

The development of co-innovation strategies:
stages and interaction patterns in interfirm ...

Bart A.G. Bossink

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Faculteit der Economische Wetenschappen
en Bedrijfskunde (FEW&B)

WUW Universiteit

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Bart A.G. Bossink
Faculty of Economics and Business Administration, Vrije Universiteit Amsterdam,
The Netherlands

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Abstract Organizations that choose or are forced to innovate in co-operation with other organizations, go through four stages of co-innovation strategy development. The stages are successively: (I) autonomous strategy making: organizations develop strategies on their own, (II) co-operative strategy making: organizations concentrate on developing innovation strategies in close co-operation with other organizations, (III) founding an organization for co-innovation: organizations found a joint organization in which they develop co-innovation programs, and (IV) realization of innovations: organizations develop innovations, based on the co-innovation strategies and programs. The description of the stages is based on an interfirm network approach and a research project in the Dutch construction industry. The stage model can be a guideline for organizations that participate in co-innovation processes and have to decide how and with whom to co-innovate.

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1. Introduction

The capability of organizations to **co-innovate** with other organizations **can** be of **crucial importance** in sustaining and strengthening **competitive** positions in **markets** (Håkansson, 1987; Rothwell and Dodgson, 1991; Gemünden et al., 1992; Tidd, 1995; Berthon et al., 1999; Doz *et al.*, 2000). Organizations **create** new **products, processes** and organizations by sharing complementary resources, knowledge and **competencies** (Grandori and Soda, 1995; **Osborn** and Hagedoom, 1997; Oliver and Ebers, 1998) and go through several stages of strategy **making** in which they interactively explore, develop and realize their **co-innovative** ambitions (Kreiner and Schultz, 1993; George and Farris, 1999). The **interactive** development of **co-innovation** strategies is the subject of this article. It is based on a research project with the following research question:

How do organizations interactively develop co-innovation strategies?

This question is divided in two sub questions:

Which stages **can** be distinguished in the interfirm development of **co-innovation** strategies?

Which interaction patterns between organizations **can** be distinguished within these stages?

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To give answers to these questions a research project is designed and carried out. The research design, data collection methods, data analysis and limitations of the research design are described in the **second** section. A literature study is carried out to identify stages and interaction patterns in the development of co-innovation strategies. The results of this study are described in the third section. Case studies are carried out in the Dutch construction industry to identify stages and interaction patterns of co-innovation strategies in **practice**. The results of the case studies are described in the fourth section. The analytical validity of the stage model is **discussed** in the fifth section and a **final** conclusion is drawn in the sixth section.

2. Methodology

In this section the research design, data collection methods, data analysis method and the limitations of the research design are described.

Research design

The case study research is carried out in the house **building** sector of the Dutch construction industry. This industry is actively innovating in the field of sustainability (Silvester, 1996; Tjallingii, 1996; Van Hal, 2000) and organizations in this industry are used to interfirm production and innovation **processes** (Pries and Janszen, 1995; Lampel et al., 1996; Pocock et al., 1996; Shirazi et al., 1996; Nam and Tatum, 1997; Conley and Gregory, 1999; Loosemore, 1999; Bresnen and Marshall, 2000). The case study method is used to make an in-depth study of the development of co-innovation strategies in its context (Eisenhardt, 1989; Yin, 1994; Cunningham, 1997).

Data collection

The research project consists of an exploratory case study and 12 analytical case studies.

In the exploratory case study a sustainable house-building project with a market value of 50 million Euro in which more than 10 organizations participate is studied. The case is studied during a three-year period and several research methods are used: study of documents, in-depth interviews with key informants, and in-depth observations in meetings (Brewer and Hunter, 1989; Kumar *et al.*, 1993; Yin, 1994). An overview of these research methods is given in table 1.

