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Research Evaluation: the case of the Brazilian Research Centre for Swine and Poultry (CNPSA)

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Resumo/Abstract:
This paper, on the one hand**,** traces some of the main features of research evaluation, points out some reasons why institutions want to have their research work evaluated, and presents some of the main problems of evaluation. On the other hand, characterizes hog production, in the south of Brazil, evaluates the technological progress occurred in this activity during sixteen years, and the contribution of the Brazilian National Research Centre (CNPSA). The results lead to the following conclusions: there was an enormous technological progress in hog production; the roll CNPSA was decisive; the enormous technological progress did not avoid a large number of hog producers to go bankrupt.

Palavras-chave/Keywords: research evaluation, economics of animal production, swine, hog producers, costs of animal feeding

Classificação JEL/JEL Classification: O33, Q16

1. Introduction

In the south of Brazil swine and poultry production are among the most important farm activities from the economic point of view. So, twenty-five years ago, the Brazilian Government – through the public research Institution called EMBRAPA (Empresa Brasileira de Pesquisa Agro-Pecuaria) – created a research unit called Centro Nacional de Pesquisa de Suinos e Aves (CNPSA), in the state of Santa Catarina in order to assist those economic activities. All the research developed in this research unit has to do with the different issues that affect pig and/or poultry production.

The administration of CNPSA, in order to know how well is accomplishing its roll in pork production progress and to improve research activities, asked for research evaluation.

It is an ambition of all research units to have its work evaluated to prove to the society that it is worth wile to pay for the research. As pointed out by Alston and Pardey (2000), estimated rates of return to research are distorted by problems of attributing the credit for particular research results, or for particular research-induced productivity increases, to research expenditures undertaken at different times, in different places, and by different agencies.

According to Stahle (1986), the most important reason for evaluation is that the process itself can influence the achievement of the research system in a positive way. Evaluation should give information not only to those who ordered it but also to those whose work is being evaluated. This is the reason why is so important that researchers get involved in the evaluation process. In fact, nobody knows better the work done and its nuances then those who do it.

There are, however, many difficulties and methodological problems in research evaluation. So, one should be careful not to go too far on the basis of evaluations reachings. On this subject, it is very interesting to notice what Stahle (1986) says:". .. there is a special charm in the fact that everybody who is involved in research evaluation seems in a way to be and remain a kind of an amateur in the field. It is, after all, rather seldom that anyone has participated in more than one evaluation in the role of evaluator. And it is extremely rare that the circumstances around two evaluations are so alike that the experiences become more than isolated cases".

Frequently, the estimation of the benefits of public institutions do not take into account the effects of private sector and underestimate the real costs incurred to obtain the benefits. Very often there are important spillovers from other private and public institutions and even from other countries that make difficult the estimation and attribution of research benefits. Also, private costs and benefits are not, necessarily, identical to social costs and benefits.

Another problem that, frequently, arises with research evaluation is the length of the period to be considered in the analysis. Investing in research is like investing in physical capital in some

respects; the investment decision taken today has consequences that last in the future (Alston and Pardey 2000). Therefore, it is difficult to limit the time period during which a research investment effects persist. Another important point related with time has to do with the lag between the moments when knowledge is available and when it is adopted by the productive sector. If there are capital restrictions or others that delay the use of the new knowledge, research institutions should be credited for it but society is not getting the benefit of it. Potential gains from technical progress are different from real gains. Only when knowledge is adopted by the productive sector society benefits with knew knowledge.

The aim of this work is to evaluate the potential gains from the research developed by CNPSA during the period 1982-1998. Therefore, we have to evaluate all the technical progress that occurred in pig production in Brazil and, afterwards, estimate what was the CNPSA contribution.

2. **Analytical framework and data**

2.1 Analytical framework

As we mention above, the evaluation problem is a complex one. So, it is crucial to state clearly the methodology used in order to make the results comparable to those obtained by other researchers.

Given that all the activities of CNPSA consist of research that as to do with the improvement of: pig feeding, pig health, pig breeding, pig well-being, and other aspects of pig meat production, the problem we are dealing with consists of evaluating the best technology available for pig production in two different moments in time: 1982 and 1998.

The boundary of the production function measures the maximum possible output that one can get for a given amount of input. So, in this situation it seems that the comparison of two production functions, one representing the state of the art in pig production in 1982 and another representing the state of the art in 1998, can be a correct way of evaluating the technological progress in pig production.

