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A Dutch public–private strategy for innovation in sustainable construction

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Influenced by the sustainable construction policy of the authorities, organizations in The Netherlands are developing, designing and building sustainable areas and objects. The actions of the authorities, authority-related organizations and commercial organizations in the Dutch construction industry and the interaction between them contribute to the realization of goals that fit with the sustainability policy of the government. Research in the house building sector of the Dutch construction industry, covering a 10-year period, has found that action by and interaction between public and private organizations directed towards innovation in sustainable construction is part of a sector-wide strategy. In this strategy public and private organizations interactively develop and adopt sustainable construction innovations.

Keywords: Sustainable construction, sustainability policy, innovation management, strategic management

Introduction

Sustainable construction has developed from a new field (Kibert, 1994) towards a discipline comprising various practical and scientific issues (Hill and Bowen, 1997; Ofori, 1998; Ngowi, 2001; Rohracher, 2001). Important international issues in sustainable construction affecting the interests of both practitioners and researchers are: environmental assessment of buildings, best practices for sustainable construction, environmental design methods in materials and structural engineering, urban sustainability, and deconstruction (Sjöström and Bakens, 1999). National governments, central and decentralized authorities and commercial organizations in the construction industry are interdependently innovating in these fields of sustainability (Larsson, 1996; Bourdeau, 1999; Rohracher, 2001).

One question is how should the public and private parties in the construction industry cooperate to develop sustainable construction innovations? (Larsson, 1996). To seek answers, a research project has been designed and implemented, focused on a central research question and three subquestions. The central research question is: how do public and private organizations interactively develop sustainable construction innovations? The three subquestions are: (1) what are the elements of a governmental sustainable construction policy; (2) what are the sustainable construction practices of organizations in the construction industry; and (3) how do interactions between authorities, authority-related organizations and commercial organizations in the construction industry contribute to the realization of goals that fit with the governmental sustainability policy?

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Research methodology

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

Research design

The research project is typified as multi-method research (Brewer and Hunter, 1989). It consists of a literature study, an interview round and case study research. On the basis of the literature study an overview was made of the elements of the Dutch governmental sustainable construction policy in the period 1989–2000. In the interview round, 62 Dutch experts in the field of sustainable construction were interviewed. Finally, on the basis of the interview round it is possible to present an overview of the sustainable construction practices of organizations in the Dutch construction industry. Case studies were carried out in six sustainable construction projects in the house building sector of the Dutch construction industry, leading to a detailed picture of the interactions between authorities, authority-related organizations and commercial organizations in the house building sector, and of the contributions of these interactions to the realization of goals that fit with the governmental sustainability policy.

Data collection

In the literature review the 1990s volumes of many Dutch professional construction journals (*Architectuur & Bouwen*, *Bouw*, *Bouwwereld*, *Bouw/Werk*, *Cement*, *Cobouw*, *Corporatie Magazine*, *de Bouwadviseur*, *Land en Water*, *Woningraad Magazine*) were studied. Also policy documents of the Dutch Government, scientific studies at Dutch universities and newsletters of commercial organizations in the Dutch construction industry covering the 1990s were gathered and analysed.

The interview round during the period 1994–1999 involved experts working for Dutch public and private organizations, varying from research institutes, provincial and municipal authorities to real estate developers, architects and construction companies (Table 1).

In the case study phase, six cases were studied during 1993–1999, all of housing estate construction in medium-size and large municipalities in The Netherlands. In these projects several public and private parties interactively and interdependently developed sustainable housing estates, consisting of areas with 100–600 houses, with market values varying of €10 million–50 million. The projects studied were: ‘Oikos’ in the municipality of Enschede, ‘Grootstal’ in the municipality of Nijmegen, ‘GWL-terrein’ in the munic-

ipality of Amsterdam, ‘Leesten-West’ in the municipality of Zutphen, ‘Nieuwland’ in the municipality of Amersfoort, and ‘Rijkerswoerd’ in the municipality of Arnhem. The 180 documents studied included agreements, design documents, decision supportive reports, contracts, meeting agendas and minutes, project plans, evaluation reports and planning schedules.

