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Two-dimensional cooperation network for system precast construction

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PAPER

1 Introduction

Due to the structural change and the globalization of the construction markets [Russig et al. 1996] in reaction to the tense earnings situation of the construction industry, at both German-speaking and international level, both construction engineering practice and research are striving to industrialize construction production processes ([Girmscheid 2005a], [Bärthel 2002]). In the field of building construction, these efforts at industrialization are causing a renaissance of precast reinforced concrete elements, modules and composite systems [Zürcher Hochschule Winterthur (Hrsg.) 2002], based, above all, on improved materials technology ([Jachmich 2001]) and efficient production processes ([Girmscheid 2000], [Ballard et al. 2003]). Although the method of construction with precast elements is used to focus primarily on the low-cost and rapid "serial production" of affordable housing ([Bongers 1998]), the potential for manufacturing individual buildings with individual shapes and functions and made from individual materials but using precast elements, modules and composite systems has meanwhile been recognized ([SwissBeton (Hrsg.) 2004]). Because of the lack of established and suitable market instruments, the industrialization potential of prefabrication has so far not been sufficiently exploited in practice.

The construction industry is increasingly seeing the opportunities offered by partnerships and cooperations as a means of synergetically exploiting not only tangible, but also intangible resources, in a competitive market [Girmscheid 2005b]. The principal architecture of such partnerships and cooperations for forming strategic networks [Sydow 1993], enhancing each company's own specific competencies [Friedli 2000] and the utilization of marketing and sales synergies ([Maier 2002]) are part of the research being conducted by neighboring disciplines, such as economics or business management.

Cooperative distribution systems as an instrument of growth for SMEs have scarcely been able to gain a foothold in neither the national nor international construction industry so far [Watson and Kirby 2000], since the idea of selling construction services right through to the client will only generally gain ground once customer orientation has been established. The ancillary construction trades are showing first signs of cooperative sales forms [Dornach 2004]. In this case the ambivalently struc-
tured construction market with its strongly local or in other cases supra-regional markets is used for cooperative networks to distribute products and services efficiently and profitably.

Embedded into the presented scientific environment, the following issues have been identified:

1. Outsourcing services that are not part of the construction company's core competencies is increasing in the construction industry. The research examines the reasons for the lack of a suitable form of cooperation that transfers the diametrical interests of the partners into a win-win situation.

2. In the construction industry, there is only a latent motivation to cooperate. The research takes the differing expectations of potential partners into consideration when developing suitable incentive systems that would allow them to perceive acting in cooperation as a win-win situation.

3. Based on the findings of the aforementioned issues, the two-dimensional cooperation structure with its associated, necessary system or cooperation partners will be developed, and the interactive, integrated process and organizational structures that are needed will be derived.

The cooperative business model with its two-dimensional cooperation network will substantially contribute towards achieving the economic goals of the cooperation partners:

- Increase in sales by increasing the market share of precast concrete elements in the considered market segment "individually designed single-family and multi-family homes"
- Increase in profits from offering customer-oriented system services with unique selling propositions that set them clearly apart from the services and products offered by the competition

2 Research methodology

The constructivist research paradigm and methods of qualitative and quantitative social research will be primarily used to reveal findings relating to the issues mentioned in the introduction. In addition, the logical models and empirical results will be validated and rehabilitated using a theoretical reference framework. The research methodology is based on [Yin 1994], [Mayring 1999], [Stier 1999] and [Girmscheid 2004].

The economic and organizational parameters required for the two-dimensional cooperation network will be identified by adopting the interpretativistic research approach using qualitative expert interviews and quantitative empirical studies. On the basis of this, the further research process will develop the logical-deductive business model by applying the constructivist research approach, give it a theory-based structure by applying the theory of structuration [Giddens 1985] and respectively the principle-agent theory and test its academic quality by means of triangulation.

3 System prefabrication business model

The fundamental structure of the system prefabrication business model comprises the two cooperation dimensions within which the players needed to successfully establish this method of prefabrication cooperate in the form of a strategic partnership. In the case of the business model outlined here, this cooperation focuses on the construction market segments for individually designed, integrated precast modules (e.g. prefabricated bathrooms and dormers) and precast systems for single-family and multi-family homes (SFH/MFH). The initiative to form strategic partnerships in the two cooperation dimensions, which will be described in more detail later, stems from a manufacturer of precast elements, whose strategic interest centers on the integration of the competencies needed for the system service. In return, the cooperation partners involved in the two cooperation dimensions benefit from the market-strategic potential of the cooperation networks, which only arises through the strategic cooperation and with the help of innovative precast technologies that enable the manufacturers of precast elements to prefabricate virtually any element independently of serial production.
At the initiative of a manufacturer of precast elements, the players from the prefabrication market (manufacturers of precast elements, planners, bonding technology companies, (partial) system suppliers, etc.) who are needed to produce a system service (e.g. SFH) cooperate within a supra-regionally operating, production oriented cooperation network (1st cooperation dimension). The system competency that is cooperatively integrated into such a cooperation structure is passed on to the locally and distribution oriented cooperation network (2nd cooperation dimension) (e.g. as a licensing).

