

AALBORG UNIVERSITY, COPENHAGEN



AALBORG UNIVERSITY  
STUDENT REPORT

# Innovation in the Facade Window Industry

*The Effect of Innovation Linkages on respectively Small  
& Big Firms' Innovation Activity*

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## Resume

Denne rapport afdækker hvordan henh. små og store producenter af facade vinduer arbejder med innovation. Rapporten tager særligt udgangspunkt i hvorledes virksomhederne drager nytte af eksterne innovations ressourcer, repræsenteret i virksomhedens værdikæder, i forbindelse med produkt-, value-, og proces innovation.

Der eksisterer i dag ikke meget viden på dette område, og nærmest intet akademisk, målrettet at forstå forskellen mellem små og store producenters innovationsaktiviteter. Projektet tager udgangspunkt i antagelser fra større danske brancheorganisationer der vurderer, at særligt de mindre producenter ikke arbejder med innovation i et tilstrækkeligt omfang. Fælles for brancheorganisationerne gælder den forståelse, at der eksisterer et reelt markedsbehov og ønske om mere bæredygtige og innovative produkter. Dette skaber forundring i og med, at der samtidig er sket en udvikling i de tekniske kompetencer og muligheder. Tages der udgangspunkt i denne antagelse virker det umiddelbart paradoksalt, at der ikke sker mere innovation i branchen – særligt blandt de mindre producenter.

Formålet med dette studie har været, at udfolde denne problematik samt skabe en forståelse af de forskellige virksomheder, deres innovationsaktiviteter, hvorledes de opfatter markedsbehovet, og gør brug af eksisterende og nye tekniske ressourcer. Dette er undersøgt gennem en indledende spørgeskemaundersøgelse blandt virksomheder i branchen. Formålet med denne undersøgelse var, at skabe en bedre forståelse for virksomhederne og branchen generelt, samt kortlægge innovationsniveauet og -aktiviteterne i bred forstand. Hovedkonklusionerne fra denne undersøgelse var, at generelt er mindre producenter langt mindre innovationsaktive end større producenter der fokuserer på både produkt-, value-, og proces innovation. Små producenter derimod fokuserer på produkt innovation forårsaget af øgede energikrav. Efterfølgende er ti virksomheder blevet interviewet med henblik på, at afdække hvorledes eksterne ressourcer, primært fra virksomhedens værdikæde, integreres i virksomhedernes innovationsaktiviteter. Resultatet af denne undersøgelse er, at store virksomheder anvender en meget systematisk og proaktiv tilgang til innovation, hvorimod små virksomheder primært innoverer fordi de er nødsaget til det. Store virksomheder anvender en aktiv søgeproces hvor de anvender diverse spredte eksterne ressourcer fokuseret på nyudvikling og innovation. Små virksomheder derimod er præget af inertie og nuværende leverandørs innovationsaktiviteter, hvilket forårsager homogenitet blandt små virksomheder.

Generelt skaber markedet en barriere for innovation hvilket naturligvis præger virksomhedernes innovationsaktiviteter. Resultater fra dette studie indikere at der er behov for markedsstimulation. Markedet har en afgørende faktor for det brancheorganisationerne betragter som et lavt innovationsniveau. Årsagen skal ikke findes hos virksomhederne, men i markedsefterspørgslen. Denne rapport anbefaler at brancheorganisationerne primært fokuserer på, at understøtte eksport blandt små producenter, bidrage til at skabe bedre udbudsprocesser til gavn for de store virksomheder, stimulere private forbrugeres renoveringsaktiviteter, samt stiller spørgsmålstejn ved markedsinfrastrukturen.



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## Introduction

This study is focused on analysing the innovation activity of respectively small and big firms in the facade window industry. Interviewed trade organisations argue that there is a general request and market demand for more sustainable and innovative facade windows, which firms seem not to have reacted upon. This seems paradoxical as the technical opportunities have improved, providing manufacturers of facade windows increased innovation opportunities, both in relation to materials and designs. Trade organisations therefore question the lack of firms' innovation activity, especially product innovation, given the incentives and the technological opportunities. Particular are small firms not perceived as having reacted on the described phenomenon, whereas big firms adopt a more proactive approach. How can that be?

In order to answer that question, this study focuses on the difference in the innovation activity, and external innovation linkages applied, by respectively small and big firms. Are big firms more than small firms, better at utilizing from technological opportunities? And what are the different firms' approaches to markets? If the assumption and world view of the manufacturers of facade windows align with that of the trade organisations, small and big firms ought to be heavily engaged in innovation and make use of external resources through innovation linkages with customers and decision makers in the downstream value chain, and technical resources in the upstream value chain. According to trade organisations, that seems not to be the case. But this is based on assumptions. Very little knowledge exists on this matter, and less is documented, which creates a knowledge gap. This makes it relevant not only to understand firms' general innovation activity, but also the key differences between respectively small and big firms. Firms' innovation activity has a vital influence on firm development in general. This makes it interesting to understand to what extent respectively small and big firms' innovation activities leads to renewal and accumulation of current competencies, and a proactive development, or inertia by focusing on current product-market paradigm.

## Research Question

**How are small and big firms' innovation activity affected by firms' innovation linkages in the up- and downstream functions of the value system?**

The research question is answered through an initial clarification of the industry and firm categories, resulting in a definition of small and big firms. This is followed by a quantitative analysis of small and big firms' innovation activity, which leads to a closing qualitative and in-depth analysis of small and big firms' innovation linkages and the effect on their innovation activity. The process is illustrated below (Figure 1):

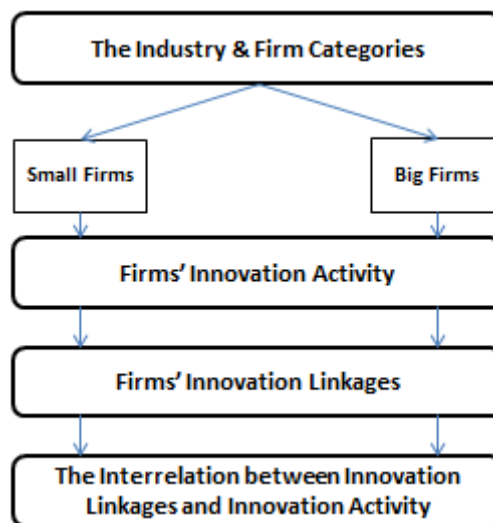


Figure 1 – Report Structure

## Research Objective

### The Author's Personal Interest

First of all, this study is a product of the author's personal and academic interest in innovation and the difference between small and big firms' innovation activity in general. The aim is to gain in-depth knowledge of how firms actually work with innovation and make use of external resources in their innovation efforts, and not to build strategies on how to optimize it. As a benefit of the AAU model<sup>1</sup>, the author's personal interest highly influence the scope of the study why above mentioned theme has been pivotal (Aalborg University 2010). Initially focus was already targeted the building material industry as innovation in that industry is found highly interesting. In the effort of finding relevant and interesting case studies, and suitable industries, three interviews with Denmark's major trade organisations<sup>2</sup>, with relevance to the building material industry, was conducted and supplemented with conversations with experts. Subsequently, attention was targeted the facade window industry as innovation, and the big vs. small firm distinction, currently is an important theme of interest to trade organisations in

<sup>1</sup> The Problem and Project Based Learning. Free project choice within the educational topics.

<sup>2</sup> Dansk Industri (DI), DI Byg, Dansk Byggeri.





that specific industry. Despite for involving those trade organisations, the primary focus of the study is based on the author's personal interest of conducting an analytical and not prescriptive/normative study focused on developing strategies and explanations on how to improve future performance. The main focus has been to analyse and understand firms' innovation activity in-depth, and not develop solutions on how to increase firm performance or improve their innovation effort. However, it is the author's opinion that once firms' innovation activity is fully understood, it is possible to provide inspiration on how to increase firm performance based on the in-depth knowledge gained. A natural extension of this report is therefore, to provide inspiration for trade associations on future focus areas and how they are able to support firm innovation, performance, and future growth (see page 80). It is the author's belief that it is not possible to study future initiatives why the academic task must be to do as described here.

### Industry Issues and Research Focus

In general the trade organisations purpose is to attend to industry members' general interests, and support growth in the respective industries as that produce socio-economic growth, which intensively has dominated the political agenda since 2008. This is reflected in the trade organisations activities and positions as they are focused on firms' growth potential and economic performance. A common denominator is that innovation is perceived as the primary mean to ensure growth and that there is a lack of innovation, especially product innovation, among firms in the facade window industry which entails an unrealised growth potential. As a consequence, the trade organisations attention is targeted innovation in the facade window industry. Interviews with trade organisations and industry experts have been conducted in order to unfold the central issues to what seems to be lack of innovation, which seems paradoxical given the incentives and technical opportunities. The conclusion was that there is a knowledge gap of innovation in the industry, and how different manufacturers of facade windows work with innovation. What wonders the trade organisations and experts is that they believe and assume that there is a market trend and demand for new sustainable and energy efficient products<sup>3</sup> which is not reacted upon. Additionally they are worried as they do not see, or think, that manufacturers of facade windows utilise from new technological opportunities to develop new products adequately. When trade organisations and experts tries to explain what seems to be lack of innovation, the plausible explanations are focused on the industry in general as being risk averse, traditional, conservative, focused on incremental product innovation, and inertia. But is that the case? The knowledge gap this study seeks to cover is whether or not firms within the facade window industry is being innovative or not, and how they make use of technological opportunities and are inspired by market demand in order to develop new products, processes, and/or value innovations . Therefore focus will be to study respectively small and big firms' innovation activities and their innovation linkages in the up- and

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<sup>3</sup> Sustainability relates to energy efficiency and the appliance of new and more sustainable (recyclable and less resource demanding to product) products.

downstream functions of the value system. There exist simply very little knowledge and insight on this matter.

The study is targeted the industry associations and others of influence, and can be used as input in their work of developing future support schemes, legislation, standards, etc. targeted respectively small and big firms. Especially Dansk Byggeri are planning on developing initiatives targeted the facade window industry, concentrated on supporting innovation among small firms. In order to develop effective platforms, the described knowledge gap needs to be studied.

## Background Information

Manufacturers of facade windows are pressured by two generic parameters of importance to domestic political actors and policy makers; innovation and sustainability. Both parameters relates to broad domestic governmental objectives: Innovation is perceived as being the mean to future economic growth while sustainability is an important parameter on the political agenda. Sustainability in the facade window industry especially concerns with energy efficiency. Facade windows energy efficiency is determined by the heat/cold diffusion through the actual window, which determines the energy balance (VinduesIndustrien 2013), (Figure 2). The energy loss for the sum of all windows in Denmark constitute 7% of the total Danish energy consumption and is 10 times more than the diffusion through the exterior wall (DTU Byg 2012). As a consequence, new energy standards of facade windows energy efficiency have been introduced, and will gradually increase by 2020. The energy standards will gradually be tightened through three rounds; the first in 2011, the second in 2015, and the last (decided) in 2020. A classification scheme has been introduced to simplify the assessment of facade windows' energy performance ranging from F-A with A-windows practically being energy neutral (Energivinduer 2011-2013), (Table 1).

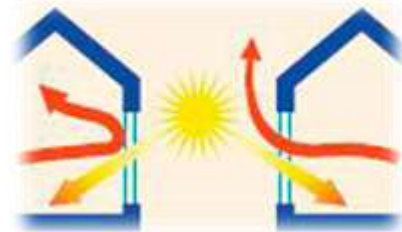


Figure 2 – Heat/Cold Diffusion

Building legislation	Energy performance/balance	Energy label/Classification
2011 (BR11)	> - 33 kW/m <sup>2</sup> yearly	C
2015 (BR15)	> - 17 kW/m <sup>2</sup> yearly	B
2020 (BR20)	> 0 kW/m <sup>2</sup> yearly	A

Table 1 – Energy Standards and Classification

The study has been designed partly to cover the influence and effect of the increasing energy standards in firms' innovation activities.



## Methodology

As earlier clarified, this study is an analytical study seeking to fill the knowledge gap of how firms in the facade window industry work with innovation and the effect of innovation linkages, which is made explicit in the formulation of the research question. This question has been answered through an empirical analysis by applying both quantitative and qualitative data guided by a theoretical framework, concepts, and best practice concerning data collection. The conclusion is narrowed to provide insights on how respectively small and big firms work with innovation within the facade window industry and cannot be expanded beyond this domain. The knowledge and insight developed in this study will be applied to provide recommendations of future actions, targeted especially Dansk Byggeri, and deal with how they potentially can stimulate firms innovation activity and general performance (see page 80). The study builds on the (theoretical) assumption that external innovation linkages are important in firms' innovation activity which is not questioned.

## Research Design

This study is a multiple-case study (Yin 2009) that applies the principles of abduction as a reasoning method. The characteristic of the abduction principle is that typically hypothesis is developed based on a sequence of empirical findings. This principle differs from deduction which seeks to prove or test theory in the real world, and induction focused on efforts to develop theories based on (single) empiric observations (Fuglsang and Olsen 2004). The abduction principle is based on no pre-defined systematic or method, but creativity and logic focusing on exploration and identification of valid hypothesis (Yin 2009), (Pedersen and Olsen 2006).

A multiple case study approach is applied over a single-case study. The practical consequence of this is that the collected empirical data is based on multiple firms instead of one single firm. The data are therefore not developed in order to be able to provide input on how to increase individual firm performance. Instead focus has been to study the consistency between multiple data sets within each firm category, which is used to develop final conclusions. The empirical data collection in this study is based on a quantitative questionnaire distributed to more than 45 firms. This has been combined with ten interviews with manufacturers of facade windows, four trade organisations, and conversations with three technical experts. The reason why a multiple case study approach is applied is based on the research question and –objective. The research question is focused on small and big firms, and the collected empirical data has been used to develop a categorisation of the different firm categories and a strong understanding of respectively big and small firms. This is done by pooling findings from the small and big firms in each category in order to develop a uniform understanding of the firms. Such knowledge is needed in order to answer the research question.

The study is based on an initial interest in innovation among small and big firms, and the effect of innovation linkages. Subsequently, interviews were conducted with experts and trade organisations narrowing the scope of the study to the facade window industry as innovation

and the small vs. big firm distinction is a current topic of interest to Dansk Byggeri within this industry. Subsequently, a questionnaire survey was conducted in order to provide data and knowledge of respective small and big firms and their innovation efforts. This was followed by multiple interviews creating in-depth knowledge. The figure below illustrates the relation between the applied methods and the cognitive process and realisation (Figure 3).

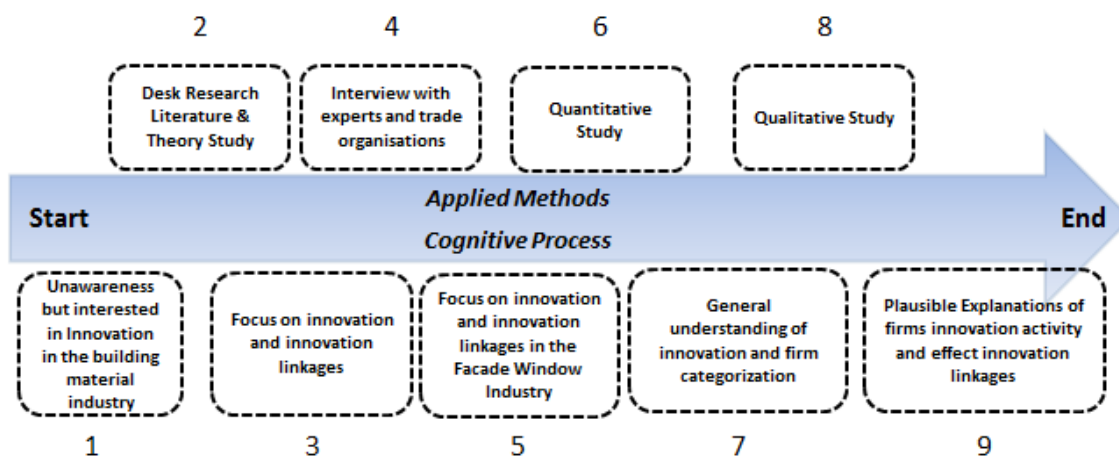


Figure 3 – Applied Methods and Cognitive Realisation

### Data Collection

A mixed method approach combining quantitative and qualitative data have been applied in collecting the empirical data for this report. The applied data collection tactics are a mix of; interviews, a questionnaire, desk research, statistics, and conversations. The benefit of the mixed method approach is expressed by R. Yin as follows: *"It can permit investigators to address more complicated research questions and collect richer and stronger array of evidence than can be accomplished by any single method alone."* (Yin 2009, 63). The combination of quantitative and qualitative methods creates synergies, as the quantitative survey (red. the questionnaire) provides industry and firm category specific knowledge, which forms as a fundament for the qualitative study (red. the interviews) to build upon. The objective and benefit of quantitative methods is that they seek to describe and understand the prevalence of specific and precisely defined and demarcated phenomenon based on statistics and numbers on limited options for respondents to answer (Fuglsang and Olsen 2004). Qualitative methods on the other hand, are not based on numbers and statistics, but on conversations and answers. Data can therefore be unstructured and diverse seeking in-depth knowledge and development of plausible explanations, opposite to broad and wide knowledge developed in questionnaires (Fuglsang and Olsen 2004). In this study, the questionnaire has been used to develop a general understanding of the industry and the different firm-categories and their innovation activities. This insight has been used to develop a general understanding of the industry and serves as input in the development of the interviewguide, ensuring that the appropriate set of questions has been asked. Throughout the data collection process, reliability and validity has been important parameters. Special attention has been to construct and



develop a reality needed in order to research and analyse, what is perceived as being the reality (Fuglsang and Olsen 2004).

### The Quantitative Study

The questionnaire was distributed to the firms within the facade window industry via Dansk Byggeri, who offered to use their membership base and name in the distribution of the questionnaire. In total, the questionnaire was distributed to 45 firms of which 15 completed the survey thereby constituting a response rate of 33%. The survey has been distributed to the vast majority of firms in the industry as it is estimated that there exist approximately 50-60 Danish manufacturers of facade windows (VinduesIndustrien 2013). The survey has therefore been delivered to 75-90% of all firms in the industry, meaning that minimum 25% of all firms have answered the questionnaire which makes it representative. The quantitative study does not include wholesalers without production or development activities/facilities in Denmark, or international firms somehow established in, or exporting to, Denmark into consideration – only Danish firms. The questionnaire was distributed via email the 27/3 2014 followed by two reminders on respectively the 2/4 and the 8/4. It was ended the 11/4 with an email notification to all who received the initial distribution email. All respondents have been offered to receive the results from the survey and the final report.

The design of the questionnaire corresponds to the international standard of innovation survey; the 'Oslo Manual'. Special attention has been given to the design, themes, question formulation, and options of answer applicable for questionnaires related to innovation surveys. Furthermore, the basic rules of questionnaires are followed which are listed below (OECD & Eurostat 2005):

- The questionnaire has been tested before it has been distributed. Both by people involved in the industry and not.
- It is as simple and short as possible.
- The order of the questions is not random, it is based on logic and prior answers that affects the next question which means that the questionnaire is as individual relevant as possible.

The analysis of the questionnaire was done by using the analysis software available in the program used to develop and send the questionnaire<sup>4</sup>. Microsoft Excel was used to make statistical calculations, graphs and models, and pivot analysis.

The results from the quantitative study and the actual questionnaire is summarised in appendix 1 (page 89). Later references in the analysis chapters refer to this analysis and appendix.

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<sup>4</sup> SurveyXact

## The Qualitative Study

In total 17 interviews has been conducted: six with small firms, four with big firms, three with trade organisations, and 3 semi-interviews with technical experts (see appendix 2).

The interviews with trade organisations and experts have been done to narrow the scope of the report (see page 7 & Figure 1).

The firm-respondents have been chosen based on criteria primarily concerning representativity and practicality. First of all, the choice of respondents is based on 'strategic representativity' which basically means that each respondent has been considered and well thought of, in order to obtain a representative value in coherence with the firms being subject of interest (Fuglsang and Olsen 2004). This is done by identifying a pool of small and big firms representing a diverse product portfolio thereby ensuring that the data collection is not based on one specific product-market. Another important factor was distance. Five interviews were conducted in Jutland why the choice of respondents was based on geographical distance as they were conducted on a two-day trip from Copenhagen to Jutland.

In order to ensure reliability, special attention has been given to the respondent's employment, role in the firm, and coherence in between interviews so that different interviews can be compared. An important criteria was that the respondent was responsible for innovation and possessed a general overview of the firms innovation activity and partners, why directors, owners, and development managers was prioritised. Some interviews have been conducted with sales managers who are not responsible for innovation but typically involved. In those situations the respondent did not possess the full overview of the firms' technical innovations but was more focused on markets. By having conducted multiple interviews with different respondents and firms, the effect of this bias is minimised and actually proved to be beneficial as the innovation process, especially among big firms, are divided in technical innovation and market knowledge. The consequence of this is that big firms' innovation linkages to markets and innovation activities based on market needs could have been studied more comprehensively had more sales managers been interviewed. Furthermore, it is important that the same questions are asked in every interview ensuring coherence without formulating leading questions as that will affect the respondent's answer (Kvale 2009). The interviewer is the most important source of bias in an interview (Yin 2009), (Kvale 2009) why great emphasis has been put on planning, preparing, and testing interview-guides prior the interviews. This effort is vital in ensuring reliability in the qualitative data collection stage. All conducted interviews apply the same categories, themes, and questions which creates homogeneity needed in the analysis. All interviews have been recorded and transcribed based on pre-defined themes which according to M. Miles & M. Huberman is a good way to "(...) *pull together a lot of separate pieces of data.*" (Miles and Huberman 1984, 216). The themes applied in the transcripts are listed below:

- The company
- The company's products



- The market
- Competition
- Market development and legislation
- Innovation
- Development of the company's products.

The transcript is done the same, or in one case the day after the interview, in order to ensure that no meanings were lost. After the transcript and analysis was done, the document was sent to each individual respondent who either commented on it, or edited the document so that nothing was misunderstood. This approach ensures validity as the margin error is minimized and that valid data is available for analysis.

The list of respondents can be found in appendix 2, the interview guide can in appendix 3, the transcripts in appendix 4. The later analysis will refer to the qualitative study as a reference which consists of the transcripts and the analysis of the transcripts.

### **Analysis of Empirical Data**

As earlier mentioned, the objective of the analysis is to develop an appropriate firm categorisation and generalisation of respectively small and big firms to be applied in the analysis of how they work with innovation.

### **Analysis Tactics of Empirical Data**

Researchers will always, knowingly or unknowingly, apply specific analysis tactics. The issue is whether or not the findings are valid and repeatable (Miles and Huberman 1984). In order to ensure validity, I have been aware of the analysis tactics applied and how to avoid bias thereby assuring quality (Miles and Huberman 1984). In the analysis of the quantitative data, statistical methods has been applied and observations has been calculated in percentages within each firm category, which makes it possible to compare and discuss observations and variables across firm category. In the analysis of the qualitative data, the analysis tactics applied are based primarily on making patterns, counting tactics, and seeing plausibility. The analysis is based on specific patterns and themes in correlation with the theoretical framework and the empirical data. The analysis is furthermore based on the frequency of observations within each category, and plausible and logical correlations (Miles and Huberman 1984). The tactics applied corresponds well with the effort to generalize the innovation activity within each firm category.

The analysis of the empirical data can be found in appendix 5.

### **Generalizability of the Empirical Data**

The data from the questionnaire are highly generalizable and builds on the principle of 'statistical generalizability' with the purpose of generalise results from a smaller sample to, in this case, the industry as a whole, divided in firms based on firm size (OECD & Eurostat 2005), (Yin 2009). In order to ensure this, it is important that the sample of firms is randomly chosen





and representative of the total industry which is fulfilled (Kvale 2009). The respondents represent the general industry demographic well which increases validity.

The generalizability strategy sought in the interviews is based on 'analytical generalizability' which opposite to 'statistical generalizability' focuses on generalization of phenomenon and observations (Yin 2009). This is done by combining and pooling the statements from all conducted interviews (in each category) meaning, that the interviews with all the respectively small and large firms are coupled to form a uniform understanding of the specific category of firms.

### Quality of the study

The study complies with the OECD standards for innovation research which are described in the 'Oslo Manual'. The manual provides input and guidance on both what type of innovation activity is relevant to investigate and how it can be done (OECD & Eurostat 2005). For public authorities and trade organisations, knowledge of firms and their different types of innovation and innovation linkages can be of great influence in future policy making:

*"(...) coverage of innovation linkages and knowledge sources (...) the forces that drive innovation at the level of the firm and the innovations that succeed in improving firm performance are of central importance for policy making."*  
(OECD & Eurostat 2005, 15).

