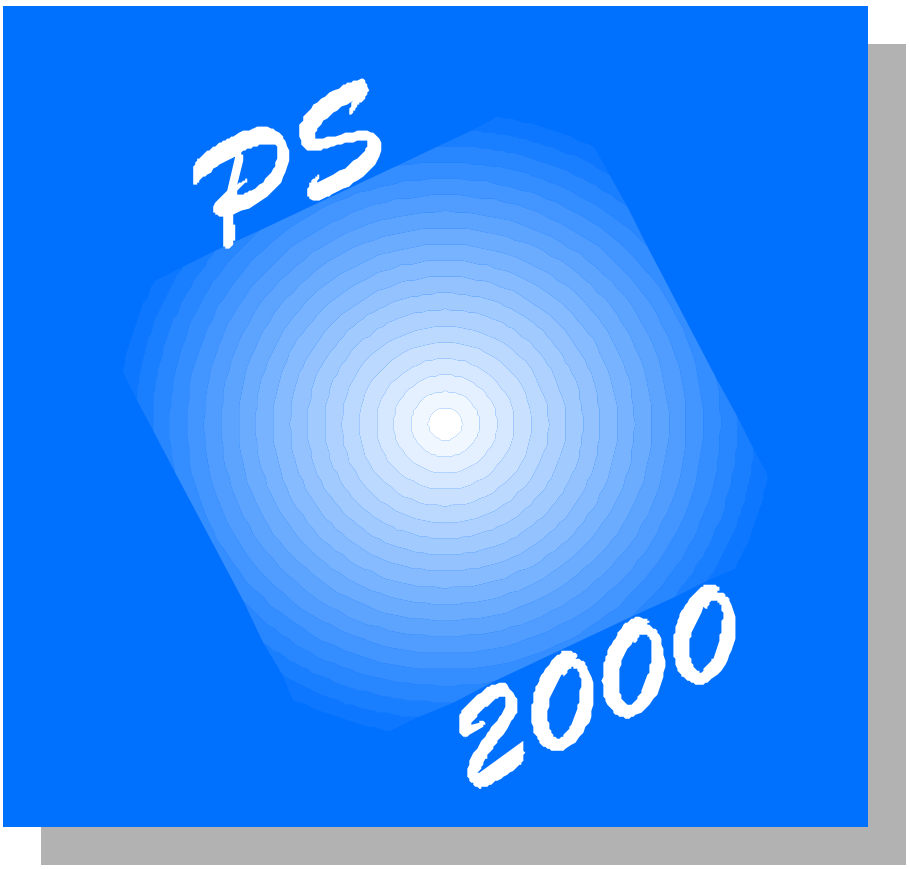
Suppliers to a building project

A Research Project for the Research Programme
Project 2000



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SINTEF REPORT

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SUPPLIERS TO A BUILDING PROJECT

A Research Project for the Research Programme Project 2000

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ABSTRACT

The problem statement for the report was to investigate the content and nature of relationships between companies operating in a project-dominated industry. More specifically, the project aimed to investigate the following two questions:

1) How are goods and services gathered for one specific building project
2) How do companies operating in the building industry interact to achieve their goals

Methodologically, a specific building project was chosen as a basis for the research, and some suppliers and sub-suppliers were picked as well. The case chosen was «Kjelehuset», a 75 mill NOK refurbishing project at the Gløshaugen campus of NTNU.

The results from this preliminary research can be arranged around two important questions. One has to do with technological development in the industry and the other has to do with customer orientation.

The research done in this project will be carried on in a larger setting, the Building project known as «Realfagsbygget», throughout 1999. This research will proceed in a similar manner methodologically, and will concentrate on the issue of technological development in the industry.

KEYWORDS	ENGLISH	NORWEGIAN
GROUP 1	Organisation	Organisasjon
GROUP 2	Logistikk	Logistics
SELECTED BY AUTHOR	Supplier relationship	Leverandørforhold
	Project organisation	Prosjektorganisering
	Purchasing	Innkjøp

SUMMARY

This report is made with the support of PS 2000 (Project 2000) which is a governmentally funded research programme at NTNU (Norwegian University of Science and Technology). The report concerns itself with establishing a list of interesting areas for analysis of marketing, purchasing and production strategies in the project-based building industry. The report will be followed by more reports at a later stage detailing the areas listed in this report as interesting.