Table 1. Data collection methods exploratoty case

| | |
|-----------------------|---|
| study of documents | 160 documents: <ul style="list-style-type: none">• 40 agreements• 33 design documents• 18 decision supportive reports• 15 contracts• 14 brochures• 12 meeting agenda's and minutes• 10 letters• 7 project plans• 6 evaluation reports• 5 planning procedures/schedules |
| In-depth interviews | 28 interviews with key informants in the studied case: <ul style="list-style-type: none">• 14 interviews with project managers, local authority• 4 interviews with managing directors, architect's firm• 4 interviews with managers, construction company• 2 interviews with managers, public housing local authority• 2 interviews with managing directors, real estate agency• 1 interview with managing director, consultant's firm• 1 interview with managing director, housing corporation |
| In-depth observations | 69 ½ hours of observation of meetings: <ul style="list-style-type: none">• 43 ½ hours in meetings of representatives of local authorities, consultants' firms, energy companies, and pressure groups• 14 hours in meetings of representatives of local authorities. architects' firms, contractors, real estate agents, and consulants' firms• 12 hours in meetings of representatives of local authorities. architects' firms, contractors, real estate agents, and consultants' firms |

In the 12 analytical case studies comparable projects are studied. In these projects more than 10 organizations **co-innovate** and innovations are developed in the field of sustainability. The projects have a market **value** of 10 to 50 million Euro. The 12 cases are studied during 12 months. **Each** case study is based on a study of project evaluation reports and several in-depth interviews with key informants in the project (Brewer and **Hunter**, 1989; Kumar et al., 1993; Yin, 1994). An overview of the research methods is given in table 2.

Table 2. *Data collection methods analytical cases*

| | |
|----------------------------|---|
| <i>Study of documents</i> | 3-10 Project evaluation reports |
| <i>In-depth interviews</i> | 3 Interviews with key informants in the project: <ul style="list-style-type: none">• An interview with a project manager of local authority• An interview with a project manager of construction company• An interview with a project manager of architectural Firm |

Data analysis

The exploratory case study is carried **out** to identify and make an overview of stages and interaction patterns in the development of **co-innovation** strategies. The analytical case studies are carried **out** to verify which stages and interaction patterns in the development of **co-innovation** strategies are analytically valid for comparable cases (Eisenhardt, 1989; Yin, 1994; Cunningham, 1997).

Limitations of the research design

A limitation of the research design is that the research **results** cannot be statistically generalized to comparable cases. Another hmitation of the research design is that the analytical case studies focus on the verification of **co-innovation** stages and

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interaction patterns that are identified in the exploratory case study and do not focus on the discovery of new stages and interaction patterns.

3. Development of co-innovation strategies

In this section an overview is given of stages and interaction patterns in the development of co-innovation strategies. This overview is based on a review of the literature.

Stage models of the development of co-innovation strategies

Kreiner and Schultz (1993) and George and Farris (1999) describe the development of co-innovation strategies in dynamic networks of organizations as a process with distinctive stages. Kreiner and Schultz (1993) distinguish three stages: (1) discovery and (2) exploration of collaborative opportunities, and (3) crystallization of collaborative relations. In the first stage representatives of organizations meet on a regular basis. Research ideas, knowledge and work plans are liberally shared. The encounters are the breeding grounds for new ideas and concepts. In the second stage the representatives of the organizations consult literature and carry out preliminary research. They confer with each other about the possibilities of a joint project. In the third stage interfirm innovation is formalized. George and Farris (1999) identify five stages: (1) recognition, (2) research, (3) relationship set-up, (4) ramp up, and (5) ongoing management. In the first stage organizations become aware of their needs for co-innovation and of the possibilities to co-innovate with other organizations. In the second stage they examine the prospects of co-operation. In the third stage they

negotiate and **define** a co-innovation project and in the fourth and fifth stage they realize this project. Kreiner and Schultz (1993) and George and Farris (1999) describe some co-innovative interaction patterns but **don't** present a **explicit** overview of co-innovative interaction patterns within the stages.

Interaction patterns in the development of co-innovation strategies

In literature **several** co-innovative interaction patterns are described. In this sub **section** an overview of these interaction patterns is made (see table 3).

