

CO-INNOVATION RESEARCH IN CONSTRUCTION

Bart Bossink¹

¹*Vrije Universiteit Amsterdam, Faculty of Economic Sciences and Business Administration, De Boelelaan 1105, 1081 HV Amsterdam, The Netherlands*

A research framework is presented with which co-innovation - i.e. interfirm innovation – processes in the construction industry can be studied. The aim of this framework is to provide a basis of content for the development of research projects into various topics related to co-innovation in construction. The framework is based on the main outcomes of ten years of research into co-innovation processes in the Dutch construction industry. The framework distinguishes the following themes of co-innovation: (1) management practices, (2) innovation drivers and (3) innovation cycles. For each theme a research structure and a basic research question is presented. These instruments can be useful for researchers who want to develop research proposals into one or more aspects of co-innovation in construction.

Keywords: innovation, co-innovation, research framework

CO-INNOVATION RESEARCH

Introduction

This paper contains a framework for research into organizational co-innovation. The co-innovation process is *the organizational development and market adoption of original ideas into new goods, services, and practices by cooperating organizations*. Co-innovations are the outcomes of the co-innovation processes. The aim of this paper is to present a comprehensive framework of content in co-innovation. In this first introductory section the three basic themes of the framework are summarized. In the following sections these themes are further explained and discussed.

The research framework

The research framework is based on ten years of research (Bossink, 1998; 2002a; 2002b; 2002c; 2004). Co-innovation processes were studied in the house building industry in the Netherlands. Three co-innovation themes were identified as important factors in the co-innovation process. The research framework consists of these three themes.

Three research themes

The themes of the co-innovation research framework are:

1. Co-innovation management practices: the organizational control routines that are used to direct co-innovation processes.
2. Co-innovation drivers: the organizational and environmental mechanisms that stimulate and direct organizational co-innovation processes.
3. Co-innovation cycles: the series of stages co-innovative organizations repeatedly go through.

¹ email: bbossink@feweb.vu.nl

Plan of the paper

This first section is a general introduction into the aim and scope of the co-innovation research framework. The research framework is presented in three themes. Each theme is the subject of a section. In these sections the fundamentals of each theme are explained in terms of a research structure, and the research structure is translated into a research questionnaire. The questionnaire contains the basic questions to be answered to assess the co-innovative status of an organization. The paper ends with a discussion of the proposed research framework and a conclusion section.

CO-INNOVATION MANAGEMENT PRACTICES

Introduction

The first theme in the framework for co-innovation research is *co-innovation management practice*. A co-innovation management practice comprises the organizational routines to direct and control co-innovation processes. This section starts with the presentation of the basic structure for research into organizational co-innovation management practices and continues with the translation of this research structure into a research questionnaire.

Research structure

Co-innovation management practices are divided into six distinctive categories: co-innovation design, co-innovation planning, co-innovation systems, co-innovation goal setting, co-innovation positioning, and co-innovation interaction (*cf.* Mintzberg *et al.*, 1998; Bossink, 2002a).

Co-innovation design

Some organizations create a grand design for co-innovation. The grand design is developed by a staff department or by a hired consultant's firm, and is based on market and business research. Top management decides to adopt or reject the design. When a final design is approved, a next organizational step is to implement the design into the organization. The design for co-innovation is presented to other management levels in the organization and is used as a blueprint for co-innovative action. Simple inspection routines are used to verify whether the co-innovation design is implemented in the organization, and to improve the implementation (*cf.* Brickley *et al.*, 2003).

Co-innovation planning

Some organizations make a co-innovation plan and co-innovative activities are planned in time. Co-innovative projects are defined, activities that have to be performed are described, and it is determined which results have to be accomplished. The planning of various projects enables the organization to direct and control co-innovation processes on a time scale. Planning practices are performed at all management levels in the organization. Instruments that are used to support planning practices are: plans, projects, planning charts, and evaluations of plans (*cf.* Cagan and Vogel, 2002).

Co-innovation systems

Some organizations use co-innovation systems. A co-innovation system consists of formal working procedures, work result documents, work result measurements, and corrective actions. The co-innovation system provides standardized processes for creating, directing and controlling co-innovative action in the organization. Co-innovation systems are practiced at the work floor level in the organization. The control function is performed by the organization's managers. Instruments that are

used to support co-innovation systems are: certified management systems like the ISO-9000 series, audits by managers, and handbooks in which the co-innovation system and its outcomes is documented (*cf.* Christiansen, 2000).

