This was due to the imported quantities supplying some of the enchorial demand, allowing for some indigenous wood to be exported. These trends occurred because indigenous wood production has not changed substantially since 1970. The critical conclusion from this discussion is that during last decade the Greek wood fuel market strengthened, thereby ensuring sustainable production. The fuel wood production can only lead to positive results. Firstly, it strengthens the Greek wood market and economy. Second, the utilization of fuel wood for industrial purposes is much smaller than household utilization, but fuel wood is a strategic resource in the efforts to fulfill the Kyoto targets and to mitigate greenhouse gas emissions (Hillring 2006).

Timber industries and constraints

There are two main state wood enterprises in Greece that could represent the state timber industry sector. These two enterprises in Kalambaka and in Litohoro have operating and

productivity problems due to bureaucratic difficulties involved with hiring seasonal personnel. For many years, operations only last for 5 to 8 months per year (Greek Forest Service 2006).

In 2005, 2 115 m³ of fir, 2 224 m³ of pine and 6 300 m³ of oak were produced. This amount of raw wood produced 1 156 m³ of fir sawn wood, 1 273 m³ of pine sawn wood and 2 946 m³ of oak sawn wood that was auctioned on the market or used for state needs (army, public services, organizations etc).

The State company of Kalabaka was founded in 1957 and was initially a sawmill. Many developments occurred during the following in terms of sawing, desiccation and impregnation. Nowadays the company has five units: (i) department for the treatment of coniferous roundwood, with a production capability of 10 000 m³ per year, (ii) department of wood impregnation, with a production capability of 50 m³ per eight hours, (iii) department of wood construction for the provision of forest recreation areas, (iv) department of prefabricated house construction, (v) department of particle board production, with a production capability of 10 000 m³ per year. The 6 000 m³ of wood used by the Kalambaka state company is harvested from nearby forests. The state wood company of Kalambaka employs an average of 52 people.

The State Company of Litohoro was founded in 1969 for the exploitation of oak roundwood. The industry has three departments: (i) department for oak and fir roundwood exploitation, with 15 000 m³ of production capability per year, (ii) department for steaming oak wood (for fungus protection and for equable color) in six specially-constructed cabins, (iii) department of wood pillar impregnation (for the national energy company or telephone company). The wood that is used by the Litohoro state company is harvested from nearby forests also.

Considering that the two state industries cover local needs and employ some seasonal

workers, their development requires at first market analysis. This market analysis should specify the existence and location of markets for these products, define the available means of transportation, explore how competitors supply the same markets, and compare competitive advantages of the producer (FAO 2005). At the same time, the identification of investment opportunities, the availability of the appropriate technology and one mixed forceful manager ship (not only for public officers) could strengthen their economic position in the market and ensure future operations.

The private sector could be approached with the presentation of a company named Akritas that was founded in 1977 at Alexandroupolis of Thrace whose activities are summarized in table 2. This company produces and sells timber products to both Greek and foreign markets. Akritas Company has an excellent location in Greece that gives it an advantage in providing export products to other Balkan countries. During 2006, exports from this company represented 3% of the total sales. The company produces particle boards with melamine or veneer and semi-finished furniture pieces. In 2001, Akritas invested 48.5 M € into expansions, which were completed in 2002. In 2003, a second expansion was undertaken, with 10 M €, that resulted in a new melamine production unit and a new system to exploit sawdust and reduce the need for raw materials. The company also started to apply new marketing strategies to reduce production cost. In 2004, the main company founded a subsidiary company named EMOS Ltd in Bulgaria, in order to expand business plans to the neighboring country. Today, the Akritas Company employs 300 people whereof 40 are bachelor owned (Table 1).

The company has four production units: (i) particle board production unit, (ii) Melamine Production Unit, (iii) veneer sheet-paper production unit, (iv) kitchen bench and doors production unit. All the company activities are summarized in the table 2. For this company,

95% of the total sales were in the Greek market, while 5% of sales were spread between neighboring countries like Turkey, Cyprus, Bulgaria and Albania. The allocation of products shows 85% are traded through a network of 700 coactive stores network and the other 15% of the products are traded directly with industrial customers. According to company reports the investment program was completed and all the new units are operational. The investments made the company competitive in the technical wood production sector of both Greece and Balkan region. The production units of the company are the largest in south-eastern Europe. The invested capital of the company was about 62 millions € by the end of 2007.

