

ECONOMICS OF PAID EXTENSION: LESSONS FROM EXPERIENCE IN NICARAGUA

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Public Agricultural Extension (Extension) faces major changes and challenges, resulting from less available public resources and from changes in demand for extension. Structural changes in extension provision and financing alternatives have been one type of response to the changes in conditions under which extension operates. Some new mechanisms, all modifications to traditional public extension, include: private extension, commercialized extension, and co-financed extension, will be called hereafter paid-extension.

Several experiences of paid-extension around the world are reported in the literature (see Keynan, Olin and Dinar for details). Most of them provide information on the structure and operation of the different paid-extension arrangements and, in some cases, some anecdotal results on the costs and benefits associated with these operations.

This article offers, in the next section, a framework to evaluate economic performance of paid-extension, and demonstrates its application, in the third and fourth sections, using two types of paid-extension programs in Nicaragua. The article is concluded with a discussion on policy implications.

Evaluating Paid-Extension Performance: A Conceptual Framework

Inputs to and outcomes of public extension services can be measured in several ways. Extension inputs can be measured in monetary terms such as expenditures on fuel,

salaries, and training, and in physical terms, such as extensionist person-hour employed in the program. In the case of private extension, there is also a need to compare between private and public expenditures on extension. Extension output can be measured by the number of farmers contacted by extensionists, farmers' participation in extension activities, changes in agricultural practices due to the provision of extension, improved farm-level economic and physical performance (yields, crop varieties, inputs). Four analyses will be performed.

Individual Producers

The impact of paid extension on individual producers can be compared with performance at the no-extension or at the public extension stage. First, by improving technical efficiency, where increase in profit at any given combination of X_1 and X_2 is observed. Second, by improving allocative efficiency, where at a given technical efficiency profits are increased due to a better economic allocation of scarce inputs X_1 and X_2 .

The extension impact in the first case is measured by the move from production isoquant Y_0 to production isoquant Y_1 ($Y_1 > Y_0$). The difference between Y_1 and Y_0 may be due to increased yield, or increased revenue (resulting from improved yield quality).

In the second case, extension improves the use of existing inputs. In a given price ratio of inputs, a producer that uses inefficiently a_1 units of X_1 and a_2 units of X_2 to produce Y can be better off by producing the same quantity Y in a more economic combination of X_1 and X_2 that responds to the price ratio P_{x1}/P_{x2} . By realizing the price ratio between the inputs, the producer uses now b_1 units ($b_1 < a_1$) of X_1 and b_2 units ($b_2 > a_2$) of X_2 . Extension contribution is translated into the introduction of cultivation or management techniques that allow the combination of b_1 and b_2 .

The individual producer is assumed to maximize the private net benefit value. In

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a simplistic way a comparison between paid and public extension is measured by the following condition $A^{\text{paid}} - B^{\text{paid}} - C^{\text{paid}} \geq A^{\text{pub}} - B^{\text{pub}}$, where A is revenue from agricultural product, B is direct production cost, and C is payment by producers for paid-extension services. A simple measure for $A - B$ might be an aggregation of crop level performances.¹

Agency/Company Performance²

The objective of the private agency/company that provides extension services is to maximize profits, or to minimize costs. The latter is the case when the government provides the company with a fixed allowance per producer.

Government Expenses

Cost effectiveness is one of the Government main objectives in moving from public to paid-extension. Therefore, from the government's point of view $\sum_{i=1}^N D_i^{\text{paid}} + F^{\text{paid}} \leq E^{\text{pub}}$ where D_i^{paid} is direct payment by government to private extension company i ($i = 1, \dots, N$), F^{paid} is government monitoring and coordinating cost of the private extension companies, and E^{pub} is government cost of public extension.