Data analysis

The data were investigated within an analytical framework (Yin, 1999) based on international research findings in the field of sustainable construction. The framework comprises three subframes corresponding to the three subquestions in the research project. The first subframe lists elements of governmental sustainable construction policies, the second lists sustainable construction practices in construction industries, and the third lists interactions between authorities, authority-related organizations and commercial organizations in construction industries.

Implication and limitation of the research design

Theory building in sustainable construction is a relatively new discipline and the research project aims to contribute to theory development in this field. Because the research design does not aim to generate propositions about interactive innovation in sustainable construction in a construction industry, to test them in a representative sample of a population, or to draw conclusions for the population, the results are not statistically generalizable to a population in The Netherlands or in any other country. International research findings in the field of sustainable construction were used to develop an analytical framework, parts of which may be used to describe and analyse interactive sustainability strategies in construction industries in different countries. The description and analysis made within the framework of this study have analytical value for the

Table 1 Experts interviewed

Expert	Number of interviews
Manager of a local authority	21
Manager of an architects’ firm	12
Manager of a construction company	11
Manager of a building association	4
Manager of a provincial authority	3
Manager of a trade company	3
Manager of a consultants’ firm	3
Manager of a real estate developer	2
Manager of a research institute	1
Manager of a knowledge centre	1
Manager of a housing corporation	1

house building sector in The Netherlands but not for other building sectors in this country or for building sectors in any other country.

An analytical framework for innovation in sustainable construction

This section presents the analytical framework used to describe and analyse the research data. The framework consists of three subframes, and is based on a study of international research findings in the field of sustainable construction: the first lists the elements of governmental sustainable construction policies, the second lists sustainable construction practices used in construction industries and the third lists the interactions of authorities, authority-related organizations and commercial organizations in the construction industry that contribute to the realization of goals that fit with the governmental sustainable construction policy (Table 2). The elements discussed are those mentioned frequently in the international literature.

Elements of a governmental sustainable construction policy

Governments play an important role in the initiation and development of sustainable construction practices, and they develop environmental policy plans to define sustainability goals for several years (Barrett *et al.*, 1999; Raynsford, 1999; Blaauw and Priemus, 2000; Haarman *et al.*, 2000). The environmental policy plans have consequences for the future direction of both public and

private organizations. In the plans a government will state what the central, provincial and municipal authorities have to achieve in the field of sustainability and sustainable construction, and also what is expected of private parties in the construction industry (Bon and Hutchinson, 2000; Haarman *et al.*, 2000; Van der Waals and Vermeulen, 2000). Laws and regulations are a second element of a governmental sustainability policy: these are prescriptive and performance-based. Governments establish codes and levels of performance, and authorities and private organizations have to work within the boundaries of the rules (Bernstein, 1996; Larsson, 1996; Gann *et al.*, 1998; Guy and Kibert, 1998; Bon and Hutchinson, 2000; Ngowi, 2001). Governments also use public-private arrangements to secure a certain level of sustainability in construction practices. In these agreements governments e.g. guarantee a part of the turnover of an entrant in the industry that is producing sustainable materials or is designing and building in a sustainable way. Another example is a government acting as a major client in the development of sustainable construction projects, and facilitating, subsidizing and protecting sustainable initiatives (Gann *et al.*, 1998; Raynsford, 1999; Van der Waals and Vermeulen, 2000). Governments also use financial incentives and obstacles to reward environmental friendly initiatives and to hinder activities in other directions. An example of an incentive is the municipal subsidy of energy efficient heating boilers, and an example of a financial obstacle is the increase in costs for dumping construction and demolition waste (Bernstein, 1996; Raynsford, 1999; Blaauw and Priemus, 2000). A fifth element of governmental sustainable construction policies are demonstration projects that are organized and subsidized by the authorities and authority-related organizations. In these demonstration projects the innovative sustainable construction options are tested, developed and prepared for use in sustainable construction projects all over the country (Reijnders and Huijbregts, 2000; Sha *et al.*, 2000).

