THE SÃO JOSÉ PROJECT AND RURAL DEVELOPMENT IN THE STATE OF CEARÁ

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Abstract

This research, based on a case study of Comunidade Recreio in Iguatú, Ceará, Brazil, seeks to evaluate the socio-economic contribution of an small irrigation project funded by the government's São José Project. The evaluation is comprised of the following components: the impact of the irrigation project on the quality of life of the population under study; the contribution of the project in creating employment opportunities; and the economic benefits of the project. The model used to measure the quality of life was developed using quality of life indicators and attributing scores and weights to each. The results demonstrate that the studied population's quality of life improved significantly from pre-project to post-project and that all the indicators in the model had a positive impact. It is concluded that the project is extremely important for its beneficiaries, contributing to overall family income and, consequently, offering them an opportunity to earn a living in their rural environment.

Key words: Irrigation, quality of life, income, employment, Ceará

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1. Introduction

The state of Ceará has recently exhibited an expressive rate of economic growth accompanied by a high rate of urbanization. Between 1979 and 1997, the state's Gross Domestic Product (GDP) grew an average of 5.8% annually, above both national and regional averages, while its population increased by the national average. Per capita income in Ceará is US$ 1,701.00, below the regional average, US$ 2,077.00, and the national average, US$ 3,262.00 (World Bank, 1999).

Although Ceará has improved public administration policies, modernized its industrial plant, and seen increased investment in transportation infrastructure, water resources, and education, little emphasis has been given to agricultural development. Forty-six percent of the state's labor force is employed in agriculture, and this agriculture sector is noted for its low level of productivity. World Bank (op. cit) figures point to the states unfortunately high level of poverty.

According to Leite (1994), it is not possible to solve the problem of excessive rural emigration and deterioration of the rural population's quality of life without creating decent jobs in rural areas. Public policies have been oriented to create employment in urban areas and have ignored the farmer. These policies have failed to solve the urban employment problem. Continued migration from rural to urban areas increases the ranks of urban job seekers faster than urban employment opportunities.

Lacki (1995) defends improvement of the small farmers' economic situation as a means of improving rural life. Social development in the rural areas of Brazil depends on economic growth, and rural economic growth can only be achieved through profitable agriculture. In order to promote rural development, the government of Ceará, with the financial support of the World Bank, reformulated the Program of Supporting Small Farmers (PAPP) in 1995. This reformulation created the São José Project to stimulate sustainable development in rural communities. The Project financed several new agricultural programs

intended to provide employment and income opportunities, basic social services, and infrastructure improvements to assist the rural poor. In this study, we evaluate the effect of one of these new programs, an irrigation project, on income, employment, and the quality of life of a small rural Brazilian population.

2. Methodology

Data Source

The data were obtained by interviewing farmers residing in the Community Recreio, in the municipality of Iguatu, Ceará. In 1994, the Small Farmers Support Program assisted forty of the community's families; however, at the time of data collection only 11 of these forty families were using the project's resources. The data from these 11 families are used in this study

Conceptual Model

In the past, the well-being of a population was defined by their per-capita income. However, this type of economic measure gives a very incomplete reflection of a population's level of satisfaction (Cebotarev, 1982). Thus, the concept "quality of life" appeared as a new measure of satisfaction and well-being.

For Sliwiany (1997) cited by Monte, "life level should always be understood as an actual situation of existing life conditions and never as desired or expected situation." According to the author, this delimitation will permit understanding of the main theoretical and practical questions related to the quality of a given population's lives.

Guerrero and Hoyos (1983) defended the idea that the quality of an individual's life is related to economic options, family type, and personal needs. For this reason, the characteristics and components

that determine quality of life are differentiated between the richest strata and the poorer segment of the society. The Quality of Life Index must be specific to the type of population studied.