Social Analysis

In a benefit-cost (B/C) analysis framework it is expected that, from a social point of view, society is doing the same or more with less resources.³ One should, therefore, take into account the private as well as the social costs and benefits associated with the reformed service. A simple approach would calculate private-level B/C ratios of paid-extension, and then estimate possible social cost associated with it. For example, social cost may include the government payment to private companies (in addition to the farmer payments). Social cost may also include the opportunity cost associated with the change in clientele as paid-extension replaces public extension. As was suggested in Dinar (1996), and was also observed in the case of privatization in the United Kingdom (Dancey), traditional clientele of public extension do not get the same extension

or any extension services when public extension is privatized. The social objective would be to minimize the differences between private (p) and social (s) B/C ratios so that $|(B/C)_p - (B/C)_s| \rightarrow \varepsilon$, where p stands for private, s stands for social, and ε is a small number. And $(B/C)_s = B/(\sum_{i=1}^N D_i + F + \sum_{i=1}^N \sum_{j=1}^M P_{ij} + \sum_{i=1}^N \sum_{j=1}^M \Delta G_{ij} + \Delta L)$ where P_{ij} is payments by producer j to extension firm i , and ΔG_{ij} is additional production cost of producer j ($j = 1, \dots, M$) working with private firm i , ΔL is opportunity cost of producers abandoned by extension in the move from public to paid-extension. ΔL can be measured as the loss in income by those producers, or as the additional funds the government has to allocate to provide other means of extension to producers that were abandoned (such as pamphlets, radio programs, field demonstrations etc. . .).

Application of the Conceptual Framework

Based on available data for Nicaragua, empirical application of the framework allows comparison between paid- and public extension performance:

- (1) *Individual Producer.* Analyses include participation shares, satisfaction rates and farm and crop-level economic indicators of performance.
- (2) *Agency/Company.* The analyses include cost indicators, cost recovery rates, ratios of farmers per extensionist, and time spent on extension provision.
- (3) *Government Expenditures.* Net government payment to private companies and to extension agencies to balance their budget are considered.
- (4) *Social Considerations.* A B/C ratio that includes social costs and benefits is calculated.

Paid-Extension in Nicaragua

The *Instituto Nicaragüense de Tecnología Agropecuaria* (INTA) was created in 1993 (see Keynan, Olin, and Dinar for historical evolution of INTA). In 1995, INTA employed about 160 extensionists (INTA, 1996), serving nearly 21,500 producers in its five regions under the *Asistencia Técnica Pública-básica* (ATPb) program. Following dissatisfaction from the service and severe

¹ Crop level cost-revenue analysis is probably the most convenient approach, and it is used in many cases in the literature.

² In the case of ATP1 this is the local INTA agency, and in the case of ATP2 it is the private company.

³ Income distribution issues are not addressed in this analysis.

budget cuts, the services were re-designed to include three main modules for service provision: mass media and demonstration free of charge (ATPb) mainly for the poorest farmers; co-financed (*Asistencia Tecnica Publica Cofinanciada-ATP1*); and private (*Asistencia Tecnica Privada-ATP2*). While the first two are provided by INTA's staff, the third is carried out by private firms.

The Concept of ATP1

The concept was to develop a demand driven extension system based on the assumptions that (1) extension is an economic input, (2) extension increases income, and (3) farmers, even if poor, will be willing to co-finance the costs of the services, if its expected value exceeds its cost. The mechanism proposed for a demand driven extension was a payment for the service that provides incentives to both the farmers and the extensionists.

The Implementation Process

The process comprised several stages: (1) Public Consultation was initiated after ATP1 concept was rejected as unworkable, unfair and contrary to tradition. (2) Field Test was carried out in the *Postrera* season of 1995 in order to test farmers' reaction and gain their confidence in ATP1; demonstrate the economic value of extension; and establish the principle that the service is not provided free. The fees⁴ (Keynan and Dinar) were designed to attract farmers, and to constitute incentives to extensionists. (3) Seventeen (of 18) groups remained in a pilot throughout the season, totaling 289 farmers, who actually paid the extensionists (63% and 65%, respectively, in 1995 and 1996; Dinar and Keynan).

Mainstreaming ATP1

During the *Primera* season of 1996, 866 producers, organized in forty-one groups, signed contracts to receive service. During the *Postrera* of that year, the number of producers increased to 2,221. Overall, some thirty-five extension agents were involved in the program during the *Primera*, and ninety-three during the *Postrera* (table 1). The growth in the number of producers (and groups) that

joined ATP1 is explained by the "over capacity" of INTA's regional offices that could absorb the growing number of producers and by the relatively low cost of the service, compared with its value to these farmers.

The Private Agricultural Technology Transfer Service (ATP2)

In order to continue the diversification of its services, INTA assessed in 1994 the possibility of providing private technical assistance to small- and medium-size producers. This was enhanced by the need to further improve the service and by finding an alternative cost-sharing scheme. During the first years of this program, most of the costs (80%) were expected to be covered by the government through a loan from the World Bank.

