Drivers of Co-Innovation Success:

Evidence from the Project Coordinators' Perspective

Paul Ingenbleek

Gé B.C. Backus

Correspondence
Wageningen University, Marketing and Consumer Behavior Group, Hollandseweg 1, 6706 KN, Wageningen, The Netherlands, phone: +31 317 482 719; fax: +31 317 484 361;

Affiliations
Paul Ingenbleek is assistant professor of marketing, Wageningen University, and researcher at the Agricultural Economics Research Institute in The Hague, the Netherlands. e-mail: Paul.Ingenbleek@wur.nl
Gé B.C. Backus is researcher at the Agricultural Economics Research Institute in The Hague, the Netherlands. e-mail: Ge.Backus@wur.nl

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Abstract

Despite the growing attention for co-innovation in chains and networks, little research focuses on the success factors of these processes. This study attempts to identify success factors by conceptualizing key concepts within the co-innovation process, and testing the impact of these factors on project performance. Quantitative data are generated from 66 co-innovation projects in which at least two firms from two different stages in the chain and two research institutes collaborate. Results show among others that successful projects are generally ambitious and take-off quickly. They have a central entrepreneur taking responsibility for the project and consist of committed companies.

Keywords: co-innovation, supply chains, organizational learning

Drivers of Co-Innovation Success in Agro-Food Supply Chains

1. Introduction

Since World War II, development of food and agriculture has predominantly focused on increase of production and effciency. This has led to agricultural systems that are often characterized by a lack of sustainability in natural resources, animal welfare and other biophysical aspects on the one hand, and a lack of market orientation in socio-economic aspects of the system on the other hand (think for example of market protection, intervention prices). Because a single actor is unlikely to create breakthroughs, stimulating innovation is suggested as a governance mechanism that can play an important role in transforming agro and food industries towards more sustainable and market-oriented systems (cf. Boehlje, 1999). Because these innovation processes increasingly involve multiple players from a marketing channel, as well as other parties like research institutes, they are examples of what Chesbrough (2003) calls *open innovation* (also referred to in the literature as *co-innovation*).

Although researchers theoretically recognize that successful innovation increasingly calls for involvement of multiple players within and beyond the supply chain (Hakansson, 1987; Porter 1990; Roy, et al., 2004; Von Hippel, 1988), they have important practical constraints to empirically examine these processes in detail. Hence, empirical studies have generally focussed on (1) case studies and network analyses of single companies and innovation projects, and (2) quantitative studies of dyadic relationships of companies with their customers (Gassmann, et al., 2006; Lettle, et al., 2006) suppliers (Wuyts, et al. 2004) or horizontal partners (Rindfleisch and Moorman, 2001), disregarding the role of other players in the innovation project.

A more holistic, yet generalizable perspective is therefore difficult to develop because project-level data on multiple projects are hard to obtain. Hence, despite the growing attention for co-innovation in agro-food systems, little is known about what makes co-innovation projects successful. This study will depart from the forementioned research traditions by applying a unique database on open innovation projects. It attempts to identify the success factors for co-innovation projects by (1) developing a methodology to identify and quantify success factors within the co-innovation process, and (2) empirically testing the impact of these factors on success measures of 66 open innovation projects.

2. Conceptual background

2.1 Measures for project success

With respect to the success of projects, we will focus on two variables: (1) the extent to which objectives of the projects are met (hereafter *project performance*, in line with common performance measures from the product innovation literature, cf. Henard and Szymanski 2001), and (2) the *spin-off* from the open innovation project, referring to all insights and artefacts that the project yields beyond the original project objectives. To this respect, it acknowledges that projects may yield new insights (Sinkula 1994; Slater and Narver 1995) and continued relationships between companies and/or research institutes (that eventually may be the basis of subsequent innovation).

2.2 Success factors

A first conceptualization of relevant factors explaining these performance measures is developed from the literature on strategic alliances, innovation, and organizational learning in supply chains and networks. In brief, this literature builds on the resource-based view of the firm (often in combination with social network theory) provides an interesting avenue of understanding open innovation. It suggests that firms (and other organizations like research institutes) have a unique portfolio of resources that provide the basis for their competitive advantage (Dierckx and Cool, 1989; Wernerfelt, 1984). Matching these resources in strategic alliances may bring new configurations that lead to innovation (Eisenhardt and Schoonhoven, 1996).