The problem statement for the report was to investigate the content and nature of relationships between companies operating in a project-dominated industry. More specifically, the project aimed to investigate the following two questions:

3) How are goods and services gathered for one specific building project
4) How do companies operating in the building industry interact to achieve their goals

Methodologically, a specific building project was chosen as a basis for the research, and four suppliers to this project were picked. For each of these suppliers, three sub-suppliers were picked as well. This gave me a simple system consisting of a building project with four suppliers and twelve sub-suppliers. The intention was to interview these 17 actors and ask questions regarding their interaction, both as regards to production, marketing and purchasing and technical and logistic matters. The case chosen was «Kjelehuset», a 75 mill NOK refurbishing project at the Gløshaugen campus of NTNU.

The results from this preliminary research can be arranged around two important questions. One has to do with technological development in the industry and the other has to do with customer orientation. Technological development in the building industry seems to be slow and underemphasized, given the size of the industry. Certain reasons for this are suggested in this report. One of the more important reasons seems to be, paradoxically enough, the bidding system. The bidding system enforces a «back-to-basics» way of doing business that forces the firms in the industry to cut back on all supporting services (including engineering and research and development).

When it comes to customer orientation, the research suggests that customer orientation is hard to obtain in the industry since the end customer usually has a very limited knowledge about what to expect from a building. Thus, they are often unable to push for the «best» solutions and «agents» of the customer, such as project management firms and architects instead shoulder the task of creating such solutions. The problem is compounded by the bidding system which makes it hard for firms in the industry to relate to each other in a long term way, thus creating problems with short-term optimalisation as well as creating a need for elaborate systems to transfer knowledge between projects.

The research done in this project will be carried on in a larger setting, the Building project known as «Realfagsbygget», throughout 1999. This research will proceed in a similar manner methodologically, and will concentrate on the issue of technological development in the industry.

Preface

In order to create this report, a lot of support was necessary. First, I want to thank PS2000 and Bjørn Otto Elvenes for the financial support of the report. Secondly, my thanks are extended to all of the interviewees and especially to Bård Nilsstad at Prosjektstyring AS for allowing me to use Kjelehuset as a case. My thanks also goes to Torgrim Torstveit and Trond Orrestad, who made a lot of interviews in their project work about the project itself, saving me some of that work. Finally, I would like to thank Ann-Charlott Pedersen, Håkan Håkansson and all the other people in the industrial networks network for the support they have given me in discussing implications from and to the theoretical basis we share.

Tim Torvatn Trondheim 3/8-97

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Chapter 1: INTRODUCTION

1.1: Background of the report

This report is based on interviews made with people working for several different companies delivering goods to the case building project, a refurbishing of a building (Kjelehuset) at the NUST (Norwegian University of Science and Technology) in Trondheim, Norway. The report is to be the first of several regarding purchasing, production and marketing strategies in the project-based building industry. Basically, this report is a first listing of interesting areas for analysis and a first attempt to describe certain elements of the case which may be interesting for the theoretical approach that I use.

The report is published with the support of PS 2000 («Project Management year 2000»; a governmentally funded research programme at the NTNU) who also have supported the gathering of empirical data.

1.2: Problem statement

The aim of this research project is to investigate the content and nature of relationships between companies operating in a project-dominated industry; in this case the building industry. This is to be done on two levels:

1) Investigating how goods and services are gathered and organised for one specific building project
2) Investigating how companies operating in the building industry are interacting in general.

In researching this, I am to be especially interested in the nature and content of relationships between companies in the industry, and how they are affected by other relationships entertained by the companies involved in one.

1.3: Methodological approach

The methodological choice for this research project is a qualitative study where a «snowballing» technique is used to decide which companies will be interviews. I have started with one specific building project (Project Kjelehuset) and am working my way backward through the supplier structure. The intentions are to cover four (out of 24 suppliers) and at least three sub-suppliers to each of these four suppliers; in total at least 12 firms involved in the building industry. The sub-suppliers chosen are usually the largest ones (for this specific order), but they may sometimes instead be of particular importance when it comes to technical matters. In addition to my own interviews, a project work by two students (Orrestad and Torstveit, 1997) under my supervision have covered the building project itself and several of the suppliers, as well as the way that the main players in the project interact. This material is also available to me.

