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# ADOPTING NEW ZEALAND DAIRY FARM PRINCIPLES AND PRACTICES IN ARGENTINA

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## ABSTRACT

The dairy sector is important to Argentina because it creates genuine wealth and employment. Milk production at competitive costs is crucial for the endurance of the Argentine dairy sector; therefore the development of competitive dairy farm systems is important for Argentina. New Zealand (hereafter NZ) dairy farm systems are internationally known for their competitiveness without the presence of subsidies. Though Argentine dairy farmers have been attracted to NZ systems for more than 40 years and despite the fact that the NZ knowledge appears to be beneficial to Argentine farms, NZ practices have been rarely adopted. This seemingly fruitless effort in extending this technology shapes the research question of the present study: Can Argentine dairy farmers benefit from adopting New Zealand dairy farm principles and practices?

Seven Argentine dairy farmers were selected as case studies because of their awareness of NZ dairy systems; the research data was collected through interviews, farm physical and economic records, and field visits to the farms. Two frameworks were utilized to analyse the qualitative and quantitative data: the Diffusion Theory (Rogers, 2003) and the IFCN network (International Farm Comparison Network www.ifcnnetwork.org), respectively.

Ten NZ innovations were defined; they were principles and practices considered typical in NZ dairy farms and not common in Argentine dairy farms. The innovations were related to four areas of the dairy system: pasture management, herd management & genetics, farm structure & organization, and human resources. The seven farmers selected differed in the level of adoption or rejection of the innovations.

Results revealed that higher levels of adoption of NZ innovations by a group of Argentine dairy farms were associated with higher levels of Return on Investment; this was mainly due to a higher utilization of the main asset and most limiting production factor of Argentine and New Zealand dairy farms, the land.

**Keywords:** Argentine dairy farm systems, New Zealand innovations for Argentina, Argentine dairy industry, Argentine dairy systems, diffusion of innovations, adoption of innovations

## INTRODUCTION

The following statistics show the importance of the dairy sector to the Argentine economy: Agriculture in general provides 10% of the total employment and produces 6% of the total GDP of Argentina (IFCN 2002). Milk, is the fifth agricultural product representing 8% of the total value of agricultural primary products after soybean, beef, wheat and maize. In the industrial phase the dairy companies are in third place among the food and beverages industries,

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accounting for 11% of the total value produced by this sector (INDEC 2003). The Argentine dairy sector has a domestic focus and exports only when there is an over-supply in the local market (Gutman, Guiguet, & Rebolini, 2003), during the 1990's an average of 10% of the total volume of milk produced was exported. Even though the sector is not focused on exporting is a competitive sector that creates genuine wealth and employment.

Historically, milk price paid to farmers in Argentina has been decreasing (calculations based on Gutman et al., 2003). In order to remain competitive , Argentine dairy farmers have been constantly developing their production systems by adopting new technologies. New technologies (and innovations in general) for the Argentine dairy production sector are usually the result of research done both within and outside the country.

Argentina has both public and private institutions whose main objective is to generate useful innovations for its farmers; however some innovations are imported from other countries. The United States (US) is probably the country of origin of the biggest proportion of foreign innovations adopted in the Argentine dairy systems. One example of this is the high influence of US genetics in the Argentine Holstein (Molinuevo, 2001) that is the most common cow in Argentine farms (IFCN, 2002). Another example is the fact that some US companies are well settled in Argentina and are investing in research and development, and are promoting their products. Additionally, some of the most renowned Argentine specialists and researchers in dairy, studied in the US. However not all the foreign innovations come from the US. Argen-

