The economic logic of the construction industry

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Abstract

From a practical perspective the construction industry is interesting for a business researcher in that it does not have had very positive economic development in terms of productivity and the degree of innovation is characterised as low. From a theoretical point of view the industry is interesting in that prior research has taken different perspectives including market, relationship and network based approaches. The paper presents a literature review of research on transaction cost (market), supply chain management (relationship) and industrial network (network) approaches in the construction industry, concluding that the 'basic technology' of this industry is characterized by different economic logics. Relating the logics to Thompson's classification of serial, pooled and reciprocal interdependencies, the paper concludes that there is need for research that provides understanding of possible combinations of the logics, i.e. hybrids.

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INTRODUCTION AND PURPOSE

The construction industry is interesting for a business researcher in several ways. One interesting aspects is that the reported economic development has not been extremely positive. In most countries the construction industry is an area that has experienced a *decreasing* or stable productivity the past decade (BNL 2002, Dainty et al 2001, Love et al 2004, Persson and Solberg 1994). The degree of innovation on how to organise and manage construction projects is also claimed to have been low during this period (Andersen et al 2004, BNL 2002, Dubois and Gadde 2002, Persson and Solberg 1994). Accordingly, it is an industry with great potential for improvement and it is also in many countries a large industry (BNL 2002, Cox and Thompson 1997, Thompson 1998, Persson and Solberg 1994, Vordijk et al 2000). For example, the Norwegian construction industry employs a total of 320 000 people accounting for approximately 15% of the total with a total turnover in 2002 of NOK 330 billion distributed on a large number of companies – 43 500 (BNL, 2002).

Another interesting aspect seems to be the way the industry functions from a structural perspective, is claimed to be traditional, fragmented and dominated by small companies (BNL 2002, Dainty et al 2001, Love et al 2004, Persson and Solberg 1994, Vordijk et al 2000). Still, studies conclude that many use the same suppliers from one project to another (Håkansson et al 1999, Persson and Solberg 1994) and that the industry is more fragmented and each project made 'far more unique than necessary' (Dubois and Gadde, 2000, p.213).

Thus, there are some good empirical reasons to investigate how this "industry" is functioning in terms of how the different type of companies being involved relate to each other. At the same time there are also theoretical reasons for asking the same question. In the traditional market perspective each company is seen as an island with clear boundaries in relation to other companies and organisations. During the last decades there are a number of different approaches, which have questioned these assumptions and have suggested chains and networks as alternatives or complements to the traditional view. There are reasons to believe that these approaches also have been applied for the construction industry and that they have given different results.

The purpose of this paper is to formulate issues and questions for research on the economic logics of the construction industry and how this differ from other industries. We start by discussing some of the specific characteristics and problems identified in prior studies from three different approaches – market (read transaction cost) approach, relationship (read supply chain) approach and network (read industrial networks) approach. The results suggests that one critical issue regards how the basic technology is looked upon in terms of important interdependences and that the economic logic has to be related to this. We conclude with the formulation of some major research issues that has to be answered in the future.

THE CONSTRUCTION INDUSTRY – PRIOR RESEARCH

Ever since Cox and Goodman published their study on 'Marketing of Housebuilding Materials' in 1956, this industry has attracted attention from researchers. In the following presentation and discussion of prior literature, we have chosen to group the identified studies into three main approaches based if the studies start out from: a market, relationships between companies or a network of companies.

Market Approaches - Contracts and Governance

The classical approach is to view the construction industry as a market where the development is influenced by market characteristics such as degree of concentration, vertical integration, size distribution of sellers and buyers and so on. During the last decades this type of studies has been dominated by the research of governance forms and the use of contracts (e.g. Cox and Thompson 1998, Constantino et al 2001, Lai 2000). The focus is on development and use of more and better contracts that fit with specific situations. The identified studies are summarized in Table 1.