In this region, there are farmers who have sows to produce the piggy that they feed up to the slaughter weight but, more commonly, farmers specialise in piggy production or in pig feeding. Farmers feed animals with ration bought in the market (usually to the slaughter house) or prepared in the farm.

Most of the farmers are “integrated” (or partners - as industries call the farmers) with the industries (slaughterhouses), that is, farmers buy the inputs from and sell pigs to the slaughterhouses. In some cases the dependence of farmers from the slaughterhouses is so strong that farmers can be, in some sense, considered employees of the industries. It can be said that this situation is similar to an oligopoly and an oligopsony, acting simultaneously.

The slaughterhouses, in this region, buy the pig with 100 kg (which corresponds to pigs 180 days old).

2.2 The results

Using experimental data from CNPSA, Pinheiro *et al*.(1982) adjusted a quadratic production function to hybrid pig, Landrace x Large White, getting the following results:

$$Y82 = 26.5083 + 0.36075\ X - 0.0002436\ X^2 \qquad (1)$$

(19.6) (24.1) (6.4)

Where Y82 is the weight of the live animal, in kg, and X is the quantity of ration, in kg, given to the animal during the stages of growing and fattening (termination). In brackets are the Student t values for the regression coefficient just above. The R^2, adjusted for the degrees of freedom, is equal to 0,97.

Therefore, we can say that equation (1) represents the best technology available (in what concerns animal breeding, health, feeding and so on), in 1982, for pig production. Interim the CNPSA continued developing knowledge in the various fields of pig production. Lately, they even come out with a new boar called EMBRAPA MS58 (the number 58 means that the animals have, at least 58% of lean meat), which is considered of great interest for quantity and quality of pork production.

Using experimental data, of an experiment, using 90 animals with weights between 24 and 26 kg, all hybrids, born from females F1 Landrace x Large White and males Embrapa MS58, the following quadratic production function was adjusted, for 1998 .

$$Y98 = 24.2737 + 0.45937\ X - 0.00038\ X^2 \qquad (2)$$

(78.4) (76.1) (15.3)

Where Y98 is the weight of the live animal, in kg, and X is the quantity of ration, in kg, given to the animal during the stages of growing and fattening (termination). In brackets are the Student t values for the regression coefficient just above.

As before, all the coefficients are highly significant and the adjusted R^2 =0.98