Cebotarev (1982) showed that the concept "quality of life" includes the conditions needed to adequately satisfy culturally defined basic requirements for normal human development. Human development may be divided into two basic types: development related to organic growth; and development related to intellectual growth. When the conditions for human development are met, one may conclude that the quality of life is satisfactory. If these conditions are not met, there is a need to take action to improve the quality of life.

In 1990, the United Nation's Program for Development (PNUD) created the Human Development Index (IDH). The index has been refined over the years, but its basic philosophy has been maintained. Using the concept of IDH, Rodrigues (1991) constructed the Index of Social Development (IDS) so that IDH indicators could measure social development. The IDS includes the following variables: life expectancy, adult literacy rate, and the Gini distribution index. The developed methodology attributes 1 (one) to each variable's best observed value and 0 (zero) to each variable's worst observed value. The intermediary numbers are calculated by interpolation.

Rodrigues' (1993) second version of the IDS added a number of new variables. The newer IDS included a health index, developed from life expectancy and child mortality figures, an education index, constructed using the adult literacy rate and the education level of the population above 10 years of age, and an income index, obtained from per capita income figures and the ratio of income participation of the richest 20% and the poorest 20% of the population.

Analyzing the social conditions of various Brazilian states, Rodrigues (1994) developed a third IDS version. In this version, the income index is now composed of the average income of the economically active population (PEA) divided by the ratio of the income

participation of the richest 10% and the poorest 20% of this population. It is observed that in subsequent versions of the IDS, the author tries to improve the methodology to better represent Brazilian reality.

In 1995, the Index of Economic and Social Development (IDES) was created to verify the relative development level achieved by each of Ceará's municipalities in 1991. The IDES is composed of only socioeconomic variables. Its income indicator includes income per capita and the Gini Index; its health indicator is the infant mortality rate; the housing indicator consists of variables representing water supply, sanitary conditions, and garbage collection; and the education indicator is the literacy rate (Oliveira *et al.* 1995).

Schwartzman (1997) gives emphasis to the fact that most efforts to measure quality of life are restricted to measuring the effect of negative variables, such as nutritional deficiency, lack of services, infant mortality, and sub-standard living conditions; and this restriction creates distortions. He asserts that in the formation of an index of the quality of life, the level of satisfaction of the investigated population must be considered. In 1997, Fernandes (1997) applied Schwartman's perception that the quality of life is linked with satisfaction to develop the Index of Quality of Life (IQV).

In this study, we employ the quality of life concept defined by Fernandes, conventional economic variables, and other economic variables specifically attuned to the studied population's level of personal satisfaction. This refinement was made because quality of life and level of satisfaction are intertwined, and satisfaction is dependent on subjective values. The rural Brazilian puts a different value on treated water, garbage disposal facilities, sanitary conditions, and access to electricity and durable consumer goods than does the urban resident.

Due to its complexity and range of application, there is no unique meaning for the phrase "quality of life"; but the concept, with its implied concern for human beings, has the potential to point rural development programs in a new direction (Cebotarev, 1982).

3. Method of Analysis

The Quality of Life Index

To verify the influence of the São José Project on the community's quality of life, information regarding the local situation was gathered from before and after the Project's effects were felt. The quality of life level is then estimated using an aggregated index of the following indicators: housing conditions, sanitary conditions, durable goods availability, education facilities, and access to the media. These indicators will suggest if the quality of life of the community has altered as a result of the São José Project.

As mentioned earlier, Fernandez developed the method used in this study to calculate the Quality of Life Index. The Index is constructed using the indicators that form the Index and scores and weightings of the variables that form each indicator. The satisfaction values range from 0 to 3 and are determined by the producer. The weightings are also determined by the producer and indicate the importance of each variable to the producer. Measurement of the satisfaction level was accomplished as follows:

Low satisfaction.....1
Medium satisfaction.....2
High satisfaction.....3

The Index of Quality of Life may he expressed in the following form:

$$IQV = \frac{1}{n}\sum_{j=1}^{n}\left(\frac{\sum_{i=1}^{m} E_{ij}P_{ij}}{\sum_{i=1}^{m} E_{max_i}P_{max_i}}\right)$$

