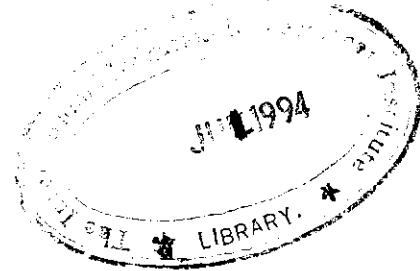


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**Short Report Series**  
**on**  
**Locally Managed Irrigation**

*Report No. 5*



**IRRIGATION MANAGEMENT  
TRANSFER IN COLOMBIA:  
A PILOT EXPERIMENT AND ITS  
CONSEQUENCES**

Douglas L. Vermillion and Carlos Garces-Restrepo

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Program on Local Management

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P.O. Box 2075, Colombo, Sri Lanka

Telephone: 94-1-867404 Telex: 22318 & 22907 IIMIHQ CE

Facsimile: 94-1-866854; E-Mail: IIMI (CGNET), IIMI@CGNET.COM (INTERNET)

## Purpose of the Series

The *Short Report Series on Locally Managed Irrigation* is designed to disseminate concise information on the role of local management in irrigation and irrigation management transfer or turnover experiences and policies. The *Series* is distributed worldwide to a broad range of people—policymakers, planners, researchers, donors and officials in both public and nongovernmental organizations—who are concerned with the irrigated agriculture sector. IIMI's goal is not to promote policies such as irrigation management transfer, but to enhance the knowledge base available to decision makers and advisors as they face questions of policy adoption and strategies for implementation.

The title of the *Series* was recently revised due to suggestions from Network members who saw the need to broaden the scope of the *Series* to also include issues of the sustainability of locally managed irrigation and support systems.

Locally managed irrigation can be of many types, such as traditional farmer-constructed diversion or tank schemes, indigenous and often new lift irrigation, government-constructed but farmer-managed irrigation systems and systems where management is or has been transferred from an outside agency to a local user organization.

By "irrigation management transfer" we mean some degree of transfer of responsibility and authority for irrigation management from the government to farmer groups or other nongovernmental entities. This generally involves contraction of the role of the state and expansion of the role of the private sector and water users in irrigation management. In other words, there is a shifting upstream of the point where management responsibility and control of the water supply are transferred from the irrigation authority to local management. This may involve changes in policies, procedures, practices and the performance of irrigated agriculture. It may or may not involve "privatization" of ownership of the assets of the irrigation system. The *Short Report Series* addresses questions such as the following.

*What are the necessary conditions which support viable locally managed irrigation?*

*What socio-technical conditions, institutional arrangements and change processes lead to sustainable locally managed irrigation?*

*What is the range of different models that are being applied worldwide for turnover or transfer of responsibility for local management for recently developed irrigation?*

*What are the effects of management transfer on the productivity, profitability, financial viability, equity, efficiency and sustainability of irrigated agriculture?*

*What are the perspectives of farmers, managers, policymakers, urban consumers and other stakeholders in irrigated agriculture about irrigation management transfer?*

*What adjustments in government may be needed as a result of turnover to provide support to locally managed irrigation systems and to improve productivity in the public sector?*

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**Dr. Douglas Vermillion or Dr. Sam H. Johnson III,  
Program on Local Management, IIMI,  
P.O. Box 2075, Colombo, Sri Lanka.  
Fax: 94-1-866854; Telex: 22318/22907 IIMIHQ CE;  
E-Mail: IIMI @CGNET.COM; Telephone: 94-1-867404.**

## **Editors' Note**

Numerous countries around the world are attempting to formulate policies or implement programs to transfer management of irrigation systems from government agencies to local farmer organizations. The first motivation for this is often the inability of governments to finance and manage irrigation by themselves. Upon failing to recover enough costs through irrigation fees, governments then often take the step to transfer management responsibility to farmer organizations.

Management transfer normally gives rise to numerous problems and questions. What legal and institutional arrangements need to be in place in order to provide the security and motivating conditions needed for farmer organizations to be viable? What aspects of the transfer process are needed to prepare farmers to take over management? And, what are the results of management transfer for water management performance, financial and physical sustainability of the irrigation system and the productivity and profitability of the production of irrigated crops?

This report provides information on key conditions, processes and results of irrigation management transfer in one of the earlier experiments with it, in Colombia. This case provides some interesting features of management transfer not found elsewhere—the farmers took the initiative for it, farmers were already paying most of the cost of O&M prior to transfer and the water users organization was a legal entity represented by a lawyer. Issues of agency reorientation and the tension between the objectives of cost-efficiency and physical sustainability of infrastructure are important in this case.



# IRRIGATION MANAGEMENT TRANSFER IN COLOMBIA: A PILOT EXPERIMENT AND ITS CONSEQUENCES<sup>1</sup>

Douglas L. Vermillion and Carlos Garces-Restrepo<sup>2</sup>

## INTRODUCTION

The 1960s and 1970s saw a huge wave of international investment in construction and rehabilitation of irrigation systems which amounted to roughly US\$15 billion per year. By the 1980s, it became apparent that the previously anticipated benefits of this investment were not being realized. This was due to a combination of factors: faulty design and construction, rapid deterioration of irrigation systems, failure to adequately finance management of irrigation systems, poor maintenance and maldistribution of water (Repetto 1986; ADB and IIMI 1986).

Also by the 1980s, governments began to privatize state enterprises and implement structural adjustment programs aimed at reducing the role of government in the management of natural resources and liberalizing developing economies (Hanke 1987). The structural adjustments were prompted mainly by inefficiencies in public agencies and by debt burdens and other financial pressures which made it impossible for many governments to continue subsidizing state enterprises (Cowan 1990).

The policy of transferring irrigation management from government agencies to water users associations is part of the more general structural adjustment process which is continuing into the 1990s. It is now very widespread and reflects the need of many countries to reduce government expenditures for recurring costs of irrigation management, particularly in countries which have been unable to collect irrigation service fees from farmers (Vermillion 1992; Small and Carruthers 1991). It is widely assumed that management transfer will reduce the costs of irrigation for governments and that farmers will be capable of taking over management and bearing the increase in costs. It is thought that farmers should have a greater incentive than government agencies to improve the efficiency, productivity, and sustainability of irrigation (Vermillion 1991).

