INVESTIGATION OF PRODUCTION COSTS, PRODUCTIVITY AND ECONOMIC YIELD, ON A FAMILY FARM WITH MODERN-STYLE BREEDING OF CAGED LAYERS FOR EGG PRODUCTION IN THE ATTICA REGION (GREECE)

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1. INTRODUCTION

The breeding of chickens for egg-production is an organised and dynamic branch of animal production, which covers the country's egg needs and indirectly contributes to a reduction in the shortfall vis a vis the need for meat. It comprises 7.7% of the gross total figure for animal production, 2.4% of agricultural production in general. Today the sector has been systematised and rationalised, to some extent replacing village-based breeding. Systematic exploitation of the breeding of egg-layers is an activity conducted for the most part in the environs of large urban centres.

There thus emerges a system of intensive egg production embracing both commercial and family enterprises, which renders the country self-sufficient in this sector, with indirect per capita egg consumption of 11-12 kg, the lowest in the European Union.

The small quantities of imported egg products in different forms [in the order of 1-4%], chiefly in the form of egg powder for use in confectionery, and other occasional exports to third countries, are not of any particular significance. In the last three decades the intensive productive system of semi-rural chicken breeding for egg production has suf-

ABSTRACT

The aim of the present work is to analyse the production costs, productivity and economic yield, on a family farm practising systematic breeding of caged layers for egg production. As far as investment costs are concerned, it was found that they amount to 4,929 drachmas per bird, including installations and mechanical equipment of all kinds, a figure which reveals the proportionally high cost of investment in the operations of the unit. As for egg production costs, it was found that they came to 25.8 drachmas apiece, while feed costs were reckoned to constitute 44.2% of the overall cost. It was ascertained that the comparatively small influence of feed costs on raising production costs was due to the high level of fixed charges. In the course of research into the productivity and viability of the investment, it was ascertained that the profitability of investment capital was in the order of 17.5% and the productivity of self-employed (family) labour came to 9.22 million drachmas per person annually. Such indicators seem more or less satisfactory. It is assumed in the above analysis and its findings that the product be placed directly onto the market by the family farm, without any intervention by third parties. Related investigation of an alternative instance of retail egg sales by a third party indicated that the unit in question was not viable, given that the egg prices earned in the wholesale market were persistently lower than the cost price and in many instances even lower than the operating or variable costs.

RÉSUMÉ

Ce travail analyse les coûts de production, la productivité et le rendement économique d'une famille paysanne qui pratique l'élevage systématique de poules pondeuses en cage pour la production d'œufs.
Les coûts de production s'élèvent à 4929 drachmes par poule, y compris les installations et l'équipement mécanique de tout type, un chiffre qui révèle un coût d'investissement proportionnellement élevé pour le fonctionnement de la structure. Quant aux coûts de production des œufs, ils correspondent à 25,8 drachmes pièce, tandis que les coûts des aliments représentent 44,2% du coût total. Il a été vérifié que l'influence relativement petite des coûts des aliments sur les coûts de production croissants est due aux charges fixes élevées. Au cours de la recherche sur la productivité et la viabilité de l'investissement, il a été constaté que la rentabilité du capital d'investissement est de l'ordre de 17,5% et que la productivité de la main d'œuvre familiale correspond à 9,22 millions de drachmes par personne par an, ceux-ci étant des indicateurs qui semblent être plus ou moins satisfaisants.
D'après cette analyse et ses résultats, il est supposé que le produit soit placé directement sur le marché par la famille paysanne, sans intervention de tiers. Une enquête parallèle d'un exemple alternatif de vente d'œufs au détail par des tiers a indiqué que la structure en question n'est pas viable, étant donné que les prix des œufs réalisés sur le marché en gros sont constamment plus bas que le prix de revient et, en plusieurs cas, même inférieurs aux coûts d'exploitation ou aux coûts variables.

fered from serious problems of economic viability of farms, so that all in all the sector has had a problematic aspect, and a large proportion of the breeders and producers have proved unequal to the responsibilities they have undertaken. This is primarily a result of the low selling prices for the product on the domestic market, in contrast to the continually rising production costs. The above brief description of the sector emphasises the necessity for investigating production costs and economic viability of breeding businesses oriented towards egg production, so that such research endeavours as are relevant and necessary may be channeled in the right direction, towards the reform and the survival of the sector. Thus, despite the particular significance that technical and economic research into the sector has acquired since the beginning of the 70s, the Greek bibliography is exceptionally poor in any comparable research undertakings, with the exception of the research into the economic viability and productivity of poultry-breeding for egg production carried out in 1981 by the research team of George Kitsopanidis et al., 1981). The purpose of the present study is therefore to analyse the production costs, productivity and economic yield, on a family farm carrying out systematic breeding of caged layers for egg production. To that end, field research was carried out at an egg production unit in the area of Megara, Attica,