**Table 1: General, Agricultural and Dairy Sector data for Argentina and New Zealand**

| | Argentina | New Zealand |
|---|---|---|
| **General** | | |
| Population (Mill.) | 36.2 | 3.7 |
| Area ($km^2$) | 2,791,810 | 268,021 |
| Population density (inhab./$km^2$) | 13 | 14 |
| Total GDP (bill US-$) | 264 | 51 |
| GDP/capita (US-$) | 7,041 | 13,754 |
| Life expectancy (years) | 75 | 79 |
| Infant mortality (per 1000 births) | 20 | 6 |
| Adult literacy (%) | 97.0 | 99.9 |
| **Agriculture (% of total)** | | |
| Land | 62% | 64% |
| Labour | 10% | 10%* |
| GDP | 6% | 8%** |
| **Dairy Sector** | | |
| Dairy Cows (Mill.) | 2.1 | 3.7 |
| Milk Processed (Mill. kg MS) | 640 | 1,107 |
| Milk Exports (Mill. US-$) | 280 | 1,710 |
| Milk Exports (% of total volume) | 11% | 90-95% |

Mainly for 2000 and 2001, but also for 1995 * and 1999 **.

INDEC, World Bank, Euromonitor (2004a), IFCN (2002), SAGPyA and APL. Statistics-NZ (2003), Euromonitor (2004b), IFCN (2002), OECD and LIC (2002/03).

tine farmers have also adopted innovations from other countries including Germany, Canada, France, Australia, New Zealand and many others.

This study focused on innovations from New Zealand, mainly for three reasons: Firstly because even though New Zealand and Argentina are very different countries (in economic development, cultural background of their people, size and topography); they have some important things in common (both countries are in the southern hemisphere, have low population densities, are able to feed animals with good quality grass all year round, and for both of them the export of unsubsidised agricultural products constitutes a significant portion of their economy). The second reason is that New Zealand dairy sector is the leading exporter of milk and milk products in the world (USDA, 2004) and can be taken as an example of coordination and efficiency for the Argentine dairy sector. The third reason, is that New Zealand farmers are considered to be among the most competitive in producing milk without the help of subsidies and they traditionally had achieved higher physical and economic performances than Argentine farmers (IFCN, 2002).

The aim of this paper is to analyse the impact of adopting New Zealand innovations in the financial and physical performance of a group of Argentine dairy farms.

## METHODOLOGY

The present research is a multiple case study design in which seven Argentine farms were selected and analysed. Farmers with knowledge of New Zealand systems were selected; it was essential to achieve the research objectives that the farmers that were to be chosen knew about the New Zealand dairy production systems and the New Zealand innovations prior to meeting the researcher. Three main aspects were investigated in each of the case study farms: a) the adoption or rejection of a list of 10 New Zealand innovations, b) the reasons for adoption or rejection, c) and the impact of adoption in the performance of the farms.

Most of the data was collected in a journey by the researcher to Argentina. The researcher first contacted the farmers and the experts by electronic mail or by telephone and invited them to participate in the research project. The conditions were explained and appointments were set with the farms and persons that accepted. Then the researcher travelled to Argentina and collected most of the data in a period of 20 days. After returning to New Zealand the researcher kept in contact with the farmers and experts in order to complete the information needed. Three data collection sources were used: archival records, semi structured interviews and direct observation. The study of the context was done through relevant literature and interviews with experts.

The interviews were focus interviews also called semi-structured. This kind of interview follows a certain set of questions, is open-ended and assumes a conversational manner. The interviews were recorded, with permission from the interviewees. The questions were about the farm and the farmer in general, the production system, and then questions in order to assess the adoption or rejection of each of the New Zealand innovations. Previous to the data collection the 10 New Zealand innovations were defined and some parameters and indicators were set in order to assess the adoption or rejection of the innovations in the Argentine dairy farms. Afterwards the tapes were heard and the most relevant information was transcribed and subsequently translated from Spanish to English. After each visit the researcher wrote his general impression of the farm, the farmer and any additional information that could complement the interviews or the farm financial and physical records.

The archival records from the farms were harmonized and then loaded to the IFCN (International Farm Comparison Network) computer model that works in a spreadsheet. Financial

and physical records were collected for the 2001, 2002 and 2003 seasons for most of the farms; however, only the last two seasons were analysed in detail.

## THE CASES

The seven Argentine chosen are bigger than the Argentine average farm that has 174 cows on a farm of 271 hectares (Gambuzzi et al. 2003). Additionally their management levels are higher than average (within Argentina top 25% dairy farms in financial performance).