Sustainable construction practices

Organizations in the construction industry work with design tools. These tools enable them to choose and evaluate sustainable materials and sustainable design alternatives and to relate them to financial incentives and obstacles, environmental regulations, and demands of clients (Atkinson *et al.*, 1996; Bourdeau, 1999; Brandon, 1999; Boonstra and Knapen, 2000; Papamichael, 2000; Reijnders and Huijbregts, 2000; Rohrer, 2001). Another element of sustainable construction is the management of construction and demolition waste. Separation of waste in several

Table 2 Analytical framework

Elements of a governmental sustainable construction policy
Environmental policy plans
Laws and regulations
Public-private agreements
Financial incentives and obstacles
Demonstration projects
Sustainable construction practices
Design tools
Waste management
Environmental management systems
Interactions between public and private organizations in sustainable construction projects
Communication of ambition and vision
Establishment of clear goals and implementation programmes
Communication with potential customers
Development and establishment of standards
Establishment of multi-disciplinary project teams
Development of new competences
Participation in (inter)national R&D projects

variants, re-use of waste and prevention of waste in the design phase are all receiving attention (Apotheker, 1990; Gavilan and Bernold, 1994; Bossink and Brouwers, 1996; Ueda and Yamamoto, 1996; Bourdeau, 1999). Another tool frequently used in practice is the environmental management system. An organization using an environmental management system integrates the environmental issue in the overall strategy of the organization and in the organizational processes and procedures (Hill *et al.*, 1996; Ueda and Yamamoto, 1996; Yip, 2000).

Interactions between public and private organizations in sustainable construction projects

In sustainable construction projects the vision and the ambitions in the field of sustainability have to be developed and communicated with the participating organizations (Bernstein, 1996; Van der Waals and Vermeulen, 2000). When there is a clear vision on sustainability and participants share the same ambitions, clear goals and an implementation plan for sustainability can be devised and realized (Hill and Bowen, 1997; Van der Waals and Vermeulen, 2000; Bell and Lowe, 2001). Investors in sustainable construction projects communicate with the market to create selling perspectives. Sustainable built houses appeal to environmentally conscious customers, but also appeal to buyers driven by economics, when for example the energy savings of the house are substantial (Blaauw and Priemus, 2000; Moll *et al.*, 2000; Van Dorst and Silvester, 2000; Kua and Lee, 2002). Standards are being developed that prescribe a minimum sustainable performance level in construction projects (Larsson, 1996; Larsson, 1999; Bon and Hutchinson, 2000) and sustainable construction projects are being developed by multi-disciplinary teams consisting of specialists working for different organizations like the authorities, real estate developers, architects, consultants and contractors (Hill and Bowen, 1997; Ngowi, 1998; Van der Waals and Vermeulen, 2000; Rohrer, 2001). Multi-disciplinary teams are activated early in the project and are stimulated to brainstorm about their contributions to the sustainable innovation process (Rohrer, 2001). The organizations that participate in the sustainable construction projects are developing new areas of competence in the field of sustainability, and this enables them to work on a higher level than other organizations, giving them a competitive advantage in the market (Rohrer, 2001). The organizations are flexible and are able to integrate new developments in the field of sustainability in their strategy and organizational processes (Hill and Bowen, 1997; Van der Waals and Vermeulen, 2000).

Highly innovative organizations are participating in (inter)national R&D projects in which radical innovations in the field of sustainability are developed, tested and improved and partners in the network of sustainable innovative organizations are found (Curwell *et al.*, 1999; Glaumann *et al.*, 1999; Kimata, 1999; Larsson and Cole, 2001; Mackley and Milonas, 2001).

Sustainable construction in the Dutch house building sector

This description of the Dutch policy on sustainable construction and of Dutch sustainable construction practices is based on the literature study and the interviews, while the description of the interactions between public and private organizations that contribute to sustainable construction innovation is based on the case studies.