The locally operating distribution and assembly oriented cooperation network, which involves the necessary players for construction site preparation, assembly and fitting (local architect, construction entrepreneur, electrical and HVAC companies), can use its proximity to the customers and the ensuing trust to efficiently market the system service. The organizational link to the first cooperation dimension is institutionalized by means of a focal company "Building construction system service". All the cooperation partners from the local sales and assembly oriented cooperation network and the planning experts from the superior production-oriented cooperation network are represented in this company. The client benefits from the advantages of prefabrication (defined manufacturing conditions/high level of finishing quality, efficient processes for building the structure/shorter delivery times, lower financing/investment costs) without having to relinquish his desire for an individual building, whilst at the same time receiving this system service from a single source. This approach enables the cooperation partners to achieve the customer-oriented strategic goals mentioned above.

3.1 Production and system oriented cooperation network

The production and system oriented cooperation network integrates the competencies needed to develop and produce an individual, customer-oriented system service (Fig. 1). It comprises a manufacturer of precast elements, who cooperates with the fastening technology company, (partial) system suppliers, architects for the conceptual system design and a planning expert to plan the prefabrication.

![Diagram](image-url)

**Figure 1. 1. Cooperation dimension – Production and system oriented cooperation network**

The production oriented cooperation network provides the following output:

- the technical and creative design of the system concept
- a suitable supra-regional marketing concept to support the distribution of the system concept
- technological planning competency for the customer oriented individualization of the system concept in the form of precast planning consulting, check lists, and planning tools to support the use of precast systems, modules and elements

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• a suitable incentive system to control the synergetic business interests and competencies of the involved partners in a target oriented fashion

3.2 Sales and assembly oriented cooperation network

The sales and assembly oriented cooperation network provides the expertise for distributing and assembling the system. It is comprised of a local architect, who is responsible for the individual, customer oriented design, a local construction company to prepare the building site, excavate, build the foundations and assemble the precast elements, and a local electrical and HVAC company to connect the installations (Fig. 2). Additional necessary services will be carried out by subcontractors. The sales and assembly oriented cooperation network provides the following contributions towards successfully establishing the business model in local markets:

• detailed knowledge of local market structures in the segment of SFHs and MFHs
• established informal local networks for acquiring suitable cooperation partners
• comfortable market access for acquiring potential clients
• operative tasks relating to preparation, assembly, commissioning and warranty works.

![Figure 2. 2. Cooperation dimension – Sales and assembly oriented cooperation network](image)

4 Conclusion and Outlook

The business model presented here comprises the production and sales oriented cooperation concept to develop and penetrate the precast market, the structure of the management concept to develop the virtually individualized service offering for customers, and the marketing of the overall product as a one-stop service and warranty. The construction management core of the business model is the two-dimensional cooperation network comprised of:

1. production and system oriented cooperation among key planners and companies to develop and produce an individualized, customer oriented system service
2. locally focused sales and assembly oriented cooperation among local/regionnal supra-regional partners to ensure proximity to the customers and exploitation of local connections

The partners involved in the cooperation networks are given the unique opportunity of sustainably increasing their sales through the specific use of precast (partial) systems, modules and elements that are tailored to the needs of potential clients in the market segment of single-family and multi-family home construction, and of consequently improving the capacity utilization of their company resources. This results in a reduction of the specific overheads relating to a project, and companies have a better chance of obtaining an improved, positive project or operating profit. In addition, prefabrication
allows the participating companies to reduce their non value adding work hours and, in doing so, to generate much higher contribution margins.

Clients obtain the commercial benefit of the business model from the efficient delivery of the construction within a considerably reduced construction time, since the building is then available for utilization much earlier, allowing, for example, a reduction in financing costs. In addition, clients benefit from the quality advantages in terms of less material and production variation and qualitatively optimized standard details and construction elements (learning system concept).

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