

Impact Analysis of the Agricultural Sector Crisis on the Performance of Water Users' Associations in the Province of Mendoza, Argentina

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ABSTRACT

THIS PAPER DEALS with the impact of the crisis of Mendoza's agriculture sector on the performance of users' associations since the early 1980s.

First, a general economic analysis at provincial level is performed. Then a plot-level examination is made of the different economic situations and conditions of two users' associations located in two different irrigation areas. The second analysis is based on the study of farm models carried out through field surveys.

The farm-level information reveals that the different impacts borne by agricultural producers is a function of their farm size and of their managerial skills. The worsening economic situation of the individual farmer has caused a weakening in the capacity of the associations to deal with the management and upgrading of the system.

INTRODUCTION

Mendoza is a province in the west of the Argentine Republic (33° South latitude) and is bordered by Chile on the west. Its total area (150,839 km²) is arid. Water is obtained from snowmelt from the Andes Mountain Range. There are 360,000 irrigated hectares in five irrigation districts. The total registered area for agricultural use is 594,792 ha. This area covers barely 3 percent of the total provincial area. Average annual rainfall is 192 mm. Mendoza is traversed by five major rivers, none of which has an annual module of more than 50m³/sec.

These conditions have resulted in the formation of five cultivated oases with an irrigation infrastructure consisting of 8,000 km of canals, of which 500 km are lined. There are 1,800 km of drainage collectors in the lower lying areas of the irrigated systems.

Groundwater use is also important and there are over 18,000 wells. Some 80,000 ha are irrigated exclusively with groundwater, while about 30,000 ha are irrigated with both surface water and groundwater.

⁴³ General Irrigation Department, Mendoza, Argentina (1991).

Water is managed and distributed by an autonomous agency — the General Irrigation Department (DGI) — together with 366 water users' associations (WUA) or Canal Inspections, each of which administers irrigated areas of 300 ha or more.

Mendoza's economy is based mainly on the cultivation of grapes, vegetables and fruits, on their associated industries (wine-making and fruit and vegetable canning), and on oil extraction and distillation.

A general economic analysis of the province cannot be undertaken without reference to the national and international contexts.

A common denominator of all irrigation systems in the world is the high investments required to keep the systems working. When the economic returns to agriculture do not suffice to make these investments, a crisis is inevitable.

This is what occurred in Mendoza in the 1980s. The economy, strongly dependent on grape production, was faced with the problem of producing final products with no market value. To this may be added a national policy with a marked anti-export bias, underrated US dollar, high tariffs, red tape, etc. On the other hand, imports affected the local industry. As a result of high interest rates savings were diverted to the financial system and speculation replaced production.

The decline of the productive sector is evinced in the share of agro-industries in the Gross Provincial Product (GPP). The GPP is about US\$3,600 million, which is roughly equivalent to 4 percent of the total gross national product.

An analysis of the GPP reveals that agriculture represents 12 percent of the total. This is an improvement as, after reaching 18 percent in the 1970s, agriculture fell to only 3 percent in the early 1980s.

These figures clearly reveal the crisis the sector has undergone. Low profitability was due to a fall in the prices of agricultural products, to deficiencies in the irrigation system, and to deterioration of soils. The hydrologically rich years of the 1980s brought about drainage problems and waterlogging.

The reduction in profits and investment capacity affected the WUA too. In this case, the situation was marked by a decrease in participation, modernization, maintenance, and investments in new works.

Two important parameters should be mentioned in this context: the cost of water and the cost of the land. For the former, irrigation water rates have ranged from US\$16.35/ha/year to US\$54.63/ha/year. The provincial average, weighted according to the area of each irrigation district, is US\$18.82/ha/year. In other words, water costs US\$0.18/m³ as the DGI delivers an average of 10,000 m³/ha/year at the intake of secondary canals.

Water may then be said to be a cheap input since, when expressed as a percentage, it represents 1 to 4 percent of the production costs of the various crops.

The cost of the land varies, but a hectare of cultivated land with irrigation rights may be estimated at about US\$3,000.

Due to the different production and marketing conditions in the different regions of Mendoza, they were affected by the crisis in different ways.

The two WUAs under study reacted differently to the crisis. The WUA of the "Constitucion" Main Canal — better organized, closer to urban markets, and with better transportation and means of communications — was able to face the crisis and is now in a position to make the necessary investments. The "Real del Padre" WUA does not satisfy those conditions and, unless it receives outside aid, will be unable to recover from the crisis.

