

Technical and organizational innovation: a collaboration between private and public sector, the case of the Ariane® apple

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Word account: 3360.

This work is an original work and is not published elsewhere.

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Abstract

Innovations that allow the development of new product are often linked to collaboration between private companies and public research laboratories. This collaboration mostly involves big companies, which have the most important absorptive capacity. To increase this capacity Small and medium-sized enterprises (SME) can get closer to the public research by working in technological parks or by cooperating to establish joint ventures in R&D. This second solution is generally chosen by companies involved in the same supply chain. We present the case of an association between rival companies in the plant breeding sector for fruit production. The initiative for this association came from a public sector laboratory which persuaded these SMEs to cooperate in order to be able to work with it. This example of organizational and technical innovation allows us to investigate the specific features of public sector research that allow it to take part in private sector innovation.

1. Introduction

Technical innovation is one of the most important sources of economic growth for companies (Audretsch et al., 2002; Link & Scott, 2001). There are two main kinds of innovation; “process” and “product” (Belderbos et al., 2004a; Tether, 2002). The first come mainly from companies R&D department. Product innovations on the other hand often result from collaboration with public laboratories, belonging to universities or public research institutions.

SMEs are more reactive than big companies to take advantage of these innovations. Their small size and lack of bureaucracy can reduce the delays in the innovation adoption process (Bhattacharya & Bloch, 2004; Link & Rees, 1990). However, this type of company tends to collaborate least with public sector research (Mohnen & Hoareau, 2003), although when it does, the innovations are more likely to be adopted by the company. These difficulties of SMEs in collaborating with public research have often been discussed in the literature. They are due to a lower absorptive capacity for scientific knowledge in SMEs than in big companies, because of the absence or small size of R&D in these companies (Cockburn & Henderson, 1998). This absorptive capacity is the “ability to identify, assimilate and exploit new knowledge” (Cohen & Levinthal, 1990). It is specifically linked to the presence in the company of engineers or scientists who can interpret and explain knowledge coming from public laboratories (Arora & Gambardella, 1994). The presence of such competence

and its preservation in a SME with limited investment in R&D is not easy. (Belderbos et al., 2004b). Such competence involves a substantial outlay for these companies. However these are the companies which will make the best of collaboration with public research, because of their considerable reactive ability (Link & Reed, 1990). They and governments need to find methods of organisation so as to improve SME innovation, especially for products which might emerge from collaboration with public research laboratories. Two main ways have been investigated either by authorities or by companies.

- Authorities build technological parks allowing SMEs to relocate near public laboratories, specifically those of universities. The impact of these parks is however modest. Thus, Tether (2002) shows that SMEs which take most advantage of these facilities are the most innovative whose strategy is based on innovation. As regards, there are few installation of the less innovative SMEs, as for example nursery gardeners, in such parks.
- Another approach is for companies to make use of SME associations. These associations, which may be of joint-venture type, aim at sharing R&D efforts (Belderbos et al., 2004a; Fukugawa, 2006). In this way, a SME can have access to R&D whilst still enjoying independent production and ensuring strong and ongoing relations with public research laboratories. These associations are generally of companies involved in the same fields, that or not have supplier or client relations, or complementary companies involves in different fields (Miotti & Sachwald, 2003). Such associations between competing SMEs are particularly rare. Indeed, where R&D is intended to develop products delivering a comparative advantage, alliances between competitors in this field are of little value. Such associations are however seen in the Japanese car industry, where a particular client may wish its suppliers to collaborate, as in the case of suppliers' club (Sako, 1996).

The informal role of public laboratories is very important for facilitating the transfer of technology (Ponomariov & Boardman, 2008). However, except for biotechnology, and the most innovative SME, public research does not take an active role in the emergence of this collaboration (Dalpé, 2003). Such situations seem of little interest in the literature. This is perhaps due to the small number of cases where this type of relationship exists. We suggest, however, that research laboratories could take a pro-active approach in their relationships with SMEs. Public research institutions can invite SMEs to build alliances in order to structure the innovation process and the relation between public laboratories and SMEs. Such a structuring, initiated by the public sector, can even lead to organizational innovation.

We present here a case study of collaboration between a public research laboratory and a consortium of small firms for the development and marketing of a new variety of apple. This case presents several elements of

interest. The public laboratory instigated the collaboration with the SMEs. This collaboration also allowed to link a technical innovation and an organizational innovation. Indeed, all the companies involved in the supply chain are associated in a joint venture to develop and market this variety. This joint venture takes the shape of a "club" (Buchanan, 1965). Although the public laboratory is not a member of the club but it instigate it. Having presented the method, which we used to carry out this study, we shall present in a general way the organization of apple market in France and we shall then focus on the case of the Ariane® apple.