Table 3. *Interaction patterns in co-innovation strategies*

| | | |
|-----------------|---|------------------------|
| Organizations.. | <i>.choose to or are forced to innovate and explore co-innovation possibilities., .negotiate about costs and revenues.. .enter into contracts.. .reach agreements... .develop innovation plans.. ..found an organization for co-innovation...</i> | with each other |
| Organizations.. | <i>.establish governance bodies in which they are represented. .come together to realize innovations. .use management methods to manage the process of innovation realization. .need innovation champions and leaders that drive innovation creation. .communicate with the market.</i> | |

Organizations choose to or are forced by the environment to innovate (Hrebiniak and Joyce, 1985; Marcus, 1988; Luke *et al.*, 1989; Haveman, 1992; Weisenfeld-Schenk, 1994; Bianchi, 1996; Shirazi *et al.*, 1996; Venegas and Alarcón, 1997; Raider, 1998; Toole, 1998). **When** they do not have the capabilities to innovate on their own, they explore the **possibility** to **co-innovate** with other organizations (**Miles** and **Snow**, 1986, 1992; Ibarra, 1992; Powell *et al.*, 1996). They persistently and cautiously negotiate about the resources, knowledge and capabilities **each** organization has to bring in to future co-innovation **projects** (Gemünden *et al.*, 1992; Littler *et al.*, 1995;

Robertson *et al.*, 1996; Sakakibara, 1997). They **also** spend a **considerable** amount of **time** on cautious negotiations about possible distributions of the costs and the **revenues** of future co-innovation processes (**Harrigan** and Newman, 1990; Chiesa and Manzini, 1998, Loosemore, 1999). **When** organizations decide to **co-innovate** they enter into contracts with **each** other and agree on the distribution of the costs and the **revenues** of the co-innovation processes (Littler and Leverick, 1995; Dyer, 1997; Pietroforte, 1997; Chiesa and Manzini, 1998; Croisier, 1998; Slaughter, 1998, **Sobrero** and **Schrader**, 1998). On the basis of these contracts and agreements they develop innovation plans. In the plans the organizations **lay** down which innovations they **produce**, how they **co-operate**, and what the individual and shared responsibilities are (Hakanson, 1993; Littler *et al.*, 1995; Ho Park, 1996). They found an organization for co-innovation in which they develop innovations (Luke *et al.*, 1989; Rothwell and Dodgson, 1991; Hakanson, 1993; Croisier, 1998). This organization has the form of a(n) alliance, joint **venture**, quasi **firm**, learning network, interfirm network, **r&d** consortium or partnership (Luke *et al.*, 1989; **Wissema** and **Euser**, 1991; Duysters and Hagedoom, 1995; Kotabe and **Swan**, 1995; Littler and Leverick, 1995; Tidd, 1995; Dyer, 1997; Conley and **Gregory**, 1999; **Bresnen** and Marshall, 2000; **Doz** *et al.*, 2000). The **co-innovating** organizations decide which governance **structures** they use to manage the organization for co-innovation (Hakanson, 1993; Ho Park, 1996; Croisier, 1998), **come** together in this organization and start realizing the innovations they planned. Innovation champions and innovation leaders are the driving **forces** in the organization for co-innovation. They drive the creation and realization of most of the planned innovations (Maidique, 1980; **Roberts** and Fusfeld, 1980; Nam and Tatum, 1997). The **co-innovating** organizations use management methods like project management and **control** systems to plan and **control** the innovation processes in the

organization for co-innovation effectively and efficiently (Eisenhardt and Tabrizi, 1995; Lampel et al., 1996; Croisier, 1998). To sell the innovative products and services the organizations for co-innovation intensively communicate with the market (Bruce and Rodgus, 1991; Bailetti and Callahan, 1995; Athaide et al., 1996; Robertson et al., 1996; Atuahene-Gima, 1996; Berthon et al., 1999; Roy and Cochrane, 1999) and position the innovations in one or more market segments (Zajac and Olsen, 1993; Dyer, 1997; Hwang and Burgers, 1997).