Management transfer may involve outright privatization of ownership of irrigation structures (Farley 1994) or it may only involve mobilization of farmer resources to manage systems (Wijayarathna and Vermillion 1994). Where farmers are already paying for the cost of irrigation services there is some evidence that farmers are more willing to take over management from the government (Svendson and Vermillion, Forthcoming). But in many cases, especially in developing countries, governments have failed to collect irrigation fees and are forced to transfer management for financial reasons. In these cases, management transfer comes at the initiative of the government and it usually means an increase in cost of irrigation to farmers. This is during a time when world grain prices have been on the decline.

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1 This study was funded by the Privatization and Self-Management Project with grants from the German Government (BMZ/GTZ) and the Ford Foundation.

2 The authors are a rural sociologist and agricultural engineer, respectively, and are irrigation specialists for the International Irrigation Management Institute. The authors wish to thank Juan Fernandez for his assistance in collecting much of the data for this study; the Instituto Colombiano de Hidrologia, Meteorologia y Adecuacion de Tierras (HIMAT) for their cooperation and farmers of Coello and Saldaña for their time and insights.

In Latin America, privatization has also been imposed and implemented by governments generally (Glade 1991). However in Colombia, farmers in the Coello and Saldaña irrigation districts pressurized the government to take over management of their irrigation systems in 1976, prior to the wave of privatization (Plusquellec 1989). In contrast to most situations, farmers in these systems had already repaid construction costs and were also paying for routine operation and maintenance. They petitioned the government to take over management on the grounds that they had the right to own the systems because, after 20 years, they had repaid the required costs of construction of the systems. They judged that they could manage the systems more efficiently by themselves and could keep the costs down in the future.

This paper<sup>3</sup> describes the context in which management transfer occurred and examines some of the effects of transfer on management performance. Key questions addressed by this study are:

- 1) What aspects of the management environment or transfer process supported or detracted from the viability of local management?
- 2) How did management transfer affect the performance and sustainability of the irrigation systems?

This case of irrigation transfer was selected in part to examine the conditions which motivated farmers to take over management. It also provides an interesting contrast to situations common in Asia where the legal status of farmer organizations is weak and where considerable emphasis is placed on motivating, organizing and training farmers to take over irrigation management (Korten and Siy 1988; Vermillion 1989). In this case, the transfer was primarily a process of negotiation and changing of staff.

## CONTEXT AND DEVELOPMENT OF THE SYSTEMS

Coello and Saldaña Irrigation Districts are located in the Tolima Valley in central Colombia (Figure 1). They are at an elevation of about 350 meters above sea level. Annual rainfall is approximately 1,200 mm per year.

People in the valley derive their livelihood mostly from agriculture. Cotton was an important crop in the early years of the irrigation systems (1950s and 1960s), but it was eventually replaced by rice which became the main irrigated crop by the 1970s. Irrigated maize, sorghum, fruit and vegetables are also now grown.

The Coello Irrigation District is a river diversion system with an intake design capacity of 28 cubic meters per second ( $m^3/s$ ), located on the Coello River. It has an irrigated area of approximately 25,600 hectares (ha), making it one of the largest schemes in the country. It has 1,347 water users with 1,826 holdings. Average farm size is 14 ha.

The Saldaña Irrigation System is also a river diversion scheme and is located south of Coello District on the Saldaña River. It has an intake design capacity of 30  $m^3/s$ . Its irrigated area is 14,000 ha, with 1,500 water users having 1,850 holdings. Average farm size is 7.5 ha.

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3 Field work for this study was carried out in 1993. It involved collection of secondary data, informal group and individual interviews with farmers, district management and board members and agency staff and structured interviews with randomly selected farmers.



Average landholding sizes have steadily declined over the period before and after management transfer, with more smaller holdings and fewer larger holdings today than before the transfer. In 1968, 26.6 percent of the farms in the Coello District were below 5 ha in size, while by 1993, 38.5 percent were below 5 ha. In 1968, 14.4 percent of the farms exceeded 50 ha. In 1993, only 6.4 percent exceeded 50 ha (Table 1).

Both systems were originally constructed and managed as a single district. Feasibility studies for the Coello-Saldaña District began in 1943 under the direction of Caja Agraria, a semiprivate agency. Construction was completed in 1953, when both systems became operational.

## TRANSFER POLICY AND PROCESS

In the early 1960s, the Government of Colombia entrusted the operation and maintenance of its irrigation districts to INCORA, a government land-reform agency. The performance of the agency in irrigation management was modest at best. Water users of the Coello-Saldaña District were not only unhappy with the poor O&M service provided but were also concerned about the high management costs. In the early stages of development in the 1950s, more than 90 percent of the farmers paid the water fee, but this percentage declined over time due to farmers' dissatisfaction with the quality of management. Declining fee collections further hindered the ability of the agency to provide an effective irrigation service.

As a result, in 1975, the farmers, who had already formed a water users association (WUA), decided at their own initiative to make a formal request to the government that management responsibility for the system be transferred to the WUA. The WUA argued that the scheme was legally their property on the basis that they had already repaid the government the capital costs of construction.<sup>4</sup>

As part of a policy to improve the performance of the irrigation districts, in 1976, the government created the Colombian Institute of Hydrology, Meteorology and Land Development,<sup>5</sup> or HIMAT, which had an initial task to turn over the management of the Coello-Saldaña District to two separate water users associations, thus establishing two separate districts, Coello and Saldaña. This was the first case of irrigation management transfer in Colombia and it set a precedence for further transfers later on.

Negotiations for management transfer were completed within a year between 1975 and 1976. The WUAs hired their own lawyer to represent them in negotiating the terms of the transfer. Issues to be resolved were the disposition of existing district staff, ownership status of scheme assets and the future degree of control or involvement of HIMAT in the districts. It was finally agreed that some of the existing staff would be retained by the districts and others would be transferred out. Ownership of assets would remain with the government. HIMAT would retain a role of oversight for district management, to ensure that the systems were properly maintained.

The transfer process employed a legal rule in the country's constitution referred to as "Delegation of Administration," by which a public good (in this case, an irrigation district) could be turned over to a private-sector corporate entity (a WUA) for administration on behalf of the state. The users were then empowered to recruit staff and organize and manage operation and

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4 Prior to construction the farmers agreed with the government to repay construction costs within a 20-year period. It was repaid by 1975.