Co-innovation goal setting

Some organizations set and realize co-innovation goals. The goals can be symbolic to provide the organization with a vision, or very specific to focus every day co-innovative organizational action. Co-innovative goal setting and goal realization is both a top down and a bottom up practice. Top management defines co-innovation goals. At lower management levels these co-innovation goals are translated into measurable targets and results, and the results contribute to the co-innovative performance of the organization and to the development of new co-innovation goals. Instruments that are used to support co-innovation goal setting are: performance measurements, the deployment of goals in the organization, target setting, and continuous improvement programs (*cf.* Merli and Bullock, 1995).

Co-innovation positioning

Some organizations gain or sustain a competitive advantage in the marketplace by positioning themselves in the market as a co-innovative company. The positioning of the organization as a co-innovative firm is prepared and executed by the marketing and sales department and heavily supported by top management. In their publicity campaigns organizations cooperate with organizations with whom they co-innovate. Instruments that are used to support co-innovation positioning are: analysis of the co-innovativeness of competitors, advertising campaigns, trademarks, and patents (*cf.* Aaker, 2001).

Co-innovation interaction

Some organizations interact with their environments. Distribution and allocation of information and knowledge is stimulated. Communication with other organizational departments, competitors and other organizations is important and creativity is stimulated. Interaction practices are supported by top management. Top managers, middle level managers, R&D officers, work floor managers, and work floor employees are responsible for cross-departmental and –organizational information sharing. Cross-departmental and cross-organizational development of co-innovations is a main goal in the co-innovation interaction practice. Instruments that are used to support interaction practices are: project teams, cross-functional contacts, and informal R&D departments (*cf.* Gray and Larson, 2000).

Research questionnaire

The research structure is translated into a research questionnaire (see Table 1). The research questionnaire facilitates the assessment of the current direction of the co-innovative management practice(s) of an organization.

Table 1: Research questionnaire for co-innovation management practices

<p>Co-innovation management practices</p> <p>Co-innovation design Has the organization a grand design for co-innovation? Is the grand design implemented into the organization? What are the co-innovation results?</p> <p>Co-innovation planning Has the organization a time-based co-innovation plan?</p>
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Does the co-innovation plan contain co-innovation projects?
What are the co-innovation results?

Co-innovation systems

Has the organization a co-innovation system?
Is the system and its outcomes administrated?
What are the co-innovation results?

Co-innovation goal setting

Does the organization have a co-innovation goal program?
Are the goals translated into targets and are these targets met?
What are the co-innovation results?

Co-innovation positioning

Does the organization position itself in the market as co-innovative?
Is the organization seen as co-innovative by the customers and competitors?
What are the co-innovation results?

Co-innovation interaction

Does the organization promote cross-departmental and –organizational knowledge sharing?
Are all employees responsible for cross-boundary knowledge distribution?
What are the co-innovation results?

CO-INNOVATION DRIVERS

Introduction

The second theme in the framework for co-innovation research is *co-innovation drivers*. A co-innovation driver is an organizational or environmental mechanism that stimulates and directs organizational co-innovation processes. This section starts with the basic structure for research into the co-innovation drivers and continues with a translation of the research structure into a research questionnaire.

Research structure

Innovation drivers are divided into four categories: environmental pressure, technological capability, knowledge exchange, and boundary spanning (*cf.* Bossink, 2004).

Environmental pressure

Environmental factors force and stimulate organizations to co-innovate. Many co-innovations are developed because of market demand, or because of governmental pressure. Customers continuously seek for new products and services. Organizations that are capable of serving the renewal needs of customers, gain and sustain market share. In addition to this, governmental bodies and regulating institutions use their regulatory power to direct the co-innovative activities of organizations. Organizations that are capable of reacting and pro-acting to these regulatory changes sustain, protect, and enforce their position in the industrial landscape (*cf.* Raider, 1998).