4. Development of co-innovation strategies in the Dutch construction industry

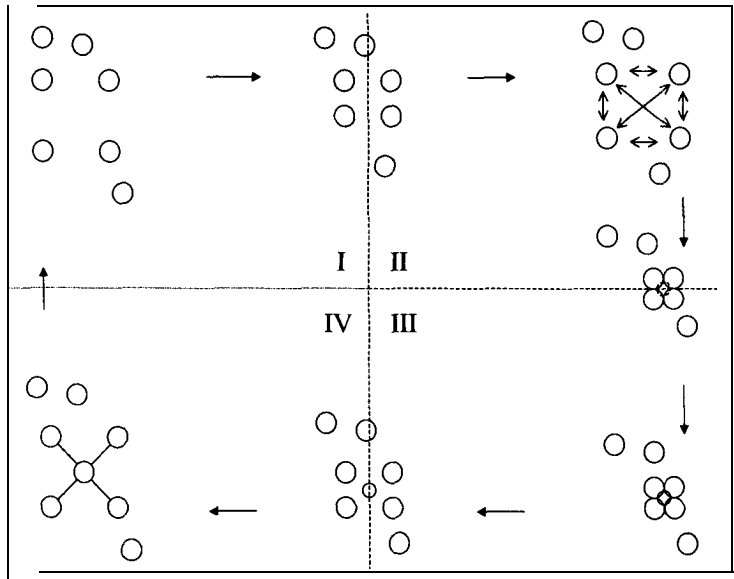
In this section a description is given of the stages and interaction patterns that are identified in the exploratory case study and all 12 analytical cases studies.

The identified developmental stages of co-innovation strategies are (see figure 1):

- I. Autonomous strategy making
- II. Co-operative strategy making
- III. Founding an organization for co-innovation
- IV. Realization of innovations

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Figure 1. Four stages in the development of co-innovation strategies



The interaction patterns that are distinguished within these stages are listed in table 4.

Table 4. Co-innovative interaction patterns

| Stage | Interaction pattern |
|---|---|
| I. Autonomous strategy making | <ul style="list-style-type: none">• Organizations choose to or are forced to innovate and explore co-innovation possibilities with each other. |
| II. Co-operative strategy making | <ul style="list-style-type: none">• Organizations negotiate about costs and revenues with each other. |
| III. Founding an organization for co-innovation | <ul style="list-style-type: none">• Organizations enter into contracts with each other.• Organizations reach agreements with each other.• Organizations develop innovation plans with each other.• Organizations found an organization for co-innovation with each other.• Organizations establish governance bodies in which they are represented. |
| IV. Realization of innovations | <ul style="list-style-type: none">• Organizations come together to realize innovations.• Organizations use management methods to manage the process of innovation realization.• Organizations need innovation champions and leaders that drive innovation creation.• Organizations communicate with the market. |

Stage **I**. Autonomous strategy **making**

Stage **I** is represented by quadrant **I** in figure 1. The organizations of the authorities, **real** estate developers, architects, **consultants** and contractors are symbolized by circles and are located in a fixed position and relation to **each** other. In this stage the organizations **operate** autonomously and **rely** on their autonomous strategies.

Fundamental **changes** in the **political**, **social**, and economical climate, and changing relations with stakeholders, force and stimulate the organizations to develop sustainable innovation strategies. The Dutch construction industry is confronted with governmental demands to innovate in the field of sustainability. In the National Environmental Policy Plans the Dutch government states that **every** organization in the construction industry has to work in a sustainable way. In the decade 1990-2000 more than 100 laws and regulations are promulgated. The laws and regulations force and stimulate organizations to develop sustainable innovations. The government and associations of architects found knowledge centers in **every province** in the country. The centers facilitate the transfer of knowledge on sustainability to their members. To stimulate the development of sustainable innovations by market **parties** the provincial and **municipal** authorities **participate** in large-scale commercial house building projects.

Organizations examine the possibilities to innovate with other organizations. **Every** year a knowledge center that is founded and financed by the Dutch government organizes a Conference on Sustainable Construction. This conference is a meeting point for representatives of **provincial** and **municipal** authorities, **real** estate developers, **architectural** firms, consultant's firms and construction **companies**. Sustainable construction **officers** of medium-sized and large municipalities coordinate **contacts** between the authorities and market parties and **contacts** between market

parties. In the **whole** country the authorities and market parties start developing sustainable construction projects with a market value of 10 to 100 million Euro. **Real** estate developers, architects, consultants and construction companies **participate** in these sustainable construction projects to develop capabilities in this field.

