

Economic aspects of the emerging Greek mushrooms industry

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1. Introduction

Literature reports more than 38000 kinds of wildy grown mushrooms. Among them, there is a wide variation in their natural characteristics (i.e. colour, shape, appearance, aroma) and in their appropriateness for human uses (Szmidt, 1997). Thus, mushrooms can be distinguished into edible and non-edible. The latter are poisonous and dangerous for human or animal consumption. It is estimated that approximately about 200

kinds of the wildy grown mushrooms are collected for human purposes. However, today only a small number of edible mushrooms are used commercially. These are mainly cultivated on an agribusiness basis. Collection of wildy grown mushrooms is limited to specific kinds regarded as luxury food, i.e. truffles.

The perishability of fresh mushrooms is the most critical factor for commercial uses. This influences the mushrooms marketing-mix, and especially the parameters of time and of the destination of delivery as fresh products. It also impacts the selling price at all stages of the mushrooms value chain. Various types of processing, i.e. freezing, canning etc. are used for offering mushrooms and their products in more convenient forms for transportation and storage purposes and also in a wide variation of prices.

Abstract

This paper deals with the analysis of the production and market structure of the infant but rapidly developing Greek mushrooms sector. It shows that despite a number of internal constraints (i.e. use of costly technology, low productivity and excess capacity), the subsidies granted and the oligopoly situation prevailing in the market allow for profitable initiatives to appear. Domestic supply of fresh mushrooms cannot satisfy domestic demand and this imbalance allows for high marketing margins to appear. It is expected that this situation will lead to a better utilisation of the excess capacity or to new initiatives for production under lower-cost conditions by means of higher productivity. Consequently, the mushrooms business activities in Greece are presently regarded as a promising sector. The success of new competitors will depend on the effectiveness of production and marketing-mix.

Résumé

Cet article est axé sur l'analyse de la production et de la structure du marché des champignons en Grèce, un secteur qui se développe rapidement. Malgré de nombreuses contraintes (emploi de technologies coûteuses, productivité modeste, capacité excessive), les subventions et la situation oligopoliste du marché permettent d'entamer des initiatives rentables. La production grecque de champignons frais ne peut pas satisfaire le marché local et la marge bénéficiaire s'en trouve accrue. Cette situation devrait conduire à une meilleure utilisation de la capacité de production ou à de nouvelles initiatives visant à une production réalisée dans des conditions moins coûteuses, à travers des moyens à productivité plus élevée. Par conséquent, la culture des champignons en Grèce est actuellement un secteur prometteur. Le succès futur de ce secteur dépendra de l'efficacité de la production et du marketing-mix.

Edible mushrooms are considered as an important food, connected with low calories consumption, with anti-cancer properties, with reduction of cholesterol in blood and also with diabetes diet and with diet suitable to anaemic persons. Generally speaking mushrooms are linked to diets fulfilling the current concept of a healthy diet. Due to the above, edible mushrooms are included in the so-called "functional" or "nutraceutical" foods. These are foods, which are considered as containing physical

compounds with pharmaceutical properties, and for this reason their demand is constantly rising.

The European Union, with the adoption of Reg. (EEC) 1900/98, introduced specific standards for the organic production of mushrooms. This step broadens the contingency possibilities for the entrepreneurial development of the sector.

The above, in conjunction with the need for the evolution of healthy diet and consumers' safety are essential determinants for the sector prospects.

Edible mushrooms are globally cultivated, but about 9/10 of the world systematic mushrooms production is located in North America, in the Far East and in Western Europe. In the European Union, and especially in Holland, there are significant advances in the mushrooms technology regarding cultivation, production and marketing of edible mushrooms. As a result the know-how for the sector's business development has been broadened significantly.

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In the European Union, more than 800 thousand tonnes of edible mushrooms are produced annually. Regarding the EU member-states supply, the main producer is Holland (approximately 30% of the total EU production) followed by France (about 22%), United Kingdom (about 13%) and Spain (about 10%). Countries producing more than 50 th. tonnes annually are Germany, Ireland and Italy. Low in mushroom production are Finland and Greece.