The Oslo Manual has especially been used to define what is of value to investigate hence narrowing and defining the scope of the study and how it can be measured. This ensures overall validity as the study itself is proved to be of value to general innovation research and Danish trade organisations, while also the actual data collection methods are valid as they are formulated corresponding to international standards.

### Validity & Reliability

The quality of any research is determined by two main parameters; reliability and validity (Yin 2009), (Fuglsang and Olsen 2004), (Pedersen and Olsen 2006), (Kvale 2009). Reliability is concerned with objectivity and refers to whether or not, the findings and conclusions of the study can be replicated by another researcher by using the same methods. Studies that can be replicated are reliable as they are perceived to be as close to the truth as possible (Kvale 2009). Reliability is concerned with data collection and whether or not this process has been conducted the right way in order to minimise falseness. Validity refers to whether or not the study illuminates the actual research objective and –question (Fuglsang and Olsen 2004). In a positivistic approach, validity is concerned with numbers and measurements while it in the qualitative domain occurs when observations and phenomenon reflect and align with the focus of the study (Kvale 2009). In short, validity refers to whether or not the methodology, empirical data, analysis, and conclusions align with the research objective. There is not a natural correlation between reliability and validity as a study with high reliability does not naturally ensure high validity.





### *Validity*

This study is only focused on firms operating in the facade window industry domain and can only be generalized within this domain. The quantitative study is statistically valid as the sample covers 25-33% of the population which is sufficient while more than ten firm-interviews are conducted in total (Yin 2009), (Pedersen and Olsen 2006). A mixed method and multiple case study approach has been applied which expand the fundamental insight in the industry and create a holistic understanding of different firms' innovation activities. Furthermore, the empirical data has also been verified as both the results from the quantitative survey have been verified by Dansk Byggeri, and the interview transcripts have been verified by the respondents. This thorough approach reduces uncertainty of the researcher's capability to be able to identify key issues and see plausibility which the quality of the analysis and study in general rely on. Even though the study and analysis is based on empirical data, a theoretical framework has been developed to support and guide the research. Theoretical definitions and research topics has been identified and developed corresponding to the 'Oslo Manual'. Other literature has been implemented to fill the shortage gap of the manual to this specific study.

### *Reliability*

The collected data is solid and reliable as it is based on the international standard for innovation studies and has been well planned and carried out. The analysis of the study is done by applying a clear theoretical framework and consciousness of the appropriate analysing tactics (see page 11). The questionnaire is developed by applying the principles of the Oslo Manual of how to formulate questions and how to collect answers. The interviewguide has likewise been inspired by the Oslo Manual while building on knowledge from the questionnaire. Initially the results from the questionnaire was studied which formed a general insight needed in order to develop appropriate sets of questions. Simultaneous, was conversations held with industry experts while a small literature study was conducted, which together formed an in-depth understanding of the industry, the value chains, and the firm configuration and constellation. The theoretical framework has likewise been developed prior, so the interviews were consistent with the theoretical framework and the subsequent analysis (Yin 2009). All these elements were incorporated in the interviewguide, which increases reliability.

There are two factors that potentially have a negative impact on reliability. Firstly, there is a difference in the persons who has answered the questionnaire and whom has been interviewed. This factor especially concern data collection among big firms. The persons who have answered the questionnaire were Directors – people in the top management of the organisation, while the interviews were conducted with technical experts in relation to primarily R&D. This potentially creates bias as the top management might not be heavily involved in the operations and daily activities but overall strategic business objectives, which might affect the coherence between the quantitative and the qualitative study. Furthermore, the interviewed technical R&D experts proved to lack knowledge of the firms' innovation activities in the downstream functions of the value chain. This means that more interviews should be held with sales managers in the big firm category in order to expound this area more exhaustive.



Secondly, big attention has been given to the forthcoming BR15 which have been a key theme in all the conducted interviews. The reason for this is that the initial focus of the study was to study the increasing complexity in the industry with special attention to the energy standards. The potential bias is that the importance of the energy standards might have been overrated. However, the analysis and conclusions indicates that the energy standards have an effect of especially the innovation activity and innovation linkages applied by small firms and not big.

Another important factor for successful data collections is the interviewer and his skills. During my education and part time jobs I have conducted several interviews. This means that I have practiced and developed my competencies in conducting interviews by being able to listen and ask good questions, which are a prerequisite for a good interview. The most important factor in order to be able to conduct good interviews is by being prepared and experienced. As described, I have been prepared well while also having conducted several interviews prior although I acknowledge, that experience is highly important and that many years of practice are required to be highly skilled. Therefore great emphasis was put on planning and preparing interviews.

## Theoretical Clarification & Demarcation

This study applies an analytical perspective on innovation which is studied both at the micro and mezo level: Innovation has been studied within the boundaries of respectively small and big firms as an interactive process concentrated on studying innovation linkages and ties between firms and external resources (Christensen 2005).

In this section, the theoretical framework and theoretical concepts will be presented while providing an exposition of how innovation is understood and applied, which is needed to study, and explain, firms' innovation activity and the effect of innovation linkages.

## The Fundamentals of Innovation

The term innovation originates from the economic domain and is perceived as a key driver for economic development. J. Schumpeter is considered as the father of innovation theory, and one of the first to describe the relation between innovation and economic development (J. F. Christensen 2005, 12). In the 'Schumpeterian' context, innovation was considered as highly complex technological innovations resulting in novel products with a significant technical and market-related newsworthiness. Such innovations changes and destruct prior solutions or 'economic order' and develop new orders, as new technology replace the old (OECD & Eurostat 2005, 29). This phenomenon is what J. Schumpeter refers to as 'creative destruction' (Schumpeter, Capitalism, socialism and democracy 1962). J. Schumpeter describes the impact of creative destruction on economic development as a:

*"(...) process of industrial mutation (...) that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one. This process of Creative Destruction is the essential fact about capitalism."* (Schumpeter, Business Cycles. A Theoretical, Historical, and Statistical Analysis of the Capitalist Process 1939, 83)

A great example of creative destruction is the telephone industry where calls initially were directed by operators until they were substituted by more effective technology. This resulted in the death of one industry and the rise of another. Such an innovation will have a major macroeconomic impact and result in discontinuity. There can be distinguished between different types of innovations and their macroeconomic effect and technical novelty. C. Freeman & C. Perez has developed a taxonomy that range from incremental innovations to radical innovations. Incremental innovation occurs more or less constantly in most industries dependent on the market situation and technological opportunities. Isolated will such innovations not have any macroeconomic effect but are important elements in progress over time. Radical innovations are innovations that typically are based on extensive R&D activities which will induce structural changes in the market. Those innovations will have a direct macroeconomic impact and can potentially bring disruptive innovation and discontinuity as illustrated in the earlier example (Freeman and Perez 1988), (Christensen 2005), (OECD & Eurostat 2005). The assumption of the trade organisations is influenced by such a fundamental

understanding of innovation. They perceive innovation as a key mechanism for growth producing macroeconomic benefit which fundamentally is their objective to support why they put great emphasis on firms' innovation activity.

The objective of this study is not to describe the effect of different innovations, but to study firms' innovation activity. At best, theoretical assumption of the future economic effect of an innovation can be made but is beyond the scope of this study. The innovations and innovation typologies studied in this project will be discussed, clarified, and operationalised in the forthcoming sections.

### Novelty & Diffusion Defines Innovation

Since the origin of the theory, different authors, theorists, researchers, etc. have contributed to the evolution of the term innovation and how it is understood today. A fundamental and basic element of an innovation is that it contains some kind of novelty and diffusion. An innovation needs to possess some kind of newsworthiness (novelty) while diffusion of the innovation will determine the impact of the innovation (OECD & Eurostat 2005). By referring to the Oslo Manual, three categories of novelty exists (OECD & Eurostat 2005):

<b>1. New to the firm</b>	<b>2. New to the market</b>	<b>3. New to the world.</b>
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At minimum an innovation must be new to the firm in order to be categorised as an innovation. If a potential innovation is new to the firm it can be considered as an innovation for the firm, independent if it is implemented by other firms. Innovations are new to the markets when a firm is the first one to implement an innovation before its competitors within a limited geographical region or product line. Innovations that are new to the world are innovations which the firm is the first one, globally, to implement and introduce on the market (OECD & Eurostat 2005). There are distinguished between inventions and innovation with the latter referring to the commercialisation and economic utilisation of an invention: *"The making of the invention and the carrying out of the corresponding innovation are, economically and sociologically, two entirely different things."* (Schumpeter, Business Cycles. A Theoretical, Historical, and Statistical Analysis of the Capitalist Process 1939, 85). The transformation of an invention to innovation is determined by diffusion which is described as the way in which innovation, or inventions, spread through markets, consumers, countries etc. Without diffusion an innovation has no economic impact (OECD & Eurostat 2005). It is the degree of diffusion that determines an innovations' economic and market impact, not the degree of novelty alone. To illustrate, an invention can be a new product which provide superior value for customers who then choose to purchase the products. First after customers' have adopted the product, diffusion has happened and the invention can be defined as an innovation. A key element in innovation is therefore that it must provide value that supersedes the costs, which is a prerequisite for successful diffusion and thereby innovation.

## Innovation Typologies

Innovation is about knowledge and the combination of different knowledge sets, both tacit and codified, and has become complex as it often requires external resources why it is important to adopt innovation linkages to external partners (Chesbrough 2006), (Tidd and Bessant 2011). Incremental innovations build on existing knowledge and technologies, while radical innovations requires development or utilisation of new knowledge, technology, or other resources to market new products e.g. in current or new markets (Burgelman and Sayles 1986), (Tidd and Bessant 2011), (Christensen 2005), (Henderson and Clark 1990). R. Henderson & K. Clark describes it as follows:

*“Incremental innovation reinforces the capabilities of established organizations, while radical innovation forces them to ask a new set of questions, to draw on new technical and commercial skills, and to employ new problem-solving approaches.”* (Henderson and Clark 1990, 9)

The conditions of incremental innovations are less uncertain and risky as these are based on what R. Henderson & K. Clark terms the ‘established design’. Radical innovations on the other hand, are connected with more uncertain and risky conditions as they are involved with development of new designs thus challenging current established designs related to product-market paradigms (Henderson and Clark 1990), (Tidd and Bessant 2011). A firm exists as a specific constellation of competencies and resources. An effort of increasing profits will require some form of changes based on development of the competence- and resource base of the firm. J. Christensen has described two forms of innovation searching firms; passive and active searching firms (Christensen 2005). The passive searching firms are the ones that perceive current competencies, knowledge, and resources as the solution within the current product-market paradigm. The search and innovation activities of the passive searching firms will be more attached to current methods, products, and business partners why the forces of inertia will be strong thus providing a good fundament for incremental innovations but hinder the development of more novel innovations (Birkinshaw, Bessant and Delbridge 2007). Opposite are the active searching firms, focusing on renewal and accumulation of current competencies, knowledge, and resources to supplement the current ones. Such firms aim at solving new problems within new product-markets potentially leading to radical innovation (Christensen 2005).

In order to operationalise theory for later analysis, the distinction between the two extremes; incremental and radical innovations, is too simplistic and will be clarified by drawing on the terms ‘components’ and ‘architectures’ provided by R. Henderson & K. Clark (Henderson and Clark 1990). Components are the elements that constitute a given product. To illustrate; a facade window can basically be made out of a wooden frame and thermal windows. A change in component in this case could be the individual change in materials used for the frame or windows. Architecture relates to the combination and configuration of the components which make up a final product (Henderson and Clark 1990). In this context incremental innovations

are improvements of current components in current architectures. Radical innovations involve development of new components possibly linked together in new architectures. Two different terms are used to describe these different innovations namely; ‘modular innovations’ and ‘architectural innovations’ (Henderson and Clark 1990). Modular innovations are changes of components which often happen through applying new technology within existing architecture and established design. A company is able to develop radical innovations through novel components. A hypothetical example could be if a facade window manufacturer found a way for glass to clean itself thus not getting dirty. Dependent on the diffusion of that innovation, it might create a radical innovation by changing the market standards and the established design. Architectural innovations are changes in architectures and configuration of components forming new designs. If a firm succeeds in developing new components configured in novel ways, which provide value for customers through successful diffusion, then the firm has developed a radical innovation. In practice modular innovation often enables the creation of new architectures while architectural innovation can lead to radical innovations (Henderson and Clark 1990).

	Incremental innovations	Radical innovations
Architectural innovations	New combinations of current components (new versions of products)	Development of new components in new systems.
Modular innovations	Improvements of components	Development of new components in current systems.

Table 2 – Innovation Typologies

### Firm Level Innovation Typologies

The underlying premise of this study is based on firms acting as economic rational entities searching for profit optimisation. A firms’ profit is determined by the input-output ratio realised by subtracting costs from revenues. There exist three methods for a firm to optimise profit; either by decreasing expenses or increase revenues – or a combination. In economic theory, firms’ compete on growth which is what determines economic success. An underlying assumption of this study is that facade window manufacturers in general seek economic growth, and that innovation is the mean to obtain it. In order to conceptualise theory, innovation will be related to generic growth and competitive strategies.

The word strategy itself is a concept subject to confusion and academic discussion (Mintzberg 2008), (Slack and Lewis 2011). However, it is not within the scope of this study to discuss this concept in depth. Strategy is simply understood as a plan that sets corporate wide and broad business objectives towards an overall goal (Slack and Lewis 2011). There are many ways and approaches to strategies<sup>5</sup>; they can be more or less explicit, emergent, and deliberate. Nevertheless, every company implicitly or explicitly follows a strategy (Mintzberg 2008). This

<sup>5</sup> For instance H. Mintzbergs 5 P’s.

study will draw on I. Ansoff’s growth matrix (Ansoff 1957) and M. Porters competitive strategy matrix (Porter 1985), which are two widely acknowledged and approved growth strategies:



Figure 4 – Two Generic Growth Strategies

M. Porters theory is based on the trade-off between costs and differentiation. According to this theory companies can basically either differentiate on product attributes or costs broadly within an industry, or narrow within specific market segments (Porter 1985). I. Ansoff is likewise focused on products and markets and suggests four generic growth strategies: (1) market penetration; serving the same market with the same products, (2) market development ; developing new markets with current products, (3) product development; developing new products for current markets or, (4) diversification; new products for new markets (Ansoff 1957), (Jobber 2007). What these theories have in common is the focus on markets and products as the mean to increase profit through three main strategies; market penetration, product development, or new markets with either current or new products. Market penetration strategies are often sought through cost reductions which occurs through process innovation whereas product development and differentiation strategies, requires product and or value innovation. The primary purpose of value innovation is to develop new markets and satisfy unfulfilled market needs (Kim and Mauborgne, Strategy, Value Innovation, and the Knowledge Economy 1999). This study is limited to concentrate on these three types of innovations. These types of innovation (process, product, and value) align with the innovation typology applied in the Oslo Manual and will be used as analytical themes in the report (OECD & Eurostat 2005).

Type of innovation	Category
The introduction of new facade window products	<b>Product Innovation</b>
New or improved processes, production facilities or production methods of producing facade windows	<b>Process Innovation</b>
Opening of new markets	<b>Value Innovation</b>

Table 3 –Three Types of Innovation Applied by Firms





## Definition of Product Innovation

According to the Oslo Manual, product innovation is defined as:

*"(...) the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials (...)."*  
(OECD & Eurostat 2005, 48)

If related to previous distinction between incremental, modular, architectural, and radical innovation, improvements of existing products (components and architecture) can be categorized as incremental product innovation and are often developed by applying current knowledge and technology. Modular product innovations are focused on enhancing product performance through new technology of individual product components. Architectural product innovations are innovations where firms change the design and configuration of the product and develop new products. Often new technology and knowledge is required in those matters. Radical product innovations occur when new products are developed with new characteristics and new technological features, which often require new knowledge and/or technology not possessed by the firm. Often active searching firms are the ones to develop novel innovations and not passive searching firms (Henderson and Clark 1990), (OECD & Eurostat 2005).

## Definition of Process Innovation

Process innovation is defined as follows:

*"(...) the implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software."* (OECD & Eurostat 2005, 49).

Process innovations are related to the operational functions of the firm which transforms input into outputs of value for customers (Slack and Lewis 2011). Process innovations are implemented internally and are often invisible to outsiders. The vast majority of process innovations are smaller incremental improvements in the processing of components in the operations practice (Slack and Lewis 2011). Process innovations are often focused on decreasing unit costs and cost optimization (OECD & Eurostat 2005). Such changes are often inspired by the 'Kaizen'-philosophy focusing on smaller and simple continuous improvements rather than large disruptive changes (Slack and Lewis 2011).

## Definition of Value Innovation

Value innovation is the mean for firms to identify, create, and open new markets by focusing on customers and market needs by *"(...) offering fundamental new and superior buyer value in existing markets and enabling quantum leap in buyer value to create new markets."* (Kim and Mauborgne 1999, 43). This type of innovations is centralised upon demand, not technology, and as a minimum increasing user's net benefit to the essential idea of escaping competition. This is done by creating new markets and performance objectives with no competitors (Kim and Mauborgne, Strategy, Value Innovation, and the Knowledge Economy 1999). Such





innovations are the key element in 'Blue ocean strategy' (Kim and Mauborgne, Blue Ocean Strategy 2004). The idea of the 'Blue Ocean' strategy concept is that it should be viewed as an alternative to traditional corporate strategies focusing on either cost or differentiation. Instead this approach is a mean to obtain greater shares of existing demand in red oceans<sup>6</sup>. This can be done through better need fulfilment or by escaping the value/cost trade-off by simultaneously applying differentiation and cost optimisation, by focusing on 'unlocking innovative value' to create new demand and markets through redefinition of problems (Kim and Mauborgne, Blue Ocean Strategy 2004). Such innovations can be considered as radical value innovations. The focus on customers, demand, and identification or creation of new market needs is the cornerstone of value innovation and differs from product innovations which focus on technology as solutions to problems (Terziovski 2007).

Appendix 6 contains a table with examples of different types of innovations and connects the different innovation typologies presented until now.

## The Firm & Innovation

The different types of innovations have different purposes but are all central to the future success, economic potential, and performance of firms (OECD & Eurostat 2005). This statement has been proven in several empirical studies and will not be questioned in this report. However, in practice it has been proven difficult for firms to manage and balance the mix of the different types of innovations. Product and value innovation are connected with creativity, risks, experiments etc. Process innovations are connected with stability, routines, direct response etc. (Christensen 2005). The dilemma is firms' ability to find a balance between effectiveness and efficiency (Jobber 2007). Effective firms are the ones operating in attractive markets and producing products valued by customers, given customers incentives to purchase. Efficient firms are the ones good at producing products at low unit costs. Efficiency is developed at the operational level of the firm and in the process of input-output transformation. Effectiveness is equivalent to 'doing the right things' while efficiency is equivalent to 'doing things right' (Jobber 2007). By drawing on the distinction between product, value, and process innovation, the first two is clearly associated with effectiveness while process innovation is related to efficiency (Table 4).

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<sup>6</sup> "Red oceans represent all the industries in existence today – the known market space. In red oceans, industry boundaries are defined and accepted, and the competitive rules of the game are well understood." (Kim and Mauborgne, Blue Ocean Strategy 2004, 2)

	Ineffective	Effective
Inefficient	<p><b>Goes out of business quickly</b></p> <p>Do not provide products of value at attractive prices.</p>	<p><b>Survives</b></p> <p>Provide products of value for customers but not at attractive prices.</p>
Efficient	<p><b>Dies slowly</b></p> <p>Does not provide products of high-value but are price competitive.</p>	<p><b>Thrives</b></p> <p>Provide products of both high-value and at attractive prices.</p>

Table 4 – Effectiveness & Efficiency

In assessing the importance of effectiveness vs. efficiency, the table and discussion above indicates that effectiveness is the most important determinant of firm survival. Effectiveness determines whether or not there is a market for the firms’ products – if customers want to buy. Efficiency determines the profit which the firm is able to derive from the market transaction. Successful firms are the ones that succeed in mixing these two (Figure 5).

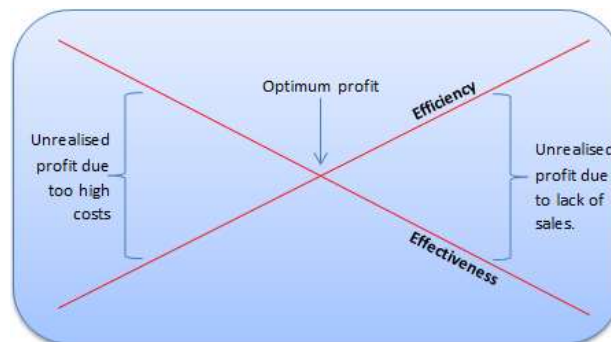


Figure 5 – The Relation between Effectiveness & Efficiency

The market situation has a major impact on the relative importance of product, process, and value innovation related to effectiveness and efficiency (Brown 1992), (Christensen 2005). Several models and theories of the relation between markets and the innovation life cycle exist. Despite for individual differences there seems to be consensus on the opinion that markets, and/or products, evolve from an initial innovation bringing discontinuity. This creates a preliminary focus on experimentations with modular and architectural product- and value innovation, until a dominant design emerges. Subsequently emphasis will be focused on process innovation until a new disruptive innovation brings discontinuity (Figure 6), (Jobber 2007), (Brown 1992), (Tidd and Bessant 2011), (Christensen 2005), (Abernathy and Utterback 1975), (Pavitt 1986), (Anderson and Tushman 1990). A dominant design can be defined as a specific architectural configuration of components, with minor differences, which the market has chosen as the ones that fulfil need and demand best. This iterative process result in ‘the innovators dilemma’: Firms tend to focus on inertia and satisfying current market needs, thus not being at the forefront of technological development overseeing potential discontinuity and new product-market paradigms (C. Christensen 1997).

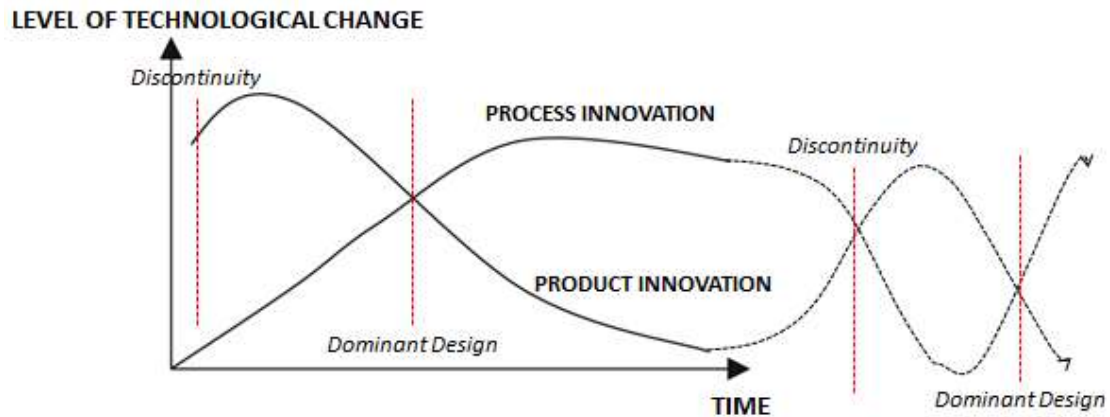


Figure 6 – The Innovation Life Cycle

### Firm Typologies & Innovation Activity

Firms can be categorized in different categories dependent on their proactivity in relation to the dynamic of innovation, the interrelation between different types of innovations, and their innovation activity. This study will draw on the typology developed by C. Snow et al. (Snow, et al. 2011), (Table 5):

Firm Typology	Description
<b>Prospectors</b>	Firms that continually develop new products, services, technologies, and markets. They achieve success by moving first relative to their competitors, either by anticipating the market based on their research and development efforts or by building a market through their customer-relating capabilities.
<b>Analysers</b>	Firms that use their applied engineering and manufacturing skills to make a new product better and cheaper, and they use their marketing resources to improve product sales. They search for proven technologies with significant potential for generating new products and services.
<b>Defenders</b>	Firms with stable product or service lines that leverage their competence in developing process efficiencies. They search for economies of scale in markets that are predictable and expandable.

Table 5 - Firm Typologies

All three types of firms are involved in innovation activity, but differ based on their proactivity and engagement in novel and radical innovation. Prospectors are engaged in novel and radical product and value innovation, and seek to develop new markets and products as pioneers or first-movers. Analysers awaits prospectors to define new potential innovation and are experts in “(...) envision[ing] the market potential for a new product or technology and their skill in rapidly commercializing innovations.” (Snow, et al. 2011, 5). Defenders are late movers and tend to focus on standardisation and efficient production of products, technologies, etc. developed by other firms (Snow, et al. 2011). The different firm typologies often co-exist in an industry where prospectors benefit from being able to charge the higher prices in the begin-

ning. Then analysers arrive, followed by defenders. The profitability often declines as time goes from the discontinuity happens (Zajac and Shortell 1989), (Jobber 2007). Prospectors and analysers will be following differentiation or blue ocean strategies through product or value innovation. Defenders search for efficiencies through process innovation. The major difference between the different firms' is the innovation search activities related to another classic discussion; exploitation vs. exploration. This will be discussed in the following section of how firms search for innovation.