OBJECTIVE

The objective of this paper is to evaluate the influence of the farmers' economic and financial situation and their productive strategy upon the general performance of two WUAs in the province of Mendoza, Argentina.

METHODOLOGY

Two WUAs similar in size and irrigation infrastructure, were selected for analysis. Each is considered representative of its respective geographical region. The "Constitucion" WUA is located in the northern oasis of the province and the second, "Real del Padre," is located in the southern oasis.

Information was drawn from the existing landownership registers, irrigation registers and from interviews with farmers. The survey furnished information on land tenure, available technology, type of irrigation and cropping patterns. This made it possible to stratify the irrigated plots according to area, and to identify the "standard" farms at each stratum with the "farm modeling" methodology.

The information was supplemented with data on marketing, regional markets, agricultural and social characteristics of the command area of each WUA, service systems, etc.

The characteristics of the associations under study are given below.

The "Real del Padre" Canal Inspection

This canal inspection (WUA) is situated in the Real del Padre District in the Department of San Rafael. It is within the Atuel River Irrigation System, from which water is diverted through a direct intake with good infrastructure. The Atuel is regulated by the Nihuil-Valle Grande interconnected dams.

The WUA serves the Real del Padre agricultural community. The irrigation network comprises the main canal and six secondary and tertiary canals which irrigate 11,525 ha with irrigation rights. The irrigation register records 1,254 users. The inspection authorities are the inspector and five delegates.

Table 1. Cropping pattern (%) in the WUA command area.

| | Real del Padre | Constitucion |
|--------------|----------------|--------------|
| Grapes | 29.1 | 55 |
| Fruit trees | 16.1 | 11 |
| Annual crops | 6.7 | 6 |
| Others | 5.4 | - |
| Fallow | 42.8 | 28 |

Soils are sandy-loam to slimy-loam, but they are impaired by waterlogging and salinity. According to the Riverside soil classification, they are in the second and third categories. Almost 52.4 percent of the area has a salinity over 5,000 umhos. The rehabilitation project for this irrigation district concerns its physical aspects in view of the declining productivity arising from drainage problems.

The "Constitucion" Canal Inspection

This WUA, in the area managed by the Lower Tunuyan River Subdelegation, diverts water from the Tunuyan River, which is regulated by the "El Carrizal" Dam. A diversion dam downstream branches off into a main canal which, in turn, flows into the Constitucion Canal.

The Constitucion Main Canal is located in the center of the area irrigated by the Lower Tunuyan River. The canal authorities are the inspector and five delegates. The irrigation network is made up of three secondary canals and fourteen tertiary canals. There are 10,573 ha with irrigation rights and 1,352 registered users engaged in agricultural activities (see Table 1 above for the cropping pattern).

In general, soils are sandy-loam to loam; i.e., in the first category. However, there are large waterlogged areas due to infiltration and seepage from the irrigation canals.

DEVELOPMENT

To compare both WUAs, the existing cadastral data and the DGI's users' register were used. With the farm modeling methodology, each association was stratified according to the irrigated plot sizes, disregarding those of less than one hectare.

A calculation was made of the share of each stratum in the total number of farms, as well as the represented area. The cropping pattern of each stratum was determined on the basis of information provided by the Cadastral Data Bank and ratified or rectified through field surveys. On the basis of this data, the standard farm for each stratum was determined.

The information was complemented with questions on:

- * Production and yields.
- * Possibilities of expansion.
- * Family composition, tenure systems and their influence on productivity levels.
- * Current and potential financial situation.
- * Capacity and willingness to pay the irrigation water rates.

With this information, four production models were developed according to the relevant variables in each area: "minifundia," small family holdings, family holdings with capital investments, and entrepreneurial concern.

The economic analysis of each of the proposed models started with a budget of expenditures, investments and income, which made it possible to compare different situations in the different areas.

The economic indicators of each model are:

1. Total income: obtained from the sale of the total production.
2. Gross margin: difference between total income and direct expenditures.
3. Operational results: difference between gross margin and indirect expenditures.
4. Gross benefits: difference between operational results and amortizations.
5. Instant profitability: gross benefit/ total capital.

The results made it possible to make an economic diagnosis of the farm models corresponding to the associations under study.

Tables 2 and 3 contain some of the indicators described for the two WUAs. An analysis of Tables 2 and 3 reveals the following.