The major worldwide commercial kinds of edible mushrooms, according to the International Society for Mushroom Science (2000), are as follows:

- *Agaricus bisporus*, with about 38% share in the global production. These are known under the common names of button or white mushrooms and as portabella or portobello. Due to their composition and their organoleptic characteristics they are considered an important substitute of meat.
- *Pleurotus* species, with about 25% share in the world mushroom production. They are known as "oyster" mushrooms.
- *Volvariella volvacea*, with about 16% share in the global mushroom production.
- *Lentinus edodes*, with 10% share in the world production. They are known as "shiitake".

As for other kinds of edible mushrooms, either cultivated or collected, commercial interest is shown for *Flammulina velutipes*, *Coprinus comatus*, *Tuber* species (truffles), *Morchella* species and various other fungi (i.e. *mycorrhizae*).

2. The mushroom sector organisation in Greece

In Greece, the systematic cultivation of edible mushrooms has a history of about 35 years. But the rapid business development of the Greek mushroom sector is recent and started in the mid

90's (Philippousis and Zervakis, 2000). In the course of the last three decades, some incentives were introduced for the sector development, but structural constraints and the lack of know-how did not allow the effective incorporation of these products into the production system.

The literature regarding the examination of the Greek mushroom production and market analysis or even outlooks regarding economic aspects of the related industry is poor, dispersed and not sufficiently documented (Kollias, 1998, Philippousis and Zervakis, 2000). In the following chapter, an attempt is made to synthesize primary investigation findings and available secondary data compilations in order to show the present economic dimensions of the Greek mushrooms industry and its prospects.

The commercially cultivated kinds of edible mushrooms in Greece are *Agaricus bisporus* and *Pleurotus* species. Table 1 presents the evolution of the supply of edible mushrooms in Greece, for the years 1990-2000. For this period, there is a significant increase in the domestic production and a change in its composition. Between 1990/92 and 1998/2000 production more than doubled (increase of 112.1%). In the same period the share of *Agaricus bisporus* showed a slight decline (-2.9%) and the share of *Pleurotus* spp. showed considerable increase (+39.1%) but the quantities of the latter are still relatively small (10% of the total). It must be noted that the do-

Table 1. *Evolution of the supply of edible mushrooms in Greece, Years 1990 - 2000*

Year	Production			Imports (tonnes) (2)	Supply (tonnes) (1) + (2)
	Quantities (tonnes) (1)	Percentage (%) <i>Agaricus bisporus</i>	Percentage (%) <i>Pleurotus spp.</i>		
1990	1192	93.1	6.9	2272	3464
1991	1144	93.0	7.0	3974	5118
1992	1153	92.1	7.9	4203	5356
Average 1990-1992	1163	92.7	7.3	3483	4646
1993	1155	91.1	8.9	5338	6493
1994	1237	92.6	7.4	7345	8582
1995	1294	91.0	9.0	7233	8527
1996	1300	87.7	12.3	6997	8297
1997	1630	86.6	10.4	7399	9029
1998	2435	91.6	8.4	9353	11788
1999	1935	87.9	12.1	15978	17913
2000	3030	90.4	9.6	7500*	10530*
Average 1998 - 2000	2467	90.0	10.0	10944	13410
Change of averages 1998-2000/1990-1993	+212,1%	-97.1%	+139.1%	+314.2%	+288.6%

* estimations

Source: Compiled data, Institute of Agricultural Engineering, Mushroom Research Unit, NAGREF, Athens, Greece and National Statistical Service of Greece.

mestic production of mushrooms is commercialised in the form of fresh products.

The imported quantities of edible mushrooms have increased faster than the domestic production in the same period (+214.2%) so that the final supply of edible mushrooms increased by +188.6%.

By using the compound growth rate method based on estimations derived by simple regression functions of a linear algebraic form, data in Table 1 give the following annual rates of change for the years 1990-2000.

Although these estimates are based on the assumption of a linear trend, they are considered as more reliable because all observations are taken into account.

- The average annual rate of change in the volume of production of edible mushrooms in Greece is +10.3%.
- There is a decline of the share of *Agaricus bisporus* which is complemented by *Pleurotus* spp.
- The average annual rate of change in the imported quantities is +13.5%.
- The average annual rate of change in the supply is +12.8%.