**Table 2: Case Study Farms Outlook (season 2003)**

| FARMS | Total cows (average for the season) | Area utilised for cows and heifers (has) | Stocking Rate (cow per ha) | Cows live weight (kg) | Milk produced per year (1000 of kg ECM[1]) | Milk produced per cow (kg ECM) | Milk produced per ha (kg ECM) | % of feed brought from outside the area | Approx market value of land (US-$)[2] | Total people working on the dairy enterprise (labour units) | Cows per person | Number of milking sheds | Cows per set of teat-cups |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Farm 1* | 6,350 | 2,603[3] | 2.44 | 605 | 2 , 44 | 4,6 4 | 11,42 [6] | 43% | 2,500 | 0.4 | 0 | 1 | 25 |
| *Farm 2* | 2,530 | 1,435 | 1. 6 | 424 | 12,3 2 | 4, 0 | ,622 | 4 % | 1,400 | 25. | | 3 | 25 |
| *Farm 3* | 1, 00 | 1,665 | 1.02 | 500 | , 3 | 5,200 | 5,30 | 3 % | 2,000 | 20.0 | 6 | 3 | 26 |
| *Farm 4* | 1,3 5 | 0 | 1. 6 | 400 | 6,6 | 4, 1 | ,5 | 55% | 2,000 | 25.5 | 6 | 1 | 24 |
| *Farm 5* | 15 | 3 1 | 2.34 | 442 | 3, 50 | 4,0 | ,5 3 | 63% | 1,400 | .2 | 100 | 1 | 30 |
| *Farm 6* | 400[7] | 250[4] | 1.60 | 520 | 1, 54[7] | 4, 6 | , 1[7] | 0%[7] | 2,000 | | 50 | 1 | 20 |
| *Farm 7* | 400 | 600 | 0.6 | 432 | 1,55 | 3, 35 | 2,5 6 | 60% | 1,400 | 3.4 | 11 | 1 | 25 |

[1] Energy Converted Milk (ECM) with 4% fat and 3.3% protein. Formula used for adjustment: *ECM = (milk production in litres * ((0.383 * % fat + 0.242 * % protein + 0.7832)/3.1138)*
[2] Calculated based on the market value of land for the typical Argentine farms (IFCN, 2004).
[3] *Farm 1* is the only farm in which the area for raising the heifers is not included, for all the other farms the hectares include all the area used for lactating and dry cows, plus the area utilised for rearing the heifers.
[4] The data for *Farm 6* was estimated from data given during the interview with the farmer (no farm records provided).

## RESULTS 1: Adoption or Rejection of New Zealand Innovations

The following table shows a summary of the innovations adopted by the case study farms. The bold numbers of the bottom of the figure are the sum of all the innovations adopted by each of the farms. For example Farm 2 with 9.4 innovations adopted (out of 10) is the case study that adopted more New Zealand innovations. The bold numbers at the extreme right of the figure are the sum of the different proportions of the same innovation adopted by the case studies. For example the Focus on Production per Hectare (innovation 1) was adopted by 7 (out of 7) of the case studies. In the same way Farm 1 is the case study that less innovations adopted, and innovations 4 (Utilization of Formal Pasture Budgets) and 6 (Less than 15 cows per Set of Teat-cups) were the innovations less adopted by the case studies.