Contracts were signed between producers, the government, and private firms in August 1995 after several months of demand evaluation. According to these tripartite contracts, the producers were expected to have a sliding payment starting with a sum covering about 20% of the cost in the first year, that increases to nearly 80% in about five years. Producers in five regions were organized in groups and as of July 1996 some 5,700 producers were served by five firms (each with its own market share).

In contrast to the ATP1 concept, the service in ATP2 covers a wide range of farm production and marketing aspects. The workload of extensionists in ATP2 was greater than that of extensionists in ATP1 (tables 1 and 7). Contrary to the trends in ATP1, in the case of ATP2 each private company reached its ceiling clientele quota quite fast (1-3 seasons), reflecting firms' attempt to maximize proceeds by arriving at their producer quota.

Eagerness to fill their quota lead to selection of producers whose performance levels were not satisfactory. This explains low collection rates in the first season of ATP2's operation. In the following seasons, farmers were recruited more carefully. By the end of 1996, 85% of the producers paid their fees, and by the end of 1997, seven firms (2 joined in 8/97) provided extension services to more than 13,000 producers through 102 private extensionists and collected 81% of the producers' fees (ranging between 64% and 96%). Drought conditions that affected coffee production, a major crop in certain regions, explain relatively low recovery rates for companies 2 and 5 (Dinar and Keynan).

⁴ Calculated seasonally per crop per Manzana (1 Manzana, MZ, = 0.7 Ha) per month.

Table 1. Participation and Extension Personnel in ATP1 1995–99

	95 Actual		96 Actual		97 Actual		98 Projected		99 Projected	
	Grps.	Prdcrs.	Grps.	Prdcrs.	Grps.	Prdcrs.	Grps.	Prdcrs.	Grps.	Prdcrs.
Total (for 5 regions)	46	289	310	3473	312	4477	525	10515	930	18622
Extensionists	24		78		93		120		120	
Groups/ Extensionist	1.9		4.0		3.3		4.3		7.7	
Producer/ Extensionist		12.0		44.5		48.1		80.3		124.1

Source: Dinar and Keynan.

The Basic Public Extension Service (ATPb)

Although not directly the focus of this article, ATPb is an extension program that will play an important role in the agricultural policy of Nicaragua. Of the total population of more than 200,000 agricultural producers, the three ATP programs approach only 40,000, and only 25,000–30,000 will be contacted through ATP1 and ATP2 by 1999. The rest are the potential clientele of ATPb, which are the poorest farmers. Data on ATPb in Nicaragua became available from a study by Escuela Economía Agrícola (ESECA) based on a sample of 270 representative farms.

Measuring Paid-Extension Performance in Nicaragua

In this section we apply the evaluation framework to available data from Nicaragua.

Individual Producer Performance

First, we will use some of the findings of ESECA to derive several performance measures. Without distinction between extension programs in the sample of the study by ESECA, most producers (94%) applied

the recommendations provided by extensionists. Of those applying the recommendations, 19%, 61%, and 20% reported a 100%, 50%–75%, and 25% effectiveness, respectively. Of the sampled producers, 43% and 50% ranked the service as “very helpful” and “helpful,” respectively. 41%, 47%, and 12% reported increase, stability, and decline in their income, respectively.

We next apply a simple farm-level analysis to data available in the *Primera* 1996 season in order to estimate the gross incremental benefits associated with ATP1. Obviously the positive result in region B3 and the negative result in region A2 dominate everything else in the analysis in table 2. The resulting incremental gross margin of Cd74,344 is not as robust as it could be.

Agency/Company Performance

Performance of ATP1. Table 3 shows that 75% of the clientele (ATPb and ATP1) were visited at least every 2 weeks (see a similar indicator in Dinar 1989). In calculating the cost of extension provision in ATP1 we use actual data available for technical assistance programs in INTA (Dinar and Keynan). The

_____ This measure can be the result of other factors as well.

Table 2. Performance of ATP1 Producers in Various Regions in Primera 1996 (Cd)

Region	Incremental income	Incremental cost	Incremental gross margin
A1	8843	2460	6383
A2	–455159	8613	–463772
B3	699010	157178	541832
B5	–8485	1614	–10099
Total*	244209	169865	74344

Source: Dinar and Keynan.