The origin of the imported mushrooms to Greece is mainly the EU member-states (about 96.6%, on average for the years 1997-1999). Small quantities are imported from third countries.

Imports of edible mushrooms can be distinguished into three wide groups: fresh, frozen and canned, with the following shares in the total imported quantities (average 1997-1999):

- Fresh products, with a share of 22.8%.
- Frozen products, with a share of about 15.3%.
- Canned products, with a share of about 61.9%.

Imports from the EU member-states present the following shares to the total volume of imports (for the period 1997-1999): 10.4% for fresh products, 24.0 % for frozen products and 65.6% for canned products.

Prices of imported quantities vary extensively due to the heterogeneity of the characteristics of the imported products, i.e. whole, sliced, salted etc., but in general prices of imported products are much lower (even by more than 50%) of the corresponding wholesale prices of the domestically produced mushrooms.

The Greek mushroom exports are small and not significant (approximately 43 tonnes, average of mushroom exports for the years 1997-1999). These exports are destined mainly to third countries.

The gross value of mushrooms marketed in Greece (domestic and imported), at wholesale prices, is estimated at about 18.5 m. Euro (year 2000), of which 48% is the value of domestic production.

The average annual mushroom consumption (fresh, frozen and canned products) in Greece was 0.455 kg per capita (average of the years 1990-1993) at the beginning of '90s and reached 1.265 kg per capita (average of the years 1998-2000) at the end of the decade (a +178% increase).

It is to be noted that until 1999 the consumption of

mushrooms in Greece used to show considerable seasonality, with lower consumption in the period from April to September. During the last few years seasonality tends to disappear. This is attributed to the appreciation of mushrooms as a healthy food item.

In Holland, the average annual consumption per head exceeds 3.0 kg and mushrooms are part of the modern Dutch diet. Furthermore, it was estimated that, the price elasticity of demand for the Dutch mushroom market is -0.7 (van Horen and van der Zouw, 2000). This figure shows that the mushrooms demand in Holland is relatively inelastic. This means that a change of 1% in the price of mushrooms will create a change of -0.7% in the quantity demanded. The Dutch mushroom market is regarded as more mature than the Greek one. Thus, regarding the mushroom demand, the previous figure probably shows a level of maximum consumption possibilities.

From the Greek consumers' point of view, mushrooms are regarded as substitutes for vegetables and it seems that there is a serious lack of public awareness about these products and their properties. The tendency of Greek consumers to seek for a better and healthy diet, as well as the fact that the country is not self-sufficient in mushrooms, create a favourable environment for business ventures in the area of mushrooms.

In the field of mushroom production nine farms operate in Greece with a total growing area of about 35530 m². Four of these farms produce *Agaricus bisporus* mushrooms (90.4% of the total Greek mushrooms production) and the remaining five produce *Pleurotus ostreatus* mushrooms (9.6%). According to recent (2000) data, the largest farm is supplying 46.2% of the total Greek mushroom production. The two farms that follow produce 19.8% and 15.2%, respectively. One of these farms has its share traded in the Stock Exchange Market of Athens and this farm is also involved in racing-horses husbandry.

For identifying the level of domestic competition in the mushroom production sector, the Herfindahl Index (HI) is estimated (Katsoulakos, 1998). Thus, for the year 2000, HI is 2877. A size of the HI greater than 1800 shows reduced competition (oligopoly situation) in the sector in question (Porter, 1998). Although there are no indications regarding informal commercial cooperation and related efforts for leadership in the Greek fresh mushroom sector, there are ample possibilities for these farms to apply desired commercial coordination in terms of production and marketing-mix.

