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**PUBLIC-PRIVATE PARTNERSHIPS
FOR INNOVATION-LED GROWTH IN AGRICHAINS:
A USEFUL TOOL FOR DEVELOPMENT IN LATIN AMERICA?**

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Abstract

Public-private partnerships have become increasingly important as an arrangement that serves to encourage innovation in agricultural production chains in Latin America. However, some observers have expressed concern that this institutional arrangement may mostly favor the interests of the private sector without producing sufficient social benefits for the public. This paper presents the results of a study of 124 cases of public-private partnerships in agricultural innovation in nine countries in Latin America. The data from the study suggest that the partnership concept is used to generate agricultural innovations in many different ways, involving public research and private entities to varying degrees and focusing on different types of agricultural products, processing, or marketing.

The results indicate that public as well as private sector actors often enter into partnerships based on unclear expectations of the benefits to be obtained, but once involved, these actors are usually satisfied with the results. Given the high degree of satisfaction that partners experience in public-private partnerships, they constitute an interesting new tool for development. However, in many cases public sector agents do not clearly establish public priorities; in consequence, public sector goals are not addressed sufficiently. Also due to the limited commitment of some of the partners to partnerships their potentials of generating synergy are not met. One key recommendation to emerge from the study is that when entering into public-private partnerships, public agents should ensure that these partnerships comply with public needs.

Key words:

Public-private partnerships, agricultural research, innovation, agrichains, Latin America

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1. Introduction

Recent years have seen a marked increase in cooperation between public research organizations and private companies in the area of innovation development for a wide range of economic activities. Public-private partnerships in agricultural research and development (R&D) are contractual arrangements between public research organizations and universities on one hand, and private sector entities such as agribusiness companies, associations, and farmer organizations on the other. Partners share authority, responsibility, and risks; jointly contribute resources and funding; and mutually benefit from the goods and services provided. It is commonly accepted that such partnerships require common objectives, active partners, interdependent and complementary contributions from the partners, and a commitment to open relationships under the criteria of equity and clear, mutually agreed rules (see, for example, Osborne, 2000; Fiszbein and Lowden, 1999).

Due to the above-mentioned characteristics, public-private partnerships provide a range of advantages: by pooling resources, the two sectors can form critical masses in research capacity and resource endowment that enable relevant and successful R&D. Further, through collaboration with practitioners from the private sector, R&D can be directed toward innovations that are of practical use, and thus more relevant for development and actual adoption. However, the public-private partnership agenda is also driven by public organizations that seek complementary (private) funding and by private entities that seek to profit from knowledge and technology provided by public R&D services.

Given the benefits that can be derived from partnering for innovation, governments and donors in many parts of Latin America now promote partnerships with the aim of developing private sector activities and agriculture at the local or national

level. However, despite the conceptual attractiveness of partnerships, the question that must be asked is whether public-private partnerships really constitute an institutional solution to the development of innovations in agriculture in Latin America. Public agents and development NGOs have raised doubts as to whether such partnerships respond to more than just the interests of a few private companies or the scientific zeal of researchers.¹ Have these partnerships in fact contributed to the achievement of broader social goals, such as empowering local small-scale farmers, involving local entrepreneurs in agroprocessing, or creating value for commodities produced in the countries? Has the public expenditure been justified?

This paper aims to respond to these questions by providing empirical evidence from 124 cases of partnership in nine Latin American countries. It characterizes the types of partnership arrangements that exist and assesses whether these partnerships have led to benefits for both the private and public sectors involved. With this analysis, the paper addresses policymakers in agriculture, economics, and science and technology; managers at public R&D organizations and universities; private company managers; administrators of R&D funds; and donor, farmer, and nongovernmental organizations interested in joining or promoting partnerships.

¹ This issue was raised, for example, by Roberts, Breitenstein, and Roberts (2002) with respect to the health sector in developing countries, and by Spielman and von Grebmer (2004) in relation to the agricultural sector.

2. Building Partnerships in the Context of Agrichains

Public-private partnerships that aim to develop innovations are created in the context of a specific sector of the economy and are subject to the interests of various public and private actors. Often such partnerships are built in the context of product or value chains—sectoral arrangements that allow buyers and sellers of a commodity who are separated by time and space to progressively add and accumulate value as products pass from one member of the chain to the next. In agriculture, product or value chains (agrichains) involve all actors dealing with a commodity or group of commodities, ranging from the agricultural input industry to the final consumer, via production, transport, processing, and marketing.

Innovation in agricultural production chains has become a major concern for Latin American countries, which in the coming decades will be challenged not only to respond to demographically determined needs for basic food production, but also to improve the quality and value added of foods, along with the increasingly important production of nonfood materials to provide income for its people. These challenges can only be met through the introduction of new knowledge and technologies that make it possible to produce greater value added on an ever-decreasing amount of arable land. Meanwhile, competitors from developed countries will continue to challenge in both world and local markets.

During the last decade, policies to stimulate innovation were not given high priority in Latin America. Traditionally, Latin American countries, like other nations in the developing world, were perceived to be assemblers or imitators of technologies imported from the North. Hence, firms were not expected to commit resources to develop innovations, but were advised to open up their production and trade regimes in such a way that technology could easily flow into their economies (Mani, 2004). At best, some

adaptive R&D was conducted, since all technologies are location-specific and thus any technology imported from abroad must be adapted to local conditions.