The initial list of success factors that is derived from the literature, is further refined in eight expert interviews with policy-makers and key representatives of companies and research institutes. The final conceptualization included statements on seven groups of variables, i.e.: (1) the type of objectives that the project aimed to achieve, (2) ambition levels of the project, (3) the types of knowledge applied in the project, (4) characteristics of the initiation of the project, (5) characteristics of the realization stage of the project, (6) risks underlying the project, and (7) the role of research institutes.

First, with respect to the type of objectives that the project aimed to achieve, nine different objectives are distinguished, including: efficiency, removal of logistic bottlenecks, risk reduction, increasing scale, creating value through new product development/improvement, market entry, sharing costs and profits, and sustainable development. A project may focus on one or more of these objectives to a certain degree.

Second, with respect to ambition levels of the project, we distinguish between the level of ambition relative to other open innovation projects and the level of ambition relative to current practices within the sector or industry.

Third, regarding the types of knowledge applied in the project, the following types of knowledge may deployed to a certain extent in a project: technological knowledge, market research, economic knowledge and organizational knowledge.

Fourth, with respect to characteristics of the initiation of the project, five characteristics are included, i.e.: whether all participants that logically would be expected in the projects are participating, whether the project partners were already involved in a supply chain relationship, whether a manager/entrepreneur with a central role in the company network took the responsibility for the project, whether the initiator of the project is the same person as the leader of the project, and the length of time before the project got started.

Fifth, on the characteristics of the realization stage of the project, eight characteristics are included, i.e.: communication between project partners, personal changes among the representatives of companies in the project, changes among participating companies during the project, a lack of experience in co-innovation among companies, a lack of embeddedness of the project in the participating companies, difficulties with companies in paying their financial contribution to the project, a lack of commitment of participating companies to the project and the extent to which participants all aim at the same direction with the project.

Sixth, regarding the risks underlying the project include administrative burden, leakage of sensitive information, regulation, technical risks, demand risks, and competitive risks between partners.

Seventh, with respect to the role of research institutes, we include the ambiguity and complexity of the applied knowledge, personal changes in the research team, inability to meet the expectations that are based on reputation, a strong disciplinary focus, and the exceeding of deadlines.

3. Method

3.1 Application

Data are collected within the context of Agro Chain Competence (in Dutch abreviated as AKK), which has been the major governance instrument to support open innovation in the Dutch agro- and foodbusiness during the past years. AKK was founded in 1994 and probably one of the longest running initiatives to organize open innovation, organizing nearly 100 open innovation projects. Its role is to put open innovation policy to practice by connecting potential partners and by bundling investments of companies, public policy and research to realize innovation. More specifically, AKK organizes Government-supported programs that run for approximately five years and that are directed towards policy objectives like sustainability and competitiveness. Within these programs, partnerships of companies and knowledge institutes applied for funding to specific projects. The decision about which projects were funded was made by the organization's board, consisting of 10 representatives from companies, representative bodies like sector organizations, and knowledge institutes.

Every project consists of at least two companies (from at least two different stages in the channel) and a minimum of two different research institutes. Each project has a project leader from one of the participating companies or knowledge institutes, and a steering committee consisting of several stakeholders. AKK supports the project by involving an experienced project coordinator who guides the innovation process from a neutral position. The projects often serve multiple, complementary objectives at one time, varying between efficiency, product development/improvement, increasing the scale of operations, risk reduction and quality management, sharing costs and benefits, market entry and sustainable development (see Table 1 for descriptions of representative projects). Crucial in each project is the involvement of knowledge institutes. Several types of knowledge may be used in the project varying from technology to process knowledge and market research.

Table 1 Descriptions op representative co- innovation projects

Main objective	Description	Participants
Efficiency	The project aims to decrease fresh food losses from the supermarket shelves by improved logistic planning and ordering management based sales figures. Chain optimization models and data sharing had to improve efficiency.	Supermarket chains Logistics company Trading company Agro and Food Technology Institute
Product development/ improvement	The objective was to commercialize pumpkins by developing a new product, i.e. pumpkins stuffed with meat. Market research was used to assess the market for such a product. Food safety knowledge was used to assess the technical feasibility, in terms of food safety requirements.	Pumpkin growers Supermarket chain Agricultural Economics Research Institute Risk analysis institute
Increasing scale	This project intended to increase the scale of organic flowers. Especially in export markets there is considerable demand for organic flowers, but the supply-side operates on a scale that is too small to meet the demand. Organic growing techniques for new types of flowers had to be developed in order to make bouquets, and logistic processes had to be expanded and coordinated.	Organic flower growers Flower trading company Organic trading company An agricultural growing technology institute Agro and Food Technology Institute
Risk reduction/quality management	The project intends to improve quality and storage of a specific fruit chain. Specifically it had to lead to fewer losses and a year round rather than seasonal availability of fruits. Technological innovations should lead to changes in growing, harvesting, storing and distributing fruit.	Fruit auction Individual fruit growers Sector organization of fruit growers Agro and Food Technology Institute Agricultural growing technology institute
Sharing costs and benefits	The organic pork chain had the objective to increase its market share. These efforts were however hindered by the absence of a fair price mechanism. An economic model on sharing costs and profits had to be developed and the technical consequences for the chain of such a system had to assessed.	Organic hog farmers Organic slaughters and traders Supermarket chain Agro and Food Technology Institute Agricultural Economics Research Institute