**Table 3: Summary of Adoption of NZ Innovations by the Case Study Farms**

| | *Farm 1* | *Farm 2* | *Farm 3* | *Farm 4* | *Farm 5* | *Farm 6* | *Farm 7* | |
|---|---|---|---|---|---|---|---|---|
| *1) Focus on Production per Hectare* | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **7.0** |
| *2) Marked Importance to Pasture Production* | 0.25 | 1 | 0.6 | 1 | 0 | 1 | 0 | **3.9** |
| *3) Quantitative Pasture Monitoring* | 0.25 | 0.9 | 0.8 | 0.9 | 0 | 0.5 | 0 | **3.4** |
| *4) Utilization of Formal Pasture Budgets* | 0 | 1 | 0.9 | 1 | 0 | 0 | 0 | **2.90** |
| *5) Skilled and Motivated People Working on Farms* | 0 | 1 | 0 | 0.8 | 0.3 | 1 | 1 | **4.1** |
| *6) Less than 15 cows per Set of Teat-cups* | 0.45 | 0.5 | 0.3 | 0.4 | 0.0 | 0.7 | 0.5 | **2.85** |
| *7) Seasonal Calving, One or Two Calving Periods per year* | 0.17 | 1 | 0 | 1 | 1 | 1 | 1 | **5.2** |
| *8) New Zealand Genetics* | 0.2 | 1 | 0 | 1 | 0.67 | 1 | 0.3 | **4.2** |
| *9) Rearing of Calves in Groups* | 0.1 | 1 | 1 | 1 | 1 | 1 | 1 | **6.1** |
| *10) Style of Milking Shed and Milking System* | 0.8 | 1 | 1 | 1 | 1 | 1 | 1 | **6.8** |
| | **3.2** | **9.4** | **5.6** | **9.1** | **5.0** | **8.2** | **5.8** | |

### Typical Dairy Farm Models (IFCN)

The International Farm Comparison Network (IFCN) compares dairy farms from the most important regions for milk production in the world. An IFCN coordinator is chosen in each region and the coordinator together with a group of experts define two or three dairy farms typical from that region. The models chosen for Argentina are the following:

The Argentine model farm with 350 cows (AR-350) is based on the average data of a group of farms in the Córdoba province. This farm model was considered typical of the farms that together contribute the biggest proportion of the Argentine total milk production (Bernardo Ostrowski, IFCN coordinator for Argentina, personal communication). This farm is bigger and has higher management level than the average Argentine dairy farm.

AR-150 is a family farm that represents the Argentine average dairy farm in size and productivity.

AR-1400: This model is based on data of a group of farmers from the west of Buenos Aires province. It is situated within the top 10% farms in size and within the top 25% in management level.

These three typical Argentine dairy farms did not adopt any of the New Zealand innovations. The New Zealand innovations were defined as principles, practices and technologies that are typical of New Zealand dairy systems and not common on Argentine farms. By definition the typical Argentine farms adopted none or very few New Zealand innovations.

**RESULTS 2: Impact of Adoption in the Farms Performances**

In this section the case studies are compared and also contrasted with three typical Argentine dairy farms and also three New Zealand dairy farms with the objective to describe the impact of adoption of the New Zealand innovation on the Argentine farms. The following table shows the names of the case studies in the IFCN format.

**Table 4: Names Given to the Case Study Farms on Figures**

| | **Season 2003** |
|---|---|
| *Farm 1* | AR-6350 |
| *Farm 2* | AR-2530 |
| *Farm 3* | AR-1700 |
| *Farm 4* | AR-1483 |
| *Farm 5* | - |
| *Farm 7* | AR-400 |

The following figures show the physical and financial performances of all the farms in 2003. Each figure is analysed and possible associations between the adoption of the innovations and increments or decreases in performances are sought.

The Entrepreneur's Profit (calculated as Total Returns – Total expenses + Non Cash Adjustments – Opportunity Costs) measures the economic sustainability of the business in the long run (IFCN, 2002).

The number of New Zealand innovations adopted by the farms analysed in this section are shown in the following table:

No association was found between the number of innovations adopted by the Argentine farms and their Entrepreneur's Profit. Farm 2 (AR-2530) was one of the best performers and was the farm that adopted the highest number of innovations. However AR-1400, AR-350 and Farm 1 (AR-6350), had similar financial performances and adopted very few New Zealand innovations.