Model A. This model represents an important number of small farmers. The instant profitability indicators show that the Atuel River irrigators are better off, but that the Constitucion Canal users have higher incomes per hectare. The gross margin per hectare is greater at Real del Padre because direct expenditures are higher in the Constitucion command area. This could be explained by a higher technological level of these farms, especially taking into account the greater capitalization per hectare in the latter WUA.

Model B. The farms in this model do not show significantly different indicators between the two WUAs. In both cases, profitability is positive but there is not much margin for economic improvement.

Table 2. Description of the water users' associations.

| Association | Model | Area (ha) | Stratum (ha) | Area (%) | Farms (%) |
|----------------|-------|-----------|--------------|----------|-----------|
| Real del Padre | A | 4.7 | 1.1 - 5.0 | 30.6 | 10.6 |
| | B | 9.1 | 5.1 - 10.0 | 34.3 | 23.0 |
| | C | 14.7 | 10.1 - 20.0 | 19.8 | 21.5 |
| | D | 24.5 | 20.0 - 30.1 | 4.4 | 25.0 |
| Constitucion | A | 3.0 | 1.1 - 6.0 | 43.0 | 17.0 |
| | B | 8.2 | 6.1 - 12.0 | 20.0 | 20.0 |
| | C | 15.2 | 12.1 - 22.0 | 8.0 | 15.0 |
| | D | 60.0 | + 22.0 | 9.0 | 46.0 |

References: A: Minifundia

B: Small family holding

C: Family holding with capital investments

D: Entrepreneurial concern

Table 3. Economic indicators (US\$, May 1990).

| Association | | Income | | Cross margin | | Capital | | Instant profitability |
|----------------|---|---------|-------|--------------|-------|---------|--------|-----------------------|
| | | Total | p/ha | Total | p/ha | Total | p/ha | % |
| Real del Padre | A | 2116.1 | 450.2 | 1147.1 | 244.1 | 11681.2 | 2485.5 | 3.1 |
| | B | 4110.2 | 451.8 | 2285.9 | 251.2 | 18096.9 | 1988.6 | 2.9 |
| | C | 7470.4 | 508.2 | 4566.1 | 310.6 | 22954.7 | 1561.6 | 10.1 |
| | D | 12249.6 | 500.0 | 3878.0 | 158.2 | 53516.5 | 2184.3 | -4.3 |
| Constitucion | A | 1597.6 | 532.5 | 528.4 | 176.1 | 8470.9 | 2823.7 | -5.0 |
| | B | 4992.7 | 624.1 | 1792.3 | 224.1 | 13312.3 | 1623.5 | 4.0 |
| | C | 11481.9 | 755.5 | 5240.8 | 344.7 | 29230.0 | 1922.9 | 2.5 |
| | D | 57199.0 | 953.3 | 31195.6 | 520.0 | 90520.0 | 1508.6 | 21.4 |

References: A: Minifundia

B: Small family holding

C: Family holding with capital investments

D: Entrepreneurial concern

Model C. In this case, the instant profitability indicator is higher in Real del Padre, while income and gross margin are greater in Constitucion. Although gross benefit is smaller in Constitucion, it should be pointed out that this is due to larger amortization shares, which stem from the users' larger capital.

Model D. In this model there are marked differences between the two WUAs. Both in the number of users and in the represented area, Constitucion shows much higher values. The per-hectare income at Constitucion is almost double that of Real del Padre; its gross margin is three times as large, and its operational results are five times larger. The differences are more evident when analyzing gross benefit and profitability because both these items yield negative values for Real del Padre. On the other hand, when other parameters are compared, it can be seen that:

- * Marketing centers are better organized and closer to the command area of the Constitucion Canal, which gives it an edge over Real del Padre.
- * Proximity to the larger urban centers makes it possible for the Constitucion farmer to live on his farm and, thus, manage it better.
- * The Constitucion farmers use more technology and have a greater capitalization. This allows them to have a better economic structure than that of Real del Padre. This situation is described in model D, where the Constitucion users are better off than the Real del Padre farmers in all economic indicators.

To complete the economic analysis of the areas under study, the average income per hectare was calculated and weighted according to the relative importance of each stratum.

Average Income Per Hectare

Real del Padre

$$IP = 450.2 * 0.106 + 451.8 * 0.23 + 508.2 * 0.215 + 500.0 * 0.25 = 385.90 \text{ (US\$/ha)}$$

Constitucion

$$IP = 532.5 * 0.17 + 624.1 * 0.20 + 755.5 * 0.15 + 953.3 * 0.46 = 767.2 \text{ (US\$/ha)}$$

The difference in income is reflected in the different capacity to pay for the irrigation service during the 1985/90 period. This is shown in the following Tables.