Given these circumstances, it is no surprise that public and private sector investment in R&D has been low. Beintema and Pardey (2001), for example, have estimated that private sector research expenditure accounts for only 6 percent of the total research expenditures in agriculture. In consequence, the output is also low. RICYT (2004) found that in 2001 the number of patents granted to local citizens across all sectors (not only in agriculture) in Latin America and the Caribbean was 2,617, compared to 87,607 in the United States; taking research capacity into account, this means that in Latin America and the Caribbean it takes 56 full-time researchers to obtain a patent, compared to 14 in the United States. These figures must be interpreted with caution, however, as they capture innovation activities only to a limited extent. Many innovation activities are not declared as such by companies, are not captured when undertaken by small-scale farmers and processors, or do not lead to patents.

In any case, there are signs that greater priority is being given to the generation of innovation. Policy measures are being applied to promote R&D, such as tax incentives for private investments, and many competitive grant schemes have been initiated that provide public and private actors with complementary funding for research and innovation endeavors.

Meanwhile, promoting agrichains has become an important development strategy in Latin America—a strategy in which technological innovation often features prominently next to developing strong performance, quality standards, and chain organization. Institutions created to enforce this strategy include various export promotion and agrichain development bodies such as the Ecuadorian Corporation for the Promotion of Exports and Investment (CORPEI), the Costa Rican Foreign Trade Corporation (PROCOMER), and Fundación Chile. Frequently the overall goal of the

strategy is to make local agrichains more competitive, and this often leads to research, development, and the dissemination of knowledge and technology. Many agrichain development strategies also embark on research that enables decommoditization—that is, moving away from commodities with low value added toward processed products (Kamplinsky and Fitter, 2004).

Agrichain development strategies have also focused on integrating the private sector more tightly into the generation and financing of innovation development. The argument is that agrichain performance depends on the intensity and effectiveness of interactions between actors involved in the generation of innovations and the dissemination of knowledge. Including the private sector in agrichain development has the advantage that the development of knowledge and technology and its dissemination can be more closely tailored to the needs of the productive sector.

3. Public-Private Partnerships as a Means for Agricultural Development: A Conceptual Framework

Public-private partnerships have become increasingly popular in development policy and practice as a means of addressing issues as diverse as health, education, environment, finance, governance, and agriculture (e.g., Fiszbein and Lowden, 1999; Bennett, Grohmann, and Gentry, 1999; Buse and Walt, 2000). They also have become popular as a way to foster the development of innovations through collaborative R&D (Faulkner and Senker, 1994; Hagedorn and Schakenraad, 1994; Hall, Bockett, Taylor, Sivamohan, and Clark, 2000; Spielman and von Grebmer, 2004). However, many public-private partnership approaches, in a privatization-like manner, seek to outsource public services to private companies. In contrast, public-private partnerships are understood here as arrangements that support the autonomy of public research organizations by rendering their work more relevant, demand-oriented, and efficient.

The Benefits of Partnering for Innovation

Development theorists have argued that public-private partnerships present advantages to both public research organizations and private sector entities, and can generate social benefits (see, for example, Spielman and Grebmer, 2004). Furthermore, some have argued that public-private partnerships evolve in the interface between technological feasibility and the response to concrete market or public demands (Vieira and Hartwich, 2002). Viable innovation partnerships can be seen as cooperative arrangements between two or more institutions of the public and the private sectors that involve shared ownership and responsibility, joint investment, shared risk taking, and mutual benefit. Increasing empirical evidence shows that where partnerships between firms and public research organizations or universities are strong, benefits are derived from quicker information diffusion and product deployment (Osborne, 2000). Public-

private partnerships allow private enterprises to increase the benefits of innovation. They also provide capital to co-finance government programs in areas in which social benefits can be achieved. Public-private partnerships for innovation development may be particularly useful in agrichains characterized by outdated knowledge and technology and limited research capacities and funding.

The incentive driving public and private agents to enter partnerships is usually the interest in profiting from innovation rents, be they private or social benefits. Here it is important to distinguish between benefits resulting from the innovation itself (regardless of whether it is generated through a partnership arrangement or not) and from the partnership arrangement. Table 1 lists some of the benefits that can result from innovation partnerships.

Table 1: Benefits of Public-Private Partnerships

Social benefits from innovations Increased agricultural production and productivity for small farmers Sufficient food supply for the poor Poverty levels reduced in portions of the society Import substitution and export opportunities State income from royalties	Social benefits from partnering Joint learning Improved relevance through contact with real problems Maintaining research infrastructure and capacity Complementary (private) funding Reduced time lags in the adoption of technology
Private benefits from innovations Increased farm production and productivity Cost reduction Increased income from sales and profits for various actors Development of new products Employment opportunities	Private benefits from partnering Joint learning Complementary (public) funding Access to knowledge and technology Publicity

While public-private partnerships can offer a number of advantages, it must also be kept in mind that these schemes are complex to design, implement, and manage. They are by no means the only or preferred option in the generation of innovation, and should be weighed against other alternatives such as contract research, outsourcing, the hiring of researchers, and the acquisition of the R&D departments of entire companies.

The Costs of Partnering for Innovation

While providing multiple benefits, public-private partnerships also generate significant costs. First there are the costs of establishing and conducting a research activity, which are incurred regardless of whether or not it is pursued in a partnership; these are a given. But there are also costs that arise from partnering itself, which occur only because of the need to interact with the partners. Using the terminology of Williamson, they are *transaction costs*—that is, costs of information, search, negotiation, screening, monitoring, coordination, and enforcement of contracts and institutions, interpreted as structures and rules of the game (Hoff and Stiglitz, 1990). These include (1) the direct costs of obtaining information, (2) the parties' negotiation costs in order to reach agreement on contract provisions, (3) the costs of communicating these provisions to all the pertinent agents, and (4) indirect costs arising from opportunistic behavior induced by the involvement of multiple agents and profit-seekers.

