

The Agricultural Technology Consortium Model in Chile

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SYNOPSIS

This IAP presents and discusses the main objectives, results, and lessons from Chile's experience with agricultural technology consortiums. These formal alliances promote joint work between industry and science within a market framework. Chile is regarded as a pioneer in using this model to focus public policy on innovation. Consortiums are a good option when industry is strongly committed to the process and the partners possess the technological capabilities to develop the kinds of products they seek. When these conditions are not met, a strictly corporate model such as the one used in Chile may not work. Special programs may be needed, for example, if consortiums are intended to include small-scale producers.

BACKGROUND AND CONTEXT

Chile's economy has grown at a remarkable pace since the mid-1980s. The country has pursued consistent economic reforms, including market liberalization and important free trade agreements, and it has developed an export model relying on its abundant natural resources and commodities. These reforms have benefited from political and social stability, underpinned by sound democratization.

An important warning signal emerged in the second half of the 1990s, however, when economic growth began to flag. The decade that followed saw near-zero growth in total factor productivity.¹ In response, the government adopted a new innovation policy to make Chile's economy more competitive. The National Council on Innovation for Competitiveness (Consejo Nacional de Innovación para la Competitividad) was formed to advise the president on strategies and policies to foster innovation and increase competitiveness in the medium and long term. The resulting national innovation strategy has three pillars: science, human capital development, and business innovation (CNIC 2007a,

2007b). In conjunction with this strategy, a new institutional framework was developed to give priority to economic sectors exhibiting the highest growth potential, create appropriate instruments to realize that potential, and allocate more public and private resources to research, development, and innovation.²

New policies and instruments have been designed and implemented to further innovation. They include the strategic use of mining royalties; tax deductions for research, development, and innovation; the organization of clusters (high-priority areas for innovation); and the establishment of technology consortiums. This note discusses the main objectives, results, and lessons from Chile's experience with agricultural technology consortiums, which promote joint research and innovation by industry and science within a market framework.

Chile is considered a pioneer in using consortiums to align public research with national innovation policies, and the government issued its first tender for a Technology Business Consortium in 2004. The Chilean consortiums were initially modeled on Australia's Cooperative Research Centres, established in 1990 (see box 4.4 in the overview of this module). The Cooperative Research Centres linked academia, public research institutes, business, and producers through a forum for dialogue, which proved to be the key to developing trust and a meaningful relationship between the parties. This process allowed researchers to understand the problems and needs of private industry and producers and seek specific solutions. It also allowed industry and producers to understand the importance of research and innovation to their business strategies.

OBJECTIVES AND DESCRIPTION OF CONSORTIUMS

As noted, Chile's technology consortiums are expected to strengthen links between research communities and local

and global business communities, thereby improving competitiveness and opening new business opportunities (Álvarez et al. 2010). Their specific objectives are to:

- Increase national competitiveness by encouraging companies to invest in research, development, and innovation.
- Implement programs for research and development that target long-term profits.
- Encourage links between science and industry.
- Develop and strengthen scientific skills and techniques.

A consortium is defined as a technology company in which one or more companies agree to carry out joint projects with universities, institutes, and/or technology centers to develop new technologies that can improve and add value to production processes and products (Álvarez et al. 2010). The theoretical justification for this type of instrument is to discover solutions for market failures limiting innovation by an enterprise and encourage partnership strategies to incorporate knowledge externalities, coordinate the use of complementarities, and share the risk of investment in technology innovation.

Public agencies³ fund and manage the consortium program. The maximum contribution of the public sector to a single consortium is US\$6 million, and each consortium can operate for up to five years. The maximum yearly public contribution to a consortium's total budget is 25 percent for research activities, with an additional contribution of 10 percent for human capital development and 15 percent for research infrastructure. This funding is matched by cofinancing of 50 percent from nonpublic consortium members. Box 4.31 describes the conditions that consortiums must meet to receive public financing.