### How Firms Search for Innovation

A key challenge in relation to firms' search for innovation and innovation activities is the balance between exploration and exploitation (Tidd and Bessant 2011), (March 1991). Exploitation relates to increasing efficiency by optimising current production processes, and the ability of being able to implement and execute efficiently. Exploration on the other hand, relates to an organisations curiosity and ability to explore the surroundings in the hope of identifying future potential innovations. Sustainable competitive advantage occurs when organisations balances the two, hence being able to search for future innovations while also being able to create value on them. An unbalance will result in 'suboptimal stable equilibria' (March 1991).

Firms exist in dynamic environments where innovations, markets, technologies etc. has become increasingly complex challenging firms' search and innovation activities (OECD & Eurostat 2005), (Tidd and Bessant 2011). The consequence is that the boundaries of the domains where firms explore for inventions, and potential innovations, have evolved from being simplistic and relatively closed, to more open models. Proactive firms expand its boundaries and actively involve, integrate, and search for external inputs in related- and unrelated industries through innovation linkages and ties with external resources (H. Chesbrough 2006), (Tidd and Bessant 2011). R. Rothwell distinguishes between five generations of innovation models (Rothwell 1994):

Generation	Key Features
1 <sup>st</sup> & 2 <sup>nd</sup>	Simple linear models – need pull, technology push
3 <sup>rd</sup>	Coupling model, recognizing interaction between push and pull models.
4 <sup>th</sup>	Parallel model, integration within the firm, upstream with key suppliers and downstream with demanding and active customers, emphasis on linkage and alliances.
5 <sup>th</sup>	Systems integration and extensive networking, flexible and customized response, continuous innovation.

Table 6 – Generation of Innovation Models

Important external resources are found in firms' value systems. A firms' value system consist of other firms' value chains related to the focal firm. Supplier value chains represent the upstream functions to the focal firm, and the downstream functions represent all the links to

the final end-user. The combined value chains is referred to as the 'value system' (Porter 1985) (Figure 7), and becomes relevant when considering a firms external linkages in their innovation activities (OECD & Eurostat 2005). Firms applying advanced innovation models have incorporated key resources from the up- and downstream function of a firms' value chain, and possibly resources from outside current value system.

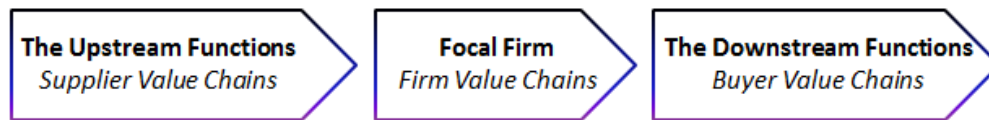


Figure 7 – The Value System

Two fundamental mechanisms for innovation initiation exists; respectively technology-push and need-pull mechanisms (Christensen 2005), (Tidd and Bessant 2011), (Figure 8). The 1<sup>st</sup> and 2<sup>nd</sup> generation models are based on autonomous push and pull mechanisms. Technology-push represents the inventive search process based on science and technological development through innovation linkages with the upstream functions of the value chain and represent "(...) a linear progression from scientific discovery, through technological development in firms, to the marketplace." (Rothwell 1994, 8). Technology is a broad term that covers components and the processing of components (Hatch 2006). J. Christensen distinguish between two forms of technology-push with 'scientific discovers, technology applies' referring to an approach emphasising scientific discoveries related to basic research refined into implementable products and, 'technology discovers' referring to innovations based on technology advancements and opportunities as a fundament for innovations (J. F. Christensen 2005). Typical for all technology-push approaches is that they are limited on a bounded understanding and attention to markets and users who are perceived as being passive, hereby decoupling the up- and downstream functions (J. F. Christensen 2005). This technological orientation was what started the Industrial Revolution and comprises the 1<sup>st</sup> generation innovation (Terziovski 2007). Opposite represent need-pull a search process based on market demand and needs through innovation linkages with the downstream functions of the value systems (Rothwell 1994), (J. F. Christensen 2005), (Burgelman and Sayles 1986). E. Von Hippel deepens the need-pull orientation by describing two different search activities namely; the (1) 'manufacture active paradigm' where the innovation searching firm chooses a market segment to gather data from, by asking questions and analysing these, opposite to the (2) 'customer active paradigm' where an idea is developed or occurs within the downstream functions (for instance a user), who chooses a firm to develop and produce the given innovation (Von Hippel 1978). The difference between these two extremes is the activeness and integration of the downstream functions within the innovating firm. The need-pull orientation constitutes the 2<sup>nd</sup> generation innovations (Terziovski 2007). A coupling of the push and pull mechanisms represents the 3<sup>rd</sup> generation of innovation models (Rothwell 1994). The key elements of the next level innovation models (4<sup>th</sup> and 5<sup>th</sup> generation) are, that they are based on intensive information exchange among the innovation active firm and external resources through integration and innovation linkages (Rothwell 1994). The difference between the 4<sup>th</sup> and 5<sup>th</sup>

generation of innovations is that the 5<sup>th</sup> generation innovation model is highly advanced and excel in integration and continuous innovation, and in reducing the development time and costs (Rothwell 1994).

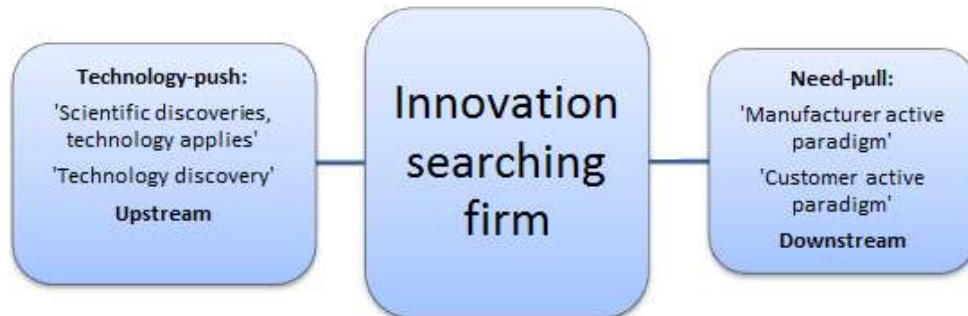


Figure 8 –Technology-Push & Need-Pull

### Innovation Linkages & Ties

As previously described, successful firms benefit from external resources through innovation linkages and ties. A variety of such linkages exists from freely available information sources to co-development projects.

*“Linkages act as sources of knowledge and technology for an enterprise’s innovation activity, ranging from passive sources of information to suppliers of embodied and disembodied knowledge and technology to co-operative partnerships.” (OECD & Eurostat 2005, 76)*

The Oslo Manual distinguishes between three types of linkages (OECD & Eurostat 2005, 82), (Table 7):

Type of linkage	Description
<b>Open information sources</b>	<i>“Openly available information that does not require the purchase of technology or intellectual property rights, or interaction with the source.”</i>
<b>Acquisition of technology and knowledge</b>	<i>“Purchases of external knowledge and/or knowledge and technology embodied in capital goods (machinery, equipment, software) and services, which do not involve interaction with the source.”</i>
<b>Innovation co-operation</b>	<i>“Active co-operation with other enterprises or public research institutions for innovation activities (which may include purchases of knowledge and technology).”</i>

Table 7 – Different Types of Innovation Linkages

As illustrated by R. Rothwell, the game of innovations has changed, and today success depends on *“(…) the ability of existing organizations to develop the strategies and structures needed to keep pace with the environmental change.”* (Snow, et al. 2011, 14). Especially important has it become to utilise from the collective assets, resources, and knowledge of different firms in the



value chain, -system, or beyond (Snow, et al. 2011). H. Chesbrough describes this as an ‘open innovation’ paradigm where the most successful firms apply a mix of all linkages and engage in co-innovation projects with relevant partners (Chesbrough 2006).

Based on the understanding and perception, that different linkages and ties are needed in order for firms to be successful with innovation, it is valuable to apply J. West & C. Simard’s classification of different interfirm ties. They distinguish between informal, formal, deep, and wide ties (Table 8), (West and Simard 2006).

Interfirm ties	Description
<b>Formal ties</b>	These ties exist between existing business partners and are based on formal agreements (e.g. contracts).
<b>Informal ties</b>	Such ties might not be visible but based on informal interactions.
<b>Deep ties (exploitative)</b>	These ties are based on repeated interactions with usual business partners and enable companies to tap into key resources for incremental innovation. Such ties represent the risk of becoming over-embedded and being closed to outside knowledge.
<b>Wide ties (explorative)</b>	These ties are based on occasional rather than frequent interactions and can provide valuable knowledge and information on new technologies and markets (red. potential innovations).

Table 8 – Interfirm Ties

In the development of external innovation linkages and ties, firms are challenged by the risk of inertia which reduce the likelihood of radical innovations leading to simpler incremental innovations (J. F. Christensen 2005), (Tidd and Bessant 2011): “(...) *past relationships between actors increase the likelihood of future relationships, which can lead to inertia and constrain innovation.*” (Tidd and Bessant 2011, 286).

The differences between deep and wide ties is interesting as they can be related to the explore vs. exploit, effectiveness vs. efficiency discussion. Deep ties with usual business partners build on in-depth knowledge of current product-market paradigm, applicable to improvements of current components and process innovations when seeking market penetration strategies and efficiency (Pisano and Verganti 2008). Wide ties are about exploring distant areas for knowledge and redefine the effectiveness parameter through novel solutions potentially leading to new industry standards or market needs (Pisano and Verganti 2008). Such ties are applicable for firms seeking product and market differentiation strategies (Table 9).





Strategic Objective	Market Penetration	Product Development	New Markets
Firm Type	Analysers / Defenders	Prospectors / Analysers	Prospectors / Analysers
Strategic Aim	Cost leadership	Differentiation	Differentiation (Export)
Innovation Types	Process Innovation Incremental innovation	Product Innovation Modular & Architectural Innovation	Value Innovation
Important Innovation Linkages	Upstream	Upstream	Upstream and Downstream
Ties	Deep	Wide	Wide

Table 9 – Strategic Objective, Firm Type, Innovation Linkages & Ties.



## The Industry & Firm Categories

### The Industry & Market Outlook

The Danish facade window industry consist of approximately 50-60 firms, who employ close to 6.000 people combined and generate close to 4,5bn DKK in turnover yearly (VinduesIndustrien 2013). The conditions of the construction industry in general can be mirrored to the facade window industry and current market conditions give rise to fierce domestic competition and reductions in firm turnover (VinduesIndustrien 2013). The activity of the industry is heavily affected by the economy and general state of the market and as such subject to periodic variations (Dansk Byggeri 2014). Prior 2008 and the financial crisis, the economy was booming. So was the construction activity. The financial crisis was followed by an economic recession which imposed severe consequences for the construction industry and the domestic activity has declined to an historical low level (Danmarks Statistik 2014), (Figure 9). The development market is stagnated and considering the figure below, even declining (Figure 10). Since 2011 commenced activity has decreased with 47% while new activity initiatives have decreased with 24%. Fewer buildings have simply been developed from 2011-2013, why the amount of completed constructions likewise decreases (Danmarks Statistik 2014). There is no reason to believe that the market for development of new buildings will improve over the next couple of years (see appendix 7 (market analysis), page 183). The major interest- and professional associations acknowledge this trend, and argues that renovation currently is the most attractive market with more activity than development (3F 2013), (DI Byg 2013), (Dansk Byggeri 2014).

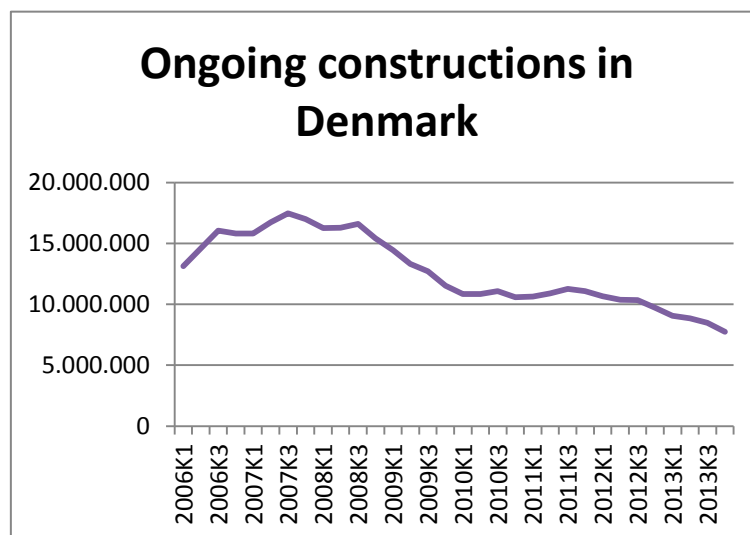


Figure 9 – Ongoing Constructions in Denmark (Danmarks Statistik 2014)

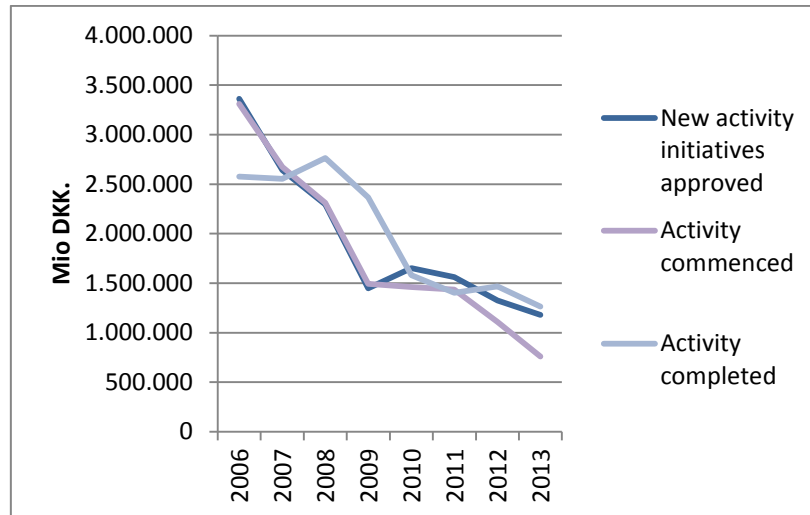


Figure 10 – Construction Industry Activity (Danmarks Statistik 2014)

The market for facade windows consist of both a B2C market with the customer being private consumers, and a B2B market which can be divided in the public- and private business sector. The market activities can be divided in two categories; (1) renovations of current building stock and (2) development of new buildings (Figure 11). The public sector (hereunder the government), is by far the largest developer of new constructions & renovations followed by the private business sector and last the private households (Danish Ministry of Climate, Energy and Building 2014).

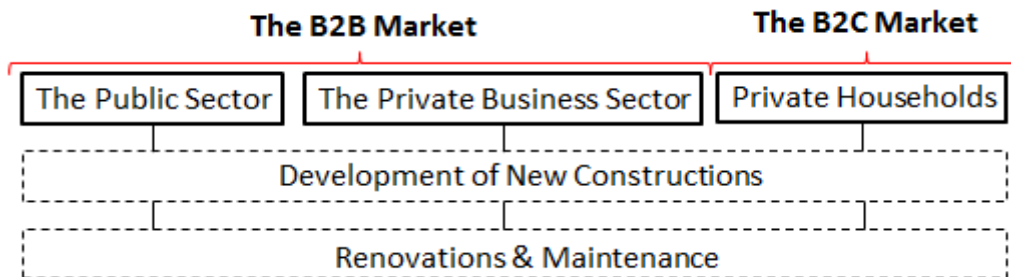


Figure 11 – The Market Configuration

The outlook for increased activity, both development and renovations, is moderate. The public sector is the biggest market and the government are aware of it. Due to the expansive economic policy, the public sector will invest in developments of new public buildings, renovations, and (energy) improvement of current ones (Ministry of Finance 2012). According to DI Byg and Dansk Byggeri, these investments will only lead to stagnation of the declining activity and thereby ensure the current activity level of the firms but not induce growth (DI Byg 2013), (Dansk Byggeri 2014), (see appendix 7). The outlook for the private business sector is even less positive. The construction activity (renovations & developments) in the private business sector market is at the lowest level since the 1940's (Dansk Byggeri 2014). Renovations and maintenance investments are not expected to increase or decrease in the coming years and will continue to be at a very low level. In Denmark there have generally not been tradition for renovations among firms and their corporate buildings; they seem to be reluctant

to invest in such initiatives (Dansk Byggeri 2014), (see appendix 7). The private household sector is likewise neutral with no outlook for growth. The availability of already developed single-family and terraced houses is sufficient to cover demand while development of new houses is unable to compete on price making it an unattractive alternative. Renovation among the private households are withheld at the same low levels as 2012 caused primarily by the stimulation of the financial aid scheme called 'BoligJobordningen' (Dansk Byggeri 2014). Through this scheme households are able to obtain economic contributions to renovation, maintenance, etc. It is perceived as a vital stimulus in order to ensure that private households are commencing renovations initiatives (BoligJobordningen 2014). This agreement (the aid scheme) will expire by the end of 2014 why private households' investments in renovations are expected to decrease in 2015 (Dansk Byggeri 2014), (see appendix 7).

Export on the other hand is a better opportunity for growth (Figure 12). By referring to an analysis conducted by Dansk Byggeri in 2013, it is estimated that especially Germany, Norway, Sweden, and United Kingdom could be fruitful export markets for the building material industry in general (Dansk Byggeri 2013). Especially Germany is highly interesting as the domestic market is very big and subject to growth. Norway and Sweden can be compared with each other, and are almost similar attractive. The market of Norway is not as big as the Swedish but represent a greater growth rate which compensate for the minor market. United Kingdom is not experiencing growth while it is reasonable to assume that the UK market is characterized by fierce competition and fight over current market shares why it might be difficult to win market shares in that market (see appendix 7).

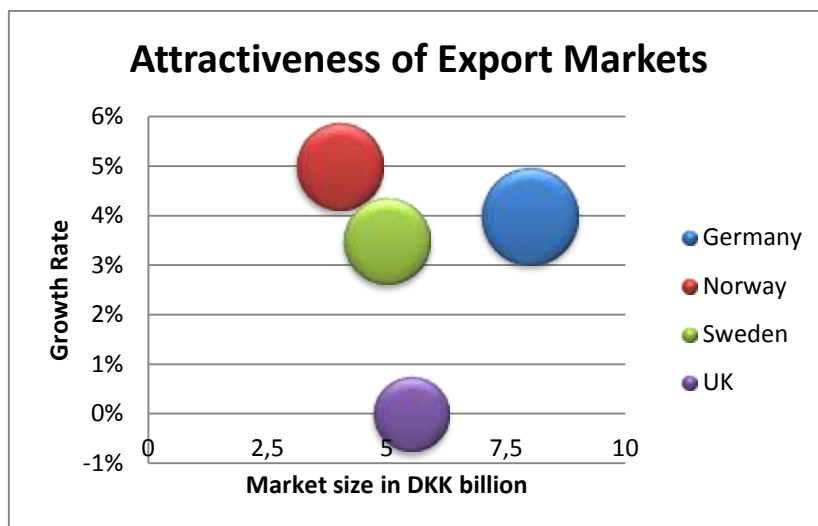


Figure 12 – Attractiveness of Export Markets

### Firm Categories

The firm categorisation is developed based on results from the questionnaire. The firms in the facade window industry can be divided in three groups based on fundamental firm specific information such as; number of employees, ownership, yearly revenue, location, and primary markets. Firms can be divided in small, medium, and big firms (Table 10). This study will

emphasise respectively the small and big firms as those firm-archetypes are the most frequent firms in the industry and of interest to the author.

Besides the great difference in amount of employees and yearly turnover, the big difference between small and big firms is ownership and primary markets. The small sized firms are all privately owned while the bigger firms typically are owned by an international concern. Furthermore, there is a clear market diversion between the two firm categories. The small firms are targeting the private consumer market (B2C) while the big firms are targeting the B2B market. By referring to previous analysis, the big firms are targeting a much bigger market than small firms, which in itself is a fundamental parameter of influence on the size of the firm. However, as none markets seems to be subject to growth, both firm categories must be affected by tough competition over current market shares and fight for turnover. It is a discussion whether such market conditions are stimulating innovation or not. Some perceive that innovation is a way to escape the market competition by delivering superior value through differentiation (either products or markets) by engaging in product and/or value innovations, or cost and price reductions through process innovation. Nevertheless, it is often seen that in challenged times, firms seem not to develop novel innovations but incremental innovation - if any. Savings often become the most important parameter (Jobber 2007). Currently markets have stagnated why present-day can be considered as more auspicious time for innovation.

Category 1 – Big firms	Category 2 – Medium sized firms	Category 3 – Small sized firms
<b>Ownership:</b> International concern.	<b>Ownership:</b> Private or family owned.	<b>Ownership:</b> Privately owned
<b>Employees:</b> +100	<b>Employees:</b> 25-99	<b>Employees:</b> <24
<b>Yearly revenue:</b> >150DKK million.	<b>Yearly revenue:</b> 25-74 million.	<b>Yearly revenue:</b> <9,9 million.
<b>Location:</b> North- and mid-Jutland and the capital region.	<b>Location:</b> Region South Denmark.	<b>Location:</b> North-Jutland and the capital region.
<b>Primary Market:</b> B2B	<b>Primary Market:</b> B2B	<b>Primary Market:</b> B2C

Table 10 – Firm Categories

As summarised in the table above and illustrated below, small and medium sized firms are privately owned while big firms are owned by an international concern or conglomerate (Figure 13). Two types of conglomerates exist in the facade window industry; holding companies and investment funds.

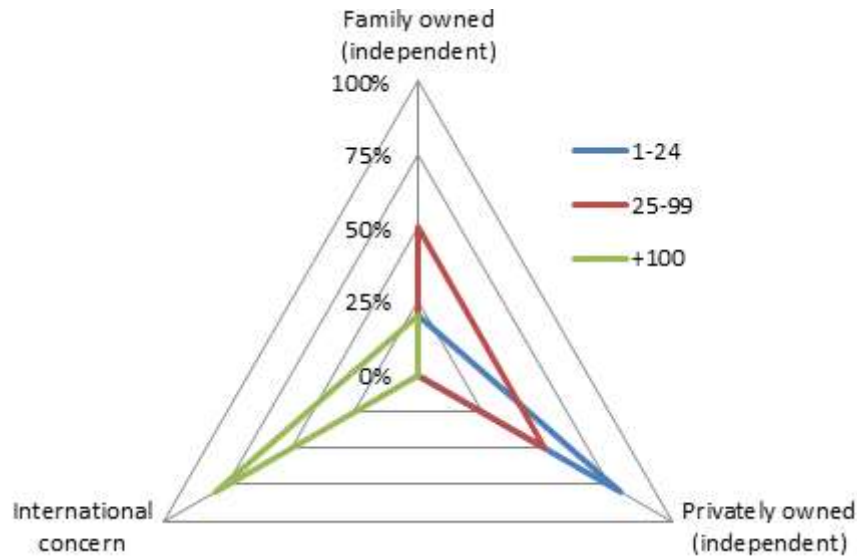


Figure 13 – Firm Categories & Ownership

Both the holding company and the investment funds overall objective is to create value by investing in firms and business areas perceived to be profitable and provide positive return on investments. Those organisations have vast financial resources and are driven by profits and positive results from investments which are the primary and most important KPI. The small firms are privately owned. Typically the owner is the Director and in charge of all the business areas (The Qualitative Study 2014).

### Part Conclusion

In general the domestic market has faced declining activity since 2008 but has stagnated with very little development activity making renovations the most attractive market. The consequence is that firms must compete over current market shares which have had a direct effect on many firms' turnover. The near markets are experiencing growth in the building material industry and especially Germany, Norway, and Sweden are potentially attractive markets.

The firms in the facade window industry consist of small, medium, and big firms. Small firms employ less than 25 employees and generates less than DKK 10 million in yearly turnover. Big firms employ over 100 people and generate more than DKK 150 million in yearly turnover. Small firms are privately owned whereas big firms are owned by an international concern. Both are affected by the general state of the market. Big firms are targeting the B2B market, which is of a much greater size than the B2C market, which the small firms are targeting. The low market activity presumably has an impact on firms' innovation activity due to its impact on resources and risk willingness. Product and value innovation is a mean to escape the tough competition through qualitative differentiation on either products or markets whereas process innovation is a mean to be more cost competitive.