5 In Spanish this is, Instituto Colombiano de Hidrologia, Meteorologia y Adecuacion de Tierras.

maintenance of the two systems with the proviso that it would be financially self-reliant and government subsidies for O&M would be discontinued.

Since responsibility for the districts was only "delegated," ownership of assets remained with the government. The government argued that under existing laws it could not relinquish ownership of scheme assets. This "delegation of administration" created a continuing labor relations conflict between the districts and the government which resulted in numerous legal debates and proceedings until the 1990s. Labor laws prohibited the firing of existing staff previously hired by the government. This problem became widespread when the government started transferring management to farmer districts throughout the country in 1990. Eventually, in 1993, a new land development law was enacted with the intent to grant full control to the districts to hire and fire personnel as they wish.<sup>6</sup>

After the transfer, WUAs for Coello and Saldaña districts elected WUA boards to supervise their respective districts. Each board had, and still has, seven members with fixed quotas for two categories of farmers—four members having farm sizes less than 20 ha and three with farm sizes of more than 20 ha. After transfer, each board recruited general managers who were engineers. The districts then became responsible for day-to-day operation and maintenance of the systems. This included setting and collecting water fees, hiring and firing their own personnel and planning yearly budgets. In practice, the government agency HIMAT retained considerable influence over the management of the districts. This included providing advice and consent over O&M budgets and work plans, water fee levels and staff disposition.

## **PERSPECTIVES OF FARMERS AND AGENCY STAFF ABOUT THE TRANSFER**

The initiative for transfer came from the water users rather than from the government. Farmers assessed the implications of transfer and gave their collective approval in general assembly meetings. By the time of transfer, farmers were already financing most of the cost of O&M and had the expectation that they would be able to keep the irrigation fees from rising or to even reduce them.

Farmers interviewed for this study had the following main positive perceptions about the transfer:

- 1) It helped keep irrigation costs down.
- 2) It improved accountability of staff to the farmers.
- 3) It improved the timeliness and responsiveness of management decisions.
- 4) It led to a decrease in political appointments for staff positions.

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<sup>6</sup> Ministry of Agriculture, Government of Colombia, *Land Development Law*, January 1993.

Interviews with WUA board members in both Coello and Saldaña indicated a strong priority for a policy of irrigation cost reduction. Interviews with farmers also revealed the widespread perception that water distribution performance, structural maintenance and cost efficiency could have been much more improved had the users had full control over staff disposition and budgets prior to the 1993 Land Development Law. Interestingly however, there is a strong feeling on the part of the users that the agency should not make a total withdrawal and that it should continue providing an advisory and monitoring role in technical and financial planning. Sixteen of 20 farmers interviewed in the Coello District stated that HIMAT should continue to be involved in administrative oversight and should not withdraw completely. Farmers also had an expectation that the government would eventually rehabilitate and expand the systems. However, 60 percent of farmers interviewed expressed the preference that the WUA should own the structures.

Some farmers expressed the view that by taking over the administration of the systems they were providing a service to the nation by diminishing social unrest related to water problems and that therefore the government had some obligation to compensate the WUA for that service.

District managers expressed concern that the strong farmer disposition toward cost reduction was resulting in some decline in service. More experienced personnel have been replaced by younger, inexperienced staff; key technical positions have been eliminated or merged and little or no expenditure is being made in training or replacement of structures.

HIMAT staff at the district and higher levels were initially generally resistant to the transfer. They had the perception that jobs would be lost and the role of the agency would diminish in irrigation management, not only in Coello and Saldaña but eventually elsewhere as well. However, the negotiations and some political contacts made by farmers eventually resulted in the transfer decision.

Later it became apparent to farmers that HIMAT's role in the districts was more than just "oversight." They saw it as restricting their ability to further reduce staff and budgets, as the WUAs had wanted. Farmers perceived the transfer as being only partial and not enough to give them full control.

## **RESULTS OF THE TRANSFER**

### **Staff and Organization**

One of the more noticeable impacts of the transfer was the significant reduction of personnel. Before transfer, in 1975, the two districts combined had a total of 300 employees. As can be seen in Table 2, the total number of staff members for both districts was 189 by 1993, which was a 37 percent reduction. Accounting for changes in area irrigated, in 1975 there were 62.3 ha of service area per district staff member. By 1993 this had risen to 147 ha per staff member. The number of administrative staff members remained the same, at 36. Most reductions were made in maintenance and technical support staff. Staff reductions were gradual and occurred mostly through attrition and nonreplacements after retirements. This was because of a law making it difficult for managers to fire government employees. The reduction in personnel allowed management to streamline the organizational structure by combining sections and integrating functions. The general manager, who is responsible to the WUA Board, supervises an administrative unit and three technical units—operation, maintenance and technical services.

There is general agreement between users and agency officials that paper work has diminished and administration has become more efficient after transfer, mostly for irrigation scheduling, fee processing and for communications between users and district management.

There has never been a formal evaluation of the performance of the irrigation system. However, there is a monthly monitoring program mostly related to financial matters, including water fee collection and budgetary control. Lately, HIMAT has realized the importance of regular monitoring and evaluation and is considering establishing such a unit as part of its new regulatory role.

## **Agriculture**

After a temporary halt in expansion of irrigated area, which occurred for four years around the time of transfer, the general trend of expansion resumed until the latter 1980s (Figure 2). Largely as a result of the introduction of green revolution varieties in the 1960s and 1970s, average rice yields increased dramatically from approximately 2,500 kg in the mid-1950s to approximately 6,000 kg in 1976, at the time of transfer. By the 1990s, average rice yields were between 6,500 and 7,000 kg per hectare. Most of the increase occurred before transfer. High yield levels were sustained, and slightly increased, after transfer (Figure 3).