A transition of **state** takes **place**. This is symbolized in figure 1 by the drawing on the borderline between quadrant 1 and **II**. The organizations of the authorities, **real** estate developers, architects, consultants and contractors, symbolized by circles, explore the possibilities to co-innovate with **each** other. At this moment they are free of obligations.

Stage II. Co-operative strategy making

Stage **II** is represented by quadrant **II** in figure 1. The organizations of the authorities, **real** estate developers, architects, consultants and contractors, symbolized by circles, examine the potential profits of co-innovation with **each** other, symbolized by arrows between the circles.

In their search for organizations to co-innovate with, the organizations try to assess the **costs** and benefits of co-innovation strategies. Sustainable construction **officers** of municipalities, **real** estate developers, architects, consultants and construction companies frequently meet at their **offices**, at seminars and at trade fairs. They have informal contact about the distribution of **costs** and **revenues** in future co-innovation projects. The ownership of scarce resources and scarce knowledge is the basis of their negotiation power. The power of authorities and **real** estate developers is based on the ownership of **building** lots. Consultants and architects specialize in sustainable construction projects and develop checklists and methodologies for sustainable design. Their power is based on their knowledge about sustainability. The power of

real estate developers is based on their access to risk capital, and the power of construction companies on their ability to build the sustainable designs. Organizations that successfully co-innovated before try to work with the same team of partners again. Forty architectural firms and consultant's firms have a national reputation for their capability to develop and design sustainable objects and infrastructures. Sustainable construction officers of municipalities and real estate developers contact and hire them when they want to develop a sustainable construction project. The organizations of the authorities, real estate developers, architects, consultants and contractors prepare for the founding of organizations for co-innovation. On the borderline between quadrant II and III in figure 1 the preparations for the founding of an organization for co-innovation are symbolized by a dotted circle, surrounded by four closed circles, representing the co-innovating organizations.

Stage 111. Founding an organization for co-innovation

Stage III is represented by quadrant III in figure 1. The foundation of an organization for co-innovation is symbolized by the transformation of the dotted circle into a closed one.

In this stage the founding of organizations for co-innovation is formalized with contracts and agreements. In a project with a market value of 50 million Euro approximately 10 organizations for co-innovation are founded. In these organizations for co-innovation the local authority, a real estate developer, an architect and a construction company participate. The organizations agree on a basic distribution of costs and incomes. Contracts are used to secure a basic level of agreement. The local authority develops the infrastructure and the real estate developer develops the houses. They sign a contract in which they agree about their investments and the

coordination of their activities. To realize the project the local authority signs contracts with a consultant and a contractor, and the **real** estate developer signs contracts with an architect, a consultant and a construction company. **Once** contracts are signed and agreements are made the organizations **concentrate** on meeting their obligations. The co-innovating organizations establish a govemance body to manage the activities in the organizations for co-innovation. The govemance body consists of representatives of the local authority and the **real** estate developer.

The organizations for co-innovation develop design drafts and **lists** of sustainable materials to be **used**. The designs are carefully **documented** and design **changes** are integrated into the design contracts. **When** the co-innovation **plans** are **completed**, the co-innovating organizations increase the autonomy of the organizations for **co**-innovation. The organizations for co-innovation start with the realization of the planned innovations.

On the borderline between quadrant **III** and **IV** in figure 1 the increasing autonomy of an organization for co-innovation is symbolized by the coming apart of the circle in the **middle**, representing the organization for co-innovation, from the surrounding circles, representing the co-innovating organizations.

*Stage **IV**. Realization ~~of~~ innovations*

Stage IV is symbolized by quadrant IV in figure 1. The **lines** between the circle in the middle, representing an organization for co-innovation, and the surrounding circles, representing the co-innovating organizations, symbohze the relationship between the co-innovating organizations with the organization for co-innovation.

The organizations for co-innovation **communicate** with potential buyers and try to **draw** their attention to the **value** of the **residential areas** and houses they develop.

Ambitious publicity campaigns are initiated. The projects are promoted in the newspapers and on television. Local authorities, real estate developers, architects, consultants and construction companies present their innovative results on information meetings and trade fairs.

The co-innovating organizations are conscious of the fact that innovation value is created in interaction with each other and is not created independently. Co-operative ties grow strong. Promises are kept and partnering organizations trust upon each other.