## Firm Categories & Innovation

By referring to the theory section, there can be distinguished between product, process, and value innovation with the latter relating to markets and demand. The quantitative survey has investigated firms' innovation activities within the last three years based on before mentioned innovation typologies. The results indicates, that in general 79% of all firms have been engaged in product innovation activities, 63% in process innovation, and 47% active in market and value innovation either seeking new domestic or export markets. The figure below illustrates the distribution of the most frequent innovation types (Figure 14).

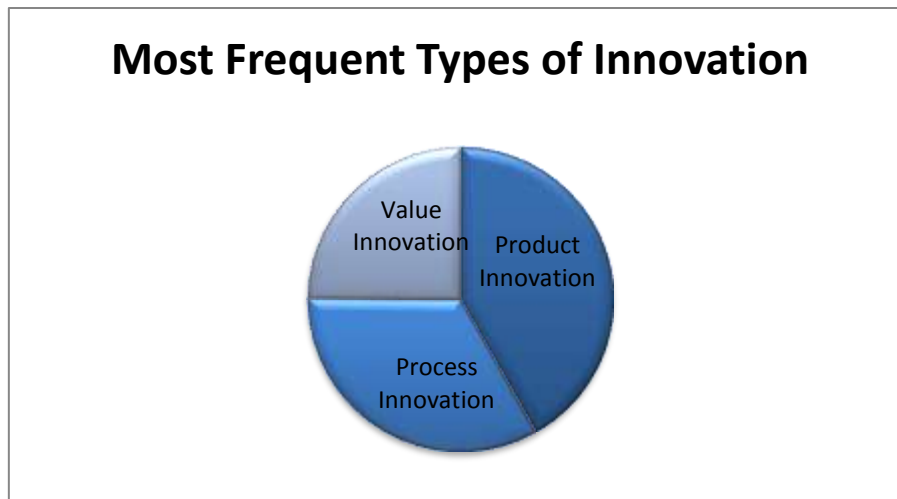


Figure 14 – Most Frequent Types of Innovation in the Facade Window Industry

The survey clearly concludes that small firms are less active in innovation in general – actually 50% less compared to the big firms. Approximately 50% of all the small firms have innovated somehow opposite to 100% of the big firms. The figure below illustrates the percentage of firm categories who has not worked with innovation within the last three years. The small firms constitute 83% of the firms that has not worked with product innovation, 88% of the firms that has not worked with process innovation, and roughly half of the firms who have not worked with value innovation (Figure 15). These numbers indicates that generally small firms are less innovative than big firms.

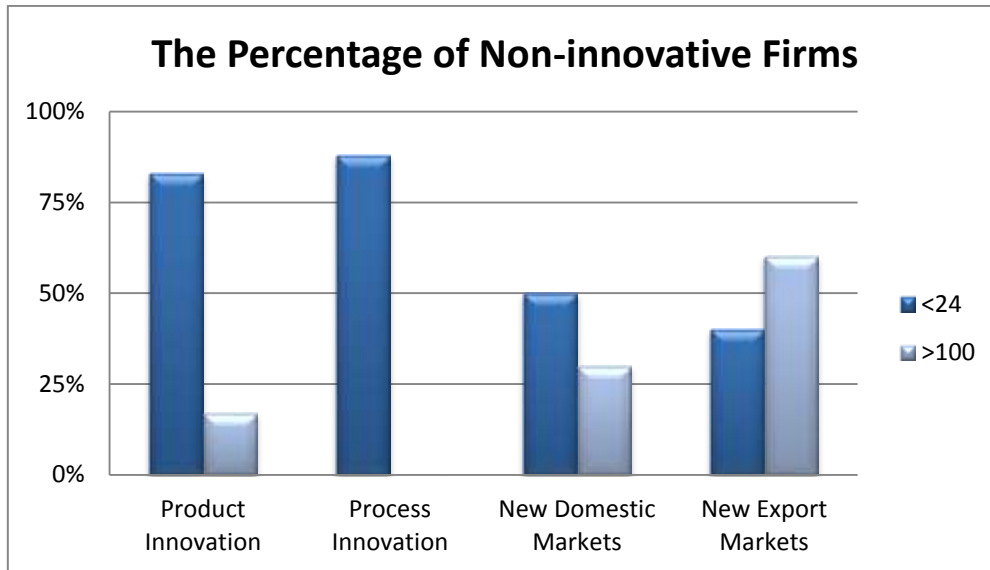


Figure 15 – Percentage of Non-Innovative Firms in Firm Categories

Furthermore, results from the survey reveal that the big firms are innovating on all four parameters while small firms are more selective and tend to focus their resources on product innovation and export (Table 11). Product innovation is the most important innovation type as this type is given the most attention in general across firm size. Export is of second most importance which indicates that current domestic market conditions are limited.

Big Firms	Small Firms
<b>Percentage active in product innovation</b>	
100%	60%
<b>Percentage active in process innovation</b>	
100%	20%
<b>Percentage seeking new domestic markets</b>	
50%	0%
<b>Percentage seeking new export markets</b>	
50%	50%

Table 11 – Firms & Innovation Activity

In correspondence with the theory section, the survey has taken novelty of the innovations into consideration. The figures in the table above are based on innovations with a high degree of novelty of minimum being ‘new to the firm’. Such efforts can be categorized as innovations while improvements in the following are referred to as incremental innovations (see page 17). Incremental innovations are omitted in the table above, but incorporated in the figure (Figure 15). In the following, the innovation activity of the different firms will be discussed in three different sections divided in respectively product, process, and value innovation.

## Firms & Product Innovation

When distinguishing between product innovation and improvements, data from the survey reveals that the same percentage of firms working with product innovation is also improving current product lines, despite for 17% of the big firms. These firms are not improving current product portfolio but seems to put emphasis in developing new ones (The Quantitative Survey 2014). The small firms are generally much less active in product innovation activities and improvement compared to the other firms. 40% of the small firms has not developed, nor improved products, within the last three years, whereas 100% of the big firms have developed product innovations. To put it simply, big firms seem to update their product portfolio and develop new products at a greater extent than small firms.

In general, the most important factors that influence product innovation are legislation (red. energy standards), market needs, and competition (Figure 16). Furthermore, 30% of all the firms that have worked with product innovation have done it as a natural continuation of current business setup, which might be an indicator of inertia. An interesting observation is that 'coincidence' has not been a factor that has influenced product innovation. It seems that firms are not seeking coincidences which are done through wide informal ties with alternative partners. This indicates that firms' search activities are less explorative, but based on clearly defined innovation processes and objectives, with partners within current value system focusing on market factors.

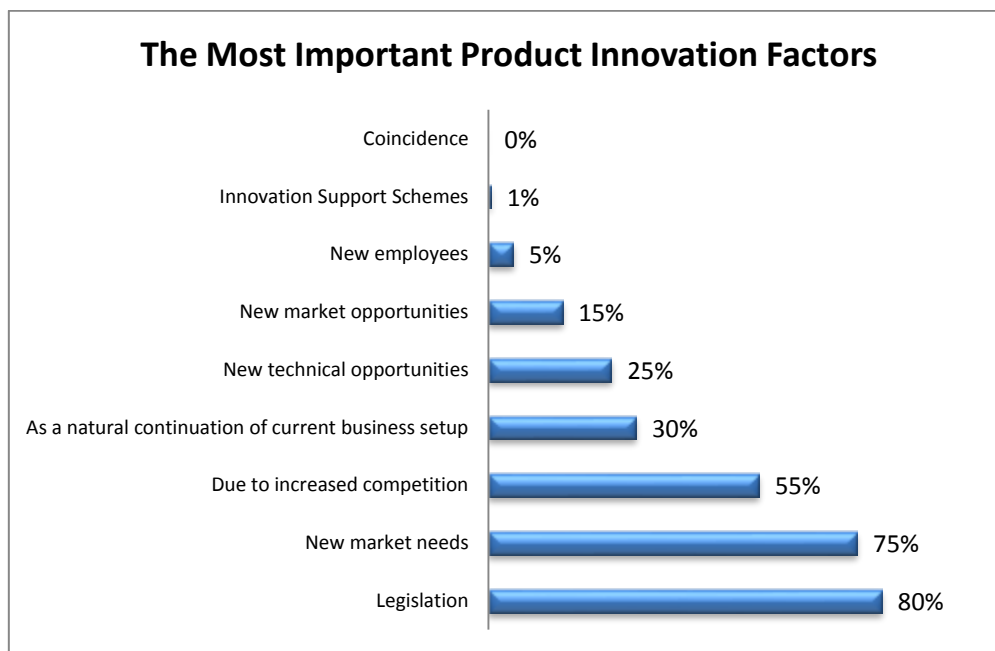


Figure 16 – The Most Important Product Innovation Factors

The primary factors for product innovation initiation among small firms are legislation, new technical opportunities, and new market needs. Legislation through new standards is by far the most important factor. This indicates that small firms are often forced by institutional factors to develop new products. The most important innovation initiation factors for big firms



are increased competition, legislation, and new market needs (Figure 17). First of all, the result clearly indicates that there are more factors that influence product innovation among big firms compared to small firms. This is consistent with the previous conclusion that big firms introduce more product innovations than small firms. These results suggest that big firms are more stimulated and sense more incentives to develop new products in general. Furthermore, the results indicate that big firms' product innovation activities primarily are initiated by market factors and the downstream function(s) of the value system, with minor focus on new technical opportunities. This indicates a correlation between value and product innovation as they tend to develop new products for new markets based on market insights. Opposite seem small firms' to be stimulated by institutional factors (legal requirements), and are more inspired by the upstream functions and technical opportunities than big firms.

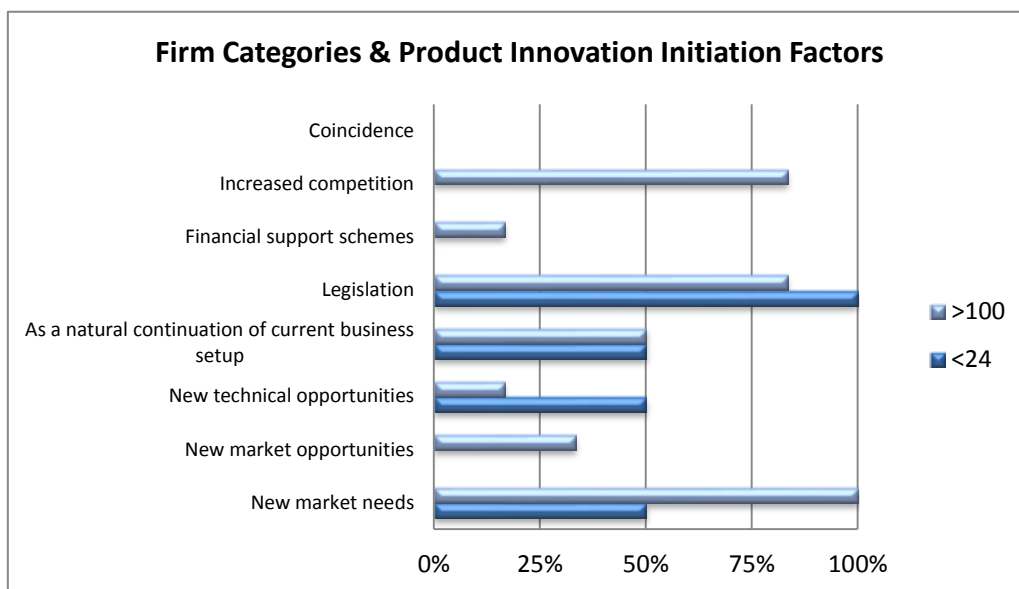


Figure 17 – Firm Categories & Product Innovation Initiation Factors

Half of all the respondents work with product innovations as a natural continuation of current business setup. This indicates that current business setup naturally affects product innovation and it happens automatically. It can either be positive or negative dependent on the firms' innovation process and innovation linkages. For passive searching firms, who apply primarily deep ties and few innovation links, such a product innovation approach will lead to inertia whereas an active searching firm, applying wide ties and a more explorative oriented innovation process and links, will be more focused on developing novel product innovations.

### Firms & Process Innovation

The questionnaire has distinguished between whether or not the firm has developed new processes or purchased new machinery ('new to the firm'), or improved current processes and/or facilities (incremental innovation) within the last three years. Results reveal that big firms are prioritizing both very high as all the big firm-respondents have introduced novel process innovations and improvements. The small firms are primarily focusing on improvements. A stunning total of 80% of all the small firms has not introduced process innovations

that are 'new to the firm' while only 40% has improved current processes or production facilities within the last three years (Figure 18). The big difference must have impact on the costs structure within each category and thereby the final price they are able to provide. A natural consequence of the difference in process innovation activity across the firm sizes is that small firms will not be able to compete on price with big firms.

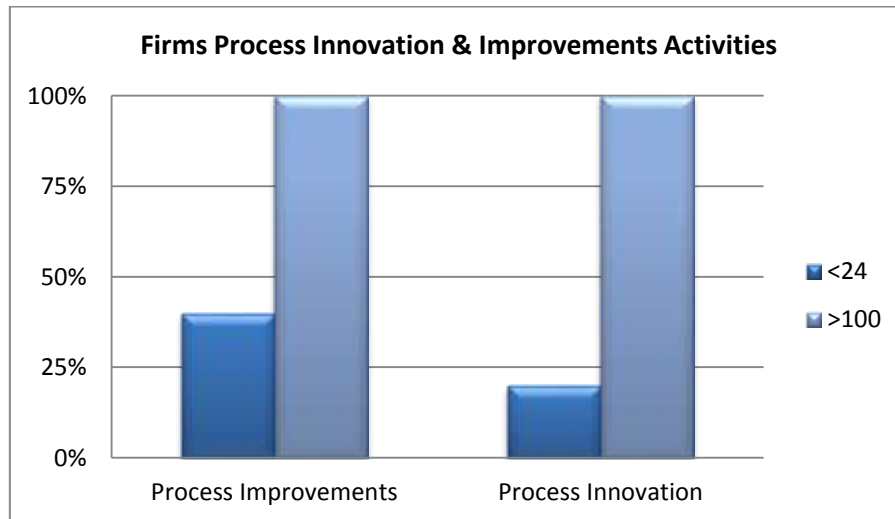


Figure 18 – Firms Process Innovation & Improvements Activities

The primary process innovation triggers for small firms are in order to be capable of improve products or produce new products (Figure 19). This means that small firms' innovation activity is determined by their product innovation factors. Process and product innovations are interconnected. Thereby, the low product innovation activity will result in low process innovation activity and opposite. Big firms' process innovation activities are not that interconnected with their product innovation activities. Their primary process innovation triggers are cost reductions as a key mean to increase profits by lower sales price, which can increase turnover or reduce costs or both. These are the fundamental profit optimization methods. This finding indicates that big firms' process innovation activities are more focused on profit optimization while small firms' process innovation activities are focused on survival presumably through cost reductions and as a prerequisite to produce or improve products.

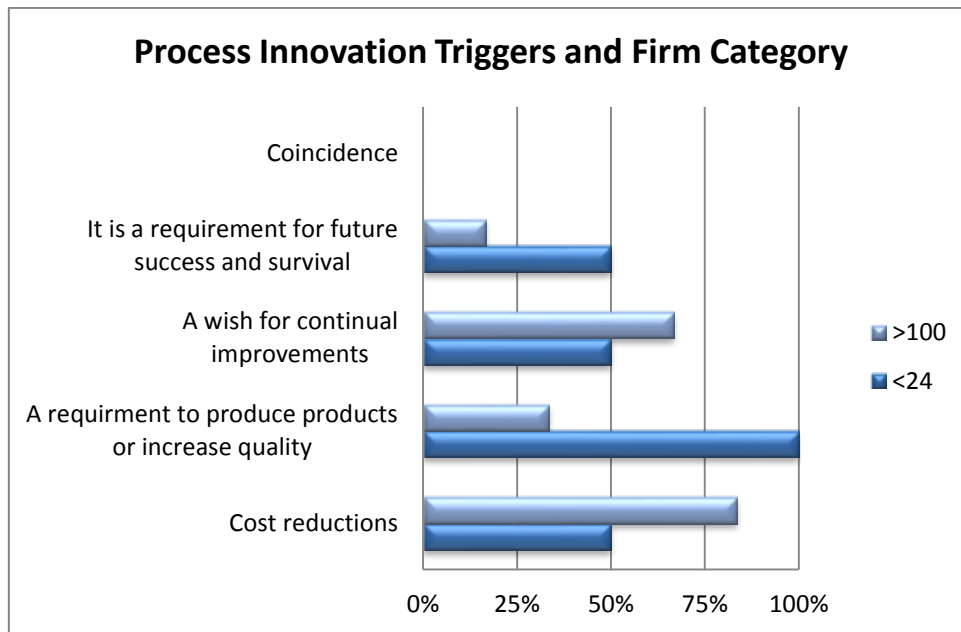


Figure 19 – Process Innovation Triggers

The findings indicate that the market must be dominated by fierce price competition especially dominated by big firms. This is validated in another question where respondents was asked to assess price competition on a scale from 1-5, with 5 the being the highest. No one answered below 4 while 82% of all respondents answered 5 which reveal that price competition is extremely fierce indicating that the market must be prioritizing price over other parameters (Table 12). This is consistent with the low market activity (see page 29).

1 (low)	2	3	4	5 (high)
0%	0%	0%	18%	82%

Table 12 – Rating of Price Competition (N=11)

Typically product and value innovation can be seen as a way to escape price competition through better need satisfaction (Jobber 2007). This assumption is not validated in this study. Many of the big firms have introduced novel product innovations and sought new market segments, but still perceive price competition to be extremely fierce. This provides indications that differentiation strategies might not lead to more favourable markets with higher margin through bigger cost and sales price difference.

### Firms & Value Innovation

A great difference between small and big firms is that big firms seem to be penetrating the domestic market by seeking new market segments whereas small firms are not: 0% of the small firms have sought new domestic markets opposite to 50% of the big firms. Furthermore, 30% of all bigger firms that are seeking new markets are also developing new products. By drawing from previous findings, this indicates that big firms are actively seeking new markets and develop new products specifically related to those market needs. This is an indication of value innovation activities as an effort to separate from the red ocean dominated by fierce

price competition. This indicates that price is simply an important decision making criteria for customers. It can be difficult for small firms to compete against the big firms' approach. Especially if summarizing previous findings, that big firms develop more novel products inspired by market needs while also benefitting from economies of scale leading to highly cost-competitive prices. This indicates, that the scope for small firms to target new market segments is small if in competition with bigger firms. Therefore smaller firms might be targeting smaller markets with less volume making them less interesting for the bigger firms.

There is a bigger correlation between export markets and product innovation than domestic markets and innovation. More than 62% of all firms seeking new export markets have developed new products whereas only 30% are developing new products for new domestic market segments. This indicates that domestic market needs are relatively homogeneous while the need and demand on the export markets differ and induce innovation. This leads to the conclusion, that when seeking new export markets firms needs to adapt or customize their products to new needs whereas this is only required at a minor degree in Denmark.

An interesting observation is that the small firms are just as active in export adventures as big firms as 50% of the firms in each category are actively seeking foreign markets. The most important export market which the companies have started export to be Norway followed by England. Norway is equally popular and important among all sizes of firms. None of the respondents have started export to our closest neighbour Germany despite for the high market attractiveness previous described (Figure 20).



Figure 20 – Most Common Export Markets

According to 'VinduesIndustrien', Danish facade window products are highly thought of in the near-markets, primarily due to Danish facade windows finish and high quality (VinduesIndustrien 2013). In 2007 and 2008 export accounted for 25% of all manufacturers of facade windows total revenue but has dropped to 18% in 2013. This is 2% points below the 2003-2013 average of 20% (Figure 21).

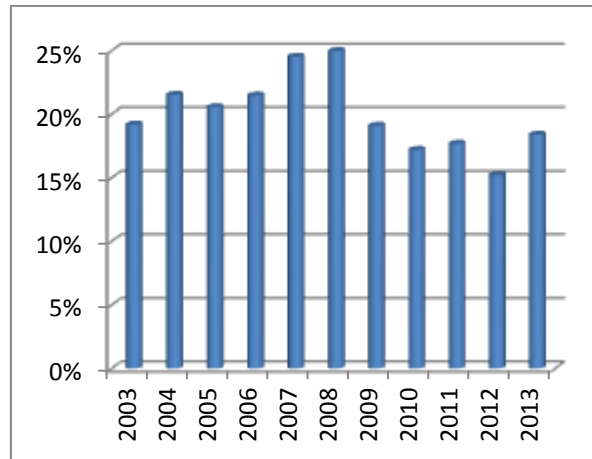


Figure 21 – The Export Ratio of Yearly Turnover for Manufacturers of Facade Windows

## Part Conclusion

*In general* small firms have developed 50% less innovations than big firms within the last three years. The biggest difference is product and process innovations and that big firms' are innovating on all parameters (product, process, value innovation). Small firms are selective and focus on product innovation and export.

*Product Innovation* is the most important innovation parameter across firm size. Nevertheless, only 60% of the small firms compared to 100% of big firms have developed new products within the last three years. This clearly indicates that small firms are not heavily involved in innovation activities. Small firms' product innovation activities are primarily initiated by legislation and legal requirements, which indicate that they more or less are forced to work with product innovation. Big firms' product innovation initiation is primarily caused by market factors such as needs and opportunities which they react on by developing new products. As such, big firms align product and value innovation. Small firms put emphasis on technology-push through technological and technical opportunities with minor focus on value innovation. Furthermore, a natural continuation of current business setup is equally important for both firm categories. This makes it interesting to study their innovation setup and linkages in order to understand, whether or not this focus of continuance results in inertia or not.

*Process innovation* seems to give rise to extremely fierce price competition, or is a result thereof. Differentiation through product or value innovation seems not to be a mean to escape the fierce price competition. Small firms' process innovation activity is focused on improvements (40%) over innovations (20%), and is interconnected with product innovation. Big firms are all involved in process innovation which is not interconnected with product innovation activity but focused on cost reductions and profit optimisation.

*Value innovation* is a mean to find new markets which especially big firms seems to apply. Big firms are penetrating the domestic market by seeking new market segments. Small firms are not. However, both firm categories are equally involved in export especially to Norway and



England. An interesting finding is that there is a greater correlation between export markets and product innovation over new domestic markets and product innovation. This indicates that firms need to customize products to the export markets, or simply the firm exporting are more involved in product innovation than others. It provides an indication that the Danish markets are relatively homogenous.

Findings from this analysis indicate that small firms will have difficulties in competing with big firms in general. Big firms' product innovations are based on market needs, thus presumably providing superior value, at a lower cost compared to the small firms. This analysis does not provide any indication of factors where small firms might outperform big firms. The consequence of this is that the markets of interest for big firms are unachievable for small firms, why small firms must be focusing on niche markets unattractive for big firms.

## Firm Categories & Innovation Linkages

An underlying construct of this study is that innovation linkages and ties to external resources are of vital influence on firms’ innovation activity. This study is focused on providing insights on how small and big firms work with innovation, how they apply innovation linkages, with whom, and how it affects their innovation activity. The resources, ties, and innovation linkages this study concentrates on, is primarily linkages to other organisations within the value system divided in the upstream and downstream functions. However, the analysis will be combined with findings related to organisations outside current value system and institutional innovation schemes which will be implemented when relevant. The potential partner organisations and their location in the value system are illustrated in the figure below (Figure 22). Information of firms’ usage of institutional innovation aid instruments, and schemes, will be complemented with data from the Ministry of Higher Education of Science which I have gained access to via my part time job (Center for Strategisk Forskning og Vækst 2014).

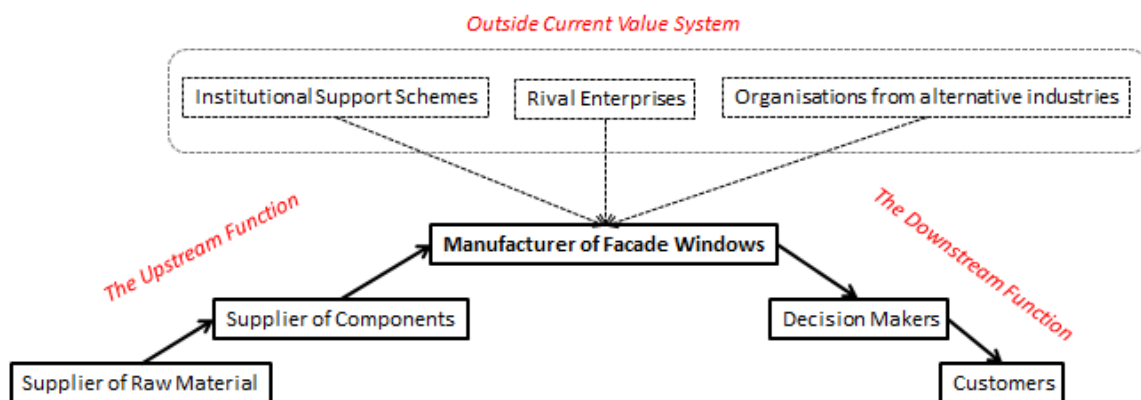


Figure 22 – The Value System

In the questionnaire, preliminary the interviews, the respondents was asked to rate different potential partners’ relevance and value as respectively a source of inspiration for ideas and as an actual collaboration partner on product and process improvements and innovations. The ranking was done using a scale from 1-5, with 5 being the highest (see appendix 1, page 89). The table below highlights the scale and interpretation of the scores.