The Dutch governmental sustainable construction policy

Environmental policy plans

In 1989 the Dutch government published the first national environmental policy plan by the Ministry of Housing, Town and Country Planning and Environment (MHTCPE, 1989). The plan was based on the strategy for sustainable development of the World Commission on Environment and Development (Brundtland, 1987). In the plan the national environmental policy for the coming four years was described, which is a guideline for the development of provincial and municipal environmental policy plans in the whole country. Approximately 50% of the actions in the national environmental policy plan apply directly or indirectly to the Dutch construction industry. One year later, in 1990, the Government published a supplementary national environmental policy plan. In this plan the construction industry is mentioned as an industry with high priority (MHTCPE, 1990). In 1993 the Government published the second national environmental policy plan. The second plan added new goals to the existing ones and planned new environmental actions for another four-year period (MHTCPE, 1993). In 1995 the Dutch Government published the first national action plan for sustainable construction (MHTCPE, 1995) and in 1997 a second national action plan for sustainable construction (MHTCPE, 1997). The plans evaluated the sustainable construction results in the preceding years, set new goals and planned new actions (MHTCPE, 1995, 1997). In 1998 the third national environmental policy plan was published: the two action plans for sustainable construction were evaluated and additional environmental

goals were set for the Dutch construction industry (MHTCPE, 1998). In 1999 a third programme was published that explicitly focused on the construction industry (MHTCPE, 1999).

Laws and regulations

The Dutch Government assures a minimum level of sustainability with laws and regulations, using the Environmental Control Act, the Building Construction Act, and the Municipality Act. Within these acts, decrees like the Building Materials Decree, the Dumping of Waste Materials Prohibition Decree, the Emissions Decree and the Building Decree, and regulations like the Provincial Corporate Waste Regulations, the Municipal Environmental Regulations, and the Building Exterior Criteria Regulations have been developed. The laws, decrees and regulations oblige authorities and organizations in the construction industry to build according to sustainability standards (Roes, 1994; Louwe and Lanting, 1995).

Public-private strategies

Within the boundaries of the laws and regulations the central, provincial and municipal authorities develop and sign covenants and declarations of intent with organizations in the construction industry. In the covenants the parties state their intent to cooperate in the area of sustainable construction, and the organizations agree on an ambition level to strive for (MHTCPE, 1995, 1997, 1999).

Financial incentives and obstacles

The government subsidizes environmentally friendly initiatives and solutions in the construction industry, and the central, provincial and municipal authorities develop decrees like the Building Subsidies Decree and the Location Subsidies Decree within the existing laws and regulations. These decrees enable the authorities to subsidize sustainable initiatives and solutions for parties in the construction industry and to hinder any initiatives that might bring harm to the environment (Liebregts, 1993; Schuurman *et al.*, 1995; Adriaansens, 1996).

Demonstration projects

In every medium-size and large municipality in The Netherlands demonstration projects have been started, comprising sustainable building projects of housing estates with a market value varying from €5 million to €100 million. In the demonstration projects the authorities cooperate with market parties. The aim of the demonstration projects is to experiment with new sustainable technologies, to develop cooperation routines

in the management of sustainable construction projects, to develop the sustainable construction competence of the participating organizations, and to demonstrate the new possibilities in the field of sustainable construction (De Vries, 1995; Buijs and Silvester, 1996; Van Hal and Rovers, 1997).

Dutch sustainable construction practices

Design tools

The development of methodologies for the lifecycle analysis of materials, energy and buildings is being stimulated by the Dutch Government. Most of the methodologies are being developed at universities and at research institutes related to universities (Bijen and Schuurmans, 1994) and used by consultants' firms in the construction industry to develop practical lists with environmentally friendly design options (Anink and Mak, 1993; Haas, 1994; Stofberg, 1995; Stofberg *et al.*, 1996). Frequently, these lists are used in demonstration projects. In 1996 the Dutch Government initiated the development of a national package with standardized sustainable construction options, developed in cooperation with more than 14 building associations, and this has been a standard for most of the construction projects in the country (Jansen, 1996).

Waste management

The Dutch Government is developing plans for the control, handling and prevention of construction and demolition waste. Construction and demolition waste is separated according to type and transported to organizations specializing in transforming the waste into materials that may be used either in the construction industry or in other industries (Moors, 1991; Wolters, 1993; Breure *et al.*, 1995).

Environmental management systems

The Government wants organizations in the construction industry to work with an environmental management system. Although the Government states in its national environmental policy plans that environmental management systems will become obligatory, in the period 1989–2000 the implementation rate of environmental management systems in organizations increased at a slow pace. Organizations that already have a management system for quality assurance and that decide to introduce an environmental management system may integrate the environmental management system into their quality management system (MHTCPE, 1989; Goes, 1994; Louwe and Lanting, 1995).