Each company is asked questions according to a pre-set interview guide. Questions asked mainly concerns four areas; the company itself, the delivery to project Kjelehuset, the sub-suppliers of the company (particularly those used on the delivery to Kjelehuset) and other customers to the company. The interview guide is attached in Appendix 1. Usually, only one representative in each company is interviewed. This is typically a sales/marketing manager but may also be a department head or a project engineer/manager (sometimes the person fills more than one of these positions). Interviews typically take 60-90 minutes to conduct, and interviews are typed and then returned to the interviewees for comments and corrections.

This particular part of the project will be finished before Christmas '97, and at that point I expect to switch my attention to a much larger building project where I will do a similar study, but with more suppliers and sub-suppliers involved. This preliminary report (to be finished in August 1997) is built upon only five interviews and the results are only able to give certain indications about interesting areas to analyse further. I have in the analytical section suggested such areas, and do talk about the indications that I believe I can see, although any firm conclusions should not be made on the limited material gathered so far.

Chapter 2: CASE

2.1: The case; a building project at the Norwegian University of Science and Technology.

In 1992, the university changed from heating produced by burning oil at a central heating plant, to reliance on heating provided by external means. This change meant that the central heating plant became obsolete, and after some discussions it was decided to refurbish the area into auditoriums and studying areas for students. This building project, (which will be referred to as «Kjelehuset») thus constituted a major refurbishing, and was expected to cost about 50 million NOK. The project started in June 1996 and was finished in the beginning of July 1997. Both cost and time estimates held true, even though the project got off to a rocky start because of a national, two-month-long strike among electricians. Thus, the project would be called successful in traditional project management terms.

The University is the user of the building, but since the university is a governmentally run institution, it means that development of lots, including all building and construction projects is the responsibility of Statsbygg, a governmentally owned agency. Specifically, it was the responsibility of Statsbygg to sign building contracts and to decide all matters retaining to the building contracts. A small «user group» consisting of a number of university employees was the only contact point between the university and Statsbygg once the project had started. The task of this «user group» was mainly to comment on the use of materials and equipment which would have a significant impact on maintenance and use of the buildings once they were turned over to the university.

The Kjelehuset project was done in two stages. The first stage was a design stage were a building project management firm, an architect and four construction engineering firms were hired for the work. For the actual construction phase, Statsbygg offered 24 packages for bidding. Of these packages, one was related to the demolition of the old buildings, six were related to the construction of the building frame, seven were related to indoor constructions, three were related to HVAC-installations, four were related to electrical and electronic installations, two were related to other technical installations and the last one was for outdoor areas (gardening, pavements etc.).

It is important to keep two factors in mind when it comes to this project. The first one is that it was a refurbishing project, thus in certain ways a more difficult task than the construction of a new building. The second one is that the space available for building rigs and storage of building materials was limited. The Gløshaugen campus is a rather crowded place, and this necessitated movable storage areas, so that all construction firms in this project had to live with working in certain areas while storing materials in other, to have that situation reversed the next week.

If we take a quick look at the macro-environment, we register that there are a lot of building projects going on, both at the University and in the Trondheim area in general. It is therefore important to keep in mind that this project is going on in a period of bonanza for the construction firms. Rates are good and there is a lot of work for everyone. Also, it is important to know that the Kjelehuset project in some

ways has been used as a preamble for the much larger (1,2 billions NOK) building project named «Realfagsbygget», which is the new building complex for the faculty of natural sciences. Certain building elements, which are to be used in Realfagsbygget, have been tested in a smaller scale in the Kjelehuset project. In addition, several of the construction firms used in the construction phase at Kjelehuset, will also be used in the Realfagbygget project.

2.2: The construction firms participating in this project and their role as suppliers

From the 23 construction firms (one firm won two packages) participating in this building project, three firms and their relationships to each other are documented in the project work written by Orrestad and Torstveit (1997) for this research project, and two more are documented in this report. The two firms documented here are Daaland AS (responsible for the buildings fronts, including glasswork and windows) and Vintervoll AS (responsible for the installation of most of the electrical cables and systems).

Daaland AS is a medium-sized construction company specialising in glasswork for building fronts. Vintervoll AS is also a medium-sized construction and installation firm specialising in electrical installations and systems for buildings.

2.3: Sub-suppliers further down the chain; the network for delivery of electrical installations

For this report, the network around electrical installations is the only sub-system which have been analysed in some detail. This sub-system is focused around the electrical installation firm Vintervoll AS. Further research throughout this year will bring in empirical data on three more subsystems; the building fronts (focused on Daaland AS), the main construction work (focused on PEAB AB) and the interior construction work (focused around Selmer AS).