Scale	Ranking
1-2	Low value
3	Medium value
4-5	High value

Table 13 –Ranking Scale of the Value of External Partners

In the following, firms’ general innovation linkages and the perceived value of different innovation linkages and ties will be described based on data from the quantitative survey. This will subsequently be followed by an in-depth analysis of firms’ innovation linkages and ties within respectively the up- and downstream functions based on the qualitative data.

## The Configuration of the Upstream Value System

The most important functions of the upstream value system are the suppliers (The Qualitative Study 2014). As illustrated prior, the upstream value system consists of supplier of raw materials (glass e.g.) and suppliers of facade window components (windows and frame-profiles). The 2<sup>nd</sup> tier suppliers (raw material supplier) deliver raw materials which then are transformed into component by 1<sup>st</sup> tier suppliers. These components are adopted by firms in the making of a window. For instance a glass supplier delivers glass to a component supplier who transforms the glass into windows applicable for manufacturers of facade windows to incorporate in the window architecture.

The analysis of firms' innovation linkages and ties in the upstream function are supplemented with other organisations and knowledge institutes hereunder; 'Teknologisk Institut', universities, consultants, and other knowledge and research institutes. These institutions are often able of providing valuable input in relation to the technical opportunities and innovation matters in relation to the upstream value system (Christensen 2005).

### The Upstream Value System's Effect on Innovation

According to the theory section, the upstream function is highly valuable in relation to cost optimisation through process innovation and differentiation strategies through product innovation (see page 18).

*"(...) the linkages between a firm (...) and suppliers can result in improvements in performance through lower costs or contribute to the creation of differentiated positions." (Jobber 2007, 788)*

The contribution of the upstream function in firms' innovation activities can be to develop novel technical products through the appliance of new technology and technical opportunities, or scientific discoveries through basic research. Such innovations can result in new dominant design and discontinuities through disruptive innovation which changes the product-market paradigm. The consequence of such an (product) innovation is that product standards and how markets are understood is changed. This will develop a new set of decision making criteria, possibly making previous products inferior. Firms developing such innovations will benefit economically and potentially become market leaders - even though they are not the ones introducing the innovation leading to discontinuity. Proactive firms and prospectors often focus on such collaborations and new technological opportunities to redefine and improve effectiveness and efficiency factors (see page 23). The upstream functions are most relevant for process and/or product innovation and not so much value innovation; such initiatives are primarily based on markets, which technical innovations and upstream innovation linkages are not (Tidd and Bessant 2011).

## The Configuration of the Downstream Value System

The analysis of the downstream functions will be based on demand primarily. The downstream value system is divided in customers and decision makers who often have great influence on



the final purchase (Byggeri 2014), (Dahl 2014), (Jobber 2007). As earlier described, the facade window industry consists of both B2C and B2B markets where private consumers purchase windows which they implement in their own building(s). They either purchase the windows directly from the manufacturer or through a wholesaler or a carpenter who are to install the window.

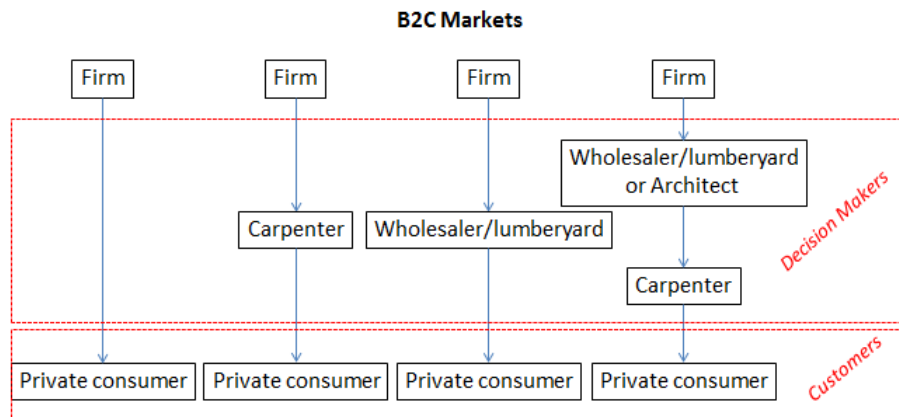


Figure 23 – The Configuration of the B2C Market

On the B2B market, public or private developers fund the development or renovation which typically is bigger projects. Such developments and renovations are often organized as projects put out to tender for contractors, developers, and advisors (architect and engineer firms) to bid on. The winner of the tender is responsible for the project and purchases all building material. A developer will often split up the project in elements and outsource different elements to advisors (architects, engineers). Applying a crude division of tasks and responsibilities, architects are often responsible for the building design and aesthetic, while engineers will be used on technical functionalities. Both can act as decision makers in bigger projects which increase the complexity of decision criteria for window purchases as the number of intermediaries and actors increases.

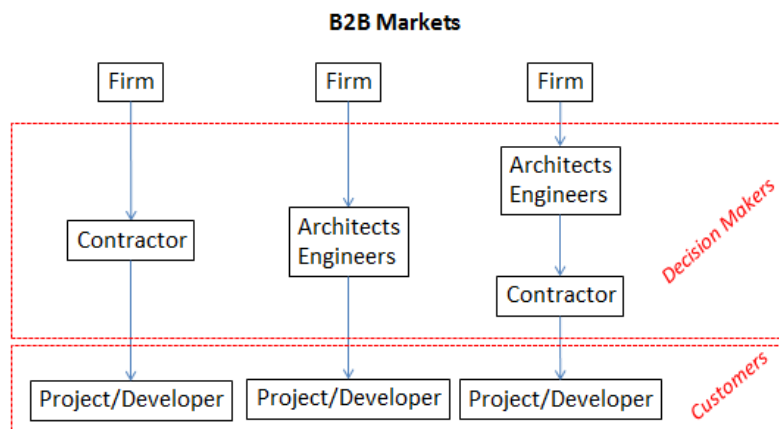


Figure 24 – The Configuration of the B2B Market

### The Downstream Value System's Effect on Innovation

According to the theory section, customers can have a major role in firms' innovation activities. Successful and 'effective' firms are the ones who possess and develop products of value for customers. Customers are simply the foundation for firm survival and growth (Table 4, page 22). Customers are especially important in value innovations and (incremental) product innovation activities. Value innovations are simply based on novel solution to new or old market needs. Likewise are customers important for firms' improvements on current products (incremental innovation) and not so much novel product innovations. This has to do with the level of abstraction; customers are more capable of providing input on improvements on current products as that is tangible, while novel product innovations often are based on technical advancements and upstream function innovation linkages (Christensen 2005), (Tidd and Bessant 2011). The correlation between customers and process innovation is cost reductions. Cost is almost always an important decision making criteria (Jobber 2007). A unique capability of prospectors and analysers is that they apply more advanced open innovation approaches often based on the 3<sup>rd</sup>, 4<sup>th</sup>, or 5<sup>th</sup> generation innovation models (Rothwell 1994). These firms utilise from innovation linkages in the downstream functions by actively searching for ideas on how better to fulfil market needs and identify new needs (value innovation). Such firms are constantly testing new ideas on customers and even letting customers develop innovations for the company (Von Hippel 1978).

In the facade window industry, the direct link between firm and end-user is divided and breached by decision makers (Figure 25). Theoretically this breach can induce implications for firms' innovation activities. Innovation is always defined by customers, and the end-user of the product, as they are the ones who decide whether an invention provides value or not, which is a prerequisite for successful innovation. The decision makers have great influence on the diffusion of an invention from firm to end-user.



Figure 25 – Decision Makers Impact Innovation

A big difference between the B2B and the B2C market is that on the B2C market, the end-user is also the customer while the customer on the B2B market is not the end-user. This has implications for innovation as an invention is only perceived as an innovation if the customers perceive it valuable. The risk is therefore, that developers constrain innovation as they often act as economic rational entities focusing on profit optimization therefore not emphasizing the needs of the end-user. However, on the B2B-market user needs are often represented and taken care for by advisors who act as decision makers. For instance, architects make sure that the building design favor users while engineers make sure that the right indoor climate exist e.g. But as decision makers, all they can do is to influence decisions. Final decisions are made by the developers (customers) (Jobber 2007). Nevertheless, manufacturers of facade windows

in the B2B-market will have to relate to this issue and reflect on whose needs should be put central to innovation. On the B2B market, decision makers are theoretically perceived to be focused on qualitative parameters such as aesthetic, design, technical specification, (red. functionalities) etc., while customers primarily are focused on costs. The same dilemma exists on the B2C market but reversed. On the B2C market, decision makers theoretically act as economic rational entities emphasizing cost as that is how they obtain profit optimization. Customers are focused on functionalities but also profit optimization, which occurs through private consumers calculations on return on investments through for instance energy savings over time, compared to purchase investment (Figure 26).

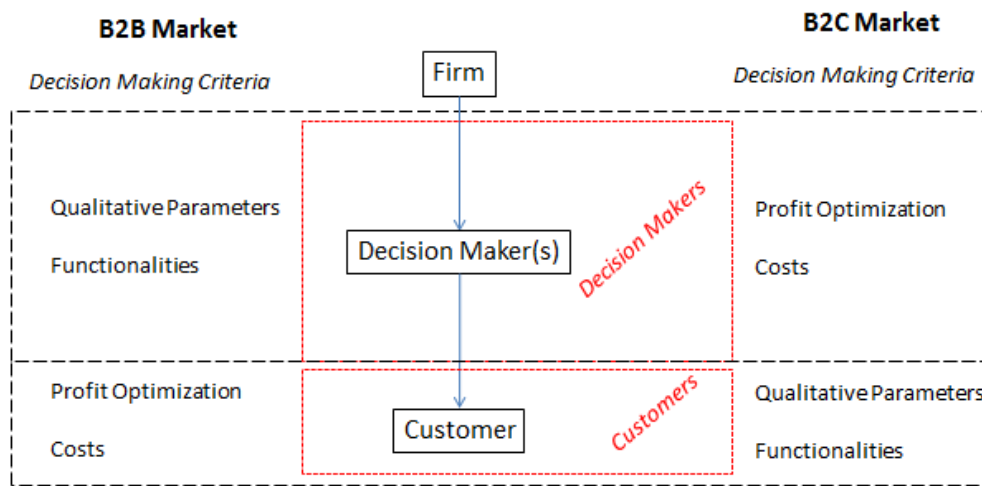


Figure 26 – Decision Makers and Customers Decision Making Criteria on the B2C & B2B Market

### Firms Innovation Linkages in General

The most widespread tendency across firm category is to either develop new products alone or collaborate with suppliers. Firms openly collaborating with external partners are most frequently collaborating with current suppliers in the upstream functions of the value chain. Only a minority (10-13%) is collaborating with the downstream functions, customers or decision makers, which are very little. Less than 10% are collaborating with knowledge institutes such as 'Teknologisk Institut' and other research organisations, while only 7% are actively seeking new partners with the specific resources and competencies needed in each initiative (Figure 27). This indicates that few firms are applying an explorative search process by seeking wide explorative ties. The findings gives the impression that the most frequent developed innovations are based on technology-push, and not need-pull, by prioritizing collaboration with the upstream functions of the value system. According to the theory section, those firms (the ones seeking wide ties) are more likely to develop novel and radical product innovations than others. These findings serve as a plausible explanation of why firms do not develop products as a coincidence (see page 41). They do not seek it.

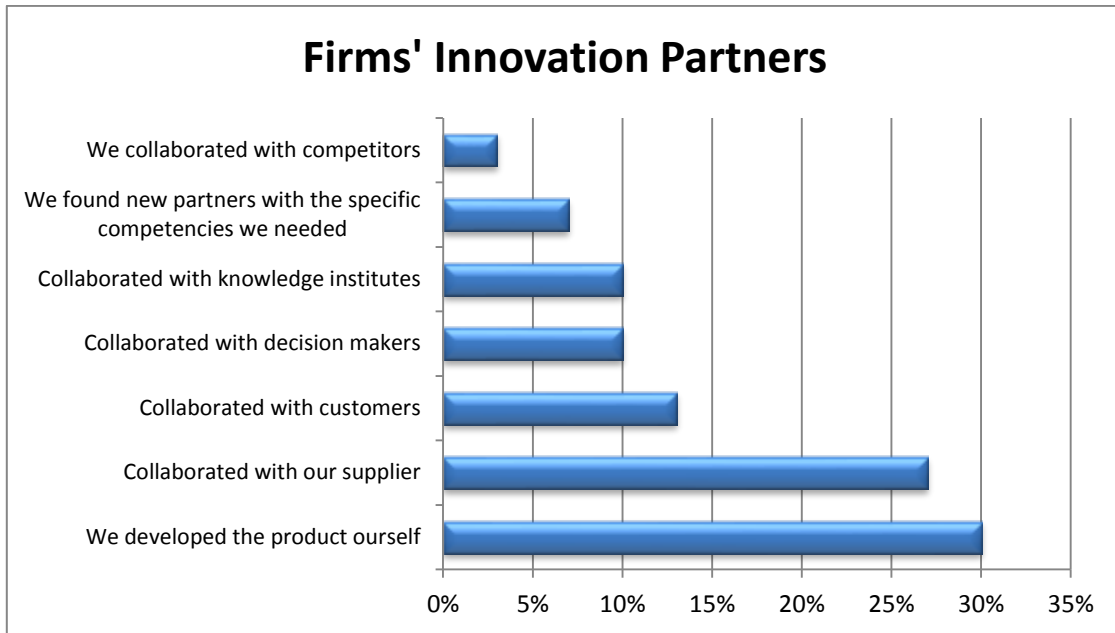


Figure 27 – Firms Innovation Partners (N=11)

By analysing data from the survey, it is obvious that the greatest difference between the small and bigger firms' collaboration partners on product innovation activities is that smaller firms are primarily working with current suppliers and competitors. Big firms are identifying and collaborating with new partners with the specific competencies and/or resources and knowledge institutes. This leads to the hypothesis, that small firms are primarily seeking and applying deep exploitative ties while bigger firms are more explorative seeking wide explorative ties (Figure 28). An interesting observation that challenges this statement is, that bigger firms are more than smaller firms developing products in solitude which seems paradoxical (The Quantitative Survey 2014), (Figure 28). Another interesting observation is that even though big firms' product innovation initiation is triggered by market factors (see page 41), they do not seem to collaborate with the downstream functions of the value chain more than small firms. The following sections will elaborate on these findings.

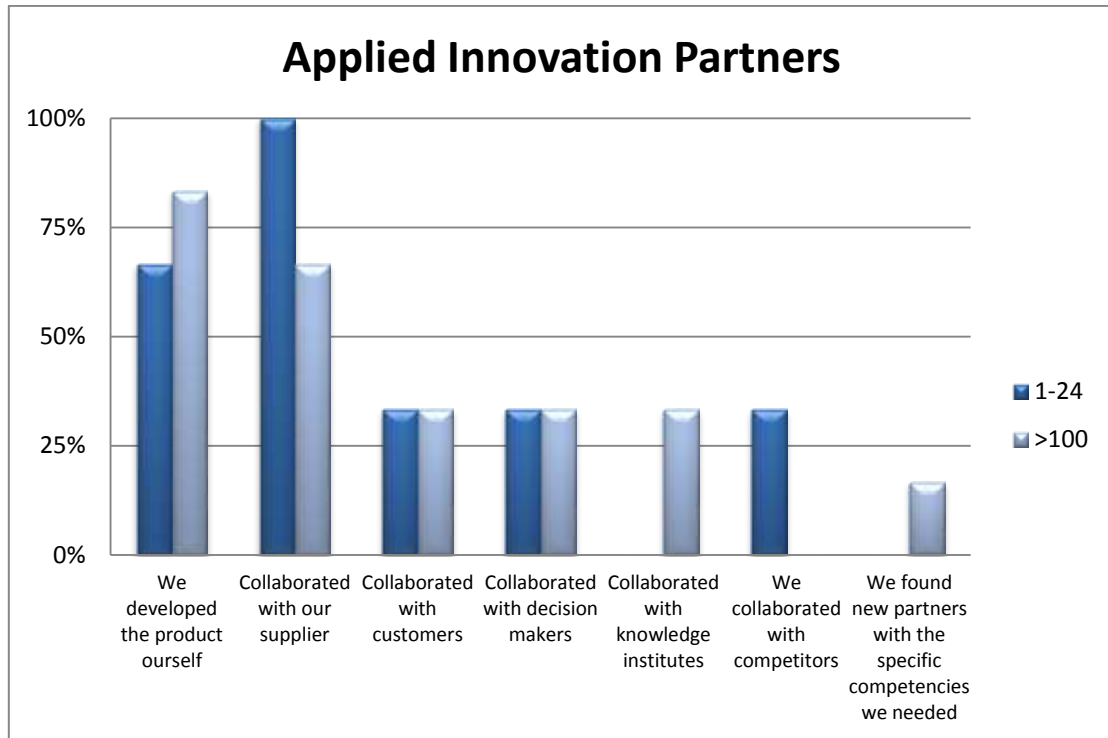


Figure 28 – Applied Innovation Partners (N=11)

### Firms Innovation Linkages in the Downstream Value System

The most frequent direct customer is carpenters and lumberyards/wholesalers. These two are the only customers who are applied by all firm-categories. The customers of the small firms are primarily private consumers while developers are big firms primary customers (The Quantitative Survey 2014), (Figure 29).



Figure 29 – Firm Category & Customers (N=11)

The primary decision makers for small firms are private consumers (directly), wholesalers/lumberyards, and carpenters. The most frequent decision makers for big firms are carpenters, advisors (architects, engineers e.g.), and developers (Figure 30).

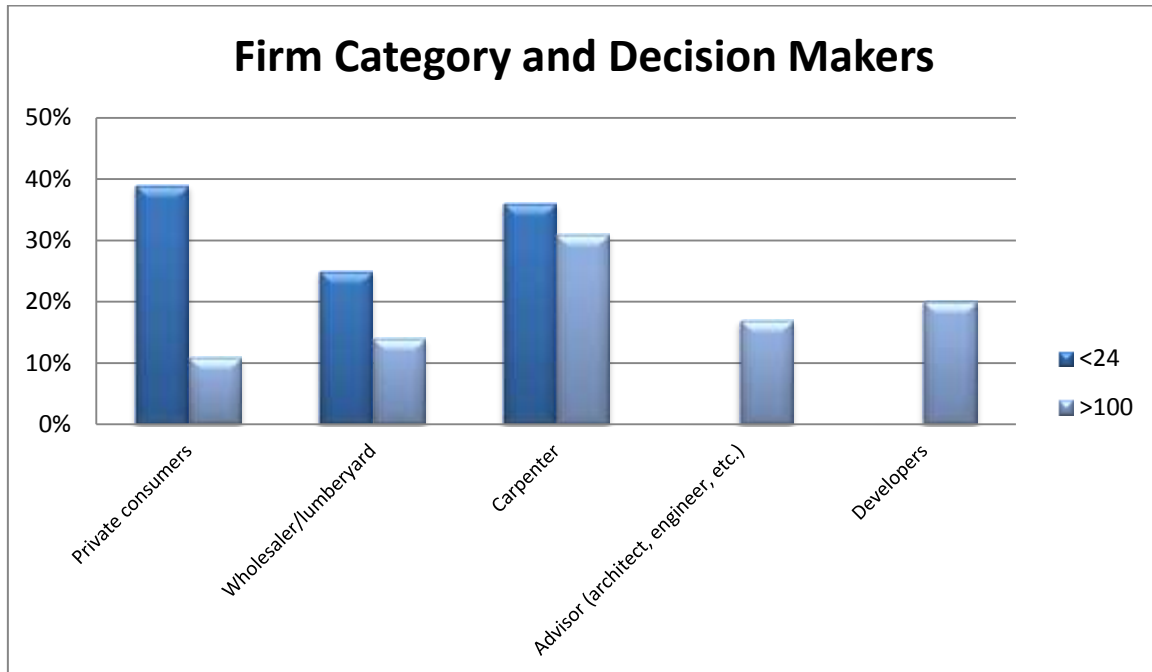


Figure 30 – Firm Category & Decision Makers

Data from this survey clearly indicates that the bigger projects, tenders, and contracts are dominated by big firms while small firms are focusing on the private household. In correspondence with customers and decision makers’ decision making criteria (Figure 26, page 47), big firms must be capable of producing great volume of products at price competitive prices leading to profit optimization at the customer. This explains why all big firms are engaged in process innovation activity (see page 41). However, they still need to fulfil the decision makers’, especially advisors and developers, requirements on technical specifications. Small firms on the other hand, must fulfil private customers’ need for functional products while also satisfying decision makers’ needs of being able to generate profit in the sale/implementation of the specific products. In general carpenters’ role as a decision maker, and influence on innovation, is important to understand as they are the most widespread decision maker firms across (Figure 30).

### Small Firms’ Innovation Linkages in the Downstream Value System

Previous findings suggest that small firms’ innovation activities only to a limited degree are based on market factors such as needs, and better fulfilment of customers and decision makers’ requirements. Their innovation activities seem merely to be initiated by legislation and presumably the new energy standards (see page 6). By not being inspired by the markets in their innovation efforts, it is unlikely that small firms will develop value innovations. The purpose of this section is to discuss and unfold this hypothesis, combined with a general analysis of the innovation linkages applied by small firms in the downstream value system and

how it affects innovation. The analysis is conducted based on the primary market constellations for small firms in general. This was presented in the previous section (page 45) and is illustrated in the figure below (Figure 31), (The Quantitative Survey 2014).

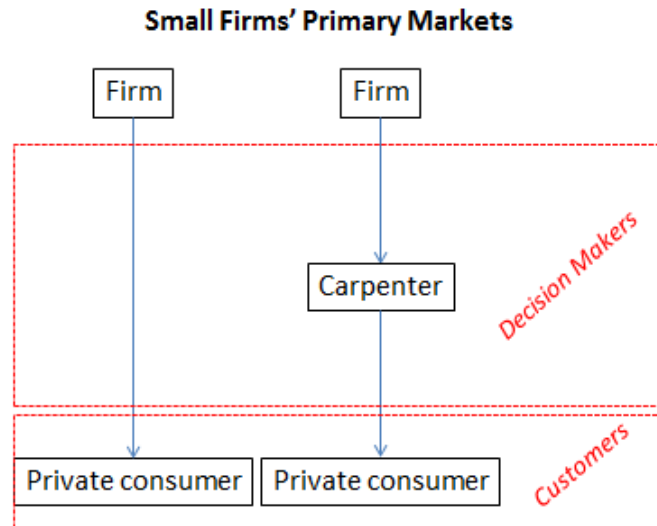


Figure 31 – Small Firms Primary Markets

The figure below illustrates that customers (private consumers) are considered as being of little value when it comes to small firms' innovation activities in general. Decision makers on the other hand, are highly valuable as an inspiration for product innovation initiatives, of decent importance in product innovation collaboration, and low importance when it comes to process innovation and collaboration on product improvements (Figure 32), (The Quantitative Survey 2014).