Like a corporation, a consortium is run by a board composed of representatives from academia and industry in a number according to their capital ratio. Their responsibility is to define the consortium's strategic aims, determine which research projects to pursue, and allocate funding to each. A general manager reporting to the board is responsible for consortium administration and management. The manager's main responsibility is to coordinate all activities of the consortium. Several consortiums have also established technical committees (appointed by the board) composed of researchers and business professionals who are not involved directly with the research; their role is to monitor

Box 4.31 Characteristics and Conditions for Business-Technology Consortiums to Receive Public Financing

The consortiums and the projects under them must:

- Produce results that contribute to economic growth in Chile.
- Create permanent capacity for research, development, and innovation in Chile.
- Use mechanisms to generate, transfer, and adopt knowledge that will achieve the anticipated impacts.
- Identify suitable participants for collaborative work, based on their capacity (including managerial skills), the proposed mode of collaboration between universities, research institutes, and private companies, and the level of commitment to achieve the desired results.
- Provide sufficient cofinancing. The commitment of the partners is expressed in the proportion of cofinancing they are prepared to commit and the returns they envision as a result.

The following conditions are expected to be met:

- The objective justifies the need for different enterprises and research institutions to undertake a sustained R&D effort through the consortium.
- The consortium's work will significantly strengthen existing industries and stimulate the emergence of new ones.
- The projected work requires public funding to be performed.
- The resources requested are consistent with the projects and their anticipated results.

Consortiums are generally formed by enterprises that seek to use cutting-edge research to satisfy the needs of their particular productive sector. An integral part of the business model for these enterprises (and usually a prerequisite for their participation in a consortium) is the development of *patentable results* that can be *licensed* and generate *spinoffs* (in the form of new businesses).

Source: Author, based on information from CONICYT.

research and ensure that it is being conducted as planned, evaluate new research proposed by the consortium, make related recommendations to the board.

INNOVATIVE ELEMENT

Technology consortiums have several novel aspects. The institutional setup of the consortiums was a major innovation because it gave a market orientation (from the companies) to research on technical solutions (to the science-based institutions). This intermediate approach does not imply that research and business should change in any fundamental way; it is simply a means to strengthen the relationship between private enterprise and science. Companies and research centers forge links by pursuing applied research for profit. Members act together “upstream” when they develop technology but act in competition “downstream” in the marketplace. Companies determine the priorities and corresponding research projects, which are executed by research institutions (either as consortium members or externally contracted agencies). When a group of companies or an industry identifies common priorities, problems, or opportunities and sets priorities, resources are allocated more efficiently to address them. Greater trust and understanding among the actors will increase their propensity to share information and achieve synergies for industry and advances for research.

BENEFITS AND IMPACT

The previous discussion has given an idea of the kinds of benefits, tangible and intangible, that can emanate from technology consortiums. As the Chilean experience with this model is so recent, however, the empirical evidence of impact is limited. Most of the consortiums studied have focused on improving the competitiveness of productive sectors rather than on improving capacity to pursue innovative activities. The consortiums’ main contributions are improved access to technological and other kinds of knowledge (such as marketing, international market regulations and requirements, and staff with specific kinds of expertise) and joint technology development by researchers with companies. On-going assessments have identified the following trends:

- The large public investment in these consortiums leveraged significant private resources for research, development, and innovation. These private investments have

risen considerably since the consortiums were established.

- Consortiums have demonstrated the capacity to identify and implement projects relevant to business or industry and to achieve economies of scale in applied research.
- Industries’ and companies’ demands for specific applied research spurred the formation of appropriate institutions and stronger research teams to develop technology.
- Participants gained access to knowledge that otherwise would have been very difficult for them to acquire.
- In some initiatives, the participation of experienced and emerging businesses allowed the companies to learn from one another. In the wine industry, for example, most developing vineyards work with more established companies.
- The trust engendered in the course of the research is likely to have important long-term implications for the actors involved, increasing the potential for further collaboration.

Given the consortiums’ short duration and the applied research they generally conduct, applications for IP protection are still very low. For the same reason, the companies in the consortiums have not yet achieved major technological breakthroughs.