The modern problems for the Greek forest sector can be placed in three major categories (Figure 4). The inability of the Greek forests to produce large quantities of high-quality timber has always been one of the major problems for the forest sector. The forest disasters that occurred during the last several years, includ-

ing summer fires and trespassing of state land, contributed to reduced productivity of domestic forest lands. In addition, a national forestry policy plan was never implemented.

The second major category of development constraints concerns the cost and the methods of harvesting and production. The state and the private Greek timber companies always had problems supplying timber from national forests. The two national companies had particular problems with the labor for bureaucratic reasons. On the other hand, the highland terrain of the Greek mountains and the low level of automation in harvesting increase production and transportation costs. On the other hand the timber sales system seems not to be fit good in the Greek sector, because it does not ensure stable prices and quantities for the timber industries. Unfortunately, the Greek market did not begin to adapt to the European specifications regarding modernization and machinery standards, certificates of timber origin, the implementation of quality control systems, the correct desiccation and oiling of wood, and the

Table 1 Akritas Company Staff from 2005 to 2007. (Source: Akritas Company, 2007)

Staff	2005	2006	2007
Servants			
production	30	33	33
promotion	34	39	40
Other activities	40	41	42
Specialized workers			
production	130	134	138
promotion	23	28	31
Other activities	11	16	16
Total	268	292	300

Table 2 The main historical activities of Akritas Company during the period 1977-2004). (Source: Akritas Company, 2010)

1977	The company is founded
1980	The chipboard unit commences production operations
1982	The melamine facing chipboard unit commences production operations
1986	The chipboard veneering unit commences production operations
1998	AKRITAS receives ISO 9002/1994 quality assurance certification from TUV CERT, Germany
2001	A second melamine unit commences production operations
2004	The third melamine unit commences production operations

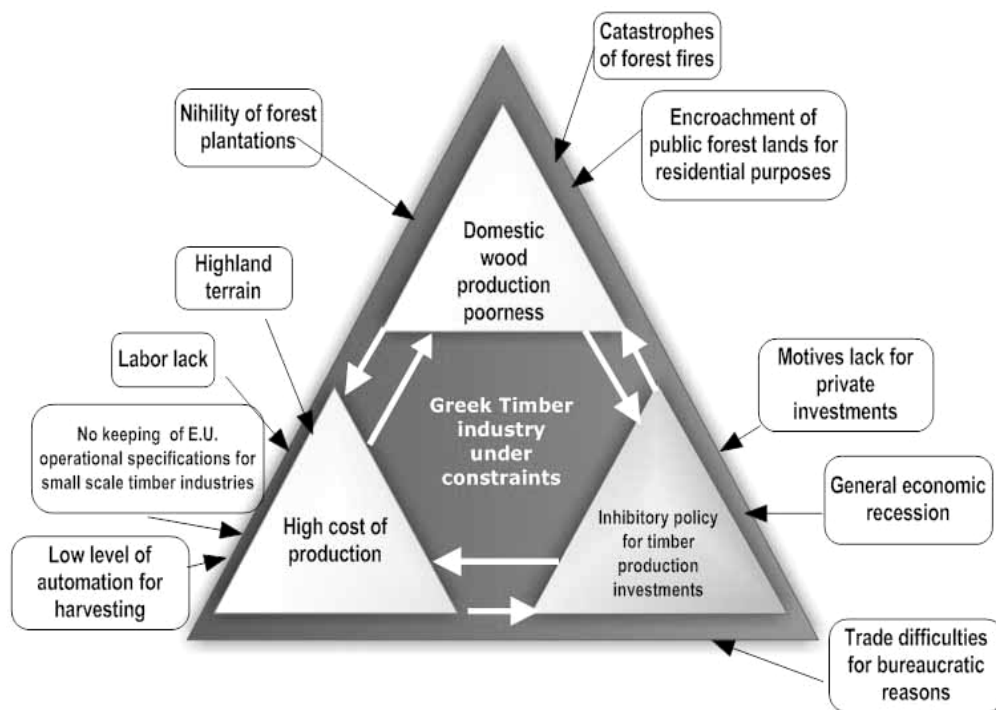


Figure 4 Greek timber industry under constraints

full training of labor. Consequently, many timber products are not usable in major construction projects.

The third major category of constraints is concerns stemming from forest policy implementation in Greece. Over the years, the forest policy attempted to address forest protection issues including land encroachment. Policy measures did not allow policy-makers to promote and plan for the sustainable development of the timber industry. This development could strengthen the national economy by decreasing the high cost of wood and amount of wood product imports. The cost for the year 2004 reached almost 1 million euro and according to Figure 5 continued to increase during the subsequent years. On the other hand, export income during 2004 was a little more than 100 000 € (Figure 5).