2. Method

In order to analyze this relation between technical and organizational innovation we used a case study (Yin, 1989) of the relationship between a public research laboratory and a set of SMEs. These companies are competitive, or else have a supplier/client relationship.

For the case study, we used primary data from semi-directive interviews with several managers of these companies as well as with researchers from the laboratory. We checked the primary data against secondary data (Jick, 1979). This secondary data came from interviews with the managers of the research institute who are in contact with several laboratories and are therefore familiar with several methods of cooperation with companies. We also made an analysis of published material (Ould Ahmed, 2008). These data allowed us to ensure a triangulation of the data (Jick, 1979).

3. The actors of the apple industry

Several professions are involved in the apple industry. Firstly there are the plant breeders who developed the variety from their selection programs. In our study the apple was bred by a public laboratory, GenHort. Once a variety has been bred, it is propagated and sold by nurseries. These nursery proprietors may also be plant breeders. Fruit growers, most of whom belong to producers' groups, assure the production of apples from trees bought from the nurseries. Their production is sold by merchants who provide the link between large-scale distribution and the producers.

4. The case

The apple variety Ariane ® is the result of almost 30 years of research led by INRA. It arose from an initial crossing, made in the USA, between a wild variety of apple (*Surcharge floribunda*) which carries two genes for resistance to apple scab, but produces small fruits, and an apple variety with good flavour and agronomic qualities. Several successive crossings were then made to select individuals with very good flavour together and resistance to apple scab. The main advantage of Ariane® lies in its resistance to apple scab, caused by *Venturia inaequalis*, which is the most harmful disease of apples in France. This resistance allows to the

number of fungicidal sprays to be reduced. The selection program for such an apple started in the 50s and was led by INRA's GenHort laboratory. However, the final crossing, which produced the variety Ariane®, was made in 1979. From then on, the evaluation of the variety began. For this purpose, GenHort restructured its collaboration with the nurseries, which had existed from the very beginning of the selection program. Indeed, the laboratory maintained regular and important contacts with several nurseries which were interested in the development of an apple variety resistant to apple scab. These relationships were formalized by research contracts funded by the nurseries. Plant breeding know-how remained mainly in the public laboratory. In 1997 the laboratory changed its relationship policy with the nurseries to reduce the cost of collaboration, asking the nurseries to group together to minimize the costs of their relationships with the laboratory:

« In 1997, we said we no longer want to work separately with each of the nurseries; we want to work with them as a group ». (F. Laurens, INRA manager of the Ariane ® program)

In response to this requirement the nurseries grouped together in a joint venture, Novadi, to ensure the development and marketing of the scab-resistant apple varieties developed by INRA or by certain nurseries. Novadi allows the nurseries to improve their collaboration with the public laboratory, and to employ graduates engineers and researchers, increasing their absorptive capacity in particular because of the sharing of tacit knowledge between both parties in the relationship (Senker, 1995). From then on the relation between the public laboratory and Novadi became closer to the model of coproduction which is generally the case with the relationships between high tech SME or big companies and public laboratories.

This first organizational innovation was followed by a second innovation in 2002 when Ariane ® entered the market. Encouraged by GenHort, the nursery proprietors of Novadi joined with the other members of the supply chain, creating a "variety club" similar to that set up for the variety Pink Lady®. This association has several objectives:

- to share the communication efforts linked to the introduction of a new variety. This effort is large compared to the economic size of these companies. The creation of a joint venture between nurserymen, producer groups and merchants results in a sharing of the costs.
- To control the image and the quality of the product by selecting growers who can ensure a high level of quality production. The formation of a club allows the members to be selected in the entrance.
- To ensure that development is centered on the variety. The objective for all the actors, including GenHort, which receives royalties on the apple production, is to plan the development of production according to the extent of the demand. In this way the benefits of the various players are protected, which is not the case for the other varieties, such as Golden Delicious.

This second organizational innovation links all the members of the chain in the same fate. They all have a common interest in the development of the variety and specifically in its growth in sales:

« The various shareholders of the company want to develop the value of the variety Ariane ®. They are linked by a common fate because the success of the company and the variety is a success for all of us. Novadi wants to strengthen this relationship of dependence and all of the shareholders get a premium through the exploitation of the exclusive license given by INRA »
(Elina Grillet, Corporate manager of NOVADI)

This common fate also allows greater R&D investment for the improvement of the variety. These investments are mainly made through partnership with public sector research.

« Our relations with INRA are always very important. Indeed we have several research contracts with them. In particular, to continue to work on Ariane® » (Elina Grillet, Corporate manager of NOVADI).