The contribution of each indicator to Quality of Life Index is obtained as:

$$C_i = \frac{\sum_{j=1}^{n} E_i P_{ij}}{\sum_{j=1}^{n} \sum_{i=1}^{m} E_{max_i} P_{max_i}}$$

where:
IQV = Index of Quality of Life of the population, measured for each period (before and after implantation of the project);
E_{ij} = score of the i th indicator, obtained by j th producer;
P_{ij} = weight of the i th indicator, defined by j th producer,
i = 1,2,...,m, number of indicators;
j = 1,2,...,n, number of producers.
P_{maxi} = maximum obtainable weight of i th indicator;
E_{maxi} = maximum score of i th indicator;
C_i = contribution of indicator i to IQV.

The difference (Δ) observed between two values of IQV define the change in the quality of life of the population. This alteration was evaluated as following:

a) Decrease in life quality: $\Delta < 0$
b) Maintenance of level of life quality: $\Delta = 0$
c) Increase in life quality: $\Delta > 0$.

Definition of Variables

The following are the variables and the scoring method used in this study.

a) Living Conditions

I - Type of home construction
i) Earthen wall.....0
ii) Wall of bricks.....1
iii) Wall of bricks and plaster..... 2

II – Type of Floor
i) Earth.....0
ii) Bricks/cement..... 1

The sum of the two items' values is the score of the variable Living Conditions.

b) Sanitation

I – Disposal of human waste
i) open or buried.....0
ii) cesspool (fossa)..... 1
II – Disposal of domestic garbage
i) open..... 0
ii) buried or burnt..... 1
III – Water for human consumption
i) not treated..... 0
ii) treated..... 1

c) Durable Goods

This variable is a measure of the quantity of durable goods possessed by the producer, and is measured both before and after the implantation of the project. The goods are organized in three groups, and each group is composed of goods of equivalent values.

1st group: stove, sewing machine, sound system, working tools, etc.
2nd group: refrigerator, television, small electric generator, satellite dish, etc.
3rd group: car, motorcycle, agricultural machinery (tractor, etc)
The variable is measured as follows:
i) does not possesses any of the above mentioned goods...0
ii) possesses at least one Group 1 good and has no goods from Groups 2 & 3.....1
iii) has at least one good from groups 1 & 2 and no group 3 good.....2
iv) possesses at least one good from each of the three groups....3

d) Access to Media
i) no access to radio, newspapers/magazines, or television...0
ii) access to the radio but no access to other media.....1
iii) access to radio and television but no access to newspapers/ magazines.....2
iv) has access to all media..... 3

Test for Difference of Means

To verify the existence of difference between the mean Quality of Life values of the same group in different periods, the panel test suggested by Levin (1978) was applied and is expressed as follows:

$$t = \frac{\overline{IQV}_A - \overline{IQV}_D}{\sigma_{DH}}$$

where:

$\overline{IQV}_A$ = mean value of index of quality of life before the implantation of the irrigation project;

$\overline{IQV}_D$ = mean value of index of quality of life after implanting project;

σ_{DH} = standard error of the differences.

Employment Generation (change in total labor force)

Total work by the rural population is the sum of labor used in agriculture and other activities (Sampaio, 1983) and is expressed as follows:

$$T = FS + QZ = \sum_i \sum_j F_{ij} S_{ij} + \sum_k \sum_j Q_{kj} Z_{kj}$$

where:

S = column vector (n x 1) of cultivated area;

S_{ij} = area occupied by crop i (i = 1, 2,..., m) in property j (j = 1, 2,..., n);

F_{ij} = labor required to produce crop i, per unit area, in property j;

F = row vector (1 x n) of labor required, per unit area, for production of S;

Q = row vector (1 x m), time spent in other activities and services;

Z = column vector (m x 1), quantity of other goods and services;

Z_{kj} = quantity of goods and services (K) produced in property j:

Q_{kj} = labor required to produce goods and services (K) in property j.