## **Operation and Maintenance**

There is no indication that the operation or maintenance of the system improved or deteriorated dramatically as a result of the transfer. In a survey of 20 farmers interviewed in 1993 in the Coello District, 16 stated that there had been no change in system management performance after the transfer. Water continues to be delivered without being measured below main canal offtakes. Farmer interviews reported cases of preferential deliveries to larger farmers and head enders, although this was apparently not very widespread. Figure 4 shows data on total annual water supply for two rice crops in the Coello District. The amount of irrigation water supplied per hectare remained about the same between 1978 and 1991, with no apparent improvement in water use efficiency. Relative water supply (i.e., supply/demand) has remained in the range of 2 and 2.5 throughout this period. This indicates a water use efficiency of between 40 and 50 percent.

Between 60 and 70 percent of all district income goes towards maintenance of the irrigation network. This percentage did not change significantly after transfer, since O&M budgets continued to be based on previous years' budgets and continued to be reviewed and approved by the agency. Farmers seem to be equally divided between those who feel and those who do not feel that the amount of water delivered to their fields is in accordance with what they were supposed to receive. Thirty-five percent said that proper water delivery happened "always," 30 percent said it happened "most of the time" and 35 percent said this happened "sometimes." Several smallholder farmers interviewed noted that some influential larger farmers, including WUA board members, tend to intervene in day-to-day management and give orders directly to ditchriders or other field staff, sometimes for partisan purposes. Farmers are also divided in their views as to whether the system is deteriorating. Since the government still claims ownership of system structures, farmers are unwilling to raise a capital replacement fund for system structures, although they do have a replacement fund for equipment.

## **Financial Management**

The Coello and Saldaña districts have both a fixed area water fee and a volumetric water fee. After transfer, the emphasis by farmers on cost efficiency has actually resulted in a decline in the area fee since transfer. However there has been an increase in the volumetric water fee in constant terms (1988 pesos). The area fee has dropped from about 2,900 pesos per hectare in 1976 (at transfer) to about 1,900 pesos per hectare in 1992 (in 1988 pesos; see Figure 5). The volumetric fee rose from about 0.42 pesos per cubic meter in 1976 to 0.54 pesos per cubic meter in 1992 (see Figure 6). Sixty-five percent of farmers interviewed stated that the water fees were "too high," while 35 percent said they were "about right."

When we combine the area and volumetric fee data on an annual basis, we find that the total annual cost of water per hectare rose 16.9 percent from the mid-1950s to the period 1989–92 (from 8,620 to 10,080 pesos, in constant 1988 pesos; Table 3). However, the cost of production per hectare for the main irrigated crop (rice) rose 116 percent during this period. Therefore the cost of water relative to the cost of rice production fell from 4.4 percent to 2.4 percent between these periods.

Figure 7 shows the changing patterns in levels of revenue and expenditures before and after management transfer in the Coello District. During the initial stages of scheme development, expenditures exceeded district-level revenues, because expenditures were partially covered by external subsidies and assistance. The drop in revenue and expenditures was due to the transition from scheme development to scheme management. After transfer, between 1983 and 1992, except for one year, revenues exceeded expenditure levels, with both showing a modest increase (Table 4). District revenues increased from about 9,000 pesos per hectare at transfer to 12,000 pesos per hectare (Figure 7). Main sources of revenue were the volumetric and area water fees. Other revenue sources—such as rental of farm equipment and district property, technical services, fines against members, sale of materials and charges for transporting equipment and materials—increased from about 10 percent to 20 percent of revenue between 1983 and 1992 (Figure 8).

Maintenance costs (including relevant staff costs) account for about 55 percent of total expenditures in the Coello District (Figure 9). This is followed by costs of administration and operation. The proportion of each to total costs has remained roughly the same after transfer.

## **CONCLUSION**

### **Viability of Local Management**

The policy of farmer repayment of construction costs and enforced payment of seasonal water fees engendered in the farmers enough of a sense of ownership in their systems that they lobbied the government to take over management and obtain real ownership of system assets. The fact that most farmers were paying water fees to cover O&M costs prior to turnover created a more motivating condition for the farmers to take over management. This is because of the expectation that they could not only improve management but could also contain or reduce the cost of irrigation. Farmers did not want to directly manage the systems themselves but to have staff more accountable to them. Also, skilled personnel which were needed to take over management, including engineers, were available in the private sector.

The "half-way" response of the government of "delegation of authority" only partially satisfied farmers' interest in obtaining full local control of system management. In practice, it became apparent to farmers that more responsibility than authority was transferred to the districts. Although farmers expected HIMAT to play an advisory role, the government retained more of a supervisory role. After transfer, the districts were unable to cut staff and costs as much as they wanted. However, it is apparent that farmers need and want the agency to continue to provide technical and financial advisory services. They see a need for HIMAT to act as an auditor and mediator to help legitimize the farmer organization and settle disputes.

One recent development of interest is the formation of the Federiegos, which is a national association of irrigation districts. This was created recently by farmer representatives from irrigation districts throughout the country to provide their own training, technical consulting, legal support, information, coordination, and other support services. One of its top priorities is to coordinate crop patterns and planting schedules around the country so as to optimize crop prices. It was created primarily to help ensure that support services to the districts after transfer would be available and would be in accordance with the farmers' own priorities.

Inequality in landholding sizes has decreased somewhat in the Tolima Valley over the last three decades and this has strengthened the position of the smallholders who represent a majority of the farmers. Although this has probably enhanced the viability of the farmer organizations, some tension remains between owners of large and small holdings. Farmers reported that the services of the government would be needed in the future to help mediate disputes and back up district policies to ensure that factions do not have undue influence over funds and distribution of water.

Another potential threat to the viability of local management is the steady rise in production costs and declining prices for grain crops over the last decade. While the cost of water is still low relative to the total cost of production, the cost of water could become more significant if the trends continue and the margin for profit becomes more thin. This could further motivate farmers to reduce expenditures for system maintenance.

In 1990, the Government of Colombia embarked on a program to transfer full management responsibility to all irrigation districts in the country. The new Land Development Law of 1993 is intended to ensure that a proper balance of authority and responsibility for irrigation management is transferred to the water users. We hypothesize that a more complete transfer of management authority (as will soon be the case under the new Land Development Law) will lead to a more favorable and locally sustainable result in Coello and Saldaña and in other irrigation systems in Colombia.

## **Effects on Irrigation System Performance**

After the transfer, the farmers' strategy was to contain or reduce the costs of irrigation while achieving a more responsive irrigation service. This was only partially successful. The area water fee declined as did the ratio of the cost of water to the cost of crop production. Nevertheless, district managers expressed concern that the strong farmer emphasis on cost reduction was compromising the physical sustainability of the systems.