LESSONS LEARNED AND GUIDANCE FOR THE FUTURE

Studies in Chile and in Latin America more broadly suggest that various factors influence consortium partners’ willingness to exchange knowledge, collaborate in R&D, and thus produce innovations (Álvarez et al. 2010):

- The greater the number of partners, the less profitable the results.
- The more that consortium partners compete directly in the final market for goods or services, the more they produce results of limited impact. Not all firms that compete in final markets produce results of limited value when they partner in consortiums, however. Firms that negotiate clear agreements for managing IP before they join a consortium produce better results, because their fears of losing trade secrets or failing to recover R&D costs are alleviated.
- The greater the geographical distance between partners, the less profitable the results.
- The greater the partners’ experience, the better the results.

- The greater the number of employees in R&D or other technical areas in the consortium, the better the results.
- The more frequent the interaction between partners, the better the results.
- The more satisfied the partners are with the contractual provisions to protect IP and resolve conflicts, the better the results.
- The greater the trust and goodwill between partners, the better the results.

Empirical evaluations of consortiums have yielded other lessons. One lesson is that the long startup times of consortiums (about one year) in relation to their duration acts as a disincentive to participation. Startup delays usually involve uncertainty over who will participate, what kind of formal relationship they will adopt, what resources each will provide (social capital, physical capital, counterpart funding), and the IP arrangements.

Part of the application process should be a formal presentation by the parties of the consortium's objectives, the issues it will address, and its projected business model, governance model, IP arrangements, legal status, national and international partners, and other important features. The consortium can operate for a startup period of up to one year with financial support to assess whether to continue or terminate the relationship. This "pre-consortium" period can be useful to define both the business and governance models that the consortium will adopt. It is essential that the business and governance models be consistent with one another. The final structure chosen for any single consortium will not necessarily work for another because in each case the business model is likely to vary.

The preconsortium stage is also the time to define IP arrangements. It is better to define these arrangements before any revenue is generated to avoid conflicts later when revenue begins to flow. The alternatives are for the IP to be owned by the joint venture or consortium or for each partner to own a share of the IP. In that case, the consortium acts as a technology broker, charging a fee for administering any royalties or commissions.

Another lesson is that governance and management make a difference. An active, committed board and technical committees as well as fluid dialogue between participants and high-level management are essential. One concern expressed by companies and research centers alike is that the difference in their objectives is the greatest obstacle to their success in consortiums (box 4.32 provides an example from the wine industry). To address this problem, the

consortium must have a very good full-time manager and constant support from government agencies *with a voice—but no vote*.

A corporate model may not be suitable for all types of consortiums. Consortiums are a good option when industry is strongly committed to the process and the partners possess the technological capabilities to develop the kinds of products they seek. When these conditions are not met, a strictly corporate model may not work.

For example, if consortiums are intended to include small-scale producers, a number of other considerations become important, such as the potential social and economic importance of smallholders' participation in the subsector; government's commitment to support their participation in a consortium; guidance for smallholders to form and function in organizations; and advisory services that enable smallholders to manage new technology and practices successfully. Potato production in Chile is dominated by smallholders with few assets and thus limited capacity to participate in consortiums. A special program could establish better links between these farmers and research institutions (box 4.33), fostering the trust and experience that could make them more effective partners in a consortium, or a less formal association could be devised.

Two strategic elements should be taken into account when implementing a consortium (Lavados 2009):

- **Business model.** From the outset, the business model needs to be clear. Is the consortium geared to develop a single product or multiple products? (To date, most Chilean consortiums have attempted to develop a portfolio of products.) Are local or global markets targeted? How will the partners acquire their medium-term revenues (royalties, licensing, product sales, or some other mechanism)?
- **Portfolio of programs and projects.** Research projects usually deliver results in the medium and long term. To attract private sector partners, consortiums will need to develop a portfolio of projects that is balanced between short- and long-term marketable products.

Another lesson is that Chilean scientific and technological capacity is not always sufficient to address companies' or industries' increasingly complex needs for R&D. A proactive plan must be implemented to generate local knowledge and/or import knowledge and expertise from abroad (immigration of specialists, alliances with international R&D centers).