As mentioned above, Vintervolls package was a total of 3,5 million NOK and contained about 65% materials purchased from sub-suppliers. Among these materials, four groups of equipment dominate the cost structure. These four groups were: lamp fittings and equipment, switchboards and distribution boards, cable gates and bridges and installation materials. The first group of materials; lamp fittings and equipment is by far the largest and constituted about 1 million NOK (30% of the total value of the package and almost half of the purchased materials), whereas the other three were each about 300.000 NOK. Three firms (Fagerhult AB, Glamox and Stokkan Lys) shared the contract for supply of lamp fittings, but for the other three groups a single supplier was used (although several suppliers were invited to make an offer).

Among these sub-suppliers, I have interviewed representatives for Fagerhult AB (which delivered the major part of the contract for lamp fittings and equipment) and Elpro-Selva (who were the sole supplier of switchboards and distribution boards).

Chapter 3: THEORY

The theoretical foundation for this research project is the industrial network theory. This theory attempts to describe the individual company as a part of a larger environment (the network) and the emphasis is on analysing how the company constantly must interact with this environment. An important element here is that the environment is represented by specific relationships towards specific partners, rather than as a general description of the environment. Also, it is of crucial importance to be

concerned about how the different relationships entertained by a specific company (to, for example, customers, suppliers, partners and competitors) interact and affect each other. Thus, the theoretical basis operates with three levels of analysis (also known as the functions of relationships); the individual firm, the one-to-one relationships and the network that these relationships form (Håkansson & Snehota, p45, fig.2.11).

The relationships and the networks are also described as containing three substance levels; Actors, activities and resources (for an explanation of these terms, refer to Håkansson & Snehota, part 2.2) All three layers are always present in a network, although they may not always be equally weighted.

A traditional complaint about the theory on industrial networks has been that it is well suited to describe static situations were the ties between companies are strong and visible, and the environment is relatively stable, so that investments in relationships will have a reasonable chance to pay off before the relationship is broken. Consequently, the theory is less well suited to describe volatile situations were ties are tenuous and the environment is unstable and highly competitive. In such situations, a theory based on competitive models should be used instead.

The construction industry is one of those industries were the situations is seen as very volatile. The industry is dominated by strongly established bidding systems were the individual construction company is «forced» to outbid its competitors, or it will fail to get the contract. Contracts are seen as being awarded mainly on the basis of price comparisons (although in later years, other considerations can also be taken if they are clearly expressed in the offers). In the spirit of the above complaint, it is interesting to analyse this industry specifically by using the industrial network view. Apparently, we may be able to see things that have not been described before, or at least not as detailed as other aspects of the industry related to competitive models. Also we may contribute to a development of the industrial networks theory.

Chapter 4: ANALYSIS

4.1: The content of relationships in the building industry

From the empirical work done by Orrestad and Torstveit (1997), it seems apparent that the industry relies very heavily on the bidding system. Data from my own interviews agree with this observation. All persons interviewed claimed that practically all contracts, large or small, were offered on a competitive basis, with the contract being awarded to the lowest price bidder. They also said that as a company you could expect to receive about 5-15% of the contracts you bid for (varying between industries and with the size of the contracts).

The way that most building contractors get their contracts also seem to carry over to their own supplier strategies. Not only were contracts and bidding heavily used to regulate the transactions between builder and building contractors, but also they were carried over to the supplier level and in many cases also further down the chain to the sub-supplier and beyond. A comment to be made here is that very few construction firms have centralised purchasing departments with purchasing managers. Instead, it is usually the project manager that is responsible for purchases, as was the case with the suppliers involved in this case. Other works done by researchers do also agree with this view.

Partly, the regulations concerning building contracts are a reason for the widespread use of contracts in the building industry. For larger work packages, bidding systems are mandated by law (both national regulations, EEU regulations and GATT regulations have limits above which it is mandatory to present the offer on an impartial basis and to make decisions regarding who will get the contract based on

specific requirements in the offer; usually price). However, bidding systems are also used extensively for smaller packages where no such regulations exist.

However, listening more closely to the interviewees one can also find signs of arrangements that are not rooted in the bidding system. All interviewed persons admitted that sometimes a contract was awarded to someone who was not the lowest bidder. This could be because the firm awarded the contract was regarded as being better (higher quality), but more often it was claimed that such actions were motivated by reference to security of delivery or bad experiences with the firm having the lowest bid.