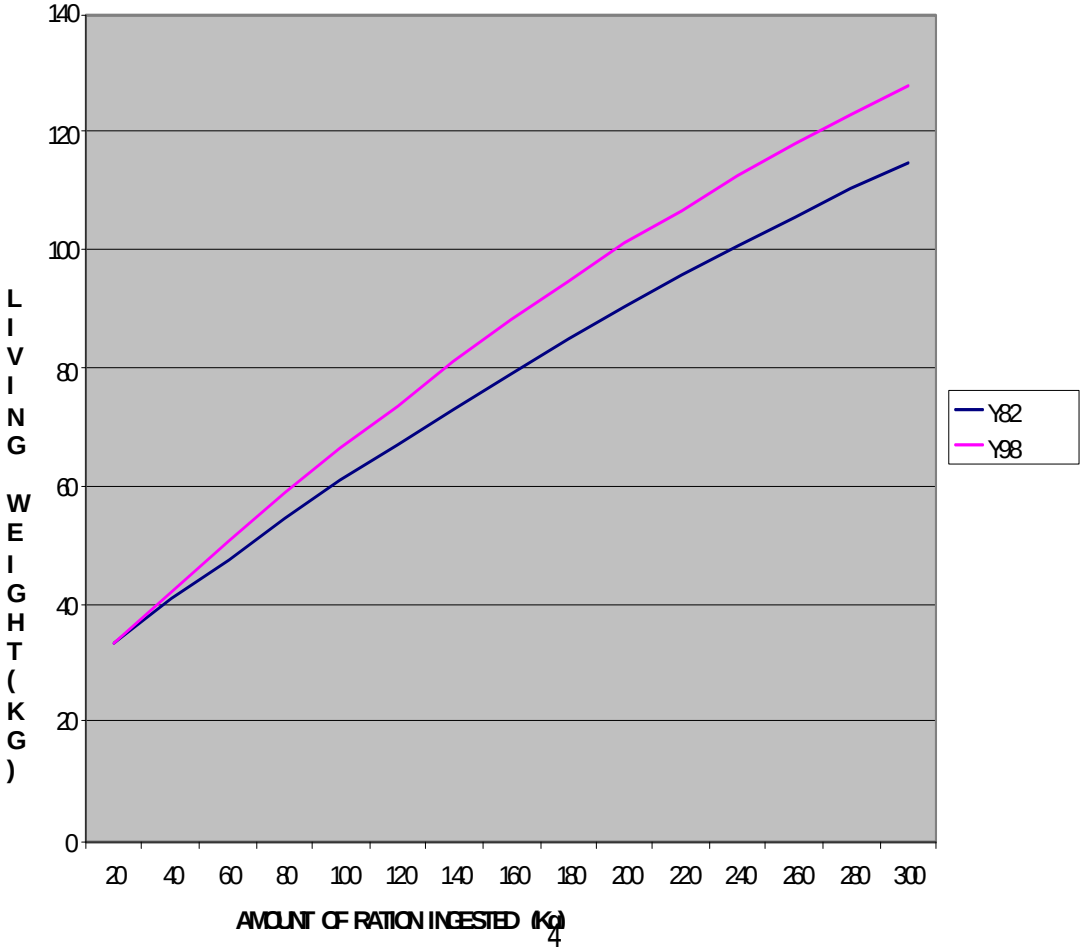

Figure 1. Relation between pig living weight (kg) and the amount of food ingest (kg) during the growing and fatting fazes, for years 1982 and 1998.

From Figure 1, which represents both production functions, it obvious that there was technological progress since for any amount of food, X, animal weight, Y, is always higher in the production function adjusted for 1998. The gain in meat is approximately 12 kg, or seeing the problem from the input side - assuming that the animals continued to be slaughtered with 100 kg of weight-, there is a gain of approximately 40 kg of ration. While in 1982 it was necessary 238kg of ration to raise a pig from 24-26 kg up to 100 kg, in 1998 for the same increase in weight it was only necessary 198kg of ration (20% gain). These results indicate a food conversion rate of 2.68 – while the weighted average for the producers is only 2.77 (this difference represents a potential gain of 6.7kg per animal of 100kg).

Besides the meat or ration gains, there are two other important points to be considered. On one hand, carcass has a higher meat lean percentage. As it was said before, Embrapa MS58 has, at least, 58% of lean meat that corresponds, in relation to the meat produced in 1982, an increase of 5% in sales price. On the other hand, as the animals grow faster they obtain the slaughter weight in less time (a gain in time of approximately 10%) which leads to save labour and other variable inputs. Also, as the animal stays less time in the pen it allows a higher rotation of animals – more animals for the same fix costs.

Another important aspect of technological progress – which is not measured through the production function, that was possible to find out -, is the increase in the number of slaughtered animals per sow per year. In Embrapa farms that number grew from 14.4 in 1982 up to 22.2 in 1998. In this field, however, there is a long way to go; farms have only an average of 17.4.

From the comparison of both production functions it is also clear that, for the same vector of prices, farmers should sell the pigs heavier to maximise profit. Actually, it was possible to verify that some industries are slaughtering pigs with 110kg and heavier.

Table 1 summarises the most important gains (in $US dollars) per animal, assuming that slaughtering will take place when the animal have 100kg of live weight.

Table 1. Summary of the most important gains per animal in US dollars

Type of gain	$ US/animal
In food	4.66
Increase in animal price	2.54
Labour	0.64
Other variable inputs	0.89
Fixed costs	0.62
Total	9.35

As it can be seen, the average annual gain per animal is 9.35 dollars per animal.

3. Contribution of the Brazilian Research Centre for Pig and Poultry (CNPSA)

As it was said before, the estimated potential gains represent all the innovations or improvements in: animal breeding, animal health, animal nutrition, animal care, and so on. But those gains are the result of the research CNPSA as well as of many other research units spread all over the world that directly or indirectly contributed for pig production improvement. Therefore, we want to find out a way to estimate the real contribution of CNPSA in the all research process. Currently, there is an intensive effort to develop several methodological approaches to evaluate research. Many authors defend that evaluation should be on quantitative indicators such as bibliometric indicators. Luukkonen-Gronow (1986), says that the bibliometric indicators for research evaluation is based upon the importance of written communication, and especially of the scientific journal, for research processes. There is no doubt that scientific journals are a very important means of communicating research, which guarantees the originality of the work and the quality of research. However, we have to agree that the importance of scientific journals for knowledge dissemination is not of equal importance in all research fields and is not the same in less developed countries as it is in developed ones. The two types of biometric indicators used for evaluation, quantity of research publications and citations counting, are problematic because, all publications are neither of the same importance nor the article or journal where the citation appears is. Moreover, nowadays there are some other important means for research dissemination. Some authors argue that the usefulness of the bibliometric indicators depend very much on the patterns of publications and communication existing in the various fields of research (Premforms, 1986).