TABLE 1: Literature on market (transaction cost) approaches in the construction industry:

Author(s)	**Content**
Bajari & Tadelis 2001	Discuss procurement contracts and use of incentives versus transaction costs. A quantitative approach to different types of pricing and information asymmetry, relating to TCE
Bremer & Kok 2000	Discusses industry arrangements that provide competition and collaboration, in particular on the bidding process. The importance of collective funds and the institutional arrangements
Constantino & Piertoforte 2002	Interprets the industry as a network of transactions. Builds on Williamson and Eccles 'quasifirm'.
Constantino et al 2001	Builds on Eccles and Williamson. Uses the concept of atmosphere to explain different approaches in subcontracting.
Cox & Thompson 1997	Different types of relations requires different contracts – portfolio approach. There no 'best-solution' – problematises and illustrates different economic logics in construction.
Eccles 1981	Problematises Stinchcombe from 1959. Much sited work on relations between type of organisation and market characteristics
Lai 2000	Contribution to the debate on contractual nature of subcontracting in the construction industry. Building on Coase's dichotomy, presenting a general characterization as the nexus of Coasian firms.
Love et al 2002	Discusses transaction costs, learning and alliances. A conceptual discussion of the three concepts with a small example on a contract supposed to give room for learning and minimization of transaction cost.
Miller et al 2002	Contracts between contractors and subcontractors – harmonization for lean construction. Argues that success within construction is determined by the interfaces between inter-dependent subcontractors. Discuss the importance of taking subcontractors' needs and opinions into consideration to a greater extent.
Piertoforte 1997	Contracts vs. federative and other mechanisms. Discuss how contracts fail to govern important matters between the parties and must be complemented by more informal mechanisms.
Rahman & Kumaraswamy 2002	Examines attitudes among project participants in light of TCA. Complements appropriate contract forms with attitudes in the contract relation in particular with regards to risk management.
Rokkan et al 2003	Develop the concept of specific investments relating it to time horizon and norms. Uses construction merely as a setting
Thompson et al 1998	Evaluate contracts in UK with regards to four Rs. Contracts and formality versus relationships and informality
Turner 2004	Develop contract selection strategies related to uncertainty and complexity. Uses TCA to analyse governance efficacy of contract types
Zaghoul and Hartman 2003	Discusses the cost of mistrust and contracting methods. Identifies some opportunities for between risk allocation mechanism and contracting strategies
Winch 1989	Introduces the transaction cost approach. Early application of TCA on construction.
Winch 2001	Development of framework distinguishing between institutional and governance level. Based on TCA, a framework for different types of contract relations and transactions are developed

It is in particular the transaction cost approach that has been the basic theoretical framework and Winch (1989, 2001), Bajari and Tadelis (2001), Constantino et al (2001) and Turner (2004) are 'typical' for this approach. They view the market as a set of individual companies who relate to each other through contracts. The relevant units are the

'firms' as opposed to the 'projects' in literature preceding the transaction cost approach (e.g. project management - see Winch, 1989). The units include clients, contractors, architects, subcontractors, component and material suppliers. They relate to each other through (bilateral) contracts, e.g. between the contractors and its subcontractors. There are different types of contracts to choose from depending on characteristics of the market (e.g. the number and size of suppliers), the buyer itself and the product or service being exchanged. There are studies that report on which contract types are used in the industry as well as more normative studies suggesting contracts that should be used. Important concepts for characterizing the exchange that is regulated through the contract include different types of uncertainties, degree of information asymmetry, frequencies, etc. The main purpose of finding the right contract is to minimize transaction costs – ex ante as well as ex post as there is often a trade-off between costs of agreeing (ex ante) and costs of renegotiating (ex post).

This approach contributes by introduction of the firm level (company profits are important for the industry to function) and the fit-for purpose thinking with regards to contracts. Particularly interesting for our paper is the introduction by Winch (1989) of different types of interdependencies, based on Thompson (1967), differentiating between sequential (traditional production process of information and material) and pooled (each project group sharing little else than overheads with its colleagues) interdependencies.

Relationship Approaches – Supply Chain Management

The supply chain management approach focus on integration of processes and their according activities and actors. Within this group we can distinguish between three different approaches: one that is approaching the construction industry as 'one' chain, suggesting 'full' integration of all activities (e.g. Akintoye et al 2000, Love et al 2004, Proverbs and Holt 2000), one that focus on parts of the construction industry with according solutions, for example builders merchants (Agapiou et al 1998a, 1998b) and subcontractors (Dainty et al 2001), and one suggesting that the construction industry consists of different chains which must be managed and organized differently (e.g. Vordijk et al 2000). Table 2 provides an overview of the studies identified within this main approach.