It is obviously impossible for the type of research that I have done here to say something about the extent to which contracts are not awarded to the lowest bidder. If that is interesting, one should rather use other methodological approaches. However, it is still of significance that all four persons being interviewed claim that this type of behaviour exists. The next question which should be asked is then why do this kind of behaviour exist? Why do firms deliberately pay more than they have to, thus undermining the purpose of the bidding system (to achieve the lowest possible price for a given service) ? It would be easy to dismiss the existence of such behaviour with a reference to an attempt to get around the system of bidding to achieve higher profits for the individual firm. We should however expect that also this kind of behaviour would be motivated by an interest in creating a better situation for the individual firm. Thus we should expect that the buying firm, in cases where they award a contract to someone who was not the lowest bidder, have an economic rationale for doing so. At least they have a rational which to them seems to be a better economic solution than the alternative.

From my point of view, and from the empirical data I have gathered, there may be two main explanations for this behaviour. One or both of these can motivate a separate occurrence, but it is likely that both play an important role in understanding this phenomenon. One of these explanations is linked to the bidding system itself. It is clear that any systematic approach to business dealings (such as the bidding system) will have consequences in that firms will adapt their behaviour to suit the system. In the case of the bidding system, it means that firms will tend to restrict their operations to the scope asked for in typical bidding contractors. For a construction firm there is very little to gain by being able to provide services and/or materials other than those asked for. The most likely result of such offers is that the firm will not get the contract. This means that the bidding system exerts a «standardisation» pressure on the firms. Over time, this standardisation pressure serves to make the firms in the industry more and more similar in abilities and practices and, ironically, also in prices. In other words, the very nature of the bidding system ensures that firms become more and more similar, and that the price differential between serious firms in the industry narrows.

The viability behind this line of reasoning is documented by the following observation made by one interviewee. «The price differential between bidders for a typical contract (of 300.000, my comment) may be as low as 3-5.000 NOK (which is around 1%).» When asked why this is so, he responded: «The construction engineers planning the project and the packages have standard times and costs». In other words, when designing a building project, engineering firms in the design phase use standardised costs for the work being done (for example to put up 1 square meter of interior walls). It is very unlikely that the construction firms bidding for such a package can deviate from these standards in a major way. Thus, any major cost differentials have to come from the purchase of materials (which usually amounts to between 50% and 60% of the total cost of a package). However, since the design and use of materials normally is similarly specified by the engineers designing the building, there is not too much room for price differentiation here either. To conclude, the standardisation pressure exerted by the bidding system leads to a situation in which the individual firms in order to adapt have to remove as many of their peculiarities as possible. The end result is that major price differentials disappear along with any ability to do things differently from the other construction companies. This, of course, may

lead to a situation in which the five offers for a specific package may vary with less than 1%. Consequently, it does not matter much (when it comes to price) which construction firm is chosen, and the buyer is more likely to look at other things than price when it comes to deciding, even though price is supposed to be the main differentiator.

It is interesting to note that the one supplier which claimed that price differentials did exist and commonly was in the range of 10-30% of the contract, also was the supplier which had do to their own designs; Daaland. Usually, there is no construction engineers hired for designing the glass fronts. Thus, the contractor for this type of work has to relate directly to the less specific architectural drawings and must make their own designs based on these drawings. One would expect that this would give these contractors a wider range of choices as to how to design the glass fronts, thus introducing more choices and a demand for a different type of competence. As expected, this also leads to the choices being economically important, in the way that they affect prices more directly.

The other main reason behind the use of contractors that do not have the lowest bid should be sought in dependencies between contractors. That such dependencies exist can be seen in the material I have collected for this research project. In this material, all interviewees are able to describe dependencies of at least two types: Time/Sequence-based dependencies and technologically based dependencies.

Time/Sequence-based dependencies arise because several contractors need certain parts of the job to be done before they do their part. For example, one interviewee described a rather complex time/sequence-based dependency between the contractor for electrical systems and other contractors for interior work. First, the contractor for this type of work must set up the interior walls. Then the electrical contractor can install cable gates, cable bridges and the main cables. After this, the contractor for interior walls must return to put on panelling and/or wallpaper. Then comes the turn again to the electrical contractor which must now put on casings for plugs and components such as switches and operator panels. Finally, the painter can come and paint the walls (if that is needed). Another complicating factor is the HVAC-installator, which also must be adapted into this sequence because of the need for ventilation ducts, and whose machinery also need electrical connections.