Data indicate that the irrigation districts were fiscally responsible in the sense that expenditures never exceeded revenues after transfer occurred. Transfer also achieved the government's objective of discontinuing subsidies and making the district financially self-reliant.

Management transfer did not have a pronounced positive or negative effect on the quality of the irrigation service, although it apparently did not interfere with the farmers' ability to sustain relatively high rice crop yields. Improvements in staff efficiencies were gradually achieved.

The failure to transfer ownership of system assets to the farmer organizations, farmers' expectation that the government would eventually rehabilitate the systems in the future, and a reported lack of trust, left farmers without an incentive to raise their own capital replacement fund. This leaves unanswered the questions of how and whether the long-term physical and financial sustainability of the irrigation districts will be assured.

### **Key Lessons of International Relevance**

1. This study supports the view that it is more effective to create motivating conditions for farmers to take over management than it is to try to motivate and organize farmers in the absence of such conditions. Where such conditions exist, the transfer process becomes more a matter of negotiation than externally induced organizing. Key motivating conditions in this case included:
  - a well-defined water right at the source,
  - full legal and political recognition of farmer organizations (which was only partially realized in this case),
  - farmer investment prior to turnover (which created a sense of corporate ownership),
  - assessing an irrigation fee prior to turnover which was based on the actual system-level cost of management by the government (which revealed to farmers the cost of management by the government),
  - farmer dissatisfaction with the irrigation service prior to turnover, and
  - farmer expectations that they could improve cost efficiency and management responsiveness.
2. Farmer organizations need full control over raising and spending of revenues, hiring and firing of staff, applying sanctions, and entering into contractual relationships.
3. The profitability of irrigated agriculture and the relative value of water are key factors which determine farmers' capacity and willingness to take over management of irrigation systems. The prospects for successful transfer are probably greater where the value of water for farmer livelihoods is most pronounced. While the cost of water relative to total production is still small in this case in Colombia, declining profit margins for irrigated agriculture could constitute a future threat to financial viability. Under such circumstances, raising secondary sources of revenue constitute the replacement of public subsidies with private sector ones.
4. The managing agency will often be resistant to a transfer policy because it may represent a threat to its budgets, staff, and influence. Hence, if a transfer policy is to be implemented effectively, it is essential to have strong political support for it. In this case, farmers had to lobby with politicians to gain approval to take over management.
5. Enactment and implementation of transfer policies should be preceded by comprehensive and participatory strategic planning which includes clear definition of future agency roles after transfer. This can also help reduce resistance to transfer by the agency, especially if new positive roles are identified to replace its prior role in

system-level management (IMPISA 1992; Vermillion 1989). Such future roles could be allocation of water along river basins and environmental monitoring and regulation.

6. Farmers may not want total and abrupt withdrawal of government agencies after transfer. How total and how abrupt the withdrawal should be depend largely on how prepared farmers are to take over management. Negotiations between farmer representatives and agencies can define a new partner relationship.
7. Prior to declaration of a transfer policy, the government and farmers should clarify who will be responsible for financing and implementing future system rehabilitation and improvements and what terms and conditions will apply. This will help prevent a tendency toward deferred maintenance and encourage farmers to raise a capital replacement fund.
8. This study and others (Svendsen and Vermillion, Forthcoming) indicate that the strong farmer interest in cost reduction after transfer may tend to sacrifice the physical sustainability of irrigation systems. There may be a weakness in farmers' ability to make an appropriate trade-off between cost efficiency and long-term investment. Clarity about future responsibility and the use of technical audits by external parties may be helpful in this regard. Governments may find it useful to link conditions for future assistance to performance assessments of maintenance which can be done through technical audits.
9. Local factional differences in rural populations, lack of effective accounting practices or skills and disputes over water rights can weaken the ability of farmer organizations to provide effective and equitable irrigation services. Some external support from government agencies or user-based federations may be necessary to ensure both sustainability of locally managed irrigation and its adaptability to changing opportunities in their external environment. Hence sustainability of irrigation systems appears to depend not on total self-reliance but on a new mixture of local resources and modest external support.



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Table 1. Number of farms by size category in Coello District for selected years.

Farm Size Category	1968		1993	
	No. of Farms	% of Total	No. of Farms	% of Total
0 – 5 ha	264	26.6	703	38.5
5.1 – 10 ha	200	20.1	386	21.1
10.1 – 20 ha	207	20.8	300	16.4
20.1 – 50 ha	180	18.1	322	17.6
> 50 ha	143	14.4	115	6.4
<b>Total</b>	<b>994</b>	<b>100%</b>	<b>1,826</b>	<b>100%</b>

Table 2. Staff levels before and after transfer.

Program	Before Turnover (1975): Coello and Saldafia districts	After Turnover (1993)		
		Coello District	Saldafia District	Both
Administration	36	18	18	36
Maintenance	161	60	50	110
Operation	51	19	24	43
Tech/Hydro./Credit	52	0*	0*	0*
Total staff members	300	97	92	189
Irrigated area (ha)	18,700	15,300	12,500	27,800
Area/staff member (ha)	62.3	157.7	135.9	147.0

\* Several technical staff members were retained but shifted to other departments.

Table 3. Cost of water (In 1988 Colombian pesos), relative to rice production, before and after transfer, Coello District. \*

Period	Cost of Water/ha	Cost of Production/ha	Cost of Water/Cost of Production (%)
1953–58	Ps. 8,620	Ps. 194,812	4.4%
1984–87	Ps. 6,698	Ps. 334,400	2.0%
1989–92	Ps. 10,080	Ps. 421,200	2.4%