5. Discussion and conclusion

5.1 Value and limitations of a case study

We were able from a case study to show the existence of a new phenomenon, or at least one which has been little studied until now. The use of such a methodology is particularly well suited to the objective of hypothesis formulation. A case study is admittedly of little interest to test and validate a theoretical hypothesis. On the other hand it is useful to emphasize new practical elements which may enrich existing theories (Sterns et al., 1998; Stuart et al., 2002). The agricultural world, due to its strong professional structure (Aggeri & Hatchuel, 2003), is well suited to provide situations to interrogate the theories. This is no doubt why case studies are used so much in agro business research (Sterns et al., 1998). Our work is part of this research trend. We did not aim to disprove existing theories on the relations between SME and public research. On the contrary, our work is exploratory. We wanted to reveal new phenomena and to formulate new research hypotheses. The validation or rejection of these hypotheses will not however be based solely on case studies. Their methodology seems to us too fragmentary to allow a real theoretical generalization. The use of methodologies involving large amounts of data, even if only qualitative, seems to us necessary to take this work further. As underlined by Stuart et al. (2002), a case study is merely one stage in a wider research program involving many iterations (Eisenhardt, 1989). The work presented here is the first iteration of such a program.

5.2 Why research consortia between competitors are so rare

Miotti & Sachawald (2003) point out that R&D consortia between competing companies are very rare, no doubt because the exploitation of an innovation stemming from this collaboration would give a competitive advantage. R&D constitutes a strategic resource for these companies (Dierrickx & Cool, 1989) who want to use it to give them a competitive advantage (Black & Boal, 1994). However, Kodama (2008) cites such consortia in the Japanese car industry. Such situations are rarely due to companies themselves forming a consortium; more often they have been persuaded to group together by a manufacturer who is the companies' customer. Such collaboration is also often based on long-term relationships between companies belonging to suppliers' clubs. The case we present here shows that such R&D joint ventures can arise from the initiative of the public laboratory which is involved in producing the innovation. However, as in the case of suppliers' clubs this organizational innovation is based on long relationships between the SMEs and the public laboratory, some of which began in the fifties.

5.3 A pro-active role for public research

We pointed out above the pro-active role played by the research laboratory in the implementation of the joint venture. There has been little investigation of such situations. Indeed, the literature on the analysis of innovation processes between companies and public research focuses mainly on the role played by companies. As regards SMEs, work focuses on the impact of public policies, such as the building of technological parks, and on their capacities to innovate and to build links with public research laboratories (Agrawal, 2001). The pro-active role of the public sector in this cooperation has hardly been investigated. We can however note the study presented by Genet (2005) who shows within a laboratory in Lyons the existence of a group set up to facilitate relations with SMEs. However, the case of GenHort differs from that of the GRETh laboratory (Genet, 2005). In the case of GRETh, the laboratory changed its organization to cooperate with the private sector, whereas in our study the reverse occurred.

The two laboratories are thus in different positions vis-a-vis their partners and doubtless have a different vision of the partnership. GRETh has decided to create a specific unit to deal with its relationships with companies, whereas in the case of GenHort, the laboratory seems obliged to work in partnership, and so structures its partners in order to limit the cost of the partnership.

5.4 University or research centres

The case we have presented, as well as that analyzed by Genet (2005) have one feature in common. These two laboratories do not belong to universities but to public research institutes, the CEA (Atomic Energy research center) and INRA (national institute of agronomic research).

These two institutes do not have an educational function: they only do research. Besides, they are strongly linked to the economic sector, the nuclear industry in the case of the CEA, agriculture and food production in the case of INRA. We can therefore propose the hypothesis that such institutes, strongly linked to an economic sector, have a greater inclination to technological transfer and to the co-production of innovation. Such an inclination is not very compatible with strong academic prestige (Ponomariov, 2008) which is sought by universities or fundamental research centers.

Acknowledgement

This research was funded by the Agence Nationale de la Recherche (French research agency) true the program Agriculture et Développement Durable.

References

- Aggeri, F., & Hatchuel, A., 2003. Socioeconomic orders and the polarization of research in agriculture: For a critique of the relations between science and society. *sociologie du travail*, 45 (1), pp. 113-133.
- Agrawal, A., 2001. univeristy-to-industry knowledge tranfer: literature review and unanswered questions. *International Journal of Management Review*, 3 (4), pp. 285-302.
- Arora A., & Gambardella A., 1994. Evaluating technological information and utilising it. *Journal of Economic Behaviour and Organization*. 78 (4), pp 678-690.
- Audretsch, D. B., Bozeman, B., Combs, K. L., Feldman, M., Link, A. N., Siegel, D. S., Stephan, P., Tassej, G., & Wessner, C., 2002, The economics of science and technology. *Journal of Technology Transfer*, 27, pp. 155-203.
- Belderbos, R., Carree, M., & Lokshin, B., 2004a. Cooperative R&D and firm performance. *Research Policy*, 33, (10) pp. 1477-1492.
- Belderbos, R., Carree, M., Diederer, B., Lokshin, B., & Veugelers, R., 2004b. Heterogeneity in R&D cooperation strategies. *International Journal of Industrial Organization*, 22 (8-9), pp. 1237-1263.
- Bhattacharya, M., & Bloch, H., 2004. Determinants of Innovation. *Small Business Economics*, 22, pp. 155-162.