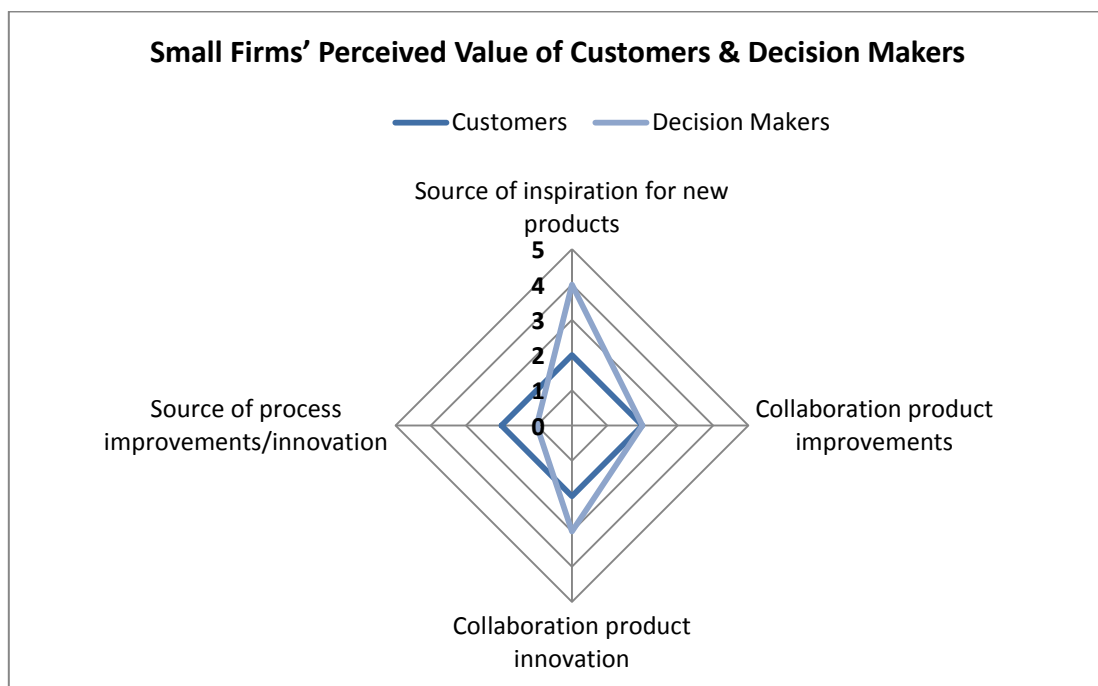


Figure 32 – Small Firms' Perceived Value of Customers & Decision Makers

### Customers' Role in Small Firms' Innovation Activities

The private household market primarily consists of renovations and consumers replacing current windows. There is no motive to believe that this will change in the near future (see page 29 & appendix 7). Private consumers' most important decision making criteria are listed below in prioritized order (The Qualitative Study 2014):

1. Economy; price, payback time on investment compared to energy efficiency.
2. Aesthetic and design.
3. Warranty.

Economy, payback time, and price are by far the most important choice criteria for private households (The Qualitative Study 2014). Often it is not profitable for private consumers to invest in windows above C-classified products. This corresponds to the fact that all the respondents (even the interviewed big firms) inform that the most sold products to private consumers are C-classified windows (The Qualitative Study 2014). This has simply to do with the small differences in window performance and energy cost savings (Appendix 8). Calculations based on four building archetypes<sup>7</sup> reveals that a typical house with approximately 20% of the total house area being windows, will witness yearly savings of only DKK 400, equivalent to approximately 600kWh/year if changing *all* windows from C-B, and the same from B-A classified products (Table 14). Furthermore, the numbers from the table below are based on houses using district heating as an energy source. The savings of the other energy sources (electricity, gas, oil) are approximately half of the district heating savings, providing even less incentives to upgrade window performance (Teknologisk Institut 2011).

Yearly Savings of Changing All Windows		
	DKK	kWh
<b>Average yearly saving from C – B class</b>	392,-	594
<b>Average yearly saving from B – A class</b>	417,-	632
<b>Average yearly saving from C – A class</b>	809,-	1226

Table 14 –Yearly Savings of Changing All Windows

A typical facade window is estimated to cost DKK 2.500 but can vary with special requirements to size, type, materials, paint etc. (XL Byg 2014), (Bauhaus 2014). A house with 20% of the area constituting of facade windows is estimated to have installed 10 windows which sums up to a total price of DKK 25.000 to purchase windows alone. Based on the interviews, the price of the windows will increase with approximately 20% for each classification upgrade. This means that the payback time for an upgrade from C-B will be 13 years, and 15 years with an upgrade from B-A (see appendix 8). All the respondents experience that customers do not perceive this as economic incentives to upgrade windows, especially if the windows are not over worn (The Qualitative Study 2014).

<sup>7</sup> Four building archetypes representing different periods; 1900-1960, 1961-71, 1972-1995 & 1996-.





*"Customers are very concerned with energy requirements and performance. But naturally they ask about price and the payback time. Off course we have to comply with the legislation, but often it is not profitable to use the newest windows which also are the most expensive. They often question what standard is and what make sense in relation to savings. The unknowing customer wants to use the classification but personally I don't think it is applicable. It is more about the total building that must fulfil some energy requirements and windows is only a little part of that. Even though you use the best windows available, there will still be an energy loss due to for instance lack of insulation. It is therefore important that the window fit with the building in total."* (Director, Jaette-Byg 2014)

In addition to the long payback times, there is little coherence with the requirements to windows energy performance and buildings (incl. houses) total energy efficiency capabilities. A window typically last for 40 years (Energivinduer 2011-2013) why it typically is elder houses that needs to get windows replaced. However, these houses are often poorly isolated etc., which means that in order for that house to be energy efficient, windows are only part of the solution. Therefore B- and A-class windows will outperform the rest of the house. This might not be a negative thing, but due to customers price focus, C-class products are preferred and B-A class products perceived as "waste of money". This attitude is shared by the small firms and affects their sales efforts which are a barrier for diffusion of B-classified products and product innovation (The Qualitative Study 2014).

Aesthetic and design is often a highly important parameter as private consumers purchase windows with the same look and feel as the old windows. Facade windows cover a great deal of the area of the building and are therefore important to the look and feel of the house. When changing windows, people tend not to experiment with new styles but would like to maintain the old design. This affects the opportunity to develop architectural innovations. They are hindered to do so as windows simply must be a replica of already installed windows.

Warranty is likewise an important parameter, and typically firms must offer five years warranty by law (VinduesIndustrien 2013). However, most firms tend to offer ten years warranty as many rival enterprises do this. It has simply become a norm or requirement for the customers. A warranty period of ten years make up for approximately  $\frac{1}{4}$  of a windows' expected lifetime as high-quality windows are expected to last for minimum 40 years (The Qualitative Study 2014). This affects small firms' risk willingness with new materials.

Customers' decision criteria's effect on small firms' innovation activities is prevailing negative. Current demand is conservative and traditional which does not stimulate new initiatives. Current products technical specifications are good enough for private consumers. In design and aesthetic matters, consumers prioritize things as they are now, and new windows must remind of the old ones which is a central barrier to architectural innovations. Big changes of facade windows entails big changes on the house itself, and that is not requested. Likewise is



the warranty period an important factor that is likely to restrain product innovation creativity. Firms must be able to fulfil the warranty norm which imposes firms to be certain that potential product innovations are durable in the long run. There have been some examples of firms that have marketed new products which in time appeared to develop mould caused by window panes with good isolating capabilities, and window frames with poor. This developed thermal bridges and condensation which in time develop mould (Ingeniøren 2008). When launching new products or modifications, firms need to be aware of those factors and how different materials react in a joint constellation (architecture). In order to be sure of how different materials react, firms rely on experts' opinions and calculations. But experts (engineering consultants, TI, etc.) are often expensive and therefore small firms do not tend to proactively search for new opportunities (The Qualitative Study 2014), (This will be elaborated on page 65).

Customers are passive in firms' innovation activities and it is unlikely that private customers demand characteristics leads to novel product innovations. Actually the opposite situation is more likely; that private consumers constrain innovation. This explains why small firms perceive that there are no reasons to, or value in, involve and engage private consumers in innovation activities. Therefore small firms do not apply innovation linkages or ties to customers who simply are not involved in small firms' innovation activities. Besides the direct negative effect on product innovation, this approach has a negative effect on small firms' potential to develop future value innovations. Customers' needs changes and can be influenced which is proven by the popularity of marketing. This also means that their needs might change in the future why it is important for firms to have some kind of linkages or ties to customers. Such ties do not have to be innovation co-operation but could be open information sources based on openly available information through wide ties (see page 26). Due to small firms' direct link to customers, they constantly engage with the private customer in the sale of their products. This means that those linkages can provide the firms with inspiration and the input needed. However, there is a challenge as the sales people often not are the ones responsible for developing new innovations. In general the small firms' lack of innovation linkages to customers is a risk of future value innovations, but make up for it by engaging with the customers where they to some extent obtain information on market trends and developments. Whether or not this is utilized in the innovation activity depends on the innovation process and if such input is incorporated. Considering earlier findings that small firms market potential is low and based on niche markets, the scope for value innovation is presumably low as the current market situation induces small firms to serve current markets domestically (see page 33). Customers' decision making criteria and configuration, primarily provides the small firms incentives to reduce cost which is done through process innovation. Modest incentives are given to product and value innovation.

### *Decision Makers' Role in Small Firms' Innovation Activities*

Decision makers, as earlier clarified, act economic rational entities whose primary decision criteria are based on profit optimization principles (Figure 26, page 47). However, they still



need to meet their customers' requirements, but those customers are the same as described above providing little incentives to innovation.

Decision makers (carpenters) are perceived as being a good source of inspiration for new product ideas and on collaboration in product innovations (Figure 32, page 51), yet still not involved in the innovation process (The Qualitative Study 2014). The reason why decision makers are perceived as being of high value to product innovation inspiration is that when a carpenter is involved, he is the one receiving customer orders. Those orders often contain requirements of non-standardized windows (The Qualitative Study 2014). Small firms are targeting niche markets and a vital part of their business is focused on being able to fulfil market needs and orders that differentiate from the norm and volume market. Therefore, customers often contact a carpenter and present the challenge for them. A typical example is materials. If a customer has a mahogany window installed they want to replace that with a similar mahogany window. Big firms do not produce windows out of special wood sorts as this does not represent a mass market (Energivinduer 2011-2013). The subsequent step is for the carpenter to contact the window manufacturer who then needs to develop and build the specific window. This explains why carpenters are important when it comes to both ideas for new products, and the actual manufacturing. Carpenters simply provide the knowledge needed for the manufacturer to build the window. Small firms are highly dependent on such 'obscure' orders provided by carpenters, as they constitute a great amount of small firms' business activity. Such new windows, even though they might be defined as innovations, are all unique and therefore not subject to be implemented in a big scale. There is no volume market related to it. Therefore the innovation dies with the sold product and the diffusion of the innovation is very little – as it often only gets adopted by that single customer.

The potential of involving decision makers in small firms' innovation activities are relatively modest. Despite for the point above, decision makers are carpenters who are installing the facade windows and make a business out of it. As being economic rational actors, their needs are focused on being able to generate profit from this transaction which occurs through the cost-turnover difference ratio. The inputs small firms are able to requisition through these actors are therefore influenced by the easiness of installing the window and problems in order to lower cost for the carpenter. Such input will lead to incremental product innovation and improvements of for instance positioning of screw holes, mountings etc., and will not lead to novel product or value innovations. Despite for the fact that small firms apply deep ties with decision makers, these ties are only appropriate for continuation of the business through orders and not for novel innovation activities. At best, decision makers can provide input inducing incremental product innovation to a limited extent. However, as this link is an economic rational entity, price and costs will always be an important parameter, why the incentives to innovation primarily will be targeted process innovations and cost reductions.

### **The Downstream Functions Effect on Small Firms' Innovation Activities**

Customers alone provide no incentives for smaller firms to innovate as their needs are simple focusing on economy, warranty and products similar to already installed windows. Further-



more, the purchase of a window is a traditional and conservative process not inducing new initiatives. The consequence is that the scope for innovation is lowered to only consist of incremental product or component innovation without it bringing cost increases. Architectural innovations are hindered as customers prioritize similar windows as already implemented. Customers do not request sustainable products and current products already supersede the energy efficiency requirements. There is little coherence with the energy standards concerning facade windows and private houses energy efficiency in total.

The small firms apply simple innovation models not including customers in the innovation process which indicate that they might risk to see new market needs should they appear. This might have a negative impact on their ability to develop value and product innovations based on identification of new needs and demand. However, even though they do not involve customers or decision makers in their actual innovation efforts, they have adopted direct information linkages to private customers. A positive effect of the direct sales link to customers is that the small firms benefit from open information sources through wide ties. This means that potentially they will see new market needs, if they should appear, and be able to react upon them. However, this depends on the innovation process applied by the small firms and if such input is integrated in the process.

Decision makers (carpenters) do bring new challenges and needs for the small firms to react on. However, these are often focused on developing specific windows for a specific order and customer. A major part of smaller firms business is to manufacture and sell products that differ from standard sizes and materials – and often it is the carpenter that brings these orders. However, the only uniqueness of these orders is size and material, and rarely performance parameters which can induce innovation. These orders are not subject to product innovation activities as they do not represent a mass market but only single orders.

To summarize, the benefit of the downstream functions by small firms is simply that they purchase products and are a source of business. However, the demand and constellation of the downstream functions does not provide any incentives to product and value innovation but process innovation. As small firms produce non-standardized sizes and a low volume of windows, there is only little scope for process innovation. Economies of scale are not an important parameter for small firms.

### **Big Firms' Innovation Linkages in the Downstream Value System**

Previous findings suggest that big firms' innovation activities are based on market needs and need pull models. Findings indicate that they tend to develop new products specifically related to new markets (see page 41). The discussion will be based on the primary markets for bigger firms which are illustrated in the figure below (Figure 33), (The Quantitative Survey 2014). To summarize, decision makers are prioritizing qualitative parameters and functionalities as they represent the end-users while the customer act as economic rational entities (Figure 26, page 47).

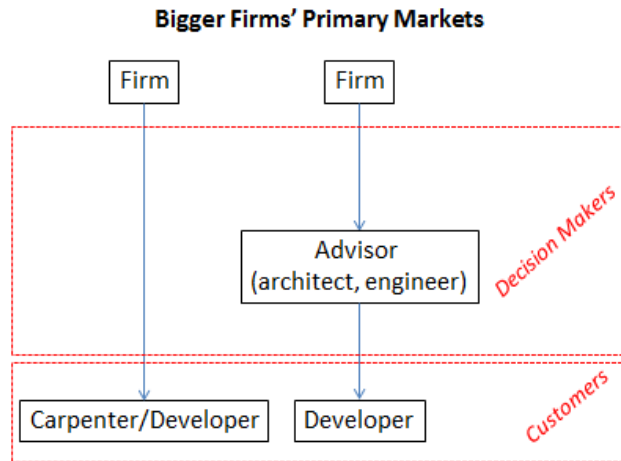


Figure 33 – Bigger Firms' Primary Markets

Again, customers are perceived as being of minor value than decision makers in general. Customers are perceived as being of the most value, but still only minor, in product innovation collaborations. Decision makers on the other hand, are perceived as being of high value when it comes to collaboration on product innovation and ideas (Figure 34).

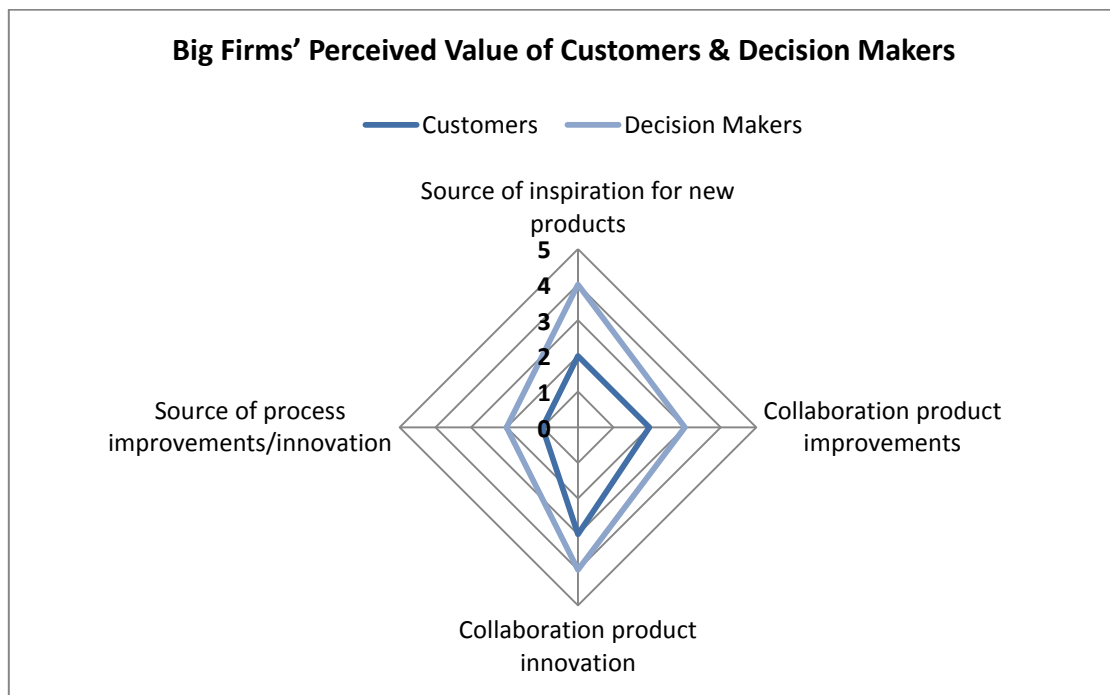


Figure 34 – Big Firms Perceived Value of Customers & Decision Makers

**Customers' Role in Bigger Firms' Innovation Activities**

As described in the theory section, successful innovation depends on novelty and diffusion and if customers perceive the innovation to provide value (see page 16). Customers obtain value through purchases which is based on their demand and decision making criteria. Therefore, demand plays a vital role in firms' innovation activity as it can either stimulate or counteract innovation. The objective of value innovation is focused on developing new demand or deci-



sion making criteria. A theoretical hypothesis of this study is that big firms' customers presumably are focused on price as a decision making criteria and as such limit innovation.

### **Customer Demand and the Influence on Innovation**

As earlier described, customers are divided in private and public developers with the activity in the private business sector being very little – actually historically low. Most of the activity and business for big firms' are renovation of current building stock with the public sector as customers (see page 29). This means that big firms' innovation efforts are targeted the demand and need specification from public developers, which will have the greatest influence on firms' innovation efforts. Furthermore, public developers' needs are often characterised by more strict technical requirements to building material than the private sector. The demand from public developers is marked by their later responsibility of having to manage the buildings and cover most costs once new constructions are developed. This means that they are prioritizing not only purchase costs, but also operating costs which is lowered through for instance energy efficient windows reducing the heat loss, which now have become an important parameter with the new energy standards (Table 1, page 6). Actually public developers requested these capabilities before the new energy efficiency standards was introduced and thought of (The Qualitative Study 2014).

*"We were met by these requirements before they became standards and legally binding. Special constructions and tenders must be good and those solutions are already developed. (...). The public make constructions and renovations for themselves and are focused on operating costs." (Marketing & Development Manager, HSHansen 2014).*

The current trend and focus on energy efficiency etc. has been widely absorbed and integrated in the market (The Qualitative Study 2014). Initially this trend, and set of decision making criteria, stimulated product innovation among big firms. All the big firms have developed energy efficient windows and actually their products currently supersede the market demand. An effect of the challenged activity in the market and economy is that the most important decision making criteria has become price and costs. In order to win orders, firms compete on who are cheapest as their products possess the functional and quality specifications needed in renovation tasks (The Qualitative Study 2014). It is an intense fight over market shares and all big firms are offering energy efficient windows that fulfil the customer requirements. This has to do with the market situation and renovations as the primary activity. Current windows fulfil the technical requirements and such task does not impose challenging requirements for facade windows (The Qualitative Study 2014). To summarize, the consequence of the market situation, general low activity, and renovation as the primary activity, is that the demand factors are not challenging the firms and does not provide incentives to innovation. The demand from developers has not followed the technical opportunities and the big firms' development in general. All the interviewed big firms express that they offer products exceeding the developers demand and requirement specifications and are therefore not



challenged. Better products are more expensive and the developers tend to emphasize price and costs why the demand or sale of new innovative products is a challenge. As a consequence manufactures often has to lower the technical capabilities of the windows as it is a prerequisite in order to win orders due to scarce competition (The Qualitative Study 2014).

*"Customers often lower the ambitions as they purchase cheaper products. It has to do with the competition. There is always someone who is cheaper. We often experience that we offer to good products compared to competitors and especially compared to the requirement specification in the tender why we offer better and more expensive products. When everyone experiences this and knows this, everyone adjust and lower the products capabilities and functionalities to the worse. The price simply reflects the product, but not always the best product is needed."* (Development Manager, Inwido 2014)

### **Sustainability and the Political Agenda**

As described earlier, sustainability is on the political agenda generating a systemic pressure for sustainable buildings and building material hereunder facade windows (see page 6). However, sustainability has not yet got a firm grasp and become an important parameter for developers in general (Danish Ministry of Environment 2011). Firms' experience that customers and developers are not keeping pace with the political visions but still, the manufacturers becomes the scapegoat and accused of not embracing the sustainable transition (The Qualitative Study 2014). Findings from this study indicate that it is the customers who hinder the development and not the manufacturers. This finding is supported by a new report published by the Danish Competition and Consumer Authority, which clearly conclude that public developers have vital influence on innovation in general and are able to make up for "(...) market-errors that limits innovation by creating a critical mass in the demand." (Rådet om Offentlig-Privat Samarbejde 2013, 4). Public developers are by far the biggest developer in Denmark why they have the opportunity to make changes trough creating a critical market volume. If these developers request innovation, firms' are provided the incentives to innovate thus making up for limited incentives in the market in general (Rådet om Offentlig-Privat Samarbejde 2013). The analysis suggests five barriers all with relevance to this study:

- Tender rules in general
- Differences in interest between public and private actors
- Lack of knowledge sharing
- Unclear distribution of roles
- Lack of risk willingness

Public developers and actually developers in general, have a conservative interpretation of current legislation and tender methods. They are risk averse and not experimenting with new solutions due to lack of knowledge, fear of future costs and troubles when experimenting or applying non-traditional tender types (Rådet om Offentlig-Privat Samarbejde 2013). This hinders the innovation potential in the industry and does not utilize the potential synergies of





new ways of collaboration. As described in the theory section, innovation has become more complex and will have to involve more actors and innovation linkages. Unfortunately, this is hindered by the traditional and conservative methods of making tenders and projects. The key issue of traditional tenders is that they tend to prioritize costs over qualitative parameters while also not stimulating cross-industry collaboration and dialogue between bidders and buyers, thus not focus on needs and end-users in depth. Instead focus becomes general and superficial solution models as costs and price explicitly becomes the most important parameter often weighing 75% in traditional tenders (Værdibyg 2012). Few experiments have been made with new and alternative tender processes which have emphasized qualitative parameters over price, while also enabling dialogue and communication between bidders, end-users, and buyers. The results were that there was developed more innovative and qualitative better offers through the better understanding of needs and corporation between different organisations. Interesting observation has been that price competition was still fierce and actually the cost of the offers was lower than expected while superseding the qualitative expectations. Unfortunately, the appliance of such tender processes has not become widely adopted and traditional linear tender processes are applied, especially among public tenders:

*"Developers can benefit by embracing more dialogue and collaboration. Unfortunately the development goes the opposite way, especially among public developers who are afraid of violate the equal treatment conditions."*  
(Værdibyg 2012, 4)

### **Big Firms' Innovation Linkages to Customers**

The empirical data does not provide any indications that big firms apply innovation linkages or ties to customers. This correspond to the finding that customers are perceived as bringing little incentives to innovation and modest value in firms innovation activities (Figure 34, page 57). Furthermore, developers are dispersed and are often different councils and housing associations boards that are difficult to get in contact, which complicate the establishment of ties and innovation linkages and even information sources. However, big firms and international concerns are often highly visionary and profit oriented as their main objective is to create positive return on investments (see page 31). Innovation, differentiation, sustainability are important parameters, and even strategic objectives for those firms. A common denominator is that their business visions typically are focused on improving indoor climate and increase people's joy of light through innovative windows (The Qualitative Study 2014). This is despite for the lacking market incentives which is a noticeably indication that they seek differentiation strategies.