Here the term *costs of interaction* is applied, which refers exclusively to those transaction costs that arise directly from partnering and not from setting up broader institutions as structures and rules of the game that guide the behavior of actors. The costs of interaction typically involve the costs of negotiating the partnership; funding, governance, and legal aspects of the partnerships; and the redistribution of benefits. Costs of interaction also include those costs which arise from communication during the partnership, meetings to report on progress and discuss additional actions, monitoring of activities, evaluation of intermediate results, and administration of the partnerships.

One might expect that potential partners would decide whether to enter a partnership only after performing a concrete evaluation of the costs and benefits arising from it. However, this study of public-private partnerships found that interest in entering

a partnership is instead determined by vague expectations about what profits will be realized.

Considerations in Entering Partnerships

Public-private partnership arrangements come in many forms and are still an evolving concept that must be adapted to the individual needs and characteristics of each project and partner. In order to understand how partnerships develop and what conditions are important for partners, the following considerations are taken into account:

1. The common interest-space condition: Viable public-private partnerships develop only in a space of interests common to the two sectors. In the case of agricultural innovations, this space is marked by the technological, market, and public demands existing in agrichains.
2. The cost-benefit condition: One enters into a partnership when the expected benefits outweigh investments plus the costs of interaction incurred from partnering. Benefits may not be only monetary and tangible, but also intangible and diffuse, depending on the partner's interests.
3. The synergy-through-collaboration condition: One enters into a partnership when the expected benefits are higher than those that can be derived from equivalent investments in nonpartnership arrangements. Synergy results from economies of scale in the use of R&D resources. It also develops from gathering critical masses in R&D resources (knowledge, funding, and infrastructure) that could not be obtained otherwise, from mixing complementary R&D resources (e.g., bringing knowledge about production and markets together), from the effects of

joint learning, and from reduced costs in seeking and exchanging information.

4. The no-conflict condition: One enters a partnership when the generation of benefits does not substantially conflict with other interests. Partnerships may be very beneficial in terms of their cost-benefit ration. In this externalities must also be considered. For example, when developing a new technology in partnership with a private company, the public sector organization may want to make sure the technology is environmentally safe. When an innovation risks creating social or environmental conflicts, public sector institutions may prefer to stay clear of partnerships. In cases in which communities and interest groups are taking strong opposing positions, the negative image that arises from collaborating with a big company may be enough to keep potential public sector partners away.

5. The proportional-benefits condition: One enters a partnership when one's own expected benefits are not disproportionately lower than those expected for the partners. Proportionality also takes into account the inputs partners provide and therefore goes beyond 50-50 benefit-sharing solutions. Moreover, there are psychological considerations; for example, if one partner gets very rich from a partnership, the other partner may want a share of the benefits that could not have been generated without its help, regardless of the inputs contributed.

Partnerships constitute a complex decision problem; each partner looks not only at its own costs and benefits, but also at those of the other partners. In order to increase benefits, each partner needs to see that the others are providing the greatest inputs possible to the partnership. The problem with partnerships is that many actors become

involved because they expect windfall profits to result from the contributions of the other partners, without considering in detail how to make the partnership work.

Furthermore, it is important to understand partnerships not as a static arrangement, but as a process that moves gradually from general ideas about “profiting one from another” to concrete arrangements with defined objectives. Hartwich, Janssen, and Tola (2003) suggest that there are five steps to consider: (1) identification of the common interest space; (2) negotiation and design of the partnership contract, including legal, funding, and governance issues; (3) implementation; (4) evaluation of achievement; and (5) deciding whether the partnership will continue if the objectives are not yet achieved, or if there are new and promising objectives to pursue in the partnership arrangement. Over time the partnership can profit from gradually improving work relationships and become strategic. Otherwise, since partnerships are flexible arrangements that are a means to an end, they may simply be phased out.

Based on the preceding theoretical considerations, a model was developed to explain the behavior of actors involved in public-private partnerships. The main assumption of the model is that partnerships are created under the following conditions:

1. Existence of a common interest space
2. Expectation of positive private cost-benefit ratios by the private sector entities participating in the partnership
3. Expectation of positive public cost-benefit ratios by the public sector
4. Existence of synergistic effects from active collaboration between public research organizations and private sector entities

The model suggests that each of the partners enters into a partnership based on its expectation of monetary and nonmonetary benefits from investments (see equation (1) and (2)). This assessment also includes the efforts that arise from building and

maintaining the partnership—that is, the costs of interaction. The costs of the activity, however, are assumed to be more easily determined; partners would not have expectations on those costs but, rather, would know what they are.

$$E[CI_{pr}] + IA_{pr} \leq E[B_{pr}] \quad (1)$$

and

$$E[CI_{pu}] + IA_{pu} \leq E[B_{pu}] \quad (2)$$

with

CI_{pr} : interaction costs of the private sector entities

IA_{pr} : private sector entities' investment in the activity

B_{pr} : benefits for the private sector entities

CI_{pu} : interaction costs of the public sector entities

IA_{pu} : public sector entities' investment in the activity

B_{pu} : benefits for the public sector

$E[...]$: expectations of the public and private sectors regarding costs and benefits