\* In 1998, 333 Colombian pesos = 1.00 US dollar

**Table 4. Revenues and expenditures, Coello District, 1983-92. \***

In million Colombian pesos

Year	REVENUES					EXPENDITURES					Total Expenditure
	Fixed Fee	Volumetric Fee	Other	Total Revenue	Administration	Operation	Maintenance	Miscellaneous			
1983	82.0	146.2	23.8	252.0	42.0	29.1	119.6	20.4	211.1		
1984	86.4	138.5	10.1	235.0	51.1	32.2	140.9	12.7	236.9		
1985	97.5	162.1	26.8	286.4	45.8	28.3	138.7	7.2	220.0		
1986	93.6	152.6	38.6	284.8	52.5	27.0	182.4	13.0	274.9		
1987	114.1	163.7	34.1	311.9	52.0	31.1	169.9	10.7	263.7		
1988	107.6	164.6	39.5	311.7	56.1	28.2	161.6	18.9	264.8		
1989	110.0	194.6	46.6	351.2	63.2	29.0	170.9	9.7	273.8		
1990	102.0	192.2	59.8	354.0	75.8	30.0	169.6	25.7	301.1		
1991	106.3	165.5	66.1	337.9	68.1	34.9	181.6	31.1	315.7		
1992	103.2	173.2	85.5	361.9	64.0	38.9	191.7	23.5	318.1		

\* In constant 1988 Colombian pesos. 1988 exchange rate was 333 Colombian pesos per US dollar. April 1994, exchange rate was 820 Colombian pesos per US dollar.

Figure 1. Locations of Coello and Saldaña districts, Colombia.

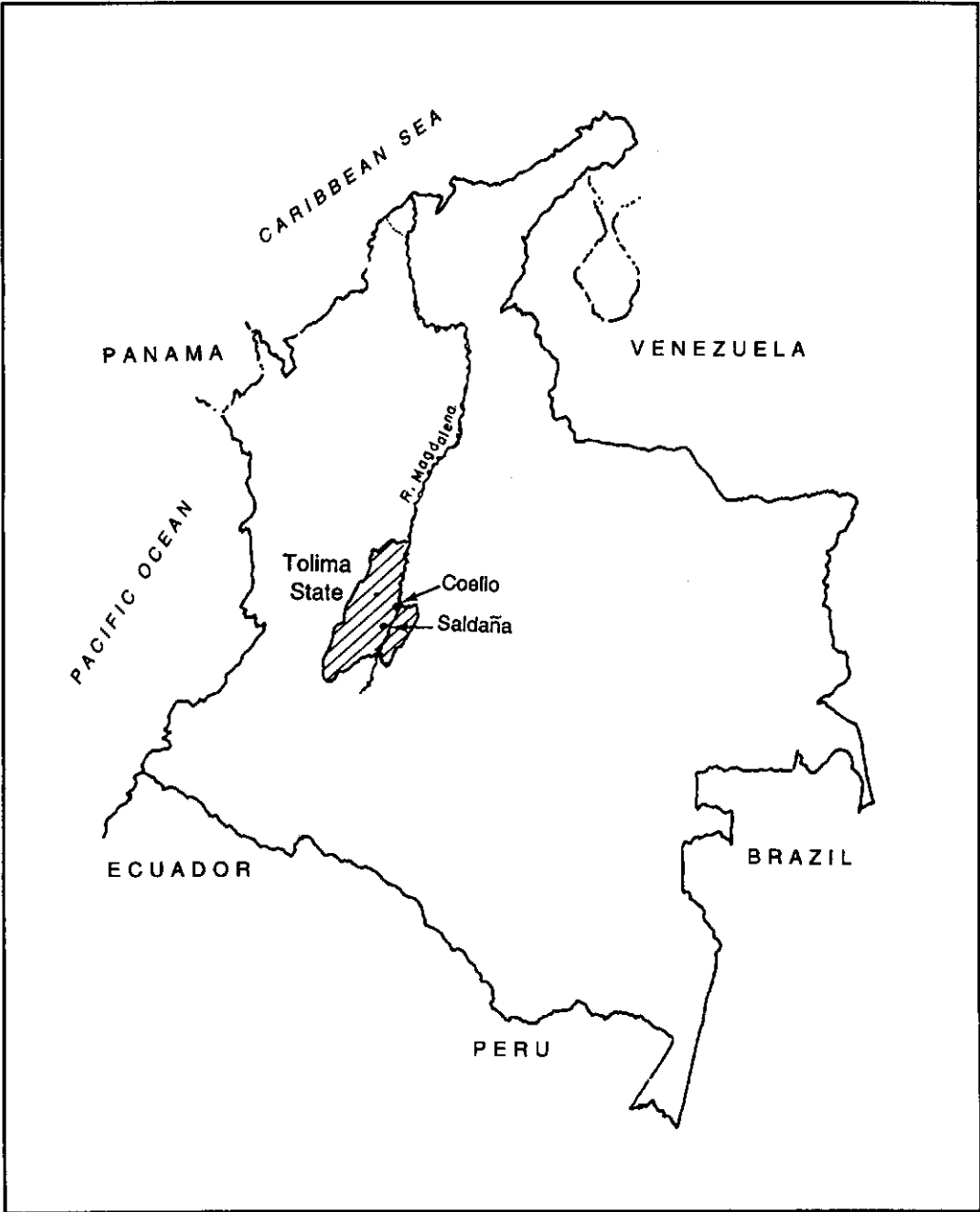


Figure 2. Irrigated area before and after transfer, Coello District, 1954-92.\*

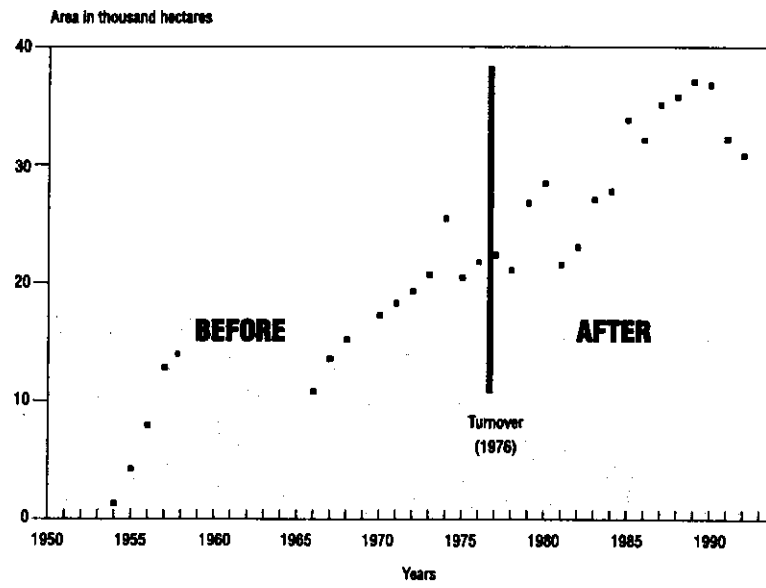


Figure 3. Average rice yield before and after turnover, Coello and Saldaña districts, 1953-93.