The motives that were given for private investments to the timber sector are deficient.

In addition, small scale forest owners did not achieve the expected results from their activities. The median private owned forest size in Greece is 1.3 ha and Greek forest owners are not generally economically dependent on their forests (Wiersum et al. 2007). On the other hand, the general economic conditions did not promote investments in large companies, but rather small scale timber companies that primarily serve local demands. In addition, the two state companies are not in a good condition at the operational level because of bureaucratic reasons and delays in hiring workers. Thus, their operations are limited to several months each year (Greek Forest Service 2006).

Discussion

Several factors negatively influenced the development of the Greek forest sector over the

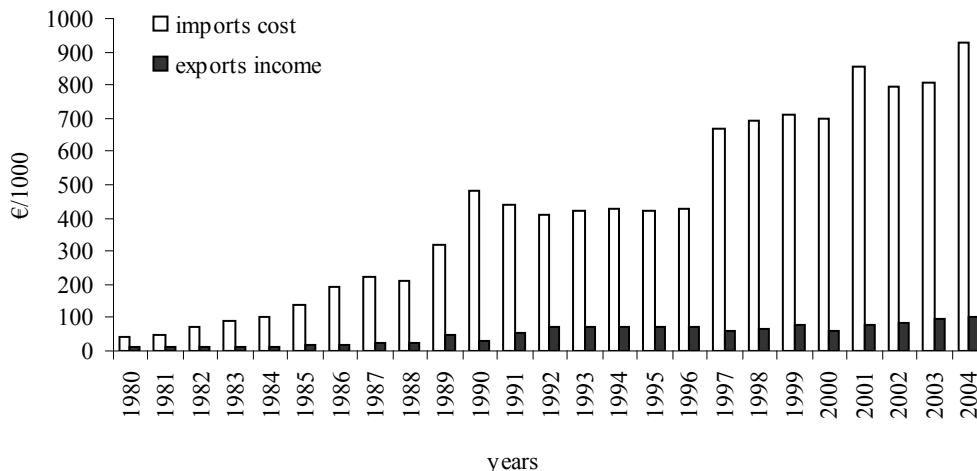


Figure 5 Imports cost and exports income for Greece over the years. (Source: Greek forest Service, 2005)

last years. The present research indicated that many of the constrains that kept the national forest sector underdevelopment can be found in the reviewing of the past discovering and analyzing as above some special characteristics and practices that used. The direct observation of the present activities of the timber industries can contribute also. The lack of forest road network (especially before 1930), the lack of efficient policies and the failure of their implementation, the particular characteristics of the Greek forest resource, the lack of modern technologies for the exploitation of roundwood, the illegal logging, the selling timber on forest-road side and the general economic recession. Also presented problems faced by the timber industries such implementation of the European rules considering the production, the storage and the certification of the Greek timber products. In addition the Greek forest sector faced problems like bureaucratic difficulties, not stable prices, lack of market research and market analysis, deficiencies of the sales network and lack of specialized and permanent personnel.

Stressed out by the limited previous studies

the historical overview provides some conclusions about the expectations, the transformations and the policy strategies about the sector for the future. If the decision makers manage to minimize or to erase some factors of these that this study indicated they could accomplished positive results for the Greek forest sector.

However the results of this study shouldn't generalized to other countries. In addition this study used a specific methodological approach that needs further validation to other national forest sectors in order to be used by other researchers, especially when tries to detect development constraints.

Future research should include financial data and economic analysis in order to further explore factors that played a negative role in the development of the sector. More specifically the results of this economic analysis will contribute in the development of tools that will assist researchers in their effort to negotiate with the above constraints.

Conclusions

This study argues that the following conclu-

sions are plausible and important for the future of the Greek timber sector.

The need for producing official forest maps in Greece is larger than ever. Large disasters from arsons and trespassing on state forest land could be avoided with the integration of this project. Unclear property rights, including those of state, must be addressed by realistic and forceful legislation.

The improvement of data and knowledge about Greek forest resources (e.g. productivity) and the forest sector in general, especially from the state services like the Greek Forest Service could play an important role for the general development and protection of the forest resources.