The model also suggests that both partners profit from their investment and that the benefits to each are greater due to synergistic effects from the mutual contributions of the private and public sectors, leading to greater benefits than could be achieved if the activity were carried out by each partner on its own. The latter condition can be specified by defining the benefits that result for the partners as being a function of the investments of both partners, as indicated in equations (3) and (4)

$$B_{pr} = f(IA_{pr}, IA_{pu}) \quad (3)$$

and

$$B_{pu} = f(IA_{pu}, IA_{pr}) \quad (4)$$

4. Methodology and Data

Based on the theoretical considerations presented in the previous section, four main hypotheses were tested:

- H1. The type of partnership chosen to develop innovations depends on the following factors:
 - 1. The way funds are allocated
 - 2. The type of activity the private partner is involved in (which part of the agrichain: primary production, processing, or marketing)
 - 3. The type of research the partnership is aiming at (basic, strategic, adaptive, or development)
 - 4. The financial participation level (high, medium, or low) and type of private partners involved (enterprises or associations of producers or processors)
- H2. The private sector becomes actively involved in public-private partnerships only if there are clear prospects of profits (e.g., gains from improved sales, cost reduction, exclusive use of technology).
- H3. In many cases the public sector provides funding or research resources to partnerships even though there is no clear analysis/expectation of a positive social cost-benefit ratio.
- H4. The good functioning of a partnership depends on internal leadership and effective internal monitoring and evaluation.

Data Collection

The analysis draws from a database of 124 partnerships in nine Latin American countries that have been analyzed within the framework of a German-funded project, Public-Private Partnerships for Agroindustrial Research in Latin America, executed by the International Service for National Agricultural Research, now a division of the

International Food Policy Research Institute (IFPRI). In each case, representatives of various partners were interviewed with regard to financing, governance, legal aspects, and the results achieved by the partnerships. The cases were randomly chosen from inventories of public-private partnerships that the national teams compiled from lists of projects and public research organizations.

The cases included are restricted to those in which partnerships actually came into existence, though sometimes only to a rudimentary extent. Data on partnerships that did not come into being were too inconsistent to be included in the sample and did not provide a basis for comparison. To complement the findings presented here, future research is envisioned on the reasons why partnerships are aborted or not finalized.

Country teams collaborating on the project collected the data using a standardized questionnaire format. The questionnaire had been developed jointly by three country teams and pretested in various partnership cases, and was designed in such a way that data were collected per partnership. For that purpose, representatives of the partnership—at least one private and one public entity—were interviewed by the research team. The teams also used the data collected for their own analysis of partnerships at the national level. However, due to the joint questionnaire design, data were comparable and could be used for this cross-country analysis. In some cases not all variables could be enumerated—for example, data on funding was available for only 99 partnership cases.

Hypothesis 1 was analyzed with descriptive and correlation measures, correspondence, and cluster analysis. Hypotheses 2 and 3 were analyzed using cross-tabulations and chi-square testing, analysis of variance, and F-testing. The variables used to test hypotheses 2 and 3 refer in part to the private and public sectors' expectations regarding certain parameters of partnership success.

Box 1: Variables Used in the Analysis
<p data-bbox="334 348 776 380">Indicators that categorize partnerships</p> <ul data-bbox="240 394 1386 850" style="list-style-type: none"> <li data-bbox="240 394 1386 562">• The mechanism for assigning funds: (1) open competitive grants for which certain institutions can apply, (2) closed competitive grants to which only a limited number of institutions are invited to apply, or (3) direct assignment according to the funding agency's criteria, for which institutions do not have to compete <li data-bbox="240 577 1386 657">• The type of innovation the partnership aims at: (1) varieties and seeds, (2) primary production, or (3) postharvest <li data-bbox="240 672 1386 751">• The type of main private partner involved: (1) a firm or (2) an association or group of producers and processors <li data-bbox="240 766 1386 850">• The nature of the research that the partnership conducts: (1) basic research, (2) strategic research, or (3) adaptive research
<p data-bbox="334 863 919 894">Indicators that determine partnership performance</p> <ul data-bbox="240 909 1386 1539" style="list-style-type: none"> <li data-bbox="240 909 1386 940">• The absolute and relative contribution of the public sector in funding the partnership <li data-bbox="240 955 1386 987">• The absolute and relative contribution of the private sector in funding the partnership <li data-bbox="240 1001 1386 1081">• The public partner's perceptions regarding the existence of leadership in the partnership, on a scale from 1 = very strong to 5 = nonexistent <li data-bbox="240 1096 1386 1176">• The private partner's perceptions regarding the existence of leadership in the partnership, on a scale from 1 = very strong to 5 = nonexistent <li data-bbox="240 1190 1386 1270">• The private partner's perceptions regarding the existence of conflicts during the execution of the partnership, on a scale from 1 = no conflicts to 5 = serious conflicts <li data-bbox="240 1285 1386 1365">• The public partner's perceptions regarding the existence of conflicts during the execution of the partnership, on a scale from 1 = no conflicts to 5 = serious conflicts <li data-bbox="240 1379 1386 1459">• Who is identifying the objectives of the partnership: the researcher, the private sector entity, both, a committee, or other <li data-bbox="240 1474 1386 1539">• Some type of study conducted by the private sector to estimate the costs and/or benefits of entering the partnership