*Not including region C6 for lack of data.

Table 3. Number of Visits by Extension Agents in the ATPb and ATP1 Programs

Frequency of visits (days)	7	15	21	30	45	60	90
Share of producers (%)	25	50	3	12	1	3	1

Source: ESECA

Table 4. Allocation of Extensionist Time and Fuel Cost Between ATPb and ATP1

Groups/Extensionist	1-2	3-5	6-8	9-10
% time & fuel for ATP1	20%	50%	80%	90%

Source: Dinar and Keynan.

annual average cost per extensionist in the technical assistance programs (ATPb and ATP1) is \$3,612 (see table for ATP1 share). Breakdown of 1995-97 cost for salaries, transportation, producer training, and administration and misc. is 70%, 20%, 5%, and 5%, respectively (Dinar and Keynan).

We use the data in table 4 to derive a cost estimate for provision of ATP1 services to individual producers. In 1995-97 the average number of producers per group was nearly 11, yielding an annual cost per producer, ranging between \$66 and \$30, depending on the number of groups per extensionist.⁵

Performance of ATP2. Cost of service provision is calculated from financial reports of five private companies for the period 8/95-8/96 (Dinar and Keynan). On the average, 72%, 10%, 3% and 15% of the cost was spent, respectively, on salaries, transportation, producer training, and administration and misc., with salary expenditures varying greatly among the companies.

Private firms' calculated average gross margin (table 5) is nearly 25%, with one exception because of low collection level, which indicates a sustainable level of profit. Based on tables 6 and 7, per producer cost of extension provision by ATP2 varies between \$53 and \$77 per year. This range is similar to the estimated cost (between \$30 and \$66) of extension provision by ATP1 that was calculated earlier, indicating compatibility among the programs.

Additional data available from INTA (1998) for the seven extension-providing

companies indicate a range of cost of extension provision for 1997/98 that varies between \$71 and \$88. The average cost for 1997/98 of \$80 is lower than that of 1996/97 (\$89), and that of 1995/96 (\$101). The increased cost effectiveness trend over the last three years in ATP2 companies is a reflection of both the experience gained by the companies, and by the competition regulated by INTA. Data for 1996 suggest that the annual government payment transfer to private companies was about \$50 per producer (56% of the cost).

Government Expenditures

Not sufficient information is available to conduct a comparative analysis of this indicator. Government transfer payments to private firms represent Government expenditure on ATP2. The sum for 1995/96 amounts to Cd3.2 million for all five companies. Similar information was impossible to extract in the case of ATP1.

Social Welfare

With all the available data at hand, it is possible to calculate meaningful *B/C* indicators, as was suggested in the analytical framework section. We present such analysis for one ATP2 company (#4) in table 8. Private *B/C* ratio (without government subsidy) is higher than the social one (1.83 and 1.77, respectively), but both are reasonable. Cost associated with terminating the existing ATPb program is not included in the analysis, which can drop *B/C* values significantly.

⁵ These values can be contrasted with preliminary budget estimates by INTA for 1995 in the amount of \$115 per producer (Dinar and Keynan, 1998).

Table 5. Financial Performance of Five Private Companies in the Period 8/95–6/96

Company	1	2	3	4	5
Income from INTA	646583	613707	713207	626676	621872
Income from Producers	127957	153466	170061	180000	142162
Total income (incl. other sources)	784816	767174	884647	806676	764034
Total operational expenses	721893	543592	697144	525279	572100
Gross margin (share)	0.08	0.29	0.21	0.35	0.25
Extension cost per producer (Cd/\$)	499/56.76	677/77.02	489/55.67	467/53.10	595/67.71

Note: Based on an exchange rate of 8.8 Cd per 1\$US in June 1996 (Dinar and Keynan).

N/A means not applicable.