Table 1 (continued) Descriptions op representative open innovation projects

Main objective	Description	Participants
Market entry	The objective was for tomato growers to enter export markets. In order to do so successfully, tomatoes had to be adjusted to foreign taste. Technological knowledge on the growing process was used to develop new tomatoes, that were subsequently tested in consumer research.	Supermarkets on export markets Tomato trading company Tomato growers Agricultural growing technology institute Agro and Food Technology Institute
Sustainable development	In order to improve its sustainability image, a large holiday parks company wants to source its potatoes and vegetables from certified sources. A super market joined the initiative, and together they aimed to motivate their suppliers to increase their production of environmental friendly grown products, and develop methods for year-round production.	Holiday parks company Super market chain Potato and vegetable farmers Environmental quality label organization Agricultural Economics Research Institute Agricultural growing technology institute

3.2 Data collection

Quantitative data are generated from five interviews with coordinators of co-innovation projects. The coordinators have an independent position among the project partners. They help the participants to get organized and they direct the innovation process. They thus are key informants to gain insight in the co-innovation process.

In the interviews, a protocol was followed about each project that the coordinator had been involved in. Interviews started with a narrative discussion about the project's objectives, participants, processes, successes and failures. This ensured that the respondent's mind was fully focussed on the project at hand. Next, a questionnaire was filled out by the respondent, in which he or she gave a score on 7-point Likert-type statements.

The success measures (performance and spin-off) are measured by respectively 7 and 4 items (Cronbach's Alpha is .93 for project performance and .77 for project spin-off). The discriminant validity of the two success measures is confirmed by a factor analysis. Success factors are measured by single items.

4. Results

To gain insight in the success factors of the 66 co-innovation projects, we examined correlations between the project performance measures and other variables.

Objectives. In projects that have relatively straightforward objectives like improving efficiency and removing bottlenecks, the objectives are more easily achieved than in projects with more complex objectives like market entry and new product development (Table 2).

Spin-off effects are particularly found among projects in which sustainable development is enhanced and in which costs and profits are redivided. From the latter, spin-off effects are probably enhanced because sharing costs and benefits requires trust between project partners and the willingness to share sensitive information. These higher levels of trust may subsequently lead to stronger collaboration within the chain. Sustainable development objectives are often set at projects in organic chains. Partners in these projects may have a stronger sense of "belonging together" than partners in mainstream chains, thus explaining the higher level of spin-off.

Table 2: Results on project objectives (correlations)

	Project performance	**Project spin-off**
Efficiency	.33**	.19
Removal of bottlenecks	-.05	.20
Risk reduction	.30*	.17
Increasing scale	-.14	.20
New product development	-.16	-.05
Market entry	-.21	.10
Sharing costs and profits	.10	.23
Sustainable development	-.16	.27*

** $p < .01$, two-tailed significance
* $p < .05$, two-tailed significance

Ambitions. High ambitions for the industry and sector appear to have a strong impact on the extent to which project objectives are achieved and on the spin-off from the project. The spin-off from the project is also affected by the ambition of the project relative to other project.

Table 3: Results on project ambitions (correlations)

	Project performance	**Project spin-off**
Project	.16	.26*
Industry, sector	.28*	.52**

** $p < .01$, two-tailed significance
* $p < .05$, two-tailed significance

Type of knowledge. Related to the finding that objectives like efficiency are more often successful, a significant correlation is found between the application of economic knowledge in the project and project performance. To achieve higher spin-off effects, technological knowledge appears to be successful. This finding suggests a technology push: the development and application of new technologies may lead to new applications of that

technology. Also other correlations with spin-off are relatively strong, suggesting that the deployment of knowledge in co-innovation projects has a long-lasting impact.