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with a capacity of 30,000 layers, for one productive period, which was combined with recording of the entire productive process, the figures for investment costs, and all operational expenses. For estimation of fixed costs, there was on-site collection of data on building plant and mechanical equipment, by means of a specialised study of the relevant market. The choice was made of the Megara area because it is the largest egg production area on the urban periphery, supplying the large Athens market but at the same time also making available quite large quantities of eggs to other areas in Greece, and above all to the islands. The choice of a farm with 30,000 caged layers was made on the premise that a farm of that capacity is a representative productive unit for systematic breeding within family-farm structures.

2. ANALYSIS OF INVESTMENT COSTS

Included in the fixed investment capital of the farm under investigation are: the land, the building installations (laying chambers for the birds, egg packaging area, feed mix preparation facilities, staff area) storerooms for raw materials and finished product), mechanical and other equipment, (laying chamber equipment, feed mix conveyance complex, egg inspection centre, egg transportation vehicle, egg refrigeration and preservation facilities, egg transportation vehicle, manure transportation vehicle, spraying machine for disinfection of chamber and surrounding area) (Kyritsis, 1987), special installations (such as staff quarters, parking area, drainage ditch, fencing, etc.) (Kalogeras et al, 1993).

On the basis of the special market research for assessment of the value of the basic components of the fixed installations, the following emerged:

α/α	Form of fixed (constant) capital	Value in '000s of drachmas
1	Land	2,500
2	Building installations	51,160
3	Mechanical and other equipment for special installations	94,230
	Overall Investment Cost	147,890

Table 1 *Value of Fixed Installations.*

Source: Research data as processed by researcher.

On the basis of the above data from **Table 1**, which concern the breeder's investment for the operation of a 30,000-bird farm, the cost per-bird of this investment comes to 4,929 drachmas, revealing the high cost of overheads in the functioning of the unit. The fixed costs or costs of fixed or permanent or constant capital, on the basis of the data in the table are as follows (Apostolopoulos, 1997) (**Table 2**).

3. PRODUCTION PROCESS AND VARIABLE COSTS (OPERATING COSTS)

In the course of the production process at the egg-producing poultry farm under investigation, the following factors were taken into account:

i. For the sake of keeping operations running smoothly, the breeding of the caged egg-producing birds takes place in two similarly-sized hatching chambers, each with facilities for 15,000 birds.

ii. There is no breeding facility for newly-hatched chicks and pullets. Twice a year there is a purchase of 15,000 14-week (three and a half month) old pullets. The purpose of this twice-yearly restocking with ready-hatched pullets is to maintain uniform egg production and deal with seasonal fluctuations in demand. Seasonal price fluctuations are likewise a familiar phenomenon owing to the surpluses and shortages that are to be observed. The former (surpluses) make their appearance around the end of spring and in the first summer months; the latter (shortages) coincide with the Easter period.

iii. Old birds are sold off when they reach the age of 78 weeks.

iv. As emerges from the aforementioned, each flock of birds remains in the hatching chambers for 64 weeks, which means that the the hatching period on the farm lasts approximately 60 weeks (Panopoulou-Diamantopoulou E., 1983; Plytas F., 1985).

v. Annual egg production does not remain constant but undergoes slight differentiation year by year (as confirmed by statistics from companies producing egg-laying hybrids: Euribrid technical information on Hisex Brown layers 1996 – Management guide, commercial layers, 1996 – ISA Brown, 1997 – Commercial Management Guide, Hy-Line Variety Brown, 1996-1997).

vi. The divergence between the various levels of egg production and the average annual production per bird – 250 eggs – is about 18 eggs.

vii. This divergence was not considered significant, so that the economic return from the farm were calculated on the basis of the average annual production of 250 eggs per bird.

viii. During the first two years 30,000 pullets annually were purchased for the farm and subsequently, in a ten-year production cycle 15,000 and 30,000 pullets a year alternately were purchased each year, such that the bird population on the farm remained constant, with differentiation in the age of the birds and a flexible orientation to the market (see preceding on seasonal demand for eggs, etc.)

ix. On the basis of the preceding, 24,000 pullets are reckoned for in the annual expenditure for purchase of pullets, as follows:

15,000 + 6·15,000/10=15,000 + 90,000/10 = 15,000 + 9,000 = 24,000

(Note: In the ten-year production cycle there are 6 years when 30,000 pullets are purchased and when 15,000 pullets are purchased.)

x. The practise of purchasing of 14-week-old pullets rather than utilising the breeding area is cited in the present work because it has become the custom lately in almost all egg production units applying modern breeding methods.

xi. Feeding costs were calculated for the entirety of the breeding period (64 weeks, i.e. 1.25 years) and subsequently converted to an annual figure (namely feeding costs/1.25 years) (also see Kalaisakis, 1982).