TABLE 2: Literature on SCM in the construction industry:

Author	**Content**
Agapiou et al 1998a	Resource oriented approach to logistics/SCM. Relate strictly to the material flow - interesting points about resources.
Agapiou et al 1998b	Focus on merchants – a much forgotten role. Points to a middleman in the construction business that is important for logistics/SCM and networks.
Akintoye et al 2000	Explain why SCM is difficult in construction. Explanations in culture, etc. but no problematising of assumptions in SCM
Dainty et al 2001	Subcontractor perspective on the integration from SCM. Provides a new perspective – SCM not wanted by all – problematise the effects.
Elliman & Orange	How to make customized supply chains. Points to the importance of standardized modules and suggest electronic channels for this.
London & Kenley 2001	Literature review on diverse streams of research related to SCM. Lacks clear conclusions and specific contributions
Love et al 2004	Model for seamless SCM for construction. Does not problematise SCM or the specifics of construction vs. SCM
Proverbs & Holt 2000	Model for low cost production in construction Eliminates everything that might be site/context specific
Vordijk et al 2000	Discuss the 'leading' role in designer/ supplier/contractor dominated supply chains. Interesting perspective on how supply chains can be designed differently depending on who takes the leading role
Vrijhoef & Koskela 2000	Identifies four roles of SCM on the integration of site and material supply. Taking the industry specifics seriously, they discuss scm in different 'chains' and identify problems within each.

From the SCM perspective the market is viewed as a set of relationships forming supply chains. Relevant units are the relationships between the actors such as contractor/ subcontractors, contractor/client, subcontractor/material suppliers, etc. Relationships are in turn related to each other in terms of chains, more precisely vertically, sequentially linked activity chains. In fact, compared to the former approach, the SCM-perspective leads back to the project and away from the firm perspective (ref. Winch, 1989). This 'actor-free' approach is rather typical for supply chain management (Jahre and Persson 2003).

With regards to the characteristics of the different chains and their according solutions, Voodijk et al (2000) suggest there are reasons to distinguish between three different subsystems of the supply chains in the construction industry:

1. *Manufacturing* of building materials and components.
2. *Construction* that directly produces the end product.
3. *Design* responsible for descriptions of the appearance, layout, functions of the building or engineering product, detailed drawings and specifications of every part.

It is the relationships between the actors as a determinant for how activities are linked, that are viewed as decisive for the overall cost and productivity of each project. Vrijhoef and Koskela (2000) do not distinguish between different chains but claim there are three main characteristics of *the* construction supply chain – it is converging (many components and many flows going together into one object), it is temporary (projects being set up just for one object) and it is make-to-order (much customisation).

The major difference between this approach and the first one is the existence of a "larger" system in terms of "chains". If we use Thompson's (1968) classification, these chains obviously build on the existence of serial dependencies between the different companies being involved in the construction industry. Looking at the chains starting in the production of raw materials, over the production of construction materials and components, to the production sites and later to the use of the constructions there are certainly important dependencies that can be more or less utilized from an economic point of view. These types of dependencies and how they can be economized will be further discussed when we now turn to the network approaches.

Network Approaches – Industrial Networks

The third approach is related to the development and operation of relationships as a basis for industrial networks. Whereas the two former approaches have focused on increased productivity (SCM) and better control (TCA), the industrial network approach is in particular concerned with innovation and technical development. Anderson et al (2004) reports successful diffusion of new technology in solar energy projects and relates it to the leading firm's strategy through three phases including configuration and combination of resources, combination of actors and translation of activities (p. 359). They claim there are several reasons for the success of this project that combine standard components in a novel way. One is the importance of selecting and managing partner networks throughout alls phases to gain access to resources. Another is the combination of actors across industries. A third is the active participation from the lead firm to help disseminating information and knowledge in the network. Table 3 lists studies with a network approach.