Indicators that describe partnership performance

- The public partner's satisfaction with the objectives set for the alliance, on a scale from 1 = completely satisfactory to 5 = not satisfactory
- The private partner's satisfaction with the objectives set for the alliance, on a scale from 1 = completely satisfactory to 5 = not satisfactory
- The public sector's perceptions with regard to congruence between the partnership's objectives and those of the public sector in general, on a scale from 1 = very congruent to 5 = not congruent at all
- The public partner's perceptions as to whether the objectives negotiated for the partnership were accomplished, on a scale from 1 = completely accomplished to 5 = not accomplished
- The private partner's perceptions as to whether the objectives negotiated for the partnership were accomplished, on a scale from 1 = completely accomplished to 5 = not accomplished.
- The public partner's perceptions as to whether the partnership contributed to improved competitiveness in the agrichain, on a scale from 1 = completely satisfactory to 5 = not satisfactory

Characterization of Partnerships

Annual funding for 99 public-private partnerships in agricultural innovation from nine different countries totaled US\$27.5 million.

Following hypothesis 1, the a priori assumption was that partnerships can be clustered according to the nature of research (i.e., basic, strategic, or adaptive)²; the part of the food chain (e.g., primary production or postharvest), and the degree of financial participation of the private sector. The study found that in Latin America, a broad variety of public-private partnerships exist in different parts of the agrichain, ranging from large national universities partnering with transnational companies, to local research organizations partnering with small and medium agroprocessors. Partnerships usually include not only a research organization and a firm, but also funding organizations, export promotion bodies, and producer associations.

² Basic research is directed toward a generalized goal (e.g., genetic research in a pharmaceutical laboratory) and generates new knowledge. Strategic research relates to the development of new methods and procedures. Adaptive research directs the results of basic research toward the needs of a specific industry and results in the development of new or modified products or processes.

The results obtained from the correspondence and cluster analysis indicate that it is difficult to attribute partnerships to distinct clusters marked by the same characteristics. One of the few significant correlations found was between the variables “type of activity in the agrichain” and “nature of research.” According to these criteria, three principal clusters can be distinguished: basic research in seeds/varieties, adaptive research in primary production, and adaptive research in processing (see Table 2).

Table 2. Number of Partnerships per Activity and Nature of Research

Type of Activity in Agrichain	Nature of Research			Total
	Basic	Strategic	Adaptive	
Varieties/seeds	21	10	4	35
Primary production	15	7	20	42
Postharvest	8	8	12	28
Total	44	25	36	105

Neither of the aforementioned variables, “type of activity in agrichain” or “nature of research,” was found to be correlated with the share of private funding in the partnership. Hence it cannot be assumed that the level of funding in a partnership depends on its type. It was found that in 50 percent of the partnership cases, the private sector’s contribution was below 33 percent; only in 27 percent of the cases was it above 75 percent of the total funding of the partnership. No correlation was found with the absolute amount of funding provided by the private sector either. The conclusion is that the amount of private funding is not determined by the type of partnership, type of activity in the agrichain, or type of research.

With regard to the correlation between the nature of research and the type of private partner (firm or association), it was found that associations of farmers, processors, or exporters tended to participate more in partnerships for adaptive research. In contrast, individual firms were involved more prominently in basic research (see Table 3).

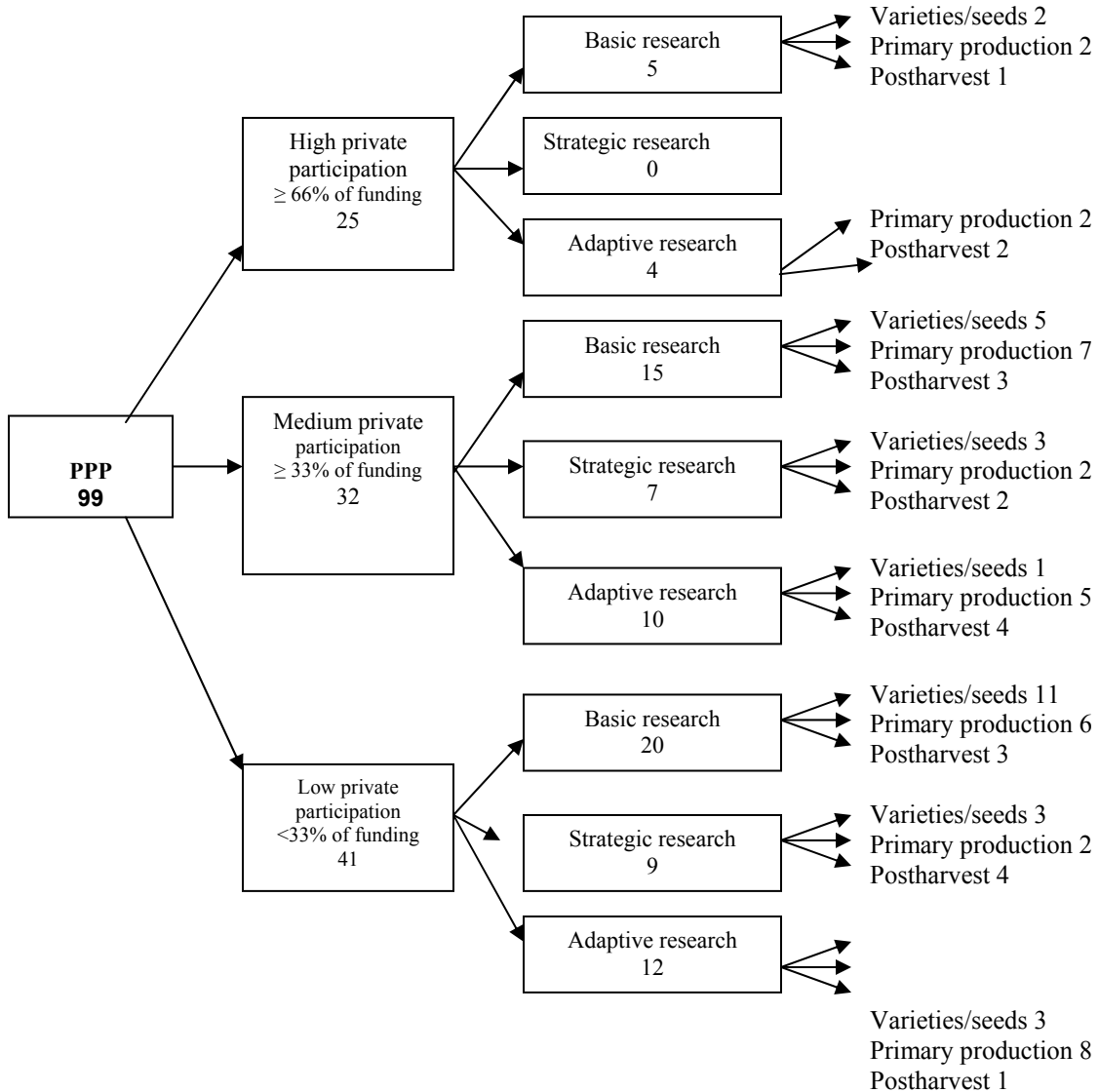
Surprisingly, associations that represent the interests of the sector or the industry have a less strategic and long-term vision about the innovation they seek to develop in a partnership.