As it was told before, in research evaluation, the choice of the methodology is a problem of capital importance. Hansen (1986) characterises the following methods for evaluation: survey description, peer review, bibliometric analyses, users evaluation, historical evaluation, activity evaluation, and capacity evaluation. Given the problem being analysed, we had to choose a summative evaluation - an evaluation concerned with quantitative measures of the research output. We tried to combine the users evaluation method with researchers activity evaluation.

In what concerns users evaluation, interviews where conducted with farmers and slaughterhouses' managers and technicians in order to evaluate the contribution of CNPSA in pork production technological progress. The authors conducted the interviews. In each visit to a slaughterhouse, we interviewed separately the different elements (the answer of one could not influence the answer of the others). The manager and technicians interviewed supervise more then 25% of the total slaughtered pigs in Brazil. Also, a large number of farmers were interview but, in general, it was very difficult to obtain from them a quantitative answer. Most of the farmers answered that they heard about CNPSA or that they even had already visited it but they were not able to quantify – in a scale from 1 to 100 – what would be the CNPSA contribution for pork production progress. As most of the farmers are integrated/associated with the slaughterhouses, when they have problems they contact their extension services rather than the CNPSA. The answers obtained from the slaughterhouses' leaders and technicians varied from a minimum of 35% to a maximum of 80%. If we weight the answer given (for each slaughter house) by the annual number of slaughtered animals the weighted average contribution of the CNPSA for technological progress of pig production is 54,3%.

Also we conducted interviews with representative researchers of all research fields of CNPSA. The researchers were asked the two following questions: (1) in your field of research what is the contribution of CNPSA for pig production technological progress? (2) considering all fields of research concerned with pig production, what is the CNPSA contribution for the overall technological progress in pig production? The answers had a large variance. In relation to the first question the answers varied from a minimum of 5% to the field research of reproduction to a maximum of 60% for the field of health. The average value is 26.3%. For the second questions the answers varied from 10% to 40%, with an average value of 26.2%.

4. Conclusions

Taking into account that Brazil slaughters more than 25 millions pig per year, we have to agree that the potential technological progress, which occurred during the analysed period, is very important.

As it was been said before, not only the costs of producing an animal decreased substantially but also the quality of meat improved and the number of animals slaughtered, per sow, per year, increased. One could evaluate the potential technological progress by the amount that the country economy would earn (or would save in animal rations), if all farmers adopt the new technology, by multiplying the amount gained per animal by the number of animals slaughtered.

There is no doubt that CNPSA had a very important contribution for the actual state of the art. It does not matter if we take the research evaluation from the users point of view or from the researcher point of view. In any case, the CNPSA contribution for technological progress of pig production was considered very important (26.2% for the researcher working in CNPSA and 54.3% for users). It is still interesting to notice that users gave a higher evaluation then researchers.

It is distressing, however, to find out that during the last ten years, only in the state of Santa Catarina, more than 25,000 hog raisers (mainly small ones) were forced to leave this activity for economic reasons.

There are two main reasons for this situation. First, the competition in the sector is very high

and small farmers are not, usually, new technology first adopters; so, they will not have the lowest costs. Secondly, and more important, the industries are moving from small farmers to bigger ones; amongst other reasons because industries prefer to deal with a few number of big farmers, which makes the assistance process chipper and more efficient and because big farmers are, in general, more open-minded.

In summary, there is no doubt that an enormous technological progress occurred, between 1982 and 1998, in pig production and CNPSA, was, certainly, the most important source of this progress. However, the technological progress did not avoid that a large number of hog raiser went to bankrupt. One could say that technological progress was biased towards large-scale production.

Notes

(1) One $US dollar is approximately equal to two Reals (the Brazilian currency)

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