Normally, the building project managers handle all such time/sequence-based dependencies at the building site. All suppliers indicated that they were loyal to this system, which means that sequence-dependent issues will be mediated through the project manager and/or through weekly meetings, and not brought up directly between the actual employees installing the packages. In practice, the project manager through decoupling of the activities usually solves such problems. This decoupling is achieved by working at different geographical areas at the same time, so that if sequencing problems arise in one place, the contractor which is «waiting» to be hooked on can do some work at another place while waiting.

Another set of time/sequence-based dependencies arises because most contractors purchase items that must be ordered. Typically, it takes 2-3 weeks before an order is delivered. This means that time/sequence based dependencies at the work site can be exacerbated by the problems they cause in the sequencing of orders to sub-suppliers. It may be that a contractor who is told to work on a different part of the site cannot do so because of the sequencing of orders, which was adapted to fit the original plan and not the re-routed sequence.

In this specific project, another type of time/sequence based dependency exist, since some of the designs used in this project are prototype testing for the larger building project referred to earlier as Realfagsbygget. This means that certain things are performed in order to learn more about the system, the way it works and the time it takes to install it. To do such a testing would also mean that the

experience from the testing will have to be available at a later stage, either by using the same suppliers or by using some sort of system for transferring experience between actors.

Technological dependencies also exist in building projects. Several choices are usually made concerning design and construction methods, both for the larger structure and for smaller details. An example of the former is the design of the supporting frame and an example of the latter kind may include choices regarding ventilation systems. Once such a design decision is made, technological dependencies between components will preclude certain solutions and allow for others. This, in turn, may also decide upon a range of suppliers suddenly becoming important for the project, whereas other may become impossible to involve. In this way, technological choices and dependencies may decide which groups of actors can be allowed to bid on a specific contract. From the Kjelehuset project, we can easily see that the choice to build fronts in aluminium and glass (as compared to for example wood and glass) opened for bids from Daaland and similar companies, but precluded wooden constructions and the actors supporting those kinds of solutions.

Since the design choices are mainly made by architects and by construction engineers, suppliers must (if they wish to argue in favour of their products) come into the process at an early stage. This leads, as we will discuss in more detail later, to a certain amount of confusion as to who the customer really is. Most companies solve this problem either by allying themselves with design engineers or by resigning and retreat to a passive role where they fight for the jobs that exist within their area of work.

In summary, technological dependencies are not always necessary to handle by the individual company, but the technological choices made in the design phase restricts the available number of suppliers, and directs the building project towards certain suppliers with capabilities within the area of work chosen.

Despite attempts from building project managers at reducing the dependencies involved in building projects, there is no way they can all be taken away. Dependencies do exist, and they can be of a technological nature or a time/sequence-based nature or both. The question is thus, how are they to be handled ? The most important coping strategy seems to be the isolation strategy. Project managers and design engineers take care to describe interfaces that minimise the dependencies across them, and thus minimise the interaction necessary between different construction companies.

It may be this very strategy which leads to the effects described above as standardisation effects of the bidding system. The isolation strategy seems to lead to a situation where construction companies become more similar in abilities and technologies. Thus, they are more easily adapted to the specific building project, but at the same time robbed of most of their competitive possibilities when it comes to developing specific technological solutions and methods of work. The result of this process is that the isolation strategy becomes reinforced, because construction companies tend to divest of the resources and competencies that enable them to handle dependencies themselves (since these competencies only add cost to the product, thus resulting in a price which will make the company less «competitive»). Whether this is a process that the industry should be satisfied with, is another matter.

In conclusion, one can say that the element of exchange in a specific relationship in the building industry is less important than in more production-based industries. Although construction firms often deliver to the same customer, this is more on a random basis than in the area of production of goods. However, this only seems to mean that the emphasis of a relationship is more towards the relationship as a way of handling dependencies. In particular, interviewees mention the use of relationship for handling administrative dependencies, for example where they use frame agreements as a means to knowing the prices in advance, so that a construction company would not have to phone its sub-suppliers and ask for a price before handing in a bid. To me, it seems as if there are possibilities for evolving the ways in which relationships are used as a way of handling the dependencies involved in

the building industry, but this may involve a restructuring of the bidding system and thus of the system the construction industry is based around.