*"The political objective suits us. We have a vision of doing something good for people. We work on improving people's joy of life and what we as humans require and want. We will do ours to ensure that the society as a whole performs optimally. At the same time we are not naive. We meet the customers where they are and seek to affect their decisions. But if people and tenders*





*want to buy C-classified windows then we deliver that.” (Concept Manager, Dovista 2014)*

All the respondents in the big firm category express that they perceive the factors influencing product innovation to go beyond just energy requirements. These factors include elements such as recycling (red. cradle2cradle), indoor climate, and life quality (The Qualitative Study 2014). These requirements are incorporated in the big firms’ branding strategies and vision statements. Big firms’ product innovation activities supersede the rather simplistic, yet complex, conception that facade windows should fulfill the explicit formulated (energy) standards, but also builds on market trends, brand value and visions. When looking at the different firms’ websites (small vs. big), it is obvious that the bigger firms’ branding are focused more on these “soft” factors and visions which is not seen similar on any of the (reviewed) small firms websites. Here are some examples of two big firms’ visions and brand values:

*“Inwido should develop next generation’s concepts for smart and innovative windows and doors that meet the consumers’ needs. The goal is to constantly launch new products and solutions that improve people’s well-being.” (Inwido 2014).*

&

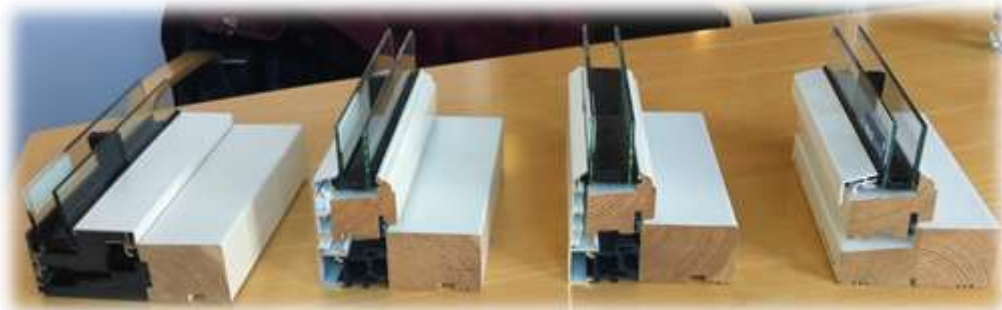
*“DOVISTA Gruppen develops, manufactures, and sells windows and doors that bring visibility, daylight, fresh air and a good environment in people’s daily life. We actively contribute to increase people’s well-being and support renewable and sustainable development of society.” (Dovista 2014)*

This naturally affects the product innovation activities as they must relate to and practice those factors incl. sustainability. They do this constantly and proactively (The Qualitative Study 2014). A common denominator between the big firms’ product innovation activity is that it is organized, administered, and facilitated centrally in the concern/conglomerate as a support division for its business units<sup>8</sup>. This central development department exclusively focuses on R&D and innovation with great emphasis on how to fulfil these broader visions and innovation factors (The Qualitative Study 2014). The R&D departments innovation activities are often based on how, and which, alternative materials can be applied and are able to fulfil the sustainability factor. As an example they are for instance actively working with innovation and development of how for instance the frame of the window can be re-thought in order to create better indoor climate and inflow of light (The Qualitative Study 2014). This explains why and how, big firms’ innovation activities are more based on market factors and product innovations bordering value innovation. It has to do with the business vision. Big firms’ product innovation activities can therefore be defined as being more concentrated on novel product innovations focusing on both modular innovations through development of novel components. As, an example two of the big firms has introduced window frames made of composite material which is a novel component innovation in the facade window industry. Typically frames are

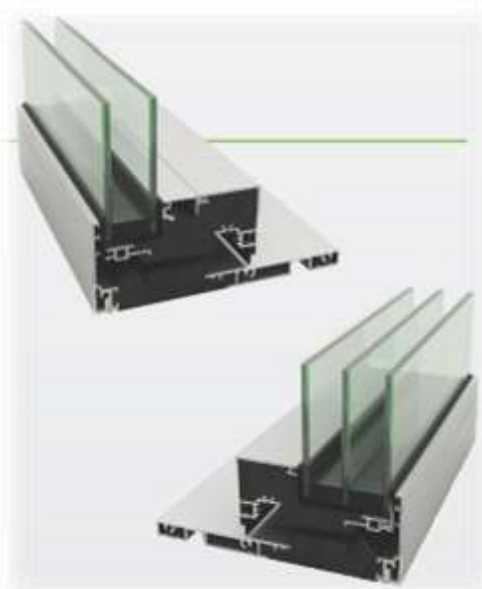
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<sup>8</sup> The individual firm selling the respective window brand.

made up of wood, wood/aluminum, or plastic (Energivinduer 2011-2013). Furthermore, they are based on architectural innovations. To illustrate, the pictures below shows four different window architectures ranged from A-C classifications. It is obvious that the manufacturer is experimenting with both component (Picture 1) and architectural innovation (Picture 2).



Picture 1 – Different Window Architectures & Components (Jesper S. Flackeberg, taken at IdealCombi)



Picture 2 – Innovative Window Architecture & Components (IdealCombi: Futura+) (IdealCombi 2013)

Picture 2 is an example of a novel product innovation, and is a good bet on how big firms seek to increase people's well-being by allowing for more inflow of light by minimizing the frame and optimizing the glass area. At the meantime it is made out of composite materials which are sustainable by being made from recycled materials (IdealCombi 2013).

This analysis leads to the conclusion that the energy standards do not trigger, or provide incentives for, highly novel product innovation, neither does the downstream functions. It happens because of the big firms visions and strategies. Their innovation activities seems to be initiated by a proactive approach and visions to improve people's joy of life and optimize societal elements which is admirable considering the current market situation and market demand which provide little incentives to product innovation and actually is a barrier for diffusion. Big firms' visions define the standards for the industry and facade windows.



### *Decision Makers' Role in Bigger Firms' Innovation Activities*

Decision makers, architects, and engineers, are the ones that attend to qualitative functionality parameters representing end-users' needs, and can therefore potentially be beneficial for firms to involve in their innovation process through ties and innovation linkages. This also explains why they are perceived as potentially bringing high value as inspiration for product innovation ideas, and as collaboration partner (Figure 34, page 57). Architects are the most challenging decision makers requesting for specific features of facade windows (The Qualitative Study 2014). However, just as facade window manufacturers, they must restrain themselves to fulfil customers' emphasis on costs.

Big firms, and the international concerns, typically apply a highly systematic innovation process and professional approach to innovation in general. A denominator among all the big firms is that they are highly market oriented and test product inventions on markets systematically. All big firms, and international concerns, adopt a clearly defined innovation process and roles. Often the concern manage R&D, and the technical elements, while the individual firm' within the concern function as a sale organization whose task is to test product inventions and ideas on the market. All the big firms apply innovation linkages and deep and wide informal ties with decision makers (The Qualitative Study 2014). These linkages are not explorative as theory states, but can be defined as 'delimitation-linkages' used to assess the boundary of new technical innovations and ensure market support for novel product innovations through open information sources with decision makers.

*"It is very little that comes from the customers and decision makers' side (...). It is typically first in the moment we have developed a product we test it among customers. But the BR15 will bring needed changes."* (Development Manager, Inwido 2014)

The quote above very well represents the process of all interviewed big firms' innovation process. The process is similar to E.Von Hippel's 'manufacturer active paradigm' where innovators uses actors in the downstream functions as sources of input to prototypes (Von Hippel 1978). This process and approach are applied by all big firms (The Qualitative Study 2014). Such approach is based on the traditional assumption that firms generate value alone, which then is adopted by the end-users, and not dynamic models of connectivity where firms and users (here represented by decision makers) generate value and develop innovation jointly (Prahalad and Krishnan 2008). Firms applying more advanced models of innovation, comparable with R. Rothwell's 4<sup>th</sup> generation innovation models (Rothwell 1994), integrates the downstream functions in the innovation process and utilize from co-creation methodologies in their product innovation efforts (Prahalad and Krishnan 2008), (Tidd and Bessant 2011). Currently, big firms are only receiving input on specific products presented to architects which means, that inputs only are used to improve the current window architecture and design. Hereby big firms are not making full benefit of decision makers' potential innovation contribution, but it ensures that they develop products which correspond to customers' needs and thereby provide value. Namely architects must be considered to be able to contribute with



great value as this profession is perceived as being one of the most innovative professions in the construction industry actively defining and developing new standards (Cembrit 2011), (DAC 2011). Danish architects have been rated as the most innovative architects within the Nordic countries and as number three in Europe, in a European study of who architects themselves perceives as being the most innovative (Cembrit 2011). Danish architects are especially considered to be creative and at the forefront of the sustainable development (ibid). Typically architects also experience with materials which provide indications that architects actually could be of relevance and provide valuable input in firms' innovation activities. However, based on the analysis of the conducted interviews, this potential synergy potential seems to be limited due to traditional tender processes.

Based on the knowledge gathered so far, an assumption of big firms' usage of decision makers in the innovation process is that decision makers are used as sources of market intelligence by simply providing feedback on how customers would think of new product innovations. An interesting thought is whether or not big firms would integrate decision makers and develop more advanced open innovation approaches if customers and the market in general provided the incentives through demand of innovative and sustainable products and through smarter tender processes.

### **The Downstream Functions Effect on Big Firms' Innovation Activities**

Big firms' innovation potential is hindered by the downstream functions and inadequate demand. The sustainability-trend has not got a grasp in the demand and tender specifications. There is simply only a narrow market for big firms' most innovative, energy efficient, and sustainable products which means, that the big firms' full innovation potential is not realized. It is therefore unfair to use these firms as scapegoats for the slow sustainable transition. The market is therefore not to be acclaimed why big firms' actually has developed relatively sustainable and novel product innovations. The only explanation of why big firms are seeking novel product innovations must be that they are highly ambitious and visionary, all seeking prospector status and differentiation strategies by marking the industry development and conquer the position as market leaders.

Big firms apply a systematic approach to innovation and relatively advanced innovation models when considering their integration of the downstream value system. They make use of open information sources through both deep and wide ties primarily with architects who are used to asses current prototypes in order to define how market might respond to it. Due to the market and demand situation, those inputs are most likely to be delimitating the scope for innovation by focusing on price and cost which means that technicalities and technical/functional opportunities must be reduced. Hereby the scope for component and architectural innovation is reduced to simpler incremental innovations and adjustments to developed prototypes. But still, these linkages serves as qualitative input needed in order to develop products of value to customers, which is fundamental for transforming inventions to innovations. It is simply needed in order to develop product innovations. Furthermore, these links are important in order to potentially develop value innovations by keeping abreast with market trends. When



assessing new alternative materials and architectural configuration, the first and most important criteria they must fulfil are efficiency, costs, and the potential to mass produce these items at a favorable price which provides incentives to process innovation and optimizing economies of scale.

Danish architects are perceived as being in possession of good innovation capabilities which indicates, that it could be interesting for facade window manufacturers to involve those in the innovation process. Danish architects are European frontrunners of the sustainability development and define new standards in the construction industry. It could be interesting to find out what kind of synergies would happen, and if innovation partnerships with architects and innovative big firms', would lead to novel product innovations. However, the Danish market for new developments is relatively small and does not demand novel products or pressures the facade window manufacturers. A sufficient critical mass-market is lacking in Denmark, and when combined with the fact that diffusion of new building material is slow due to lack of risk willingness etc., there is a need for the public developers to step up and incorporate sustainability and other parameters as conducive for big firms' innovation activities. Public developers have a big role which they do not seem to fulfil, both through inadequate demand specifications and traditional tender processes not stimulating collaboration and dialogue in the tender process.

### **Firms Innovation Linkages in the Upstream Value System**

As earlier described, the upstream functions will affect primarily firms' process and product innovation activities. This section will describe respectively how small and big firms relate to the upstream environment and make use of these external resources in their innovation activities, through innovation linkages and ties.

#### **Small Firms' Innovation Linkages in the Upstream Value System**

All the small firm-respondents that have worked with product or process innovation, express that they have collaborated with suppliers. None express that they collaborate with knowledge institutes who also are perceived as only contributing with minor value as a collaboration partner, and little more as a source of inspiration for product innovations/improvements (The Quantitative Survey 2014).

#### ***Upstream Innovation Linkages and Small Firms' Product Innovation Activity***

Previous analysis concluded that generally small firms' are less involved in product innovation compared to big firms, but that they are pressured by legislation to develop new products. Furthermore, the analysis concluded that when small firms develop new products, they primarily do it based on technological opportunities (see page 41). The objective of this analysis is to unfold this finding and provide in-depth knowledge of the innovation linkages applied in product innovation activity.

The conducted interviews reveal that all the small firms see the increasing energy standards as by far the most important factor for product innovation. This has to do with the fact, that they

are now facing the challenge of having to develop new products or improve current ones in order to fulfil the new standards, which will become effective as of 2015. The majority of all the firms already fulfilled the requirements for the C-class prior the introduction of the BR11 in 2011. This explains why less small firms have been active in product innovation for the last three years. Firms that do not fulfill the B-classification requirements will have to improve or develop new products by 2015 in order to fulfil the new standard, which is a legal requirement that currently pressures product innovation initiation (see page 6). The decision of the BR11, BR15, and BR20 was decided in 2008. Initially the increased legislation received negative feedback and criticism from small firms as they did not think it was possible for them to fulfil the standards (The Qualitative Study 2014). However, the general development in the industry, and at suppliers, has made it possible for firms to fulfil the new energy standards and even develop energy neutral facade windows complying with the BR20.

*“In 2008 I did not believe we would be able to fulfil the standards. But there has been a strong development in the window industry and among glass manufacturers. There is also a lot going on in the wood industry where different insulators have been implemented combined with other constructions. Plastic windows have in many years consisted of stagnant air which functions as insulation. This was done by chambers of stagnant air, and now wood frame manufacturers are beginning to be able to do this as well. There are really a lot going on.”* (Director, Jaette-Byg 2014)

The development has resulted in all the small firms being aware of how they will be able to fulfil the new requirements, and are ready to implement those changes by 2015. Fundamentally, they plan on doing it by applying one of two basic solution-models (The Qualitative Study 2014):

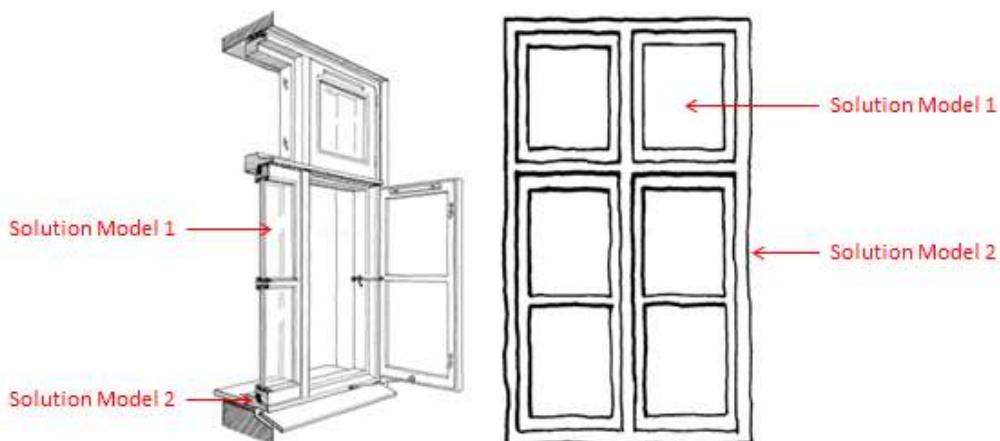
Solution Model 1	Solution Model 2
<p><b>Purchase a thicker type of thermal glass by supplier or apply multiple glass layers.</b></p> <p>The consequence of this solution is that the window will have to increase by size to fit the thicker glass layer. The firm will have to modify the frame and design to fit the glass.</p>	<p><b>Purchase new frame-profiles which contain an insulator, for instance pressed rock wool or cork.</b></p> <p>To illustrate, a firm that produces wood-frame windows purchases the wooden profiles from supplier in meters. The facade window manufacturers cut four bars out of these profiles and assemble them around the window panes to make a final window. This solution model is based on purchasing alternative frame-profiles where the supplier has installed an insulator within the profile. It has simply been divided in two with the</p>



	<p>insulator in the middle. An alternative to cork or rock wool is to have air chambers in the profile (holes in the profile with stagnant air). The stagnant air will isolate just as physical insulators.</p>
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Table 15 – Energy Efficiency Solution Models

As the picture below illustrates (Picture 3), a facade window consists of two major components; window and frame-profiles that surrounds and hold the windows. Those components make up for more than 90% of the total window, only supplemented with a sealing, mountings, and a list between the glass-layers (The Qualitative Study 2014), (Altomhus 2014). The small firms purchase these components at suppliers and assemble them into a final facade window. Small firms’ core competences are the craftsmanship, and being able to manufacturer attractive looking windows in (almost) whatever material and size customers request. The actual manufacturing of the components are beyond their core competencies and business expertise.



Picture 3 – The Solution Models Illustrated (Altomhus 2014)

This explains why the upstream functions are perceived to contribute with more value when it comes to product innovation than the downstream functions, and why small firms primarily work with suppliers (see page 43). Current suppliers simply make small firms capable of satisfying the new energy standards, which is what force them to develop new products. Even though it is relatively easy for the firms to adopt these solutions and comply with the new energy standards, it will have other consequences for the small firms. When applying a thicker type of glass they need to adapt the current design, which will carry a cost increase of 10-20% as the materials are more expensive. The firms predict that they will be able to use these solutions to fulfill the 2020 standards as well. Another consequence is that the weight of the products will reach a critical point. Most likely the weight of the products will exceed the maximum weight personnel are allowed to lift manually due to the law of working environment (The Qualitative Study 2014). The effect of this will be that the manufacturer of facade

windows and carpenters will have to invest in lifting equipment when handling these elements. Especially for carpenters this scenario will make smaller renovations less attractive as they need more equipment.

### **Small Firms' Innovation Linkages in Product Innovation Activities**

It is rarely that small firms engage in co-product innovation projects with suppliers focused on new window components and architectures managed and initiated by the small firms. The opposite scenario occurs, with suppliers initiating and managing innovation projects in order to satisfy a new market demand. In this case it is focused on how suppliers are able to help manufacturers of facade windows fulfil the new energy standards:

*"We pass on whatever demand we meet to our suppliers who work on how to fulfil these norms and requirements. The suppliers have a huge product portfolio which we make use of."* (Sales Manager, Frovin 2014)

&

*"My suppliers are already working on developing the plastic profiles and systems so they can be improved. There is no doubt that something will appear within the next 4-5 years which is much better than current solutions."* (Director, Modum Vinduer 2014)

The suppliers of windows and frame-profiles are global suppliers and have a lot of customers in the facade window industry (The Qualitative Study 2014). Just as any firm, they need to monitor and keep abreast with the general market development and provide products of value for customers. The demand from Danish facade window manufacturers has been focused on energy efficiency why suppliers have had to develop new products enabling the firms to use these products to manufacture energy efficient windows. The window and frame-profiles are simply important components in relation to energy efficiency, why the requirement and innovation naturally is located at the suppliers of these components:

*"The way it works is that we look at the markets and assess what is required. There has been a development in relation to Uw-values which has been stricter and improved through the window panes. It has always been my suppliers' development to fulfil those requirements. Glass is an enormous element in concern to energy."* (Sales Manager, PTvinduer 2014).

In 2008 the energy efficiency standards triggered a development in the industry and novel innovations, which caused new industry standards especially among suppliers of components such as glass, windows, and frame-profiles. Suppliers were given the market incentives opposite to firms in the facade window industry. Small firms can fulfill the energy standards by applying suppliers' off-the-shelves products which enables the firms to fulfil even the BR20 standards. A traditional window with a three layered glass will be highly energy efficient, and combined with the insulator, likely to be able to fulfill even the BR20 standards.





The innovation activity is anchored at the supplier and not the small firm, but with both making use of their business relation and their deep exploitative ties to each other. It is the supplier that develops and manages the innovation process with the small firm providing ideas, testing, suggest improvements, and find implications in the assembly and final outcome of the window.

To summarize, small firms engage in product innovation activities with suppliers who manage the product innovations. This means that the supplier owns the product which they then are free to sell to the other firms in the industry. Small firms' role in the innovation process leads to incremental innovations and improvements and are not concerned with copyrights (The Qualitative Study 2014). The supplier markets the final products and through diffusion, it becomes available for all manufacturers of facade windows as suppliers' standard solutions. As small firms adopt the same components from the suppliers, their products will simply become uniform with only minor differences. They are simply all based on the same technology or solutions supplied by current suppliers. There exist three key mechanisms that cause the described phenomenon. Firstly, it has to do with core competencies and business expertise. Such activity is beyond the scope of small firms. Second, the suppliers are big companies with vast resources to invest in development projects and a setup applicable. Third, current suppliers already have all the certificates needed in order to be allowed to market the products (The Qualitative Study 2014).

Additionally small firms lean and wait for the big firms to develop the dominant design. For small facade window manufacturers the timing of new products is highly important. They do not have the resources to develop new products and compete with the bigger firms over whose product innovation will become the dominant design. The big firms are the ones that define standards of which component to use, and in what window architecture, to what price. Big firms work with multiple product versions before they identify the most appropriate combination that can be produced at a cost effective price. Small firms cannot compete with that. However, they are able to inform their suppliers of the development trends, who then are able to respond to it.

*"Us small firms, we typically await the bigger firms and see where they pull the market to. It is no use that we develop insulation method if the big firms do not if it proves that it becomes too expensive and unnecessary. The big firms define standards for what is being sold and the price. It does not make sense that we invent something that is too expensive and better than other products. The timing must be right. Off course we have to follow the general development but we only have one shot. The big firms are developing 3, 4, 5 generations of wood/alu products that form where they are today. This means that we will be able to purchase some of the products from our suppliers that are similar to the big firms and comply with the standards and way of making windows. We purchase those. It becomes cheaper for us to purchase our suppliers off-the-*



*shelves products which we have to, and want to. We can make some minor adjustments and customize the products. We don't have to think about copyrights.” (Director, Jaette-Byg 2014)*

This makes it difficult for small firms to compete with the bigger facade window manufacturer as they apply a follower and late-mover strategy. This can be illustrated by using an example of applied materials and sustainability: As earlier described, sustainability has not got a grasp in the market but big firms expect it to be in the future. When looking at the list of approved facade window systems<sup>9</sup> and data from the interviews, all the firms that experiment and have introduced windows made up of sustainable materials are big firms. They use composite materials and have developed their own method of transforming recycled, and recyclable, composite materials into innovative frame-profiles (Energivinduer 2011-2013), (The Qualitative Study 2014). The small firms suppliers has not yet done that, but might have to in the future if these solution will become the new dominant design with either BR15, BR20, or through future customer/market demand – now they are not. These products are still newly introduced and diffusion has not yet happened as market demand primarily is focused on price and costs (see page 55 & 64). Dependent on the future diffusion of these inventions, it will be interesting to see how small firms will react on this; are their suppliers capable of, and interested in, developing frame-profiles out of composite materials or is that beyond their business? If that is the case, small firms will hopefully be able to find alternative suppliers. This has major influence on small firms' future competitiveness as they rely on their suppliers to provide those materials. This is the risk when product innovation is anchored externally – it is uncontrollable. Or maybe, the suppliers are able to develop even more novel and valuable products, or the same materials at a more cost competitive price compared to the big firms? For instance, component suppliers has now identified a method of manufacturing wood frame-profiles with incorporated holes, copying the method of plastic windows to obtain low heat loss and insulation through stagnant air in chambers of the frame-profile. However, this study is not able to provide any answers on these matters as the diffusion of different inventions and future scenarios are beyond the scope of this study.

### **The Effect of Knowledge Institutes and Other Relevant Partners**

In general small firms think that knowledge institutions contribute with little value as a collaboration partner, and minor as a source of inspiration and ideas (The Quantitative Survey 2014). This has to do with the implications related to the assembly and approval of new products. As described above, the small firms purchase components at the suppliers, which they then assemble into a final window were they have to decide which sealing to use etc.

*”We purchase the parts by our suppliers. Our role is to make sure that we practically are able to product and make adjustments as for instance sealing strips. In such cases we apply external consultants and engineers for instance TI*

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<sup>9</sup> 'Positivlisten' from Energivinduer. This is a list of all certified windows and their technical specifications (Energivinduer 2011-2013).



*who calculates the energy level. TI helps by providing the right numbers in order for us to be able to produce it. But we make sure that the solutions we purchase can be produced at a reasonable price.”(Sales Manager, PTvinduer 2014)*

The assembly of the new windows initially happens on paper by drawing the final window and specifying the specification of the components and the method of assembly. Based on this, it is possible for experts to calculate the energy values which the manufacturer uses to make the decision on whether to produce the window or not. Any decision will influence the technical performance and functionality of the window. It is important that the manufacturers are aware of especially the windows  $U_w$ - &  $E_{ref}$  value related to the energy performance and receive a CE marking which is a legal requirement for them to market and sell their windows. It is possible for most engineers and such to calculate the  $U_w$  &  $E_{ref}$ -value, but only ‘Teknologisk Institut’ have the legal authority to provide CE markings and to approve the final  $U_w$  &  $E_{ref}$ -value (The Qualitative Study 2014). The calculations and the final documentation are costly and highly resource demanding for small firms.