Interactions between Dutch public and private organizations in sustainable construction projects

Communication of vision and ambition

A vision of and an ambition on sustainability are the essence of starting sustainable house-building projects. Organizations meet on a regular basis and discuss the sustainability ambitions of the projects. The organizations hire consultants who are specialists in sustainable affairs, and they in turn coach and advise the project managers in the development of the sustainable vision.

Establishment of clear goals and implementation programmes

The sustainability vision may be translated into clear goals using design tools for sustainable materials, energy and buildings. The project managers use methods like planning schemes, milestones, and deliverables and budgets, to ensure that options are integrated in the areas and objects that are developed in the sustainable house building project.

Communicating with and informing potential customers

The organizations are aware of the fact that potential customers have to be informed about the special character of the areas and houses they are developing, and consultants are hired to advise and coach the project managers in their communications with market segments. For example, information centres are established, information meetings are organized, and advertisements are put in the newspapers. The designs are presented at trade fairs and meetings, and the quality aspects of the sustainable house building projects are promoted.

Development and establishment of standards

Consultants introduce and use trademarked design methods and lists. The architects conceptualize the spatial designs and the designs for houses with these methods and lists. At the end of the design stages the authorities evaluate the sustainability of the designs with an evaluation methodology approved by the Dutch Government. In the projects most designs have attained a score of 'innovative' or 'very innovative'.

Establishment of multi-disciplinary project teams

Most sustainable house building projects in The Netherlands result from cooperation between provincial authorities, municipal authorities, real estate developers, architects, consultants and contractors. In these projects several disciplines are integrated: e.g. town and country planning, traffic affairs, energy affairs, architecture and construction. Real estate developers and the authorities are the entrepreneurs that develop

marketable concepts. They hire architects and consultants to integrate all disciplines in the design stage, and they develop innovative sustainable areas and housing concepts. Then the contractors are hired to realize these concepts.

Activation of disciplines in an early stage

Municipal project managers organize workshops and brainstorm meetings to create a shared innovation vision and ambition. Experts in various disciplines consider the sustainability topic with a view to developing a shared frame of reference. The high level goals are agreed upon at the start of each sustainable house building project, and kept intact during the development, design and realization stages.

Development of new areas of competence

Members of a small network of consultants, architects and contractors participate in almost every sustainable house building project in The Netherlands. These organizations position themselves as green organizations in the market, and promote themselves as capable of developing sustainable areas and high quality projects. Organizations that want to develop competence in sustainable construction participate in sustainable house building projects and learn from these innovation leaders.

Participation in (inter)national R&D projects

The network of green organizations consists of knowledge transfer centres established by the Dutch Government, green consultants, green architects, green real estate developers, and green contractors. Frequently, members of the network cooperate in demonstration projects, many of these organizations being related to universities and research centres.

The Dutch public-private strategy for innovation in sustainable house building

Some elements of the Dutch sustainable house building framework are highly coherent and together constitute a national public-private forum for sustainable construction (Figure 1). The elements of the public-private strategy are: environmental policy plans, (inter)national R&D projects, design tools, demonstration projects, and laws and regulations.

Environmental policy plans

The national environmental policy plans describe and set the future direction of the Dutch Government and the construction industry in the field of sustainability. The national environmental policy plans legitimize the

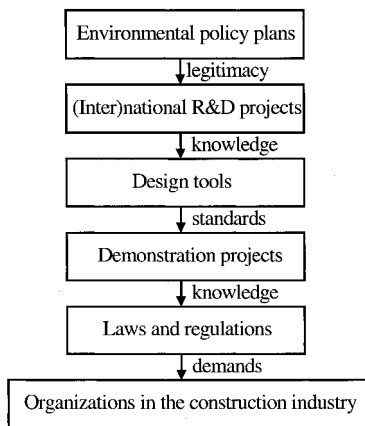


Figure 1 Dutch public-private strategy for innovation in sustainable housing

initiation and funding of (inter)national R&D projects, in which universities play a dominant role.

(Inter)national R&D projects

In R&D projects the basic fundamentals of sustainable construction are researched, and basic solutions are developed and further improved. Methodologies for lifecycle analysis are developed and data are generated on the environmental impact of materials and energy.