Box 4.32 A Vine-and-Wine Consortium: Vinnova Merges with Tecnovid in Chile

The quality and prestige of Chilean wine have risen to the extent that Chile now ranks among the top five nations in global wine sales. Two consortiums, Tecnovid and Vinnova, have joined forces to maintain and enhance this position and achieve the economies of scale required for successful R&D. The R&D requirements are set by the companies and executed by university research teams. The consortium ultimately seeks to become a viable enterprise that manages continuous innovation in the wine industry, from processing to marketing.

Through their merger, the consortiums will improve the productivity of the wine industry, develop programs for disseminating and adopting knowledge that will enable the wine industry to use research results quickly and efficiently, and develop the human capital needed to innovate at high scientific and technological levels. The research programs focus on improving the quality, productivity, and differentiation of wines and on developing sustainable production practices. For example, researchers are studying which wines are most competitive among consumers, nationally and internationally; strategies to ensure that planting material is free of disease and pests; the origins of certain physio-

logical disorders in Merlot grapes; the fermentative capacity of various strains of yeast, and winemaking processes that yield higher levels of antioxidants in the final product.

The anticipated benefits and results of the collaboration include: positive and synergistic interaction between academia and the wine industry (all teams consist of business professionals and university researchers); a competent professional team attuned to corporate and business requirements channels the industry's needs for research and innovation; and research that not only solves scientific problems but produces results that can be incorporated into an enterprise's management and marketing.

Lessons include the importance of sound leadership, of working with mature enterprises, and of focusing on innovations that are important to the national economy and the industry. To meet global challenges, the wine industry increasingly needs collaboration upstream in R&D, needs to acquire additional technology and knowledge, and needs to increase its competitiveness in the wine market. If the best expertise to reach those goals does not exist in Chile, industry must seek it abroad.

Sources: Vinnova and author.

Box 4.33 A Business-Technology Consortium for Potato

Potatoes, an important part of the Chilean diet, are grown by 15,000 producers on 50,000 hectares, mostly on small farms. The potato subsector contributes only a fraction of agricultural GDP. A business-technology consortium has been formed to improve the competitiveness of Chile's potato industry through stronger participation in the international market for potato seed, potato for consumption, processed products, and potato varieties. The Consortium has taken the form of a new company, Consorcio Papa Chile SA, through which a large part of the potato industry (mainly small-scale producers) entered into a formal association with technology institutes. The company has 17 shareholders, of which 15 are producer organizations

(representing 1,500 small- and medium-scale farmers who operate 4,500 hectares in various locations) and 2 are research entities: the Instituto de Investigaciones Agropecuarias (Institute of Agricultural Research) and Los Lagos University.

The Consortium has five lines of action: developing technology, strengthening human capital, adding value, management, and transferring and diffusing technology. It pursues research to develop production technologies adapted to particular agroecological conditions and market requirements and is developing new potato varieties with better postharvest characteristics and traits that match consumers' preferences. It has implemented a market intelligence system as well.

(Box continues on the following page)

Box 4.33 A Business-Technology Consortium for Potato (continued)

The main benefit of the Consortium, aside from assembling commercial and public partners to produce innovations requested by the industry, is that it is likely to increase private investments in science and technology for the subsector.

One lesson from the potato Consortium that may prove useful elsewhere is that it is quite difficult to launch a consortium in an industry with multiple, diverse, geographically dispersed, and heterogeneous

actors, for which the products generated are essentially public goods. A second important lesson is that a corporate structure does not seem to be the best match for a subsector with these characteristics. Finally, given the characteristics of the subsector and heterogeneity of the partners, a special program is needed to foster trust between partners (producers, companies, and technology institutions) if they are to work toward a common goal.

Source: Potato Consortium and author.

Finally, the role of public agencies in designing, implementing, and evaluating the work of consortiums must be reconsidered. The specific capacities required in personnel charged with tracking and monitoring consortiums as a

whole must be reviewed. The technical, administrative, and financial procedures used in consortiums should also be analyzed with a view to learning which practices enable consortiums to produce the best research outcomes.