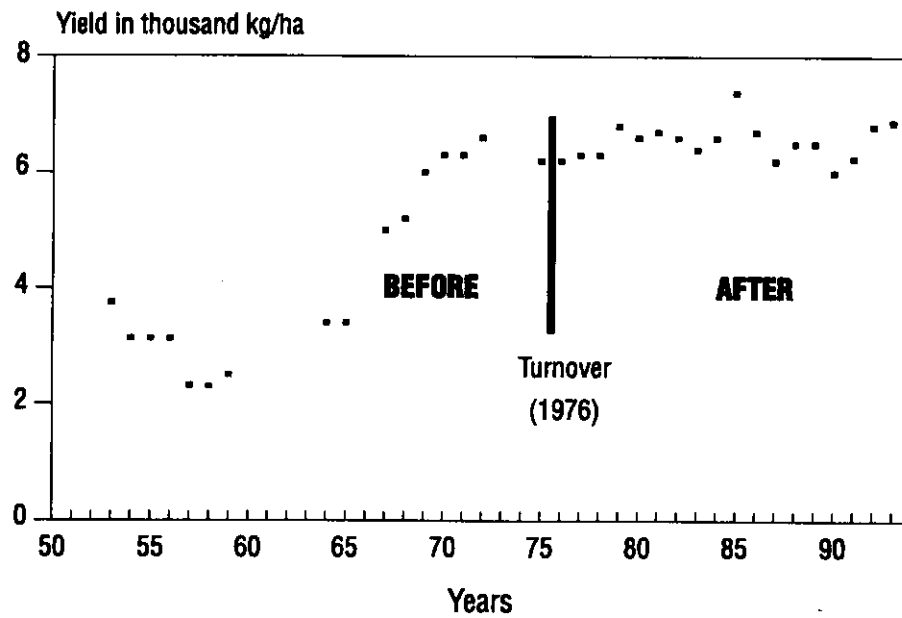


Figure 4. Total annual water supply for two rice crops, Coello District, 1978-91.

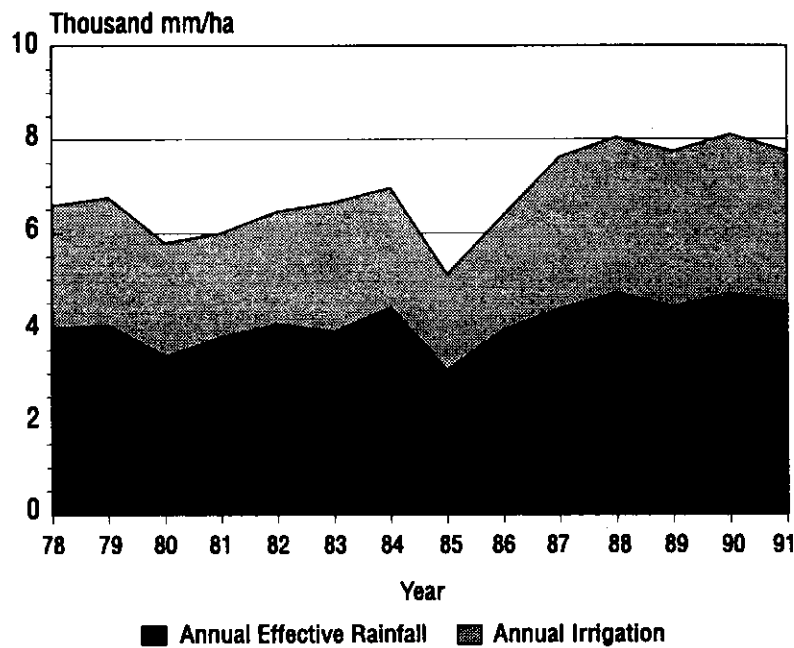
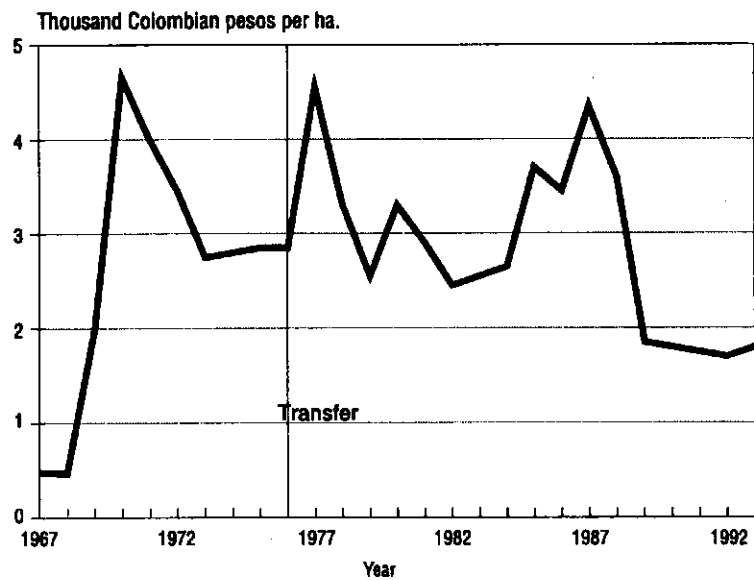
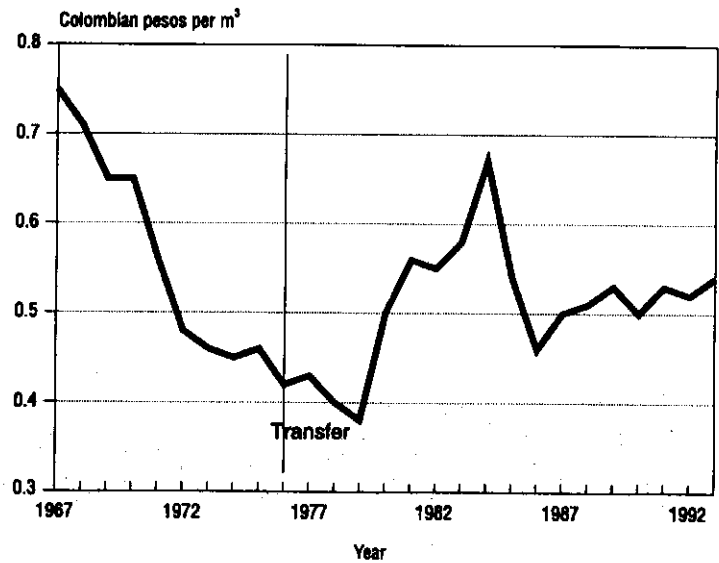