Design tools

The knowledge developed in the R&D projects is used to develop and improve design tools for the use of materials, energy, buildings and space. Methods and lists are developed and used to standardize sustainable construction practices in demonstration projects.

Demonstration projects

In the demonstration projects, cooperating innovation leaders in the field of sustainable house building experience the do's and don'ts of working with options mentioned in the design methods and lists. This experience is evaluated by the authorities and used to develop laws and regulations.

Laws and regulations

Sustainable house building options that are ecologically and economically sound, are made integral parts of national laws and regulations and become obligatory for all organizations in the house building sector.

Public-private strategy

The public-private strategy for sustainable house building enables the authorities to continually innovate in the field of sustainability and to integrate innovations in practice. Other elements of sustainable house building that support this national public-private strategy are public-private agreements, financial incentives and obstacles, waste management programmes, environmental management systems, vision and ambition building, establishment of clear goals and of implementation programmes, communication with potential customers, and development of sustainable competence. The authorities use public-private agreements to ensure that organizations in the house building sector conform to the new laws and regulations, and financial incentives to stimulate the use of innovative sustainability options in demonstration and other projects. The authorities use waste management programmes to stimulate the separation, handling, control and prevention of construction and demolition waste in demonstration and other house building projects. They also stimulate the development of environmental management systems to implement green rules and procedures in the primary processes of organizations in the house building sector. The interaction between public and private organizations in the house building sector concentrates on the development of a sustainable vision and ambition, the establishment of clear goals and implementation programmes, communication with potential customers and on the development of sustainable competence by the organizations that participate in sustainable house building projects.

Factors that led to failure or stagnation in the sustainable house building projects studied were the absence of a shared vision and ambition and the absence of clear goals and implementation programmes. Due to a lack of vision or the absence of shared ambitions, organizations continued discussing sustainability instead of directing their activities towards a shared vision and ambition. In addition to this, the absence of clear objectives and implementation programmes caused confusion. Many architects and contractors lost track, and decided to work with traditional designs, materials and construction methods.

The public-private strategy is used to create innovations but is not used to implement them in mainstream house building projects in the sector. Knowledge about sustainability is created and developed at universities and research centres, and transferred to a small network of consultants who use it in demonstration projects. In the demonstration projects they work with a limited number of representatives from the small network of green authorities, real estate developers, architects' firms and construction companies. These

green individuals and organizations develop competence in the field of sustainability, but the transfer of knowledge and competence in the field of sustainability to other individuals and organizations is not facilitated or stimulated. Mainstream professionals who work for mainstream organizations in the house building sector are confronted with laws and regulations that are extracted from experience in the demonstration projects, but they do not have the experience, knowledge and competence to work within the boundaries of these laws and regulations. The development of the experience, knowledge and competence to implement the sustainability innovations is not part of a sector-wide public-private strategy. The positive results with the interactive approach in sustainability innovation creation support the conclusion that a public-private interactive strategy could be used to implement the sustainability innovations in the mainstream building projects all over the country. This strategy could be an addition to the existing 'laws and regulations approach' of the Dutch authorities.

At the moment the Dutch authorities are developing public-private strategies for sustainable construction in utility building, road construction, and civil engineering, and the strategy in the house building sector is being used as a blueprint.

Conclusion

Research in the house building sector of the Dutch construction industry, covering a 10-year period, illustrates that action of and interaction between public and private organizations directed towards innovation in sustainable construction is part of an industry-wide strategy. In this strategy the authorities stimulate and facilitate the development of innovations in the field of sustainability by market parties. The public-private strategy consists of several interrelated elements: environmental policy plans, (inter)national R&D projects, design tools, demonstration projects, and laws and regulations (Figure 1). The public-private strategy is supported by public-private agreements, financial incentives and obstacles, waste management programmes, environmental management systems, vision and ambition building, establishment of clear goals and implementation programmes, communication with potential customers, and the development of sustainable competence by organizations in the construction industry. The public-private strategy is directed towards the creation of sustainable construction innovations in demonstration projects. The implementation of these innovations in mainstream building projects may be the subject of an extended public-private strategy in the coming years.

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