Technological capability

Technologies enable organizations to develop co-innovations. Many organizations build their strong reputation with a technology strategy and with technological competencies. They develop new technological solutions and seek for opportunities to

integrate it in new co-innovative products and services. In many cases the integration of new technologies by co-innovating organizations results in original products. New markets have to be developed for these technology-driven co-innovations. The market adoption of the techno-co-innovations is stimulated by information campaigns, marketing effort, and financial support from capital investors (*cf.* Sakakibara, 1997).

Knowledge exchange

Knowledge enables organizations to co-innovate. Knowledge about technological developments, about opportunities in markets, and about the possibilities to work with other organizations, is necessary to co-innovate. The creation of knowledge networks consisting of universities, research institutes, and commercial organizations, enables knowledge exchange in and between organizations and industries. Industry-wide programs promoting collaborative arrangements between organizations contribute to organizational co-innovation projects. In a co-innovative industry and in co-innovative organizations, research & development is a crucial activity (*cf.* Powell, 1998).

Boundary spanning

Initiatives that go beyond departmental, organizational and industrial boundaries enable organizations to co-innovate. A cross-departmental initiative is the integration of the design, production and marketing functions in an organization to develop a co-innovative and marketable product design. A way to go across organizational boundaries is the integration of suppliers' innovations or innovative customer demands in the organizational processes and organizational products. Examples of cross-organizational and cross-industrial initiatives are strategic alliances and long-term relationships with other organizations (*cf.* Doz *et al.*, 2000).

Research questionnaire

The research structure is translated into a research questionnaire (see Table 2). The research questionnaire facilitates the assessment of the current state of the co-innovation drivers of an organization.

Table 2: Research questionnaire for co-innovation drivers

Co-innovation drivers

Environmental pressure

Does the market stimulate and force organizations to co-innovate?

Do governmental bodies stimulate and force organizations to co-innovate?

What is the organizational co-innovative response to the market and the regulations?

Technological capability

Does the organization have a technology strategy?

Does the organization have technological competencies?

How does the organization develop markets for technology-based co-innovations?

Knowledge exchange

Does the organization participate in knowledge networks?

Does the organization participate in industry-wide collaboration programs?

What is the organization's R&D-function's contribution to co-innovation?

Boundary spanning

Does the organization have alliances for co-innovation?

Does the organization integrate externally developed innovation in its processes and

products? Does the organization integrate design, production and marketing?
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CO-INNOVATION CYCLES

Introduction

The third theme in the framework for co-innovation research is *co-innovation cycles*. A co-innovation cycle is a series of stages a co-innovating organization repeatedly goes through. This section starts with the basic research structure for assessing the position and direction of the organization in the innovation cycle and continues with the translation into a research questionnaire.

Research structure

An innovation cycle is divided in four stages: independent strategizing, co-innovative strategizing, co-innovative organizing, and co-innovation realization. Co-innovating organizations go through all four stages, and in the sequence presented. Organizations often go through a co-innovation cycle several times, and often are in several innovation cycles at the same time (*cf.* Kreiner and Schultz, 1993; George and Farris, 1999; Bossink, 2002b; 2002c).

Independent strategizing

An organization independently sustains and strengthens its competitive market position. The market, the society, the political climate, and the stakeholder interests change, and the organization is forced to innovate. The organization explores the possibilities to innovate independently. The product portfolio is analyzed and the organization tries to renew existing products, to enter new markets with existing products, and to develop completely new products for new markets. Projects are started to renew products, to study developments in markets, and to define, design, produce and market innovative products on existing and new markets (*cf.* Powell, 1998).

Co-innovative strategizing

An organization wants to co-innovate. It meets with other organizations and explores the possibilities for joint research & development and co-innovation projects. Places where organizations can be met are: conferences, trade fairs, and industrial networks. Research ideas, knowledge, and capabilities are shared and the organizational awareness of the co-innovative potential of other organizations grows. The organization chooses other organizations - and on the other side, is chosen by them - to co-innovate with. Together they develop a co-innovation strategy, define co-innovative projects, and determine the expected output of their co-innovative activities (*cf.* Chiesa and Manzini, 1998).

Co-innovative organizing

Organizations organize for co-innovation. They negotiate about the distribution of costs and revenues, and enter into contracts with each other. They start co-innovation projects, and develop co-innovation plans. The organizations decide which innovations to produce, how to cooperate, how to divide and share responsibilities, and how to govern the co-innovation projects and processes. They establish a co-innovation organization in which the planned innovations have to be developed, designed and produced. The co-innovation organization has the form of a(n) alliance,

joint venture, quasi firm, learning network, interfirm network, R&D consortium or partnership (*cf.* Croisier, 1998).