The Greek wood market must adapt quickly to European conditions in order for Greece to effectively participate in developments like models predict about special interesting in Europe about future supply and demand for wood and the structure of trade in forest products. Greece as a political and financial member of the European Union must have timber companies that follow the European specifications about facilities, productions, products and working labor in order to produce premium, competitive and certified timber products.

Difficult bureaucratic problems must be resolved rapidly with new policies and legislation based on tested approaches. The general situation of the Greek timber sector creates important problems for the long-term viability of the wood harvesting and sale, especially for large industries that do not invest in modern facilities. This type of problems can not be solved by using exports incomes because those exports are small and decreasing. Mixed system of manager ship in the state industries, large investments and market analysis and research could be some tools for development.

At the same time, imports are increasing rapidly over the years. Despite the general economic recession and the state economical problems (large national debt etc), the state could promote national programs for the develop-

ment of the small scale wood elaboration and wood selling industrial units. **This perspective** is more compatible with prevailing production, harvesting and protection conditions in Greek forests. **The proposed programs must involve** the two state industries. According to the Akritas Company's yearly balance-sheet (2007), management estimated that the general development of the Greek wood product industries would depend on future country economic situation. Greek state policy must support economically the wood products industry.

Finally, it is important to emphasize that all Greek forest based industries, state and private owned, must always follow the path of the European forestry strategy (European Commission 1999). This strategy promotes wood production from sustainably managed forests and certification procedures to ensure that timber, wood and non-timber forest products harvested under non-sustainable forestry practices would not reach the EU markets.

References

- Arabatzis G., Klonaris S., 2009. An analysis of Greek wood and wood product imports: Evidence from the linear quadratic aids. *Forest Policy and Economics* 11(4): 266-270.
- Akritas Company., 2008. Annual Financial Statements for the year 2007. Alexandroupoli Thrace, Greece. Web: <http://www.akritas.gr> 5.5.2008.
- Brodrechtova Y., 2008. Determinants of export marketing strategies of forest products companies in the context of transition — The case of Slovakia. *Forest Policy and Economics* 10(7-8): 450–459.
- European Commission., 1999. European Council Resolution on a Forestry Strategy for the European Union. Official journal of the European Communities, OJ C56, 26.2.99., pp.1.
- Food and Agriculture Organization of the United Nations, 2001. Forestry/ Countries profiles. Web:<http://www.fao.org/countries> profile.
- Food and Agriculture Organization of the United Nations., 2005. Microfinance and forest-based small scale enterprises. Forestry paper 146, Rome.
- Glavonjic B., Vlosky R., 2008. Timber-Sale Systems in the Balkan Region. *Journal of Forestry* 106(4): 206-213.
- Greek Forest Service., 2006. Assessment of activities for the year 2005. Ministry of Agriculture Development and Foods, Athens.

- Hillring B., 2006. Wood trade and forest products and wood fuel. *Biomass and Bioenergy* 30(10): 815-825.
- Kangas K., Baudin A., 2003. Modelling and Projections of Forest Products Demand, Supply and Trade in Europe. A study prepared for the European Forest Sector Outlook Study (EFSOS). Food and Agriculture Organization of the United Nations New York and Geneva.
- Klonaris S., Arabatzis G., 2009. Empirical Demand Analysis of Long-Length Roundwood (Sawlogs) in Greece. *NEW MEDIT (Mediterranean Journal of Economics Agriculture and Environment)*. VIII(3).
- Koulelis P., Lefakis P., 2010. A simple method to forecast the timber forest products in the Mediterranean European countries using socioeconomic factors. *International Conference Forestry: Bridge to the Future*, 13 – 15 May 2010, Sofia, Bulgaria. *Journal of Forestry* 1st (in press).
- Merlo M., 2003. Forest products, markets and socio-economics: ten years of pan European research co-operation at EFI. *Forest Policy and Economics* 5: 111–122.
- Papastavrou A.C., 2006. Forest policy, Especially in Greece. Issue B'. Aristotle University of Thessaloniki. Thessaloniki.
- Roche M., 1990. The New Zealand timber economy, 1840-1935. *Journal of Historical Geography* 16(3): 295-313.
- Solberg B., Moiseyev A., Kallio A.M.I., 2003. Economic impacts of accelerating forest growth in Europe. *Forest Policy and Economics* 5(2): 157–171.
- Stanturf J., Kellison R., Broermanc S., Jones S., 2003. Innovation and forest industry: domesticating the pine forests of the southern United States, 1920–1999. *Forest Policy and Economics* 5(4): 407-419.
- Wiersum F., Elands B., Hoogtra M., 2006. Small Scale