Table 4. Annual irrigation rates collected in two canal inspections, 1985/90.

| Constitucion Main Canal - 10,573 ha | | | | | |
|---------------------------------------|-------------------------|-------------|-------------------|-------------|-------------|
| | Irrigation rates billed | | Amounts collected | | |
| | US\$/ha | Total(US\$) | US\$/ha | Total(US\$) | % Collected |
| 1985 | 8.80 | 93,042.40 | 3.91 | 41,357.14 | 44.45 |
| 1986 | 10.89 | 115,139.97 | 4.79 | 50,681.95 | 44.92 |
| 1987 | 12.78 | 135,122.94 | 4.60 | 48,666.59 | 36.02 |
| 1988 | 7.76 | 82,046.48 | 3.18 | 33,666.53 | 41.03 |
| 1989 | 6.19 | 65,446.87 | 3.71 | 39,302.78 | 60.05 |
| 1990 | 16.56 | 175,088.88 | 6.62 | 70,074.95 | 40.02 |
| Real del Padre Main Canal - 11,525 ha | | | | | |
| | Irrigation rates billed | | Amounts collected | | |
| | US\$/ha | Total(US\$) | US\$/ha | Total(US\$) | % Collected |
| 1985 | 7.25 | 83,556.25 | 1.23 | 14,216.56 | 17.01 |
| 1986 | 11.09 | 127,812.25 | 1.66 | 19,174.44 | 15.00 |
| 1987 | 10.01 | 115,365.25 | 1.80 | 20,784.33 | 18.02 |
| 1988 | 5.51 | 63,502.75 | 1.65 | 19,058.41 | 30.01 |
| 1989 | 5.19 | 59,814.75 | 1.25 | 14,375.53 | 24.03 |
| 1990 | 14.37 | 165,614.25 | 2.30 | 26,502.72 | 16.00 |

The average irrigation water rate collected in the period under consideration is 44.23 percent for the Constitucion and 20.05 percent for the Real del Padre Canals.

The different investment capacity in physical improvements of the two WUAs according to their respective average incomes, may be seen in the following Table.

Table 5. Physical investments in the two associations (in US\$).

| Year | Constitucion Total investment (10,573 ha) | Investment per ha | Real del Padre Total Investment (11,525 ha) | Investment per ha |
|------|--|----------------------|--|----------------------|
| 1987 | 11,684.75 | 1.01 | 2,561.21 | 0.21 |
| 1989 | 1,055.13 | 0.09 | 248.59 | 0.02 |
| 1990 | 5,868.45 | 0.51 | 1,510.15 | 0.12 |

CONCLUSIONS

The impact of the agriculture sector crisis on two representative users' associations was analyzed in this paper. Through the analysis of simple economic-financial indicators, a marked difference may be observed between them during the period 1985/90.

Although the two associations are similar in size and irrigation infrastructure, their entrepreneurial structure strongly affected their economic-financial performance.

Differences in profits affect their payment and investment capacity, as shown in Tables 4 and 5. A low payment and investment capacity leads to a passive attitude on the part of the users, which eventually results in the obsolescence of both the administrative system and of the irrigation infrastructure.

With respect to the DGI projects which include canal lining and the installation of drainage systems, from this analysis it may be seen that one of the associations is in a position to carry them out and the other is not.

In the case of the Constitucion Main Canal WUA, the proposal consists of lining 11,200 m of one of the secondary canals and in the construction of different works, such as the rehabilitation of the drainage collector network. It is expected that water use efficiency will increase and that the processes of soil salinization and waterlogging will be reversed.

The Real del Padre Project includes the construction of a main collector and secondary drainage works in order to counteract worse deterioration processes than those of Constitucion.

Although the economic analysis of both projects renders positive results, the capacity of the associations to bear the costs is different. As a result, the financial feasibility of the Constitucion Canal is positive, while that of Real del Padre is negative.

The importance of the productive structures and the income levels of the users' associations as performance indicators, is also evinced by this analysis. The different economic development of the two command areas accounts for their different technical and administrative skills. The performance of the associations will always reflect their socioeconomic situations.

Programs designed to strengthen users' associations in order to help prevent the deterioration of their systems, should be closely connected to improving the economic situation of the agriculture sector and should monitor the indicators herein proposed.

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