Co-innovation realization

The co-innovation organization realizes the innovations planned. Co-innovation management practices are used to direct and control the co-innovation processes. The output of the co-innovation organization is positioned in existing or new markets by means of intensive information and marketing campaigns. The adoption of the co-innovations by the market is a main objective. When the planned co-innovations are designed, developed and can be produced, the co-innovation organization transforms from a design-construct-oriented organization into a communication and marketing organization. The communication and marketing activities are directed towards the adoption of the innovation by existing or new markets (Berthon *et al.*, 1999).

Research questionnaire

The research structure is translated into a research questionnaire (see Table 3). The research questionnaire facilitates the assessment of the current position and direction of the organization in the innovation cycle.

Table 3: Research questionnaire for co-innovation cycles

<p>Co-innovation cycles</p> <p>Independent strategizing Does the organization sustain and strengthen its competitive position on the market independently? Does the organization innovate independently? What are the organizations autonomous innovation projects?</p> <p>Co-innovative strategizing Does the organization explore the co-innovation possibilities with others? Does the organization have a co-innovation strategy with other organizations? What are the organization's co-innovation projects?</p> <p>Co-innovative organizing Do organizations enter into co-innovation contracts with each other? Which organizational forms are used to co-innovative? Which co-innovation projects and plans are executed?</p> <p>Co-innovation realization Does the co-innovation organization realize and market the planned innovations? Which co-innovations are realized? What is the market share of the realized co-innovations?</p>
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DISCUSSION

This section discusses the three basic themes of the research framework.

A question to discuss is why these three basic themes are part of the framework, and other themes that are often emphasized as important in the innovation literature, aren't. In the case research that was carried out in the last ten years – 28 cases in Dutch construction practice (see Bossink, 1998; 2002a; 2002b; 2002c; 2004) – the three basic themes played a crucial role in every case. The reason to emphasize these

themes is to present a framework for future research consisting of the most important themes on the basis of the case study findings.

A question that relates to the question above is why the themes are divided in a certain and limited number of elements. The choice for these elements, and not for other elements that are emphasized as important ones in the literature, is based on an intensive analysis of the literature (see Bossink, 1998; 2002a; 2002b; 2002c; 2004).

The elements that were frequently emphasized in the literature were selected to be the representing elements of the themes in the framework. To ensure that relevant literature was studied, all issues of all volumes of the last ten years of the relevant innovation management journals and construction management journals were reviewed.

The reason to select a limited number of themes and elements was to construct a framework for future research in co-innovation that emphasizes major topics. This does not mean that topics that aren't part of the framework aren't important and should be ignored, or shouldn't be subject to scientific investigation.

Another relevant question is in which way the themes in the research framework relate. The analysis of the literature shows that the theme 'management practices' is mostly discussed in terms of 'business processes', with an emphasis on the operational aspects. It also shows that the theme 'co-innovation drivers' is described as a set of factors located in the organization's environment and in the organization itself.

Finally, the third theme 'co-innovation cycles' is a theme that is discussed in the literature as a process on the strategic, tactical as well as the operational management level in the organization. Every theme looks at co-innovation processes from a different perspective. The three themes complement each other.

A final remark to be made is that the research framework provides a basis of content, but doesn't provide a guideline for an appropriate research design or research method to investigate co-innovation processes in construction organizations and their environment. The strength of the framework is that it provides a theoretically and empirically based framework of content into relevant themes and elements of co-innovation processes. The weakness of the framework is that it highlights a limited number of themes and elements. It doesn't provide a basis of content for the discovery of completely new relevant co-innovation themes.

CONCLUSION

The framework for research in co-innovation in construction emphasizes three themes: co-innovation management practices, co-innovation drivers, and co-innovation cycles. The framework provides a basis of content for research into co-innovation processes in organizations in the construction industry. It does not provide a basis for methodological choices and it doesn't describe guidelines for the research methods to use. The renewing perspective of the research framework is that it focuses on the main themes and elements in construction innovation. The main value of the research framework is that it supports the choice of one or more relevant themes or elements to be the subject of further research in co-innovation.

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