Black, J. A., & Boal, K. B., 1994. strategic resources: traits, configurations and path to sustainable competitive advantage, *Strategic Management Journal*, 15, pp. 131-148.

Buchanan J., 1965. An economic theory of club. *Economica* 32 (1), pp. 1-14.

Cockburn, I. M., & Henderson, M., 1998. Absorptive capacity, coauthoring behavior and the organization of research in drug discovery, *The Journal of Industrial Economics*, 46 (2), pp. 157-182.

Cohen W.M., & Levinthal D.A., 1990. Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly* 35, pp 128-152.

Dalpé, R., 2003. Interaction between public research organizations and industry in biotechnology. *Managerial and Decisions Economics*, 24, pp. 171-185.

Dierrickx, I., & Cool, K., 1989. Asset stock accumulation and sustainability of competitive advantage. *Management Science*, 35 (12), pp. 1504-1511.

Eisenhardt, K. M., 1989. Building Theories from case study research. *Academy of Management Review*, 14 (4), pp. 532-550.

Fukugawa, N., 2006. Determining Factors in Innovation of Small Firm Networks: A case of Cross Industry Groups in Japan. *Small Business Economics*, 27 (2), pp. 181-193.

Genet, C., 2005. La diffusion des connaissances vers les PME: vers un modèle d'exploration collective". *Proceeding of the XIV^o international conference of strategic management*, Angers (FR), 8-9 /06/2005.

Jick T.D., 1979. Mixing qualitative and quantitative methods: triangulation in action. *Administrative Science Quarterly* 24, pp. 602-611

Kodama, T., 2008. The role of intermediation and absorptive capacity in facilitating university-industry linkages- an empirical study of TAMA in Japan. *Research Policy*, 37, pp. 1224-1240.

Link, A. N., & Rees, J., 1990. Firm size, University Based Research and the returns to R&D. *Small Business Economics*, 2, pp. 25-31.

Link, A. N., & Scott, J. T., 2001. Public/Private partnerships: stimulating competition in a dynamic market. *International Journal of Industrial Organization*, 9, pp. 763-194.

Miotti, L., & Sachwald, F., 2003. Co-operative R&D: why and with whom?: An integrated framework of analysis. *Research Policy*, 32 (8), pp. 1481-1499.

Mohnen, P., & Hoareau, C., 2003. What type of enterprises forms close link with universities and government labs ? Evidence from CIS 2. *Managerial and Decisions Economics*, 24, pp. 133-145.

Ould Ahmed S.M., 2008. Stratégies collectives pour la gestion de la durabilité des résistances variétales. *Master thesis. Université Versailles-St Quentin*. 99 p.

- Ponomariov, B. 2008., Effect of university characteristic's on scientist interactions with the private sector: an exploratory assessment. *Journal of Technology Transfer*, 33, pp. 485-503.
- Ponomariov, B., & Boardman, P. G., 2008. The effect of informal industry contacts on the time university scientist allocate to collaborative research with industry. *Journal of Technology Transfer*, 33, pp. 301-313.
- Sako, M., 1996. Supplier's associations in the Japanese automobile industry: collective action of technology diffusion. *Cambridge Journal of Economics*, 20, pp. 651-671.
- Senker, J., 1995. Tacit knowledge and models innovation. *Industrial and corporate change*. 4, (2), pp. 425-447.
- Sterns, J. A., Schweikhardt, D. B., & Peterson, H. C., 1998. Using case studies as an approach for conducting agribusiness research. *The International Food and Agribusiness Management Review*, 1 (3), pp. 311-327.
- Stuart, I., Mc Cutcheon, D., Handfield, R., Mc Lachlin, R., & Samson, D., 2002. Effective case research in operations management: a process perspective. *Journal of operations management*, 20, pp. 419-433.
- Tether, B. S., 2002. Who co-operates for innovation, and why: An empirical analysis. *Research Policy*, 31 (6), pp. 947-967.
- Yin, R., 1989. *Case study research: Design and methods* (Rev. ed.). Newbury Park, CA: Sage Publishing.