On the basis of the above mentioned figures relating to the productive process, the annual variable production costs (operating costs) for the third year of operation of the farm and after are as follows in the table 3.

On the basis of the figures for fixed costs (permanent costs) (**Table 2**) and variable costs (operating costs) (**Table 3**) it emerges that the total annual production costs of the farm come to 177.738.000 drachmas (Apostolopoulos, 1997). For calculation of the feeding costs per bird (which constitute the most basic element in

production costs), the ages of the birds during breeding were broken down into the following categories: from 14-19 weeks, from 20-45 weeks, from 46-65 weeks and 66-78 weeks (Kalaisakis, 1982).

4. ECONOMIC YIELD

According to the figures in the preceding paragraph, egg production costs were found to come to 25.8 drachmas apiece, with feed costs calculated as amounting to 44.2% of the overall costs or 57.5% of the operating or variable costs. It was ascertained that the relatively low proportion of the quite high production costs that can be attributed to feed costs is a reflection of the high level of fixed costs and more generally the high economic costs in monetary terms. The economic yield of the farm, when in full production (in the third year and after), with eggs selling at an average price of 26 drachmas apiece, is as follows:

Table 2 *Value of Fixed Costs.*

α/α	Fixed Costs	Value in '000s of drachmas
1	Land Rent	125
2	Annual depreciation	27,928
3	Maintenance	3,348
4	Insurance Premiums	826
5	Interest on Fixed Capital	11,631
	Total Fixed Costs	43,858

Source: Research Data as processed by Researcher.

Table 3 *Variable (or operating) expenses.*

α/α	Variable (operating) expenses	Value in '000s of drachmas
1	Working self Wage	11,340
2	Working outside Wage labour	2,835
3	Poultry feed	78,667
4	Veterinary treatment	469
5	Purchase of pullets	22,080
6	Electricity	240
7	Water	192
8	Packaging material	4,050
9	Removal of manure	936
10	Energy	720
11	Interest on circulating capital	12,175
	Total Variable Expenses	133,880

Source: Research Data as Processed by Researcher.

Table 4 *Economic yield* ([1]).

α/α	Form of economic yield	Value in '000s of drachmas
1	Gross Return	179,100
2	Gross Profit	45,220
3	Net Return	122
4	Net Profit	12,956
5	Breeder's Family Income	24,712

On the basis of the economic yield in **Table 4,** the following indicators emerge for productivity and viability of the farm:

a. Profitability of invested capital ([2])   17.5%

b. Productivity of self-employed (family) labour   9,220,000 drs. per person annually

c. Production cost of egg   25.8 drs. apiece.

d. Operating cost (or variable cost) of egg   19.8 apiece.

e. Cost of poultry feed   11.4 drs per egg

f. Proportion of feed cost in operational or variable cost of egg production   57.5%

g. Proportion of feed cost in overall cost of egg production   44.2%

h. Break-even point for farming operation([2])   174,039,000 drs.([3])

[1] See Appendix: Methods of calculating economic yield.
[2] See Appendix: Methods of calculating economic yield.
[3] An amount only very slightly smaller than the gross return, which comes to 179,100,000 drs., signifying the marginal viability of the unit as a business.

5. SENSITIVITY ANALYSIS

1. Analysis 1

The results presented here are influenced by the currently high rate of bank interest (1997 Agricultural Bank of Greece interest rates: 16% for investments in fixed or constant capital and 21% for investment in variable capital).

To bring to light how significant is the effect of interest rates on the economic indicators for the farm, sensitivity analysis was carried out on the basis of a 50% reduction in interest rates as a result of the introduction of the anticipated Economic and Monetary Union (EMU). The results of this analysis showed that egg production costs fell by 1.8 drachmas (from 25.8 to 24 drachmas apiece), foreshadowing the favourable effects of the probable changes in interest rates (due to the EMU) on the financial position of the farm, given that it entails a 7% reduction in production costs and improvement in the economic situation of the farm in the order of 12 million drachmas.