Table 3: Number of Partnerships (Percentage) per Nature of Research and Type of Private Partner

Nature of Research	Type of Private Partner		Total
	Firms	Associations	
Basic	24 (66.7%)	12 (33.3%)	36
Strategic	7 (33.3%)	14 (66.7%)	21
Adaptive	8 (28.6%)	20 (71.4%)	28
Total	39 (45.9%)	46 (54.1%)	85

Figure 1 shows how the partnerships studied were categorized into groups and subgroups. The appearance of many small groups confirms that there is no clear tendency toward cluster variables. Subgroups consist of unexpected combinations, such as partnerships with low private sector financial participation that engage in adaptive research in primary production, an area that one would expect the private sector to be more interested in. However, the existence of this type of partnership may be explained by the funding schemes that support activities in this domain and do not require a high degree of participation.

Figure 1. Typology of Public-Private Partnerships for Agricultural Research in Latin America



In conclusion, no empirical typology of partnerships could be obtained using the variables of funding source, type of activity in the agrichain, type of private sector partners, and financial participation of the private sector.

5. Results

Private Sector Rationale for Entering Partnerships

Based on the analytical framework presented above, the hypothesis of the study was that the private sector becomes actively involved in public-private partnerships only if there are clear expectations of profits. These profits can either stem from gains attributable to new or improved products or from cost reductions in producing and processing traditional products. The next challenge of the study was to make available qualitative information about the partners' perceptions regarding such profits.

Two types of private partners were observed: firms, and associations of farmers, processors, or exporters. These private actors have different objectives and thus strive for different benefits: the former are profit-oriented, while the latter represent broader sectoral interests. The data show that private partners analyze the potential costs and benefits of a partnership to a different extent. Most firms (73.8 percent) conduct some sort of return-on-investment analysis (ranging from formal to informal), unlike the associations (only 39.5 percent). This indicates that private partners act according to their nature: before entering into a partnership, firms look for profit and make sure that partnerships will generate benefits for them. Associations, in contrast, are anxious to solve the pressing problems of their members and entire production chains, and tend to focus on adaptive rather than applied research.

Table 4 shows the level of satisfaction of private partners regarding the objectives established for the partnership, the results obtained, and the extent to which the partnership has improved the level of competitiveness of the agrichain. There is a noticeable concentration on the positive side of the satisfaction scale. Most of the partners were satisfied with the objectives proposed and the achievements. A high percentage perceived positive impact with respect to improvement of competitiveness.

Table 4: Satisfaction of Private Partners with Regard to the Objectives Established for the Partnership, the Results Accomplished, and Improved Competitiveness Achieved

<i>N</i> = 124	Objectives	Results	Competitiveness
Very satisfied	79	65	47
Satisfied	19	34	33
Just satisfied	9	11	12
Not satisfied	5	2	2
Missing	12	12	30

Furthermore, it was found that most companies conducted some sort of profitability studies to support their decision to enter partnerships; those studies, however, were rarely of a formal quantitative character providing a cost-benefit ratio. Companies tended to provide more funding when products could be protected by intellectual property rights.

The level of satisfaction with the results and with the way those results improve competitiveness suggests that there is congruence between the initial objectives and the results obtained. Altogether, these results indicate that when the private sector enters into a partnership, it expects to obtain immediate benefits; apparently, in some cases this was achieved. In other cases the private sector did not invest substantially in partnerships and therefore was comfortable with the benefits achieved, even if they were low.

Public Sector Rationale for Entering Partnerships

The hypothesis with regard to public sector motivation was that the public sector providing the funding or research resources for partnerships often enters into those partnerships without properly analyzing their costs and benefits and the overall impact they generate.