TABLE 3: Literature on the industrial network approach in the construction industry:

Author	Approach	Contribution	Comment
Andersen et al 2004	IMP	Innovation in networks attributed to ARA	Reports on a successful project – uncommon in this literature.
Bengtson 2003	IMP	Introduce a new material or component	Stresses the importance of embeddedness
Bossink 2002	Innovation/IMP	Stage model and interaction patterns for co-innovation	Assumes clear strategy and stages – does not coincide well with basic IMP approach
Cheng et al 2001	Project mmgt /Engineering	Design information infra-structure for partnering	Network and partnering completely related to information exchange
Dubois & Gadde 2000	IMP	Use of external resources through co-operation	Interesting characteristics of networks effects in the construction industry
Dubois & Gadde 2002	IMP	Proposes construction as loosely coupled systems	Problematises the different logics relating this to characteristics and solutions with regards to couplings.
Holmen et al 2003	IMP	Framing supply networks	Discusses how supplier relationships and the configuration of networks in the construction industry is related to view points
Håkansson et al 1999	IMP	Learning is related to the number of connections in a network.	Looks at learning in relationships and brings forward the importance of context - the other relationships.
Huemer & Østergren 2000	Strategy	Learning related to corporate identity and strategy	Learning depends on action and learning of others, internal and external factors
Loosemore 1999	Social network analysis	Discusses power in relationships.	Problematises the importance of contracts.

Dubois and Gadde (2000, 2002) report that the construction industry faces some challenges due to the industry's specific attributes relating to interdependence and uncertainty:

Table 4: Characteristics of the industry (Gadde and Dubois 2002)

Central features of construction	Interdependence	Uncertainty
Focus on single projects Local adjustment Utilisation of standardised parts Competitive tendering Market-based exchange Multiple rules	Number of technologies and interdependence Rigidity of sequence between the various main operations Overlap of stages or elements of construction	Lack of complete activity specification Unfamiliarity with local resources and local environment Lack of uniformity of materials, work and teams with regard to time and place Unpredictability of environment

They found that supply of materials primarily is characterized by exchange of standardized products. Even if the site-specific solution is customized, standard components are used –

what Dubois and Gadde call ‘collective adaptations’ (2000, p. 211). Another important feature is the temporary network (project) within the permanent network (the actors in the industry). ‘The project network activates resources in the permanent network to perform the activities required for completion of the building’ (p.213). The resources of a firm are simultaneously activated in a number of projects and therefore the use of them needs to be co-ordinated on the project level, the firm level and also at the relationship level. They conclude that the strong reliance on standardised components and interfaces does not foster technical development and that the current co-ordination mechanisms hamper product development.

Dubois and Gadde (2002) put forward the idea of the construction industry as a loosely coupled system, claiming that coordination it is required within and between different layers including within construction projects (activities being sequentially interdependent but also organized in parallel sequences which results in stages or elements of the construction process being overlapping), within supply chains (for example in the production and supply of materials) and among firms beyond the individual construction projects where standardized components are important. Their main conclusion is that ‘The tight couplings in individual projects combined with the loose couplings in the permanent network embedded in the community of practice make it possible to come to grips with uncertainty and interdependence.’ (p.627).

Bengtson (2003) makes an extensive analysis of how frames of wood are reintroduced into the Nordic countries in the middle of the 1990s. These frames were forbidden for houses

higher than two stores 100 years earlier due to some large city fires. However, such frames continued to be used in the US and when the laws were changed in the 90s some actors believed that the use of them also in the Nordic countries could reduce the total costs. The analysis shows that it is very difficult to economize on the use of a single product because the main rationalizations can only be achieved if a number of other products as well as production processes are changed. In this way the study demonstrates that the used products as well as the processes are mutually dependent on each other, i.e. the reciprocal interdependence from Thompson (1967).

In summary the network studies give a picture of a complex industry where a large number of different interdependencies and uncertainties have to be handled. The picture clearly points to the need to discuss more in detail what kind of technology is dominating within the construction industry.