2. Analysis 2

The results presented were also influenced by the high cost of purchasing pullets for egg production (900 drachmas and more per head). For this reason, so as to to highlight the importance of the operation of the breeding area on the farm's economic indicators, a relative sensitivity analysis was carried out on the assumption that the farm operated a breeding area for newly-hatched chicks and pullets for egg production and did not purchase 14-week-old pullets ready to be caged.

The results of this analysis indicated that egg production costs fell by 1.06 drachmas, highlighting the relatively small but favourable implications for its financial position of the potential for breeding pullets on the farm itself (3.9% reduction in production costs and a 7.2 million drachma improvement in the economic situation of the farm).

6. DISCUSSION

In the course of the research into the productivity and viability of the farm, it was ascertained that the profitability of the invested capital was in the order of 17.5% and the productivity of the self-employed (family) labour came to 9.22 million drachmas per person annually (with full-time employment of two members of the family in production and distribution of the product),

indicators which seem more or less satisfactory, but at an average selling price of 26 drachmas per egg and average productivity of 250 eggs per bird annually (optimistic scenario). From the third year of operations and after, the break-even point for operation of the unit was found to be below the level of gross income, amounting to 97% of that figure and so confirming the borderline viability of the family farm as an entrepreneurial unit.

It is important to emphasise that the whole analysis presented here is based on the product being placed directly onto the market by the family farm, without any intervention of third parties. Related investigation of an alternative instance of retail egg sales by a third party (securing prices between 18 and 23 drachmas apiece) indicated that the unit in question was not viable, given that the egg prices earned through middlemen in the wholesale market were persistently lower than the cost price and in many instance even lower than the operating costs.

The high economic cost in monetary terms indicates that it is neither possible nor advantageous today to establish and operate a new poultry-breeding unit for egg production if distribution of the product is not secured by the producer himself at relatively high retail prices, even if he is able to raise from his own funds the initial investment capital, which is very high in relation to the value of the outputs. During recent years (the 80s and 90s) the tactic of having the producer himself take over distribution of the product is becoming more and more prevalent in the Megara region and will probably soon have become universal, for the sake of the continued
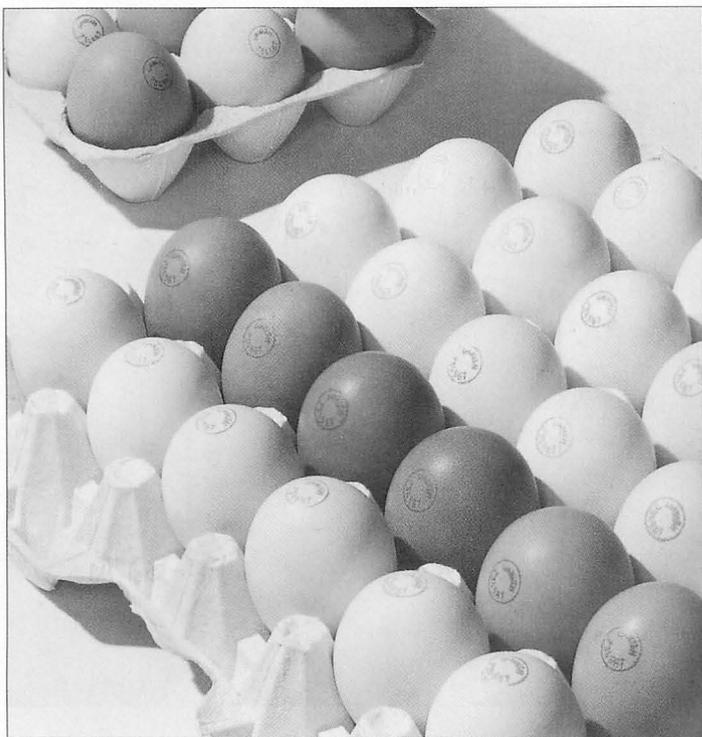
survival of this sector of the economy, which in any case is a key element in the local economy of the area around Megara.

Despite the fact that the relevant sensitivity analysis showed that the breeding of newly-hatched chicks and pullets on the farm itself gives a considerable boost to producers' incomes, they themselves nevertheless insist on buying ready-hatched pullets, for two main reasons:
• either because they are not in possession of up-to-date breeding areas and, given that there is no provision for funding by the Agricultural Bank of Greece, nor any subsidy available under relevant developmental legislation, they are not able to acquire them,
• or because they want to devote their time and energy to getting their product on the market rather than to the laborious and – in their eyes – essentially petty task of raising newly-hatched chicks and pullets.