4.2: The problem of barriers between producers and end users

Customer-oriented strategies are spreading like wildfires in todays business world. While the idea is sound in itself, there are certain problems in using it. Specifically, two problems are often referred to in the literature; the problem of customer knowledge about their own needs and the problem of gathering that information for use in their own processes. Both of these problems are present in the construction industry, and serves to raise barriers between the end customers (the users of the buildings) and the producers (the construction companies).

Buildings are complex constructs, and although some end customers (users) may be both interested in, and have knowledge about building techniques; very few customers have more than a vague notion of what to expect from a building. These notions are not nearly enough information for the producers to tailor a building to the customers needs. In reality, buildings are therefore black boxes were the typical customer is both unknowledgeable about, and uninterested in, how the different parts function.

The transformation of the vague notions that customers have about their building needs (usually expressed as a certain floor space, maybe also the layout for rooms and the requirements for ventilation and sanitary facilities) into technical specifications must therefore be the task of companies acting as agents for the customer. Architects and construction engineers are usually used in this role, while construction companies very rarely are involved in this process.

This pattern means that not only do the end customer have very little specific knowledge about his own needs, but the construction company is only privy to these needs in a transformed form. A construction company is therefore faced with a challenging task if it chooses a customer-oriented strategy. Who are the real customers? The construction engineers, the owner of the building or the users of the building?

Most of the representatives of the construction companies I talked to had recognised this problem. One of them complained about the difficulties involved in getting feedback on the appropriateness of their products. They knew very little about what the customer really wanted when it came to technical details, and even the design engineers gave very little feedback to this particular construction firm. Two other construction companies said that because of the structure in the industry, it was necessary to work both with the owners/builders (such as Statsbygg) AND towards the engineering firms working with the design of buildings. The latter was particularly important when it came to design choices made by the design engineers. As we touched upon when it comes to technological dependencies above, it is important for a construction company (at least in certain situations) that the design engineers are knowledgeable about the technical abilities of their company. Otherwise, they may design technical systems which would put the construction firm at a disadvantage when buying supplies. We should remark that this is most relevant when it comes to buying supplies, since the installation techniques very rarely differs from one company to another.

This, of course, also means that suppliers to the construction companies face an even more difficult marketing situation where they have to think about the construction companies, the design engineers the builders/owners AND the users.

In conclusion to this point, one can say that the situation in the industry seems to be so that it is difficult to know which customer is to be focused on. Also, the end customers have very vague notions about what they really want, or, to be more specific, there are many ways in which the technical systems can

be built to achieve the vague needs of the customer. Thus, talking with the customer may not be very helpful in order to decide how to construct a building. These two problems lead to the building and construction industry being a rather enclosed, self-referencing system where the input from the surroundings are mainly received through governmental regulations on building materials and construction methods. We would therefore expect technical development in this industry to be dependent upon the construction firms and their need for more productive (less costly) construction methods, rather than customer needs.

4.3: Technological development in the project-based industries

Above, we claimed that building industry is a partially enclosed system where technological development is more of an internal nature (related to what makes production and distribution of products more efficient and/or less costly) than a result of external pressure and directions. The questions I asked around technological development in the firms I interviewed seemed to confirm this notion. They all mentioned that their own role in technological development was very limited; to relegating information from design engineers to sub-suppliers, and the occasional suggestions about improvement of the design supplied by the design engineers. However, it should be noted that this may be a result of the way in which I have asked about technological development. It seems to be the case that technological development is seen as major changes to the way that materials and/or products function. Thus, the interviewees often does not see forward minor adaptations made by themselves as technological development and are therefore less likely to bring these minor adaptations forward in an interview.

However, all interviewees brought forward comments on the (in their opinion) large resources used on research and development by some of their suppliers. It seems to be the case that most of the suppliers are either large corporations or very specialised in certain areas. In both cases, they put a lot of money and resources into research and development. Technological development was thought (by the interviewees) to bring about less costly products, more efficient ways of transporting the product and more technically sound products (both better suited for the task demanded from them AND easier to produce). Also, technical development was necessary to cope with new regulations concerning constructions and concerning environmental issues.

The construction firms felt that they had a very minor role in this technological development process. and in at least one case, they struggled to keep up with the technological change. In that specific change, they had to cope with a new technological system which have not been installed by this company before. A sub-supplier who is a large multinational company, and was offered at a discount because the sub-supplier wanted to introduce the system into the Norwegian market supplied the system. Both the construction company AND its wholesaler (another sub-supplier) put in more work hours than paid for in order to «learn» about this system and how it is installed and used.