Figure 5. Area-based water fee, Coello District, 1967-93 (in 1988 Colombian pesos).\*



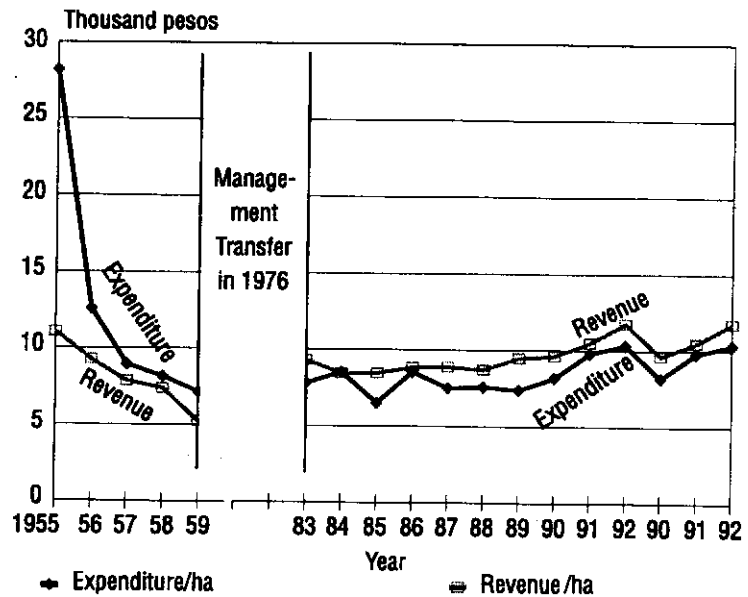
\*1988 exchange rate was 333 Colombian pesos per US dollar  
 April 1994 rate was 820 Colombian pesos per US dollar

Figure 6. Volumetric water fee, Coello District, 1967-93 (in 1988 Colombian pesos).\*



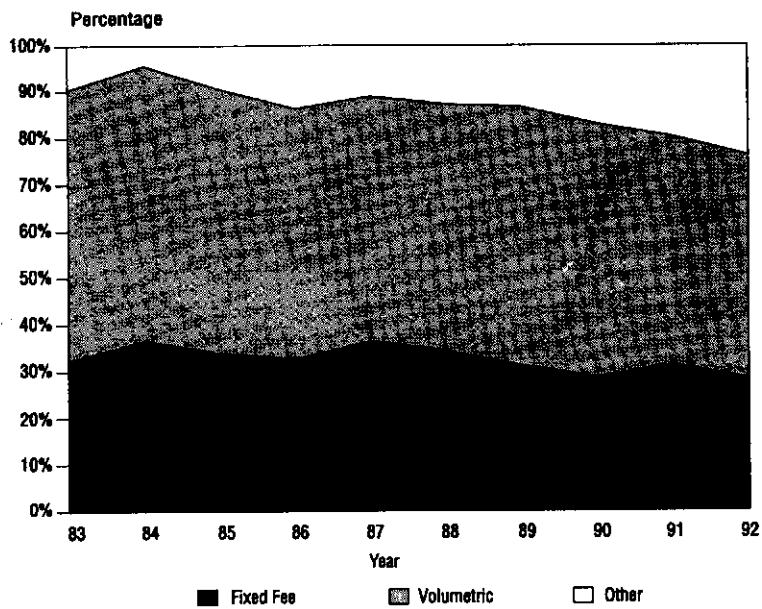
\*1988 exchange rate was 333 Colombian pesos per US dollar.  
 April 1994 rate was 820 Colombian pesos per US dollar.

Figure 7. Total expenditures and revenues per hectare, Coello District, 1955-93\*.



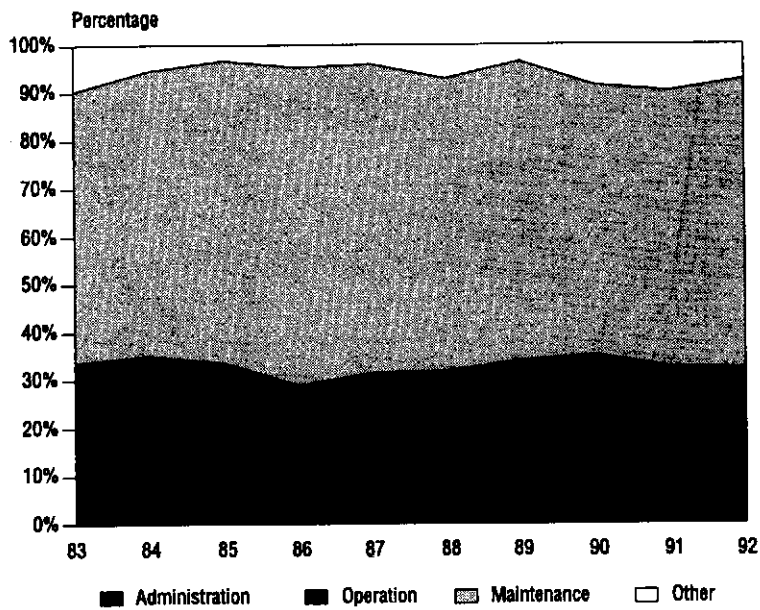
\* In constant 1988 Colombian pesos: 1988 exchange rate was 333 Colombian pesos per US dollar. In April 1994, exchange rate was 820 Colombian pesos per US dollar.

Figure 8. Revenue sources as percentage of total revenue, Coello District, 1983-92.\*



\*In constant 1988 Colombian pesos.

Figure 9. Types of expenditures as percentage of total, Coello District, 1983-92.\*



\*In constant 1988 Colombian pesos.