As $\sum S_{ij} = S$, where S is the total cultivated area, change in amount of agricultural employment due to change is total cultivated area (S), area planted with each crop (S_i) and labor required per unit area (F_i) can be deduced. An increase in cultivated area will create more jobs in the rural area.

$$t = \frac{\overline{IQV}_A - \overline{IQV}_D}{\sigma_{DH}}$$

On the other hand, the labor force may change without any change in total cultivated area, due to substitution of non labor intensive crops for labor intensive crops. The level of employment may increase

even though total cultivated area diminishes or total employment may diminish even though total cultivated area increases.

$$\Delta T = \sum_i \sum_j F_{ij} \Delta S_{ij} \gtreqless 0, \quad \text{independently } \Delta S \gtreqless 0.$$

It is also known that a change in production technology may change the need for labor. When new production technology is labor intensive, the level of employment increases.

$$\Delta T = \sum_i \sum_j S_{ij} \Delta F_{ij} > 0$$

Generally, changes in technology that lead to increased agricultural productivity are labor saving, consequently, reducing employment.

$$\Delta T = \sum_i \sum_j S_{ij} \Delta F_{ij} < 0$$

Technological innovations usually contribute to the expansion of area under cultivation, thus compensating for the negative employment effect caused by the technology's labor saving aspect. In the similar way, other activities may increase or reduce the level of employment.

Considering a certain project, the change in the level of employment may he measured

$$\Delta T = \sum_i \sum_j F_{ijt_1} S_{ijt_1} - \sum_i \sum_j F_{ijt_0} S_{ijt_0} + \sum_k \sum_j Q_{kjt_1} Z_{kjt_1} - \sum_k \sum_j Q_{kjt_0} Z_{kjt_0}$$

Change in Income

The change in agricultural income of a given farm population is due to various factors: change in total cultivated area, change in cultivated area of each crop, variation in profit per unit of crop, and change in average productivity.

Sampaio, considering the effect of a project in a specific region,

used the following calculation to determine the income of the producers benefited by the project:

$$R = PLS - CS + \dot{P}Z$$

where:
R = income;
P = row vector (1 x n) of prices received by producer;
L = diagonal matrix (n x n) of productivity;
$\dot{P}$ = row vector (l x m) of net prices of services and other bens produced;
C = row vector (1 x n) of cost per unit area, paid by farmer;
S and Z = as previously defined.

In general, the change in income in relation to before and after project implementation may he calculated as:

$$\Delta R = \left[\sum_i\sum_j P_{ijt_1} L_{ijt_1} S_{ijt_1} - \sum_i\sum_j C_{ijt_1} S_{ijt_1}\right] - \left[\sum_i\sum_j P_{ijt_0} S_{ijt_0} - \sum_i\sum_j C_{ijt_0} S_{ijt_0}\right]$$

$$+ \left[\sum_k\sum_j \dot{P}_{kjt1} Z_{kjt1} - \sum_k\sum_j \dot{P}_{kjt0} Z_{kjt0}\right]$$

where:

P_{ijt_1} = price per unit of product i received by producer j at the time the project was evaluated;

L_{ijt_1} = productivity of crop i, obtained in property j;

S_{ijt_1} = area planted with crop i, on property j at the time of evaluation;

C_{ijt_1} = production cost per unit area, to produce crop i in property j at the time of evaluation;

P_{ijt_0} = price per unit of product i received by producer j at the time of beginning the project;

S_{ijt_0} = area planted with crop i, on property j at the time of implanting the project;

C_{ijt_0} = production cost per unit area, to produce crop i in property j at the start of the project;

$\dot{P}_{kjt_1}$ = net unit price of other goods and services produced by farmer j at the time of evaluation;

Z_{kjt_1} = quantity of other services and goods (K) produced by farmer j at the time of evaluation;

$\dot{P}_{kjt_0}$ = net unit price of other services and goods (K) produced by farmer j before the project;

Z_{kjt_0} = quantity of other services and goods produced by farmer j before the project.