One or more innovation leaders and champions enter the stage. The innovation leaders and champions are the drivers of the conception and realization of sustainable innovations. Representatives of the local authority, the consultants they hire to support them, and the architects that are hired by the real estate developers, function as driving forces in the realization of the planned innovations. They initiate and contribute to the development of sustainable systems for drainage, ecological gardens, methodologies for the use of solar energy, methods for the selection of sustainable materials, methods for waste management, checklists and methodologies for sustainable design, environmental quality systems and environmental impact assessments. Some architectural firms and consultants' firms own trademarked checklists and methodologies for sustainable designing.

The organizations for co-innovation head for the realization of their innovation plans. The designs for residential areas and houses are evaluated with a methodology that is approved by the Dutch government. Ninety percent of the designs is classified as 'innovative' or 'very innovative'. The governance bodies manage the innovation realization processes with project management methods such as: milestones and deliverables, accounting systems and planning systems.

When the co-innovating organizations are satisfied with the innovation results, they dismantle the organizations for co-innovation. They concentrate on the development of an autonomous strategy to exploit their new capabilities. Real estate developers, architectural firms and consultants' firms develop new sustainable design methodologies and real estate developers and construction companies position themselves as green organizations. Trade companies transform into trade & consulting companies and advise architects and construction companies how to use new sustainable construction materials. Consultants transform into project managers and are hired by municipalities and real estate developers to manage sustainable construction projects. Traditional construction companies transform into sustainable construction companies.

The dismantling of an organization for co-innovation is symbolized in figure 1 by the transformation of the network of organizations from quadrant IV to I. The organizations are situated in a renewed state of the first stage.

5. Discussion

In this section the analytical validity of the model described is discussed and directions for further research are suggested.

The research is designed and carried out to generate a descriptive model for the development of co-innovation strategies and to generate a model that can be analytically generalized. The model that is described in the third and fourth section is based on an in-depth case study and a confirmation in 12 comparable cases. This research design and the outcomes indicate that the model is analytically valid for the

description of comparable cases: Dutch construction **projects** in the sector house **building** with a market value of 10 to 50 million Euro, in which more than 10 organizations **co-innovate** in the field of sustainability.

International research identifies co-innovative interaction patterns in construction industries in Canada (**Lampel** et al., 1996), Sweden (Bröchner and Grandison, 1992), the United **Kingdom** (Korczynski, 1996) and the United States (Nam and Tatum, 1989; Tatum, 1989; Nam and Tatum, 1992; **Lampel** et al., 1996; Nam and Tatum, 1997). Although these industries have their own **specific** characteristics and **dynamics** the research design and its outcomes and these international research results **indicate** that (parts of) the model (are) is analytically valid for comparable cases in construction industries in other countries. Further research **can** be **carried out** to verify the analytical validity of (parts of) the model in construction industries in other countries.

International research also identifies co-innovative interaction patterns in: the aerospace industry, agricultural industry, biotechnology, chemical industry, **consumer electronics**, education, energy industry, food industry, health **care**, information and communication industry, **metal** industry, petrochemical industry, pharmaceutical industry, pump industry, semiconductor industry and the textile industry in various countries **all** over the world. In table 5 an overview is given of industries and countries in which co-innovative interaction patterns are identified.