Regarding the level of technology, the farms that are producing *Pleurotus ostreatus* mushrooms apply traditional technology and those producing *Agaricus bisporus* mushrooms are of modern technology. It is interesting to note that both types of mushroom-growing farms apply manual collection of the product. From the technical point of view manual collection helps prolong the commercial life and also contributes to retaining the desired characteristics of the products for post-harvesting purpo-

Table 2. Indicative structure of production cost of a Greek mushroom farm using modern technology and applying manual collection, Year 1999

Production expenses	Percentage (%) share to cost	
	Production cost	Full cost
<i>Fixed and semi-fixed capital</i>		
Land	0.07	0.05
Buildings	13.01	10.45
Machinery	14.69	11.79
Vehicles	0.55	0.44
Other equipment	0.07	0.06
<i>Sub-total (1)</i>	28.39	22.79
<i>Operating capital</i>		
Raw materials	14.48	11.62
Additional materials and consumables	3.70	2.97
Fuel - lubricants	4.18	3.36
Electric power	1.72	1.38
Packaging materials	10.86	8.72
Other expenses	0.06	0.05
Operating capital interest (3.5%)	2.60	2.09
<i>Sub-total (2)</i>	37.60	30.19
Labour	34.02	27.30
<i>Sub-total (3)</i>	34.02	27.30
Production cost (1) + (2) + (3)	100.0	80.28
Management cost (4)		7.82
Disposal cost (5)		11.90
Full cost (1) + (2) + (3) + (4) + (5)		100.0

ses. Economically speaking, manual collection is a factor increasing the cost of production.

The cost structure of mushroom production in Greece varies according to the specific characteristics of each farm and the technology used. Table 2 shows an indicative structure of production cost ("industrial" cost) and of full cost (including management and disposal costs) for a farm of modern technology, using manual collection. This cost structure is based on data collected by personal research. It is obvious that these types of farms are capital intensive but labour is a critical factor that influences the level of the production cost.

According to these estimates, the impact of the invested capital (fixed and semi-fixed capital) upon the production cost of mushrooms in Greece is significant (28.4%). The EU's subsidies (Reg. (EEC) 1257/99 etc.) for the establishment, operation and modernisation of mushroom farms and for the commercialisation of their products, seriously contribute to the reduction of the cost of investment and consequently of the mushroom production cost (Papageorgiou and Spathis, 2000). This allows the operation of the farms at viable levels. It is also estimated that, especially in the case of small farms, which are characterised by low productivity, their operation is close to the borders of viability (marginally viable levels). The tech-

nologically modern farms are seriously influenced by seasonality of demand because in such cases capacity remains under-utilised and this increases the cost of production and reduces the profitability of these farms (Cramer et al., 2001). As was said above seasonality seems to have decreased considerably in recent years.

It should be noted that the Greek mushroom farms, typically, are applying the so-called "two-zones" production system. According to this system, the compost is produced and pasteurised in a certain place, and then is transferred to the growing rooms. This process is rather costly. The application of a mass pasteurisation technique can permit the full exploitation of the room available exclusively for production purposes thus increasing the number of the production cycles per year. The latter also contributes towards the reduction of expenses for energy and labour, and subsequently to more competitive production.

Greek mushroom farms using modern technology sell their products in the main urban centres of the country and especially in the city of Athens. The vehicles used (lorries equipped with refrigeration) are usually owned by the farms themselves (often by a subsidiary firm dealing with the marketing side). Their clients belong to a wide range of wholesale or big retail firms. These are various forms of intermediaries, super-market chains, traders providing pizza products, caterings, restaurants etc. Farms using traditional technologies dispose their products in the nearest cities. The fresh mushroom products, either whole parts or sliced, are traded without standardisation in small packages (dishes or boxes covered with plastic film) or in bulk packages. Due to deficient organisation and to insufficient investments, problems appear in relation to timely provision of the market in the required quantities.

In order to present systematically the parameters affecting the Greek mushroom sector, the SWOT method of analysis is adopted (White and Uva, 2000). SWOT stands for the words: Strengths, Weaknesses, Opportunities and Threats. This qualitative procedure can effectively support the design and formulation of a successful market competitive strategy (Haines, 1999). The SWOT findings are presented in Table 3.