In general, public funding for partnerships is substantial. Total annual public funding in the 101 partnership cases analyzed (data on funding were not available for all

124 partnership cases) was US\$16,911,180. This represents 66 percent of the total funding available to those partnerships.

Table 5: Public and Private Funding of Partnerships in USD

<i>N</i> = 101	Mean public	Mean private
Seeds and varieties	170,820	107,173
Vaccines	30,554	34,396
Other inputs	23,941	10,454
Primary production	146,040	57,162
Storage and transport	9,968	4,295
Processing	54,731	17,375
Marketing	61,960	17,128
Other	77,684	44,651
Cumulative all groups	16,911,180	10,610,127

Funding is weighted toward those parts of the agrichain concerned with seeds and varieties and primary production (Table 5). Fewer funds are available for projects relating to agricultural inputs and postharvest aspects of storage and transport, processing, and marketing. Also, public funding amounts are significantly different from private funding amounts in the categories of seeds and varieties and primary production, and less so in processing aspects. Here it can be assumed that the specificity of technologies in the postharvest sector drives the private sector to more substantial investments. The public sector assigns more funds to the types of primary production technologies for which benefits cannot be easily attributed to a single private actor (as a private good) but rather to the entirety of agricultural producers (as a public good).

Given the public sector's considerable commitment to partnerships, public agents becoming involved in partnerships may also have clear expectations with regard to benefits. The public partners' perceptions of the degree to which the partnerships have

responded to the objectives established were extremely positive, with only 2 of 124 representatives of public organizations saying they were not satisfied with the results (see Table 6).

Table 6: Public Partner Satisfaction with Regard to the Objectives Established for the Partnership, Results, and Improved Functioning of Agrichains

<i>N</i> = 124	Objectives	Results	Improved functioning of agrichain
Very satisfied	79	65	45
Satisfied	19	34	29
Just satisfied	9	11	17
Not satisfied	5	2	10
<i>Missing</i>	<i>12</i>	<i>12</i>	<i>23</i>

Furthermore, 95 percent of the public partners considered that the partnership's objectives coincided with those of the public sector.

Given public partners' positive perceptions regarding their involvement in partnerships, as detected in the survey, partnerships should be highly beneficial. However, some doubts remain when considering two problems. The first concerns the self-interest of the respondents, in most cases leading researchers from the public research organization in the partnership. These respondents tend to be biased toward the interest of their research organizations in maintaining their infrastructure and toward their own interest in working within their field of specialization. The second problem has to do with respondents' understanding of social benefits. It was found that public partners, especially researchers, did not always have a clear picture of what the overall public goals were, their organization's strategy to attain them, or how their research contributed to them. Usually rules of thumb were applied, such as: "Maize is a priority crop; therefore any R&D on maize is a priority." Hardly any partnership cases can be reported

in which the public sector entity applied a more in-depth ex ante analysis of the effects of the R&D to be conducted in the partnership.

In most of the cases, public researchers were the initiators of the partnerships and hence determined their objectives. According to the perceptions of the public sector respondents, in 28 percent of the cases the objectives of the partnerships were set by the researchers, and in 60 percent by both the public researchers and private sector agents. Thus one can say that the partnership agendas are driven to a large extent by public interest. In addition, 55 percent of the public and 61 percent of the private sector respondents considered that there was no conflict of public and private interest during the execution of the partnership. This indicates that while partnerships have the potential to be controversial, controversy often does not arise or occurs only after the partnership arrangement has been established and the activities planned are carried out.

In 65 percent of the partnership cases, funding for the partnership was provided by competitive grant schemes administered by the government; in these cases the decision about whether to become involved in the partnership was not made by the public research organization (though it may have agreed to submit the proposal), but by the administrators of the competitive grant in compliance with criteria established for the fund and corresponding to its general goal. Box 2 shows the most common types of funds.

Box 2: Funds Supporting Public-Private Research Partnerships in Agriculture

- Funds of the ministries of science and technology: These usually promote scientific excellence and outputs in basic research, taking into consideration the project's impact on the capacity of academics and on companies in need of innovations.
- Funds of the ministry of agriculture: These usually apply criteria related to the promotion of agricultural production and productivity, farm technology, plant and animal health, and rural development. The focus is often not so much on scientific advances but on practical solutions to problems in agricultural development.
- Funds of the ministry of the economy: These usually apply criteria related to improved competitiveness of sectors, export promotion, promotion of foreign investment, and the development of local and global value chains.
- Funds of development aid donors: Multilateral funds are often channeled through the above three ministries, but there are also stand-alone bilateral funds

Overall, the goals of the partnerships in which public agents are involved seem to coincide with public goals, but only to the extent that they are in the interests of the public research agents involved in the partnerships and funding agencies that subsidize the partnerships. Those interests sometimes conflict with private sector interests. These conflicts, which can be foreseen to only a limited extent in the contract, become more pronounced when the partnership enters into action mode.

Success Factors in Partnering

The final hypothesis relates to the issue of what contributes to the good functioning of partnerships. The first assumption here is related to the argument of good leadership. Leadership can contribute to the partnership's success by solving conflicts, motivating partners, and guiding negotiation and implementation processes.

Comparisons were made of the perceptions of public and private partners vis-à-vis factors relating to leadership, conflict during the development of the projects, and satisfaction with the achievements of the partnership. The data suggest that there are no significant differences in the perceptions of the two sectors.