Characterising the Basic Technology In the Construction Industry

One way to summarise the earlier studies is to relate them to what kind of basic structure they assume exists in the industry. Market studies clearly assume that the structure is a market but might as we saw in the earlier analysis point to systemic aspects within the market. The existence of chains are clearly advocated by all supply chain studies even if such studies also can acknowledge some important shortcomings: '...no easy answers to developing a fully integrated supply chain solution' (Dainty et al 2001, p.846, based on Thompson et al 1998), and '...the practical methods for SCM implementation have to be

developed so they take into account the characteristics and the specific situation of construction (Vrijhoef and Koskela 2000, p. 177).

Stabell and Fjeldstad (1998) building on Thompson (1967) suggest that the value chain metaphor (on which supply chain management is based) is only one out of three possible value configurations. It is based on the long-linked technology, while there are other generic value configurations that models intensive and mediating technologies, i.e. the value shop and the value network respectively. The characteristics of the configurations are described in Table 5.

Table 5: Overview of alternative value configurations (Stabell and Fjeldstad 1998)

	Chain	**Shop**	**Network**
Value creation logic	Transformation of inputs into products	(Re)solving customer problems	Linking customers
Primary technology	Ling-linked	Intensive	Mediating
Primary activity categories	• Inbound logistics • Operations • Outbound logistics • Marketing • Service	• Problem-finding and aquisition • Problem solving • Choice • Execution • Control/evaluation	• Network promotion and contract management • Service provisioning • Infrastructure operation
Main interactivity relationship logic	Sequential	Cyclica, spiralling	Simultaneous
Primary activity interdependence	• Pooled • Sequential	• Pooled • Sequential • Reciprocal	• Pooled • Reciprocal
Key cost drivers	• Scale • Capacity utilisation		• Scale • Capacity utilisation
Key value drivers		• Reputation	• Scale • Capacity utilisation
Business value system structure	• Interlinked chains	• Referred shops	• Layered and interconnected networks

In the original article the three are used for analysing firm-level competitive advantage. However, it is also interesting to relate the same three generic types of technologies to a whole industry such as construction. We have earlier in this article pointed out how different researchers have found that all these types of interdependencies can be found in construction. In line with this, Håkansson and Persson (2004) found that all three technologies also exist in logistics networks. Building on Thomson (1967), relating it to supply chain management, they suggest that there are a number of economies in logistics networks that relate to other than serial or sequential interdependencies. Their main conclusions is that 'while economies of integration can be achieved by exploiting serial interdependencies, and economies of scale as well as economies of scope may be achieved by exploiting pooled interdependencies, exploiting reciprocal interdependencies means to pursue the economies of adaptability and change. In other words, it concerns being innovative, agile and responsive to change.' (p.14).

The same arguments can be used in relation to the construction industry. There are distinct serial interdependencies as illustrated by the supply chain studies. But as some of the network studies have demonstrated there are also important mutual or reciprocal interdependencies between, for example, the products and components used. Furthermore, the use of projects also gives rise to important pooled interdependencies. Thus, all three types of dependencies exist in parallel with each other.

CONCLUSIONS – THE ECONOMIC LOGIC

Prior literature has in varying degrees touched upon the point of different economic logics related to this industry including short vs. long term goals, transactional vs. relational exchange, temporary vs. stable networks, different types of supply chains, standardisation vs. customisation, tight vs. loose couplings, varying actors' perspectives etc. We would like to go one step further and claim that because of the existence of a mix of interdependencies –all the three basic types identified by Thompson (1967) are important in the construction industry - an economic logic that must be described as a hybrid is created.

Thus the conclusion is that the construction industry has the features of a mix of different economic logics - logics that are based on different dimensions. This might also be the reason why the market concept has been so much used – because of many different logics none of them becomes the driver on which solutions are based, and thus none of them is taken into account. However, this might be a very inefficient solution. That several types of interdependencies exist does not mean that they neutralize each other or 'take each other out' as implicitly assumed by a market solution. Instead we have to find a solution where all the different types of interdependencies are handled at the same time. It probably means that we cannot use any of the basic models (long-linked, intensive and mediating technology) described by Thompson (1968) and further developed by Stabell and Fjeldstad (1998). Rather, there is a need to define hybrids consisting of combinations of the three.

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