Table 6. Allocation of Extensionist Time in the Seven Private Companies of ATP2

Company	Technicians	Days per Month	Distribution of Technicians' Time among Activities							
			Producers Visits		Training		Office Work		Misc.	
			Days	%	Days	%	Days	%	Days	%
1	10	24	20	83.3	2	8.2	1	4.2	1	4.2
2	7	24	20	83.3	2	8.3	2	8.3	–	–
7	6	23	18	78.2	2	8.7	2	8.7	1	4.4
6	8	24	20	83.3	3	12.5	1	4.1	–	–
3	11	22	18	81.8	1	4.5	2	9.1	1	4.5
4	10	22	18	81.8	2	9.1	2	9.1	–	–
5	8	22	17	77.3	2	9.1	3	13.6	–	–

Table 7. Extension Provision for the Seven ATP2 Private Companies as of 9/1997

Company	Producers	Continue from last year (%)	Extensionists	Groups	Groups per Extensionist	Producers per Extensionist
1	1710	69.4	13	105	8.1	131
2	2333	25.8	25	97	3.9	93
7*	1200	N/A	8	83	10.4	150
6*	1294	N/A	8	63	7.9	156
3	1078	58.8	8	63	7.9	135
4	1344	70.4	9	63	7	149
5	1200	60.0	10	100	10	120
Total	10159	40.2	81	574	7.1	125

Source: Dinar and Keynan.

*Operational from 10 to 96.

Table 8. Benefit-Cost Ratios for a Representative ATP2 Extension Firm (Cd.)

Value of Production	Direct Production Cost	Gross Margin	Producers Payments	Government Transfer	Private B/C	Social B/C
(1)	(2)	(3) (1) – (2)	(4)	(5)	(6) (3)/(2) + (4)	(7) (3)/(2) + (4) + (5)
30,393,420	16,375,867	14,017,553	180,000	626,676	1.835	1.769

Source: Dinar and Keynan.

Policy Implications

There are several issues that can be extrapolated from Nicaragua's experience:

Improvement of the services provided. One of the objectives of paid-extension is to improve service to producers. Although the data is insufficient to fully compare public vs. paid-extension quality of service, it is apparent from the increasing and stable participation over time that producers are satisfied with the service.

Cost effectiveness of the service. It appears from the available data that paid-extension provision costs are decreasing over time, which affects both the quality of service by the extension agency/company, and the ability and willingness to pay by the producers.

In the case of Nicaragua, the estimated extension cost for ATP1 are lower than those for ATP2 (\$30–60 compared with \$50–70). This difference is explained by the almost double annual cost per extensionist (\$3612 and \$7559, respectively) and number of producers per extensionist (58 and 125, respectively). Since these programs offer different packages it is difficult, with the data at hand, to compare the cost effectiveness between ATP1 and ATP2.

Cost recovery of the service. Cost recovery rates as reported for ATP1 (36–81% in 1995/96) are lower than those for ATP2 (67–96% in 1996/97), but still, both programs indicate cost recovery rates that are at the same level as in other countries (e.g., Netherlands—see Dinar and Keynan). Although we witnessed relatively high rates, it might be desirable to increase cost recovery to 100%, in order to continue providing these services and to ensure that they are not affected by government budget cuts.

The exclusion effect of private-extension and its social cost. Paid-extension may have negative impact on poor and subsistence farmers who are left out by paid-extension. ATPb has been modified to address this issue but its effectiveness is questionable.

Conclusion

In early 1999, the concept of co-financed, and/or paid-extension was well accepted in

Nicaragua by Government and farmers' organizations. The various extension initiatives were thriving, the number of farmers attained by all modalities was going up—13,000 in ATP1, 14,000 in ATP2, and more than 62,000 in ATPb which was transformed into Asistencia Tecnica Publico masiva (ATPm). More importantly, data shows that yields per MZ attained under ATP1 were higher than the national average by about 30% in maize, 35% in beans, 15% in sorghum, 50% in potatoes, and 45% in coffee (Dinar and Keynan).

It appears that the principle of private producers equating the value of extension services to its cost works even in a poor country such as Nicaragua. Producers are prepared to pay for information and knowledge. Although too early to conclude, it seems that the two paid extension systems in Nicaragua achieved the objectives of improving extension services, and of increasing agricultural production and producer profitability.

Bottom Line

In July, 2000, the Government of Nicaragua and the World Bank signed a loan for a comprehensive project—Nicaragua-Agricultural Technology Program—The project development objective is to establish an efficient, demand-driven, agricultural technology, knowledge and innovation system. It will gradually replace the existing ATP1 and ATP2 programs with competitive grants for provision of knowledge and extension services.

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