Table 5. Co-innovarive interaction *patterns world-wide*

| <i>Industry</i> | <i>Country</i> |
|-------------------------------|---|
| Aerospace | <ul style="list-style-type: none">• Russia (Shaw, 1996) |
| Agriculture | <ul style="list-style-type: none">• The Netherlands (Wissema and Euser, 1991) |
| Automotive | <ul style="list-style-type: none">• Japan (Baba, 1989; Gulati. 1995; Dyer, 1997)• United States of America (Gulati, 1995; Dyer, 1997; Doz et al., 2000) |
| Biotechnology | <ul style="list-style-type: none">• Denmark (Kreiner and Schultz, 1993)• Germany (Whittaker and Bower, 1994)• Switzerland (Whittaker and Bower. 1994)• United Kingdom (Rothwell and Dodgson, 1991; Whittaker and Bower, 1994)• United States of America (Shan et al., 1994; Whittaker and Bower, 1994; Powell et al., 1996; Powell, 1998) |
| Chemical | <ul style="list-style-type: none">• France (Bidault et al., 1992) |
| Construction | <ul style="list-style-type: none">• Canada (Lampel et al.. 1996)• the Netherlands (Pries and Janszen, 1995)• Sweden (Bröchner and Grandison, 1992)• United Kingdom (Korczynski, 1996)• United States of America (Nam and Tatum, 1989; Tatum, 1989; Nam and Tatum, 1992; Lampel et al., 1996; Nam and Tatum, 1997) |
| Consumer Electronics | <ul style="list-style-type: none">• Europe (Tidd, 1995)• Japan (Baba, 1989; Tidd, 1995)• United States of America (Tidd, 1995; Ho Park, 1996) |
| Education | <ul style="list-style-type: none">• United States of America (Kraatz, 1998) |
| Energy | <ul style="list-style-type: none">• Japan (Sakakibara, 1997)• United States of America (Doz et nl., 2000) |
| Food | <ul style="list-style-type: none">• Sweden (Elg and Johansson, 1997) |
| Health Care | <ul style="list-style-type: none">• Canada (probably)(George and Farris, 1999)• United States of America (Luke er al., 1989; Goes and Ho Park, 1997) |
| Information and Communication | <ul style="list-style-type: none">• Japan (Duysters and Hagedoorn, 1995)• United Kingdom (Littler and Leverick, 1995; Littler er al., 1995)• United States of America (Ouchi and Kremen Bolton, 1988; Wagner, 1991; Duysters and Hagedoorn, 1995; Doz et al., 2000) |
| Metal | <ul style="list-style-type: none">• Europe (Gulati, 1995)• Japan (Gulati, 1995)• United States of America (Gulati, 1995) |
| Petrochemical | <ul style="list-style-type: none">• France (Bidault et al., 1992)• Japan (Sakakibara, 1997) |
| Pharmaceutical | <ul style="list-style-type: none">• Canada (probably)(George and Farris, 1999)• France (Bidault et al., 1992)• Germany (Whittaker and Bower, 1994)• Switzerland (Whittaker and Bower, 1994)• United Kingdom (Whittaker and Bower, 1994)• United States of America (Whittaker and Bower, 1994; Powell, 1998) |
| Pump | <ul style="list-style-type: none">• United States of America (Ouchi and Kremen Bolton, 1988) |
| Semiconductor | <ul style="list-style-type: none">• Asia (Macher et al., 1998; Stuart, 1998)• Europe (Macher et al., 1998; Stuart, 1998)• Japan (Ouchi and Kremen Bolton, 1988; Kremen Bolton et nl., 1994; Sakakibara, 1997; Macher et al. 1998; Stuart, 1998)• United States of America (Spencer and Grindley, 1993; Kremen Bolton et al., 1994; Browning et al., 1995; Macher et al., 1998; Stuart, 1998) |
| Textile | <ul style="list-style-type: none">• France (Bidault et al., 1992) |

This indicates that parts of the model are analytically valid for a description of co-innovation processes in different industries and countries. Further research can be carried out to verify the analytical validity of the model in the industries and countries listed in table 5.

6. Conclusion

On the basis of an interfirm network approach and a research project in the Dutch construction industry 4 stages and 11 interaction patterns in the development of co-innovation strategies are identified and described (see figure 1 and table 4). Organizations that choose or are forced to innovate in co-operation with other organizations go through four stages of co-innovation strategy development. In the first stage they develop strategies on their own. In the second stage they concentrate on developing innovation strategies in close co-operation with other organizations. In the third stage they found an organization for co-innovation in which they develop innovation programmes. And in the fourth stage they develop innovations, based on the innovation strategies and programmes they developed in the second and third stage. When the co-innovating organizations are satisfied with the innovation results they dismantle the organization for co-innovation. This situates them in a renewed state of the first stage. Organizations that want to strengthen or have to defend their autonomous positions in markets partially give up their autonomous position, develop and implement co-innovation strategies with other organizations, and use the results of these strategies to reinforce their autonomous market positions.

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