Finally, it is a fact that the egg-producing farms that are in existence today do not take into account their economic cost of operations from the monetary viewpoint, and because they market their product only slightly above the level of operating costs, (without including interest payments on circulating capital), they survive on the boundaries of economic viability.

7. CONCLUSIONS

1. Investigation of production cost indicated that on present-day egg-producing farms there is no easy way to impose further downward pressure on costs, given that they are to a large extent dependent on costing factors which cannot readily be influenced by the produc-

er (feed, purchase of ready-hatched pullets, economic and financial charges). For this reason, the producer himself is obliged to undertake both organisation of production and organisation of product distribution.

2. As for the organisation of the productive process and the procedure for distribution of the product, it is worth pointing out that a farm without product surplus, whose production can nevertheless cope with the seasonal fluctuations in egg sales, is in a position also to cope with the difficulties of the present period and to survive, yielding a reasonably satisfactory income for the breeder family. This position can be further reinforced through distribution of the product by the producer himself, who is thus able to take advantage of the relatively high retail prices.

3. The size and the dynamism of the unit must correspond to the work capacity of the breeder family, also taking into account the work required for direct distribution of the product by the producer himself, so as to avoid dependence of the producer on networks of egg traders and middlemen.

4. Breeder-proprietors of family farms oriented towards egg production must become organized, enlisted into co-operatives or joint-ventures or producers' groups for collective distribution of the product having the capacity to improve the economic position of the sector and help to avoid the establishment of a dangerous oligopoly, as is occuring in the broiler division of the poultry sector.

5. The above-mentioned organisation of breeders must be capable of contributing to a reinforcement of their negotiating role against the great supermarket chains, but at the same time also to displacement of the networks of middlemen. It must be capable also of contributing to the shaping of other commercial outlets for eggs, for example by promoting the manufacture of egg powder and making it available to confectioners and food producers on an industrial and light-industrial scale.

6. Finally, it is believed that the the grim present-day picture of the sector will, in a free-market economic system, give way to a new situation in which the healthy forces will be able to emerge, to the advantage of both the primary sector and the National Economy in general. ●

BIBLIOGRAPHY

1. Apostolopoulos, K. (1997) "Academic traditions in Commercial Animal Production at the Animal Production Department of the Athens Agricultural University", Athens (in Greek).

2. Kalaisakis, P. (1982), "Applied Nutrition for Farm Animals", Athens, (in Greek).

3. Kalogeras, N., Kirpotin, H., Touliatos, P. (1993), "Issues in Construction", Athens, (in Greek).

4. Kitsopanidis, G., Martika, M., Psychoudakis, A., Papanagiotou, E. (1981), "Economy and Productivity in Poultry-Breeding for Egg Production", Thes-

salonica, (in Greek).

5. Kyritsis, S. (1987), "Farm Construction and Poultry-Breeding", Athens (in Greek).

6. Panopoulou-Diamantopoulou, E. (1983), "Notes on Poultry-Breeding", Zootechnics Laboratory of the Athens Agricultural University, Athens, (in Greek).

7. Plytas, F. (1985), "The hen's egg", Athens, (in Greek).

Reference books- publications

8. Euribrid technical information on Hisex Brown layers, 1996.

9. Management guide, commercial layers, 1996.

10. ISA Brown, 1997.

11. Commercial Management Guide, Hy-Line Variety Brown, 1996-1997.

APPENDIX

CALCULATION OF ECONOMIC YIELD

1. Gross Revenue = Gross Value of Production* + Income Support**+ Insurance Compensation ± Variation in capital

*sales turnover

**subsidies

2. Gross Profit = Gross Revenue −Variable (or Operating) Cost

3. Net Profit* = Gross Revenue −Total Cost

*also called Business Profit

4. Net Revenue = Gross Revenue −(Total Cost −Interest on Capital −Land Rent)

or

Net Revenue = Interest on Capital + Land Rent + Business Profit

5. Breeder Family Income = Gross Revenue −(Monetary Expenses + Depreciation)

or

Breeder Family Income = Payment for Family Labour + Return from Family Labour

6. Profitability of Investment Capital = $\dfrac{\text{Net Revenue}}{\text{Average Investment Capital}} \times 100$

7. Break-even Point in Operations (BeP) = (CE) : (1 −VE/TI)

where

BeP: Break-even Point

CE: Constant Expenditure (or Fixed Costs or Cost of Fixed Charges)

VE: Variable Expenditure

TI: Total Income (gross) or Gross Return