One construction company departed from the other in choosing a system of single supplier relationships (instead of the usual competitive bidding systems). They claimed that one of the advantages was that they could stay more informed about technical development in their industry. One example was that they received technical help from one supplier through computer-assisted design programs containing the whole range of variants delivered by that supplier. According to the interviewee, this enabled the company to do the design process quicker and more precise, while saving costs.

Chapter 5: CONCLUSIONS

5.1: Conclusions

Firms in the building industry are faced with a number of difficult choices when it comes to handling their relationships (and thereby also their own efficiency). Sometimes, these choices are of a general nature, but often they are due to special circumstances in the construction industry.

One of the most difficult problems arises due to the function of the relationship/network level. Because of the uncertainty in who will be getting a specific contract, sub-suppliers are often unwilling to bind themselves into long-term agreements with contractors. Instead, sub-suppliers often choose to try to relate to all of the important contractors in their field and/or they try to work directly towards design engineers or builders/owners in order to have their products specified in the design, so that it does not matter which contractor will get the contract.

When working towards owners/builders, contractors experience another type of problem; owners/builders often use the «competitive» strategy when acquiring their buildings. This causes a heavy focus on price and a strong pressure towards reducing costs and standardising operating procedures. The use of design engineers from specialist firms also serves to increase standardisation pressures, and takes away from the contractors the need for (and usefulness of) developing design competence.

Because of these two pressures, many contractors react by cutting costs wherever possible and by removing superfluous competence. This in turn weakens their ability to develop technical competence, forcing them to become more reactive than proactive when it comes to technological development and adaption. It also weakens their ability to handle long-term relationships, and to co-ordinate time/sequence-based and technologically based dependencies. Over time, this has been such a marked change in abilities that the builders/owners now see the need for project managers who can handle these dependencies on behalf of the contractors. Furthermore, the strategy makes the contractors more similar to each other in what they can do and how they do it. This means that a particular company is easily replaceable, a short-term advantage from the builders point of view but a problem from the contractors point of view. Developing «competitive advantages» becomes very difficult in this situation, since the three main ways of differentiating the product (different products, different process technology and a decision-making ability when it comes to design) is removed from the hands of the constructor. All in all, this seems to indicate a negative cycle for the companies in the industry, and this cycle may easily be seen as a «vicious circle», at least from the viewpoint of the construction firms.

The research so far has only lead to some preliminary conclusions, which need to be checked with a larger basis of data. Also, the arguments need to be developed and strengthened and they need to be checked with alternative explanations. Thus, there is a large body of work left to be done with this material. However, the approach has lead to some interesting observations and if the preliminary conclusions hold true even after a closer examination, a firm platform should be established for the use of industrial network theory in project-based industries.

5.2: Further research

As mentioned many times in this report, the research project focusing on this area has only just begun. More empirical data will be gathered (from at least 12 more firms) and these interviews will be compared to the interviews already gathered to check for congruence and/or interesting exceptions to the preliminary conclusions drawn above. We will expect some of the preliminary conclusions to fall, while others will be strengthened.

Of special interest is it to follow up on the importance of technological development in the industry and to try to answer the questions; who does this development, and why do contractors seem to play such a minor role in this work. Another interesting venue is the time/sequence-based dependencies and the way that they are handled. It may be an idea to translate these dependencies into the vocabulary used in industrial network theory (activity links, resource ties and actor bonds) to see if this would enable us to understand the phenomena better. Whether this is done or not, the way that the dependencies are handled by the firms is certainly a key to understanding the industry. A third area is the choices made by the companies regarding strategies for purchasing and marketing. As I have indicated above, the firms checked so far are fairly similar in these respects, but I would expect some more diverging data here. These strategies are interesting because they may represent a venue out of the cycle I have described as a vicious circle for the industry.

In a larger context, there are also other ways of following up on this study. One way of doing so is to study other project-based industries (such as the Norwegian offshore contracts or consultant work). Another way is to broaden the empirical basis for this type of studies by choosing more building projects. I should mention here that this is what I will be doing in the next research project, which will be centred around the building project called Realfagsbygget. Also, it deserves mentioning that colleagues in Sweden are working in a similar manner to describe and analyse two Swedish building projects. A third way of developing the study is to make a comparative analysis across different parts of the building industry. Apparently, circumstances regarding the construction of building fronts are different from those faced by general constructors and by electrical installators in that the construction firms in the building front business does not normally relate to design engineers. Finally, a comparative study of the situation in different countries could also be made.