4. Results and Discussion

Family Quality of Life

a) Sanitary Conditions Indicator

The results related to sanitary conditions were obtained by aggregating the values obtained for the following variables: destination of human sewage, disposal of domestic garbage, and use of treated water for human consumption (Table 1).

Before the irrigation project was implemented, 90.91% of the human sewage was destined to open space; after the project's implementation, this percentage fell to 81.82%. The use of cesspools was 9.09% before the project and rose to 18.18% at the time of data collection.

Before the project was implemented, 63.64% of the farmers' domestic garbage was disposed of in open space; after the project, this percentage fell to 45.45%. Families buried or burned 36.40% of their garbage before implementation and 54.55% after.

In both periods, drinking water was obtained from wells. It is observed that there was a great increase in the percentage of families consuming treated water in the, rising from 18.18% to 81.82% in the second period.

Table 1 – Absolute and relative number of families studied, distributed by sanitary conditions before and after installation of the Recreio Community irrigation project.

Specification	Before		After	
	Number	%	Number	
Destination of human sewage	**11**	**100.00**	**11**	
open space	10	90.91	9	
Cesspools	1	9.09	2	
Disposal of domestic garbage	**11**	**100.00**	**11**	
open space	7	63.64	5	
buried or burnt	4	36.36	6	
Drinking water	**11**	**100.00**	**11**	
Untreated	9	81.82	1	
Treated	2	18.18	10	

Source: Research data.

The Sanitary Conditions indicator pointed to significant improvement in sanitation after the project was implemented. Since unsanitary conditions are a major contributor to disease, a significant improvement in sanitation will undeniably lead to a better quality of life.

b) Living Conditions Indicator

Derived from home wall and floor construction considerations, the Living Conditions indicator shows a decrease in the percentage of

family homes with earthen walls. The percentage of families building walls from bricks finished with plaster increased 17.18%, from 54.55% before to 72.73% after the irrigation project (Table 2).

The percentage of homes with earth floors diminished 9.09%, from 18.18% before the project to 9.09% after the project's implementation. The percentage of homes with brick and cement floors increased from 18.82% before to 90.91% after project implementation.

These figures point to an improvement in living conditions in the later period. It is important to point out that the families are living in their own houses and are using gas or kerosene small lanterns for illumination.

Table 2 – Absolute and relative frequency of families studied, distributed by type of home construction before and after the installation of irrigation project in Recreio Community

Specification	Before		After	
	Number	%	Number	%
Type of construction	**11**	**100.00**	**11**	**100.00**
Earthen walls	2	18.18	1	9.09
Brick	3	27.27	2	18.18
brick/plaster	6	54.55	8	72.73
Floor type	**11**	**100.00**	**11**	**100.00**
clay	2	18.18	1	9.09
brick/cement	9	81.82	10	90.91

Source: Research data.

c) Accumulation of Durable Goods Indicator

According to study data, shown in Table 3, the most acquired durable good after project implementation was the television set. The percentage of families possessing a television increased from 9.1% before the project to 100% after. Before the project, 72.7% of the families had a stove in their house; this percentage also increased to 100% in the second period. 9.1% fewer families owned manual

cultivators after the project was implemented, due to the mechanization of soil preparation.

Table 3 – Absolute and relative frequency of families, distributed by durable good ownership before and after implementation of the Recreio Community irrigation project

Specification	Before				After			
	Yes		No		Yes		No	
	Number	%	Number	%	Number	%	Number	%
Radio	11	100.0	0	0.0	11	100.0	0	0.0
Sewing machine	5	45.5	6	54.5	5	45.5	6	54.5
Bicycle	7	63.6	4	36.4	8	72.7	3	27.3
Stove	8	72.7	3	27.3	11	100.0	0	0.0
Television	1	9.1	10	90.9	11	100.0	0	0.0
Sound equipment	0	0.0	11	100.0	3	27.3	8	72.7
Hand grinder	6	54.5	5	45.5	7	63.6	4	36.4
Cultivator	4	36.4	6	63.6	3	27.3	8	72.7

Source: Research data.