Table 4: Results on type of knowledge (correlations)

	Project performance	Project spin-off
Technological	.14	.26*
Market research	.11	.22
Economic	.33**	.23
organizational	.20	.21

** p < .01, two-tailed significance
* p < .05, two-tailed significance

Initiation of the project. With respect to the initiation of the project, results show that a slow start has a negative impact on project performance. Having an entrepreneurial manager in the project from one of the companies, appears a very strong successfactor for both project performance. This finding points to the importance of entrepreneurship in innovation in agro-food chains. Companies that already share a relationship do however not perform better than others. This finding suggests that experience is not a requirement to innovate successfully.

Table 5: Results on initiation of the project (correlations)

	Project performance	Project spin-off
Not all participants included	-.22	-.08
Existing relationships	.16	.05
Central manager	.46**	.29*
Initiator is project leader	.17	.15
Initiation time	-.39**	-.22

** p < .01, two-tailed significance
* p < .05, two-tailed significance

Realization of the project. For the realization of the project, timely and suffcient communication between project partners appears to be a success factor to achieve project objectives. The extent to which the interests of all participants remained aligned untill the end of the project is found to correlate significantly with both performance measures. A lack of commitment, unwillingness to fulfill financial obligations, personal changes among company representatives in the project, and insufficient embeddedness of the project in companies, lead to lower achievement of the objectives.

Table 6: Results on realization of the project (correlations)

	Project performance	Project spin-off
Communication	.46**	.22
Personal changes	-.29*	.00
Change of participants	.03	.05
Lack of experience in co-inn.	-.18	-.16
Lack of embeddedness	-.28*	-.20
Problems with payments	-.47**	-.12
No commitment	-.42**	-.21
Sharing same direction	.43**	.26*

** p < .01, two-tailed significance
* p < .05, two-tailed significance

Risks. In terms of risks underlying the project, a high administrative burden and competitive tensions between partners may negatively influence the achievement of objectives. The administrative burden is caused by transparency that is required by public policy that invests subsidies in the projects. Competitive tensions emerge from the fact that companies in a supply chain may, despite their relationship in the co-innovation project, at the same time struggle for market power. The positive effects of regulation and leakage of sensitive information are caused by the fact that projects that face these risks are of often more ambitious (and thus more successful) than other projects.

Table 7: Results on risks underlying the project (correlations)

	Project performance	**Project spin-off**
Administrative burden	-.28*	.04
Leakage of sensitive inf.	.31*	.24
Regulation	.27*	.31*
Technical risks	.14	.17
Demand risks	-.22	.02
Competitive risks	-.34**	.17

** p < .01, two-tailed significance
* p < .05, two-tailed significance

Role of research institutes. The role of research institutes has a remarkably small impact on achievements and spin-off from the project. One explanation may be that in most cases, research institutes are carefully selected for the project and thus have smaller variation with respect to success rates. Their impact may also be contingent on other project characteristics.

Table 8: Results on the role of research institutes (correlations)

	Project performance	**Project spin-off**
Ambiguity	-.27*	-.07
Complexity	-.06	-.02
Personal changes	-.24	-.03
Not meeting reputation	-.13	.17
Disciplinary focus	-.06	.16
Exceeding deadlines	-.19	.04

** p < .01, two-tailed significance
* p < .05, two-tailed significance

5. Conclusions

Overall, this study managed to develop a method that is promising to create insights in the complex process of co-innovation in agro-food chains. Co-innovation is an important, and often the only, means by which firms can respond to changing customer needs and societal requirements like food safety and sustainability. The results from our study show that the projects should not only be evaluated in terms of the extent to which they achieve the objectives, but also to in terms of their spin-off to creating new insights and continued collaboration within chains.

Successful projects are generally ambitious and take-off quickly. They have a central entrepreneur who takes responsibility for the project. The projects consist of committed companies (that also pay their bills). The project partners communicate frequently, and have the project well-embedded in their organization, and have a single person that represents the

company until the end of the project. Projects should not be hindered by competitive tensions and large administrative burdens.

The project is limited with respect to the single perspective that is used (only project coordinators) and by its limited scope to AKK. Future research may collect data from the perspective of other participants and from other co-innovation programs. It may also apply more advanced modelling techniques to the data presented in this study. This will generate insights in the impact of different variables relative to each other, and it may identify conditions to success by testing interactions between success factors and other project characteristics.

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