Table 3. SWOT analysis of the Greek mushroom sector

Strengths	Weaknesses
Production Adequate modern farm technology Desired quality Use of appropriate practices for retaining post-harvesting quality	Production High perishability of products Production instability
Market Positive acceptance from the informed consumers with further possibilities of broadening the consumption, especially in the case of fresh products	Market Wide dispersion of supply points Excess capacity of the farms resulting in high prices Moderate competitiveness Insufficient standardisation for the domestic market Non systematic promotion of the Greek mushrooms
Opportunities	Threats
Production Possibilities for subsidized investments for farm establishment and modernisation of the existing ones Use of modern know-how Organic mushroom production Use of EU regimes for overall quality improvement in all stages of the value chain Coordination for mushroom production	Production High costs due to various forms of capital, to fuel and to labour High labour cost due to governmental policy on migration High cost of distribution Difficulties in finding the appropriate certified composts for organic mushrooms growing Slow process in the modernisation of the farms using traditional technology
Market Information of the public and linkage of mushroom consumption with healthy and low calories diet Expansion of the distribution channels and of sales Standardisation of the fresh product	Market Competition and substitution by frozen or canned mushrooms or by other food products, i.e. vegetables

vement of this level, it is necessary that an investment policy framework be introduced, primarily for the existing promising farms with the aim of increasing their production, as well as for the establishment of some new modern farms and for the modernisation of the existing traditional but promising ones. Crucial factor will be the competitiveness of the mushroom farms, that will allow a more flexible pricing policy and sustainability.

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3. Concluding remarks

The demand for mushrooms follows an upward trend in Greece. According to the available data and following contacts with competent persons, in the year 2002 per capita consumption will reach the level of 0.235 kg. In the immediate future, the annual per capita consumption in the country is expected to reach approximately 1.5 kg, causing an increase in the Greek mushroom demand by about 2500 tonnes.

If consumers are informed about the mushrooms properties as food, the consumption of mushrooms in Greece is expected to increase further. If this increased consumption refers to fresh products, the impact on the domestic production will be positive.

In order to satisfy the demand an increase in the domestic supply of fresh mushrooms may probably benefit modern farms. These farms can achieve lower production costs, apply effective organisation in their value chain, seek and develop special products with increased added value and increase their negotiating ability in the food market. All these elements can result in a better utilisation of their capacity, develop economies of scale, widen the variety of the products offered to the market, achieve a better pricing policy, increase the list of clients etc. In addition, if there is a national strategic plan for the sector development and for the substitution of imports, at least in the fresh product, then the quantities, deriving from domestic production, might reach the level of 5000 tonnes. For the achie-

References

- Cramer G., Jensen, C., Southgate, D. (2001) *Agricultural Economics and Agribusiness*. 8th Edition, John Wiley & Sons, Inc., New York, U.S.A.
- Haines, M. (1999) *Marketing for Farm and Rural Enterprise*. Farming Press, Ipswich.
- Katsoulakos, Y. (1998) *Micro-economics Policy*. Typothito - Giorgos Dardanos Editions, Athens, Greece. (in Greek).
- Kollias, C. (1998) *Investigation on the Production and on the Disposal of Mushrooms in Greece*. Unpublished dissertation, Department of Agricultural Economics and Rural Development, Agricultural University of Athens, Athens, Greece. (in Greek).
- Papageorgiou, C., Spathis, P. (2000) *Agricultural Policy*. Agricultural University of Athens, Stochastis Edition, Athens, Greece. (in Greek).
- Porter, M. (1998) *Competitive Strategy*. The Free Press, New York, U.S.A.
- Philippoussis, A., Zervakis, G. (2000) *Cultivation of Edible Mushrooms in Greece: Presentation of the Current Status and Analysis of Future Trends*, Paper presented at the International Society for Mushroom Science Congress 2000, May 15-19, Maastricht, The Netherlands.
- Szmidt, R. (1997) *Mushroom Growing*, Scottish Agricultural College Horticultural Advisory Service, Auchincruive, Ayr, Scotland, U.K.
- Van Horen, L.G.J., van der Zouw, M. (2000) *Price-Elasticity of the Demand for Mushrooms*, Paper presented at the International Society for Mushroom Science Congress 2000, May 15-19, Maastricht, The Netherlands.
- White, G.B., Uva, W.L. (2000) *Developing a Strategic Marketing Plan for Horticultural Firms*, Department of Agricultural, Resource, and Managerial Economics, College of Agriculture and Life Sciences, Cornell University, Ithaca, New York.