These results indicate an increase in demand for leisure goods (television), newer technology, and necessary goods (stove).

d) Media Access Indicator

The data presented in Table 4 show a significant increase in access to media after the project's implementation. Before the irrigation project, 9% of families had access to radio and television; this number increased to 90.9% at the time of data collection.

Table 4 – Absolute and relative frequency of families divided according to access to media before and after the installation of irrigation project in Recreio community.

Specification	Before		After	
	Number	%	Number	%
- access to radio and no access to television	10	90.9	1	9.1
- access to the radio and television	1	9.1	10	90.9

Source: Research data.

Analysis of the Quality of Life Index

The contribution of each indicator in the formation of the Quality of Life Index is given in Table 5. The Table shows that during both periods in the study, the type of home one lives in, earthen or brick and plaster, is the most influential factor in the Index's composition. Before the project, the Living Conditions indicator's weighting accounted for 51.8% of the IQV, followed by Durable Goods (26.51%), Media Access (13.25%) and Sanitary Aspects (8.43%). Post-project data also show that the Living Conditions indicator again contributes the most substantial portion of the IQV (30.90%); this is a reflection of the importance of home to the selected families' feelings of well-being. The weightings of the other indicators in the post-project IQV were as follows: Durable Goods, 28.65%; Media Access, 22.47%; and Sanitary Aspects, 17.98%.

It is also observed that the change in all indicators after project's implementation positively affected the IQV. The Living Conditions indicator increased .0303 (a 27.91% increase); the Sanitary Conditions indicator increased .0631 (a 357.14% increase); and the Durable Goods and Media Access indicators increased .0732 (increases of 131.82% and 263.64%).

Table 5 – Participation of indicators in the composition of the Quality of Life Index (IQV) for the population of Recreio Community before and after the irrigation project

Indicators	IQV "before"		IQV "after"		Difference		Increase in the Value of Indicators (%)
	Contrib.	%	Contrib.	%	Contrib.	%	
Living Conditions	0.1086	51.81	0.1389	30.90	0.0303	12.63	27.91
Sanitary Aspects	0.0177	8.43	0.0808	17.98	0.0631	26.32	357.14
Durable goods	0.0556	26.51	0.1288	28.65	0.0732	30.53	131.82
Media Access	0.0278	13.25	0.1010	22.47	0.0732	30.53	263.64
Total	0.2096	100.00	0.4495	100.00	0.2399	100.00	780.50
Increase in IQV				114.46			

Source: Research data.

The IQV value increased by 0.2399 ($IQV_{before} = 0.2096$ and $IQV_{after} = 0.2399$) after the Recreio irrigation project was implemented. This increase represents an improvement of 114.46% in the quality of life of the benefited families. However, since the IQV index can reach unity, the observed IQV increment in 1998 is still low. It may then be concluded that there is much to be done if the families of Recreio Community are to reach a desirable level of well-being.

The test of difference of means indicates that the two indices, IQV before the project and IQV after project implementation, differ statistically at a significance level of 5%. This suggests that the irrigation project substantially improved the beneficiaries' quality of life.

Similar, results were obtained by Fernandes (1997) when he studied the effect of a mining project on the quality of life of a population in the Cajari region of Brazil. The author observed an 86.95% increase in IQV.

Change in Employment

Table 6 shows the estimates of total employment before and after the project and the number of jobs added or subtracted. There was an abnormally rainy period in 1998, causing some of the family

farms to suffer partial or total loss of agricultural production and certainly influencing our results.