**Figure 1: Returns and Profits (season 2003)**

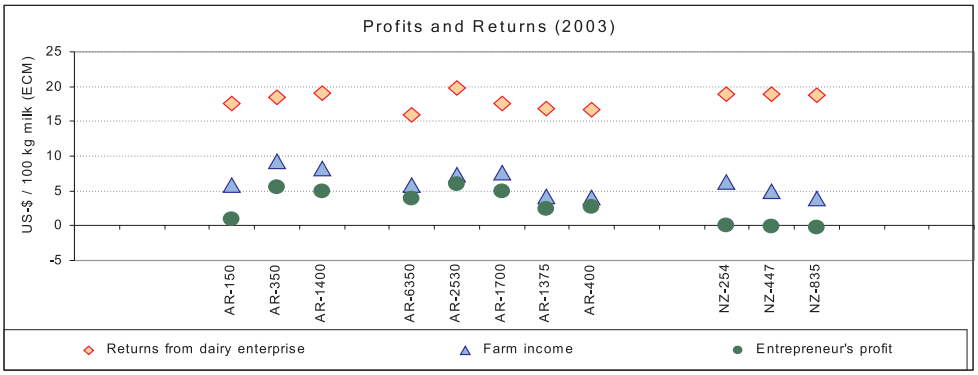


**Table 5: Number of New Zealand Innovation Adopted (out of 10)**

| *AR-150* | *AR-350* | *AR-1400* | *Farm 1* | *Farm 2* | *Farm 3* | *Farm 4* | *Farm 5* | *Farm 7* |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 3.2 | 9.4 | 5.6 | 9.1 | 5.0 | 5.8 |

An association was found between the number of innovations adopted by the Argentine farms and their Operating Profit Margin in 2003. In general, the farms that adopted more New Zealand innovations had lower Operating Profit Margin in 2003.

An association was found between the number of innovations adopted by the Argentine farms and their Return on Investment in 2003. In general, the farms that adopted more New Zealand innovations had higher Return on Investment in 2003.

In the following paragraphs, the different cost components are analysed. The components of Total Costs defined by the IFCN are: Labour Costs, Land Costs, Capital Costs and Costs as Means of Production.

The analysis of the Total Costs by each cost component (also called production factor) can be done independently of the analysis of other indicators and provides an idea of how each factor is utilised and how it impacts on the general performance of the business.

### Labour

The factors that affect Labour Productivity are so numerous that is very difficult to assess the impact of adopting New Zealand innovations on it. However nearly all the case studies had Labour Productivity higher than all the typical Argentine farms. Interestingly, the three farms that most fully adopted the sixth innovation (Less than 15 cows per Set of Teat-cups, etc) had the highest Labour Productivity; these farms were Farm 7, Farm 2 and Farm 1.

### Land

Land was, on average, 81% of total assets for the typical Argentine farms in 2003. For case studies AR-6350 (Farm 1), AR-2530 (Farm 2), AR-1375 (Farm 3) and AR-1375 (Farm 4), which are the case studies that own land, land was 69%, 62%, 73% and 62% of the total assets, respectively. For the typical New Zealand farms, land was, on average, 56% of the total assets of the business. The case studies, all of which have adopted the first New Zealand innovation (Focus on Production per Hectare), had lower Land Costs per kilogram of milk than the typical

Argentine farms in both seasons (with the exception of AR-400 in 2002). The two farms with lower Land Costs were also the two farms that adopted the highest proportion of New Zealand innovations (Farms 2 and 4). This does not necessary imply that the fact of adopting New Zealand innovations has an impact on Land Costs per kilogram of milk produced, however proves an association between the two factors.

### Capital

Capital Costs (on an annual basis), were calculated using a real interest rate of 6% for borrowed funds, and a real rate of 3% for owner's capital (buildings, machinery, livestock and others). Capital Costs were similar and relatively low for most Argentine dairy farms in both seasons mainly because they did not have any long-term loans. AR-150 model has higher capital costs because it had a relatively large loan. Farm 1 and 2 had the lowest Capital Costs in both seasons. If the AR-150 is not considered (because it was the only Argentine farm with some long-term debt) an association was found between the adoption of New Zealand innovations and increments in capital costs.