Evidence exists for causal relationships between a partnership's impact on competitiveness and the variables "previous experience with partnerships with public organizations" and "previous relationships with the current public partner." Table 7 illustrates this relationship. The performance of the partnership is highest when there is a previous relationship and previous experience with partnerships. Partners who know their counterparts and are familiar with the pros and cons of a partnership are more likely to profit from the partnership than are those without these relationships and experience.

Further evidence suggests that leadership in partnerships reduces conflicts; the stronger the leadership, the less conflict occurs. For example, in 72 percent of the partnerships with strong leadership, there were no conflicts. The same was true for the relation between leadership and satisfaction with the results of the partnership: when there is strong leadership, there tends to be more satisfaction with the results achieved.

Table 7: Previous Experience and Relationships in Partnerships

Impact on competitiveness	Previous relationships	Previous experience with partnerships		Total
		Yes	No	
High	yes	30	7	46
	no	1	8	
Above average	yes	21	7	33
	no	3	2	
Intermediate	yes	7	2	12
	no	3		
Low	yes		2	2
	no			
None	yes	3		4
	no	1		

The information gathered overall indicates that leadership is an important factor in determining the success of a partnership. However, leadership alone—in the form of a person or a group that manages, guides, and coordinates the activities of the partnership—is not a sufficient condition for partnership success; other conditions, such as a mismatch of interests, low potential of the innovations developed, and the costs of R&D can be unfavorable. In any case, experience working in other partnership arrangements and knowing one's current counterparts are important factors that, at least in the Latin American context, contribute to success in building partnerships. With regard to monitoring and evaluation mechanisms it appears that most of the partnerships analyzed have not yet developed much concrete action in this field. There is evidence that till now, monitoring and evaluation is rather a neglected field.

6. Conclusions

Public-private partnerships are not a rare phenomenon in Latin America and may soon become a dominant mode of funding for agricultural research in the region. The number and resources of partnerships focusing on innovation development in agriculture are substantial.

Based on the data collected in this study, no empirical typology of partnerships could be constructed. In some agrichains, partners choose very specific problems and solve them through a one-on-one interaction. In others, whole sectors use a kind of partnership platform to develop a common vision and plan activities for improving competitiveness. One can therefore conclude that there is no single way of using public-private partnership in agricultural R&D.

The study shows that with some exceptions, despite broad support from funding and development agencies, the two sectors “public research” and “private production, processing, and marketing of food and fiber products” have not been able to form viable partnerships leading to systematic upgrading of agrichains in Latin America. The private perspective continues to dominate, and the public sector often does not identify and support those partnerships that generate social benefits. There is not enough strategic planning or priority setting by either public or private sector associations with regard to where innovations are most urgently needed and where they can have the greatest positive impact on people and society. Instead, public-private partnerships are created mainly for three reasons:

1. The public sector researcher wants to continue working in his or her field of specialization, and in the search for funds realizes that partnering with the private sector will provide access to either public grants or private funds.

2. Individual firms seek partnering to generate innovations that, for reasons of finance and capacity, they would be unable to generate on their own. Such innovations usually relate to improving the quality and quantity of primary production, which the firms will then use for processing and which allow them to reduce costs and enhance marketing possibilities. The firms mostly profit from tax exemptions based on their investment or in-kind contribution to the partnership, such as the time of their staff or use of their equipment.
3. Local small-scale farmers and processors try to obtain public support to increase the value added of their agricultural production and raise the quality of their products so that they can access local and international markets.

The two sectors still have to establish learning routines for partnering and to realize the true potential of partnerships. One reason may be that the two sides do not yet understand the organizational culture of their counterparts or realize that their counterparts must also reap benefits in order to participate in the partnership. On one hand, private companies may perceive public research as a free service that public agents are required to supply. The private sector's willingness to provide funding is therefore limited; often contributions are simply in-kind or offered only when tax exemption is possible. Researchers at public institutes, on the other hand, may see partnership agreements with the private sector as sources of funds or as necessary arrangements to meet the criteria of competitive grants. As a consequence, in the latter case, most partnerships are not based on genuine demand; do not produce the expected synergistic effects from complementary use of resources, co-innovation, and joint learning; and do not respond to common interests.

The study further found that leadership and partnering experience contribute to partnership success. Indeed, were it not for visionary leadership, some public-private partnerships might never have been created

Based on the above conclusions, the public planner may look into a number of policy options to promote public-private partnerships as a development tool and to ensure that these partnerships generate benefits for both sides:

- Improve public planning and priority setting and provide researchers with clear strategic guidance if they enter into specific research areas to be pursued through public-private partnerships.
- Develop an evaluation framework to assess the social benefits of public-private partnerships. This goes beyond protection of intellectual property rights to examine evaluation criteria regarding the socioeconomic and environmental costs and benefits of a potential innovation. However, such an evaluation framework should be practical and allow for rapid appraisals under conditions of limited data availability.
- Set up outreach units in research organizations, universities, and governments to help apply planning and evaluation procedures and to support public agents in negotiating partnership arrangements, setting them up, and ensuring their functioning. In fact, public and private sectors alike will need to raise their profile in negotiating, designing, and executing partnerships.
- Revise the funding strategies of public funds to avoid supporting pseudo-partnerships in which only one partner benefits (while the other has a representational role).
- Raise awareness and build capacity among private entrepreneurs and public researchers concerning the benefits of partnerships and what is required to make them successful.

- Further train those who can provide leadership for partnership development—not only research leaders and administrators, but fund managers and representatives of organizations that promote innovations.

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