Table 6 – Employment by crop (expressed in man/day)

Crop	Before (a)	After (b)	Difference (b - a)
Rice	738.5	708.2	-30.3
Corn	205.5	209.1	3.6
Bean	259.0	532.5	273.5
Cotton	31.0	181.5	150.5
Banana	-	153.0	153.0
Mixed cropping (corn-bean)	53.0	138.3	85.3
Total	1,287.0	1,922.6	635.6

Source: Research data.

The results show a substantial increment of new jobs. This is mainly due to the use of additional labor to produce beans and bananas. It is observed that few families cultivate bananas, and employment in cotton cultivation was stimulated by new government incentives.
In 1998, family labor accounted for 64.0% of the community's total farm labor force; the remaining 36.0% was hired labor. 98.35% of the total labor force were men, 1.20% were women, the remaining 0.44% of the labor force were children of more than 14 years. The largest proportion of hired labor (41.08%) was employed to manually clear weeds, followed by harvesting (28.07%), planting (17.06), irrigation (5.97%), fertilization (5.76%), and soil preparation (2.06%). Small farms employ labor intensively because they use traditional agricultural production technology.

The study found that the main non-agricultural occupations are teacher, cook, washer, maidservant, and mason.

Change in Total Gross Income

The income of Recreio Community families comes from crop

production, pension payments, animal husbandry, and other activities. The information given in Table 7 suggests that average monthly family income just before the project was R$ 207.48, equal to 1.6 times the monthly Brazilian minimum wage. In 1998, this value increased to R$ 251.64, 1.94 minimum monthly salaries.

Table 7 – Total gross income of Recreio Community families before and after irrigation project implementation.

Income Source	Before			After		
	Annual Average Gross Income (R$)	Average Gross Monthly Income (R$)	%	Annual Average Gross Income (R$)	Average Gross Monthly Income (R$)	%
Agriculture	899.06	74.92	36.11	873.61	72.80	28.93
Animal husbandry	517.95	43.16	20.80	616.09	51.34	20.40
Retirement	850.90	70.91	34.18	780.00	65.00	25.83
Other activities	221.82	18.48	8.91	750.00	62.50	24.84
Total	2.489.73	207.48	100.00	3.019.70	251.64	100.00

Source: Research data.

It should be remembered that the drought year of 1998 caused a decrease in agricultural production and, consequently, the income of the interviewed families. It is also worth noting that well water is used to irrigate when there is insufficient rainwater for crop production. When the drought is severe, water is used only for human consumption.

Retirement income represents a significant proportion of total community income. Before the project, retirement income represented 34% of the community's average annual gross income. In 1998, retirement income accounted for 25.83% of the community's average annual gross income. The percentage of total community income coming from pension income makes retirees an important influence on crop planting and goods acquisition decisions. Mendes Segundo (1998), evaluating the socio-economic aspects of farmers benefited by the Jaguaribe Apodi-CE project, observed the importance of retirement

income to the population's gross income, accounting for 24.84% of the total income of the families under study.

5. Conclusions and suggestions

The irrigation project contributed more than 100% to increase the Comunidade Recreio's quality of life. However, the calculated IQV value for the second period is below the average national value. This suggests that though the increase in the population's IQV was significant, their quality of life remains substandard. Financial resources supplied through the project permitted only the purchase of a set of motors and the construction of four wells, not enough for irrigation during the drought period.

The Living Conditions indicator was the largest constituent of the IQV in the two periods studied. The indicators Durable Goods and Media Access also contributed substantially to the Quality of Life Index. The change in all indicators after the project's implementation had a positive effect on the IQV. The irrigation project improved well-being, created new jobs, and contributed to increase family incomes, thereby helping to reduce rural migration to urban areas and the social problems this migration often initiates.

It is clear; public policy should promote small irrigation projects to develop rural agriculture. Government agriculture support programs should be principally oriented toward small farmers, providing them with access to credit and a rural agricultural extension service. This type of program would increase rural income and, consequently, improve the quality of rural life.

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