## DISCUSSION

The adoption of the New Zealand innovations was found to be associated with increments in Return on Investment (ROI) and decreases in land costs per kilogram of milk. Additionally case study farmers mentioned that the adoption of the New Zealand innovations could increase land productivity (milk produced per unit of capital invested in land). The New Zealand innovations related to pasture production and pasture utilization (increments of phosphate levels in soils, utilization of quantitative pasture monitoring, and utilization of pasture budgets) were considered to be most strongly associated with higher land productivity by the case study farmers. Grazed pasture was one of the main sources of feed on the Argentine dairy farms. Pasture covered between 30% and 68% of the total cows' annual requirements on the case study farms, and between 52% and 61% of the total cows' annual requirements on the typical Argentine farms. In typical New Zealand farms, grazed pasture covered between 70% and 82% of the total annual requirements of cows. The adoption of New Zealand innovations were considered by the case studies to be related to increments in pasture production and utilization per hectare, and consequently in overall land productivity overall. Higher land productivity was probably the main reason why the adopters of New Zealand innovations had lower land costs (capital invested in land per kilogram of milk produced). Additionally land was the main investment for the typical and real Argentine dairy farms; this partly explains why improvements in land productivity were associated to increments in ROI. ROI is possibly the ultimate indicator of financial performance. ROI is calculated as the operating profit (called Economic Farm Surplus in New Zealand) of a business as a percentage of the total investment in the business. Dairy farms with higher ROI provide to their owners a higher profit per dollar invested in the business. ROI is also useful to compare the returns from the investment in a dairy farm with the potential returns from other possible businesses.

The adoption of New Zealand innovations was found to be also associated with increments in labour productivity. The main New Zealand principle associated to labour productivity was having less than 15 cows milked per set of teat-cups (or more than 67 teat-cups for every 1000 cows to be milked). Other innovations related to improvements in labour productivity were seasonal calving, rearing of calves in groups, and New Zealand style milking sheds and systems. Despite their higher labour productivities, farms that adopted New Zealand innovations had higher labour costs per kilogram of milk produced because they also paid higher wages, and the difference in wages was larger than the difference in labour productivity. It is important

to mention that none of the case studies fully adopted the New Zealand innovation in relation to the number of cows per set of teat-cups. It is possible that some of the case studies that had adopted many of the New Zealand innovations, including more skilful and motivated people, would have had higher labour productivities if the number of cows per set of teat-cups had been decreased. This increase in labour productivity would have been associated with lower labour costs. However, some capital invested have been required in order to increase the number of sets of teat-cups, therefore capital costs would have increased. Further research should be done in order to study the trade off between level of investment in plant and machinery and the amount of labour needed for Argentine dairy farms. There is probably a level at which typical Argentine farms would decrease their labour costs at a rate which is higher than the rate of increment in capital costs. It is the opinion of the researcher that the costs of adding sets of teat-cups (up to certain level) to Argentine dairy milking sheds, could be repaid by lower labour costs.

## CONCLUSIONS

### Related to Entrepreneur's Profit and Return on Investment (ROI)

Higher levels of adoption of New Zealand innovations by a group of Argentine dairy farms were associated with higher levels of Return on Investment (ROI). Although, no association was found between level of adoption of New Zealand innovations and the level of Entrepreneur's Profit per kilogram of milk produced. However, ROI is increasingly been considered as a more relevant financial indicator for dairy farmers in New Zealand (Nicola Shadbolt, personal communication) and also some of the Argentine farmers mentioned that they were focused in maximizing returns of their investment.

### Related to the Cost Component "Land"

Higher levels of adoption of New Zealand innovations by a group of Argentine dairy farms were associated with reductions in land costs per kilogram of milk produced. The main advantage of the adoption of New Zealand innovations found in the case study farms (especially "increments of phosphate levels in soils", "utilization of quantitative pasture monitoring", and "utilization of pasture budgets"), was the association between the level of adoption and level of milk production per hectare .

### Related to the Cost Component "Labour"

Higher levels of adoption of New Zealand innovations by a group of Argentine dairy farms were associated with higher levels of labour costs per kilogram of milk produced, because of higher average wages paid per hour of work, and despite higher levels of labour productivity . The New Zealand principle "less than 15 cows milked per set of teat-cups" was found to be the innovation most closely associated with increases in labour productivity. Other innovations adopted by the Argentine farmers that could be associated with increases in labour productivity were: seasonal calving, rearing of calves in groups, and New Zealand style milking sheds and systems.

Additionally, the adoption of New Zealand innovations was associated with increasing levels of formal education of people working on dairy farms, which was also associated with higher wages paid.

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