*”Every time we make something new or modified we have to get a signature and documentation from TI. We can get things tested at our suppliers, but they do not have the signature. It costs us 5.000 – 15.000 to get a product tested and receive the documentation.” (Director, Modum Vinduer 2014)*

In all the small firms, there is no development department. Any innovation or development activity is initiated and executed by the owner of the company who also has many other roles as both being sales person and responsible for administration and development (The Qualitative Study 2014). There is simply no slack time or financial resources to innovation and development, which in many case studies has proven to be highly important (Tidd and Bessant 2011). This also serves as an explanation why small firms have been less active in product innovation within the last three years. It is simply costly to have a big product portfolio. The majority of the firms who have introduced B and even A-classified products are often bigger firms who have a broader product portfolio containing of different products with a variety of technical specifications (C, B, and A- classified) and designs (Energivinduer 2011-2013). Smaller firms typically possess a smaller product portfolio constituting of a few products with more or less the same technical specification (The Qualitative Study 2014). It simply has to do with costs, and it does not make economic sense for small firms considering their limited market size. The institutional environment and need for documentation creates a barrier to innovation. When considering that ‘Teknologisk Institut’ (TI) is one of the nine non-profit ‘Godkendt Teknologisk Service’-institutes (GTS) whose purpose is “(...) to secure innovation and development among Danish companies especially SME’s” (Godkendt Teknologisk Service 2013, 12), it generates wonders why it has to be that expensive, and to what extent TI exploit their monopoly. This study provides no evidence that actually TI provides value for, or



stimulates, innovation at the manufacturers of facade windows across firm size (The Qualitative Study 2014).

### *Upstream Innovation Linkages and Small Firms' Process Innovation Activity*

This section will cover how firms work with process innovation and the effect of innovation linkages. It will draw upon earlier analysis that concluded that small firms are generally not focused on process innovation but emphasise improvements, which seems paradoxical as the industry is characterised by fierce price competition and big firms being highly focused on process innovation.

Small firms are not significantly involved in process innovation as economies of scale are not what small firms in general strive for. However, naturally small firms are focused on reducing waist and optimize the production setup in order to save costs. But that can be done, and are done, internally by consulting with the production staff and test new initiatives such as time used and physical burden of different types of screws e.g. (The Qualitative Study 2014). When changing the components by purchasing new parts to the window, it will have implications for the machines and tools used. Sometimes current machines and tools do not fit with the new materials. In such cases, the small firms contact the supplier of machines or tools who provide input on how to fix it (The Qualitative Study 2014). However, even though that is valuable for the firms and new tools are 'new to the firm', it cannot be considered as a novel process innovation as it does not provide customers any value, but is a prerequisite to produce the windows. Only two out of the interviewed six small firms seek efficiency improvements by investing in new and full-automatic machinery and equipment. Such investment can be defined as process innovations that are new to firm and will bring cost savings through increase of efficiency, thus be defined as an actual innovation. This trend is not widespread among the small firms. This has to do with the fact, that they often develop 'obscure' windows on non-standardized measures and materials why such initiatives bring less value. Among smaller firms, the scope for process innovation and efficiency is simply limited.

The process innovation activity of small firms is primarily targeted the capability of being able to produce the windows with the new components supplied by suppliers and requested by carpenters. Process innovation at small firms are not targeted efficiency and cost leadership but is a prerequisite for the ability the manufacturing of facade windows.

### *The Effect of the Upstream Function on Small Firms Innovation Activity*

Small firms' upstream innovation linkages are limited to deep exploitative ties with usual suppliers. The analysis suggests that small firms rely on their suppliers to develop the components they need. Product innovation projects are managed by the suppliers who involve the small firms, who test and provide suggestions on how to optimize components. Small firms can therefore be defined as passive searching firms not expected to develop novel products or accumulation of current competencies, which means that their development will lead to inertia. Furthermore, they do not mix different ties or apply wide explorative ties. The consequence is that their future development depends on the suppliers' offerings and



innovation activities causing homogeneity in between smaller firms whose products will become (and are<sup>10</sup>) uniform. Denmark is at the forefront of the European development and therefore Danish manufacturers of facade windows, and the Danish market, is where suppliers collect inspiration and input for product innovation. Small firms rely on suppliers' interest in the Danish market as that is what provides suppliers with incentives for product innovation.

An important parameter for firms' innovation activity in general is slack resources. Small firms are not in possession of slack financial- and employee-resources which itself is a barrier for innovation. However, the innovation potential is further reduced as the implementation of new components in the manufacturing process, requires adaptation and adjustments of the manufacturing process which reduces the slack employee resources. Additionally, most product changes require documentation from TI which for small firms is costly. This explains why smaller firms have not introduced B-A-class products, it is simply too costly to expand the product portfolio –not technically impossible at all. The infrastructure structure and need for documentation restrain small firms' eagerness to experiment and produce new products.

### **Big Firms' Innovation Linkages in the Upstream Value System**

Innovation linkages and ties with potential partners in the upstream value system are a mean to process and product innovation (see page 26). As earlier described big firms are engaged in product innovation due to their visions and differentiation growth strategy, while also being engaged in process innovation as cost and price is an important market requirement which forces them to. Furthermore, big firms primary markets are volume markets which enable economies of scale. Optimization of that becomes an important parameter for bigger manufacturing firms.

Big firms have multiple informal and formal ties and innovation linkages in the upstream function, both through deep ties with usual business partners and wide ties with other relevant partners in relation to specific ideas or technological opportunities, general research, and conferences etc. (The Qualitative Study 2014), (The Quantitative Survey 2014). Besides collaborating with firms and organisations within and outside current value system, big firms are involved in formal wide and explorative ties through innovation networks and research programs like 'videnkupon'<sup>11</sup> and industrial PhD's. More than 86% of all manufacturers of facade windows that apply institutional innovation aid schemes and platforms are bigger firms (Center for Strategisk Forskning og Vækst 2014), (see appendix9\*). Furthermore, they apply informal wide ties with new partners and other organisations with the specific resources needed in relation to specific projects (see page 43). It means that big firms, more than small firms, are searching in distant areas for knowledge, inspiration, and technologies which are a proactive and explorative search process meaning that they, more than small firms, are likely

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<sup>10</sup> This is obvious when studying 'Positivlisten' from Energinet.dk (Energivinduer 2011-2013)

<sup>11</sup> 1 year long innovation projects funded with DKK 100.000 but can be extended to 250.000 – 1 million (Ministry of Higher Education and Science 2014).

to identify new potential opportunities and innovations, while being able to collaborate with those organisations.

Big firms' product innovation activity is focused on developing novel architectural innovations through novel components focused on fulfilling the technical requirements, standards, and the sustainable transition through recyclability and environmental issues. At the same time they are focusing on their visions of improving people's joy of life through bringing the benefits of the outdoors indoor (see page 64). This is a complex challenge and requires a proactive innovation search process, awareness, and experiments with new technologies and materials. Opposite to the small firms who are focusing on usual business partners and purchase their innovations through direct suppliers of windows e.g., big firms collaborate with suppliers and manufacturers of raw materials (e.g. glass), and not only suppliers of components specifically related to the facade window industry (Figure 35).

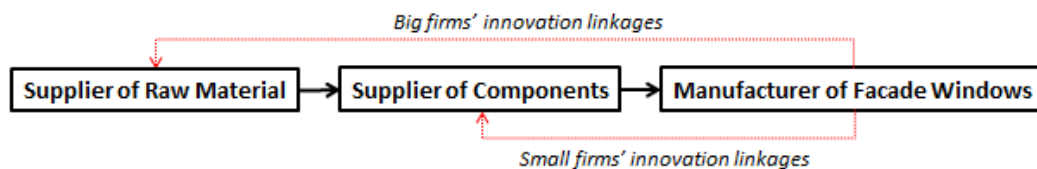


Figure 35 – Firms Innovation Linkages in the Upstream Function

This opens up and widens big firms' opportunities to develop novel modular component innovations. They have the opportunity to mark the development of raw materials which then is transformed into components for the facade window industry. Most organisations (suppliers or not) would be willing to collaborate with the international concerns as they possess vast financial resources. The smallest concern generates a profit of approximately DKK 125 million yearly after tax and the biggest DKK 1 billion, while they individually own more than 15 international firms of window manufacturers (Inwido 2014), (VKR Holding 2014). Hereby big firms are attractive and form a market by themselves, whereas smaller firms only are attractive when forming a unified market. This means that the concerns interest in an innovation itself, and potential sales to that organization alone, is enough for suppliers to be willing to invest in the innovation. Small firms do not have that benefit as only the sum of many small firms provide suppliers the incentives to do so. However, as the figure above illustrates the raw material suppliers are able to sell these improved components directly to suppliers of components to the facade window industry why they might in time get adopted by small firms dependent on the copyrights (Figure 35).

A good example is glass and windows. Where small firms rely on window manufacturers and suppliers to supply energy efficient windows or multiple glass layer systems, big firms collaborate with glass-manufacturers and others, on how for instance to develop invisible coatings integrated within the glass in order to reduce heat loss and increase heat intake.



*"Let's take windows as an example. There is constantly something going on, improvements on window structure etc. to figure out how they work the best. This is something we actively participate in and work with. The composition, and how we optimally can use the building blocks available and develop new ones for instance is coatings something we work with. We bring those components down to the window level and work with all the things that the consumers can't see. We consider how we can get a better inflow of light, how a window look the best etc." (Concept Manager, Dovista 2014)*

The big firms are capable of initiating such a process at the suppliers, thus providing the big firm novel components to experiment with. Such a coating for instance might in the future be able to allow manufacturers of windows to use fewer layers of glass, and still fulfil the energy standards (The Qualitative Study 2014). Hereby the size of the window frame can be reduced which will allow for architectural experiments and novel solutions as an example. If such an innovation becomes the new dominant design, the firm that invented it will have created a radical innovation and will be able to harvest economic benefit as being a first mover. In time, the diffusion of the innovation, or variants of it due to copyright, will happen through the value system and finally might become available for the small firms to use. Therefore, big firms are proactively and constantly seeking to develop new innovations (The Qualitative Study 2014). It is only possible for big firms to engage in collaboration of such an innovation if there is a potential future market for it. The partners in between make an agreement, and formal contract, of how both parties can benefit from it in the future, often by ensuring sales to the supplier and exclusivity to the firm in a limited period.

*"We make a formal agreement and collaboration with a partner and get exclusivity the first couple of years. The agreement also covers volume and what we and they get out of it. It is all about making an agreement where both parties are happy. It is a business potential we collaborate on." (Development Manager, Inwido 2014)*

Big firms and their suppliers have a dynamic relationship that grasps both the 'manufacturer active paradigm' and the 'customer active paradigm'. The firm is able to provide ideas and innovation projects to the supplier, and the supplier uses the firms to develop innovations with.

*"Sometimes we develop ideas and send those to our suppliers. We make a sketch which the suppliers refine. Sometimes it is the other way around. They come with product ideas and they seek a customer to develop with. There are also examples where the supplier brings new ideas and materials." (Development Manager, Inwido 2014)*

This dynamic relationship is based on trust through previous projects, transactions and business communication. The big firms often have formalized relationships with key partners





and just a good collaboration with others (The Qualitative Study 2014). In combination with the more or less formalized deep ties, big firms in general are highly explorative and search for new technology in other industries and technology-fields. However, firms are constrained when it comes to alternative and new materials for the window frames, as it can be a radical change to move from wood to composite production for instance. Therefore there has to be big advantages both concerning production, price, functionality, etc. when seeking new materials. However, these factors do not limit the search process, but simply act as assessment parameters when evaluating different opportunities (The Qualitative Study 2014).

The big firms are vulnerable to the classic explore vs. exploit dilemma. The issue in this case is that their focus on process innovation might influence and restrain their search for novel product innovations (see page 24). However, the negative consequence of this dilemma is reduced by their innovation models and approach with a clear distinction between product and process innovation. Product innovation is anchored in a central development department in the international concern working with product innovation for all the different firms and concentrate on that exclusively (The Quantitative Survey 2014). Hereby, they reduce the dilemma of having to balance between explore and exploit as product innovation is centralized and process innovation decentralized. The individual firms' responsibility is to produce the product and reduce unit costs while the development department's responsibility is to explore for new technical opportunities and technologies.

### **The Effect of the Upstream Function on Big Firms' Innovation Activity**

Big firms' innovation setup with a central development department focusing on product innovation through both architectural innovation and component innovation is an effective setup, which small firms cannot compete with. The big firms' development departments make use of both deep and wide ties, formal and informal, and are due to their size an attractive business- and innovation partner for most organisations. Through the use of these multiple ties, bigger firms can be defined as 'active firms' not focused on inertia, but on renewal of current competencies and resources, and novel product innovations through both new materials and new configuration of materials. They have the opportunity to do so because they are collaborating with supplier of raw-materials before the raw-material are transformed into components ready for actual implementation in window constellations. They thereby actively engage in the definition and design of raw-material to components, and are therefore able to influence requirements to components. Through novel components, the firms are able to experiment with novel architectures as they will have greater opportunity of changes.

In sum, big firms actually have the innovation setup and linkages making them capable of developing disruptive and radical product innovations changing the dominant design and bringing discontinuity. If continuing applying this active innovation seeking approach based on technological opportunities, likely a radical innovation will be developed potentially leading to prospector and first-mover status for the most effective firm(s). However, whether or not this will happen depends on the degree of diffusion determined by the market.



## Conclusion

Small firms are generally less engaged in innovation compared to big firms who are engaged in product, process, and value innovation. Small firms focus on product innovation and can be characterised as passive searching firms, with strong forces of inertia focused on continuation of current product-market paradigm. Big firms on the other hand, are active searching firms at the forefront of development by applying an explorative search process. Small firms are reactive as they are pressured to innovate due to institutional factors whereas big firms proactively seek to develop better products based on market needs. The consequence of the small firms' approach is that it leads to homogeneity and uniform products between small firms, whereas the approach of the big firms enables them to potentially develop radical innovations, changing the dominant design and bringing discontinuity in the industry. Small firms apply a follower and late-mover strategy, while big firms are seeking differentiation, cost leadership, and market penetration strategies, which indicate that small firms are unable to compete against the big firms.

## Big Firms' Innovation Activity and the Effect of Innovation Linkages

Big firms' apply a systematic approach to innovation and advanced innovation models. They couple technological opportunities and upstream innovation linkages, with market needs and innovation linkages in the downstream functions. The innovation process is practically divided in markets and technological development. Novel product innovation is centralised in a development department under the concern, while the individual firm, or sales organisation, is responsible for testing products on markets, and provide input related to market developments. This approach ensures that market knowledge and input is incorporated in the product innovation activity. The coupling and alignment of technical product innovation and market insights potentially leads to value innovation. Simultaneously are they capable of utilizing economies of scale and cost reductions through a continual focus on process innovation. However, due to the current market situation, big firms must put great emphasis on process innovation and efficiency. This affects firms' innovation search process to be focusing on cost and future production efficiency as key assessments criteria, which potentially have a negative effect on product innovation novelty.

In the upstream function of the value chain, big firms apply a mix of different ties and innovation linkages while also being engaged in basic research, through for instance industrial PhD's, which often is focused on innovation with a high degree of novelty. They incorporate both current suppliers and new partners with the specific resources needed in a given project. This is a key characteristic of active searching firms seeking renewal and accumulation of new knowledge. Big firms try to challenge the current product-market paradigm. They integrate 2<sup>nd</sup> tier suppliers (suppliers of raw materials (e.g. glass)), and not only suppliers of existing components (window panes) in the product innovation process. This enables them to mark the development of raw materials, which brings greater opportunities to develop novel components and potentially radical product innovations. Through the development of novel components, big firms are engaged in modular innovation, which increases their capability to



experiment with architectural innovation through new facade window design and standards. Such innovation activity potentially leads to future radical innovation. Big firms and their suppliers adopt a dynamic approach to innovation and grasp both the 'manufacturer active paradigm' and the 'customer active paradigm', as both the big firm and suppliers are active.

In the downstream functions of the value chain, big firms align their product innovation activity through integration of decision makers in the innovation process - especially architects. Big firms make use of ties and innovation linkages with decision makers in order to assess current prototypes and how customers might respond to it. The current market situation restrains innovation as customers emphasise costs over qualitative and functional parameters. The downstream innovation linkages therefore serves as 'delimitation-linkages' ensuring that product innovations fulfill the market requirements, which reduce the scope for highly novel product and value innovation. Nevertheless, these innovation linkages are important for firms in order to potentially develop value innovations by keeping abreast with market development. Despite for the limited market incentives, findings from this study indicates that big firms are actively involved in novel product innovations driven by strategic objectives focused on differentiation, visions of improving people's joy of life, and a proactive approach to market trends. Sustainability has become an important parameter in other industries, and big firms believe that eventually sustainability will become important parameters and requirements for facade windows. As a result, they have already begun developing more sustainable products.

The current market situation characterized by renovations and traditional public tenders has resulted in fierce price competition, why big firms put great emphasis on process innovation and cost optimization. This affects firms' innovation search process to be focusing on cost and future production efficiency as key assessments criteria, which potentially have a negative effect on product innovation search mechanisms. Additionally it hinders diffusion of inventions as novel innovations simply are not required and correspond to current market needs. Big firms innovation activity and rate of introduced innovations are lowered as a consequence of this.

### **Small Firms' Innovation Activity and the Effect of Innovation Linkages**

Small firms' innovation activity is based on simple innovation models inspired by the technology-push paradigm. Their approach to innovation is based on technology advancements and opportunities, needed in order for them to fulfill the new energy standards. In the innovation process customers are not integrated, which means that small firms does not seek value innovations based on market needs. The innovation approach applied is a simple linear process where the supplier develops components, which the small firms adopts in current window architectures and pass on to the markets. Small firms emphasise product innovation over process and value innovation as they are forced to develop new products due to the coming energy standards and individual orders. The new energy standards will become effective as of 2015, and current products need to be modified to fulfil those. In order to cope



with the standards, small firms make use of their deep exploitative ties with current suppliers of components and rely on them to develop the materials needed.

In the upstream value chain, small firms engage in simple co-product innovation projects managed by the supplier. The innovation activity is anchored at the supplier who is working with component innovation in order for the small firms (their customers) to be able to fulfil the new energy standards. Small firms' role is to provide inspiration for product innovation, and test the prototypes developed by the suppliers. They provide suggestion on improvements related to the use of the components in the assembly of the final facade window. As such, small firms' input leads to incremental innovation. The innovation is anchored at the supplier who is responsible for the actual innovation and development of novel components leading to modular innovation. Such innovation is a prerequisite for small firms to fulfil the new energy standards. In the product innovation process, small firms awaits the big firms to determine the dominant design and industry standards, which they then seek to adopt and lean on. The approach of the small firms causes homogeneity and uniformity in between small firms, as they all make use of the same solutions provided by suppliers of facade window components.

In the downstream value chain the market demand provides no incentives to product innovation as current products already fulfil, and even supersede, customers' requirements. The scope for innovation among small firms is lowered to only consist of incremental product or component innovation without it bringing cost increases. Architectural innovations are hindered as customers prioritize similar windows as already implemented. The only ties and innovation linkages small firms have to customers are based on the direct sales link to private consumers. They hereby benefit through open information sources with customers and potentially reduce the risk of overseeing coming market trends. However, the study provides no indications that small firms proactively seeks to (re)define new market needs through innovation as no such input is incorporated in the innovation activity.

Only a minority of small firms are engaged in novel process innovation whereas most of their process innovation efforts are process improvements focused on adaptation of new components in the manufacturing process. These process improvements are interconnected with suppliers' product innovation and specific customer orders. Process improvement activities are primarily based on the capability to be able to produce facade windows by using new components, and carpenters bringing specific customer orders with special requests on materials and sizes. Such process improvements do not lead to cost reductions and efficiency, but merely the manufacturing of the product. Small firms typically produce non-standardized windows of low volume why there is only little scope for process innovation. Economies of scale are not achievable for small firms.

## Recommendations

The following recommendations are targeted the trade organisations and especially Dansk Byggeri who focus on innovation, growth, and firm performance in the facade window industry. The recommendations provide inspiration on how Dansk Byggeri potentially can increase innovation and growth among firms in the industry.

### **Recommendation 1: Support Small Firms' Export Activity**

Small firms are caught in a domestic 'small firm – small market vacuum' which seems difficult to escape. Based on this study, small firms are not able to compete with big firms on the B2B market, and any other volume market attractive to big firms, while not being able to challenge big firms through innovation. This blocks the opportunities of domestic market penetration and growth, as they are limited to current niche-markets. The best option for profit and growth is to stimulate market demand and thereby increase the market size (recommendation 3) and to support small firms' export activity. Trade organisations should bridge the road to especially Norway, Sweden, Germany, and other relevant export markets, and prepare and support small firms in this activity. This should be based on a study of which support mechanisms firms require which then should be developed.

### **Recommendation 2: Institutionalize Public Tenders and Enhance Innovation among Big Firms**

Public developers and tenders are the biggest market for many firms through both development and renovations, and can be designed to support innovation. Typical tenders are often focused on price and costs over qualitative parameters, which lower the opportunity and incentives for innovation. Different cases reveal that, by rethinking tender processes and develop customized tenders based on for instance the competitive dialogue form of procurement, innovation can happen among the involved partners. Findings from this study suggest that collaboration between architects, engineers, and facade window manufacturers might create synergies potentially leading to novel innovations. This should be supported in the tenders. Other analysis suggests that the reason why traditional tenders are often applied is basically due to risk averse and unprepared developers. Therefore, there should be developed an institutional system that support innovation enhancing public tenders. This system should provide guidance and support for public developers in the planning and carrying out of those tenders. The objective of this system should focus on knowledge sharing, developing and diffusion of best practice, legal support, organization, and other important elements needed. It is not the objective to intervene in firms' innovation activity, but to support it and provide incentives, and the platform for it among different partners. Result from this study indicates that firms themselves are applying appropriate innovation approaches which there are no point in interfering with.

### **Recommendation 3: Stimulate B2C Renovation Market Activity**

This study clearly concludes that the market is a central barrier for innovation, growth, and firm performance. The study indicates that innovation is not the key mean to unlock the



situation of inferior market demand not stimulating innovation and creating growth. The key issue is costs! Cost is the most important choice criteria and greatly affects demand which can be stimulated by institutional factors and schemes. It is expensive to do energy renovations and the financial support schemes 'BoligJobordningen' stimulate renovation among private consumers. This financial support scheme will discontinue with the end of 2014 and is expected to create a drop in the market. It is important for the market activity that such a financial support scheme is available as it reduces the price consumers have to pay, thus stimulating demand. First of all, the trade organisations should find investments to continue such financial schemes. However, the form of the scheme can be rethought. Doing energy renovations, private consumers have different alternatives; changing windows, improvement of attic-, floor-, and facade insulation etc., which creates competition among them. In order to reduce the competition, there can be developed different programs and solution models containing different methods and related economic support and/or methods of funding. A suggestion is that future financial contributions are based on the energy saving percentage and effectiveness of the energy renovation initiative in the house. This would be consistent with the political focus. There should also be thought of alternative funding methods which create synergies with other initiatives. As an example, it has become a requirement that all sold houses have HPFI relays installed which means that private house sellers must invest in such a system if they do not have it already. The cost of this replacement could be deducted from the cost of the energy renovation as one example. Another suggestion is to combine the funding with the current smart grid transition. Key element of the smart grid electricity network is that electricity consumption happens when renewable energy<sup>12</sup> is available. This will be controlled through intelligent IT soft- and hardware installed in private homes, which can shut of electrical devices when renewable energy is not available. A key barrier in this transition is the implementation of such IT soft- and hardware in private homes which is a requirement. This could likewise be deducted from the cost of doing energy renovations. The implementation of this will have many positive side effects and benefit all firms on the B2C market which assumable makes it a reasonable public investment:

- ✓ The private consumers will save money thus increase consumer spending in general.
- ✓ It is of significant importance in the smart grid transition and will have direct positive environmental consequences.
- ✓ It will contribute positively to the political objective of Co2 neutrality in 2050.
- ✓ It will give rise to other business opportunities in relation to smart grid etc.

In order to increase the effectiveness of this initiative, it should be combined with marketing and education of users, focusing on creating awareness and dissemination of the benefits of these activities.

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<sup>12</sup> Renewable energy sources: Wind, solar, biomass, etc.



#### **Recommendation 4: Question the Market Infrastructure**

As described in recommendation 3, cost is a vital parameter. Findings from this study indicates that the institutional structure composing of different labelling schemes, need for documentation, etc., increase firms' operating costs and reduce the already scarce resources needed for innovation. Logically these costs affect the final prices and demand negatively. 'Teknologisk Institut' (TI) is managing the CE-marking among others, which is required for sale of facade windows and most building material which especially for small firms, is a barrier resulting in minor product portfolios and product introductions. TI is a non-profit GTS-institute which means that its overall purpose is to attend to SME's interests and underpin growth and innovation among them. The GTS-association<sup>13</sup> was provided totally DKK 850 million in the period of 2013-2015 to conduct application-oriented innovation projects called 'Resultatkontrakter' (GTS 2013). In the period from 2010-2012 TI alone received DKK 350 million in such funding (Teknologisk Institut 2012). However, findings from this study reveal that manufacturers of facade windows find TI to be of little value in their innovation activities. Combined with the conclusion that both firm categories actually handle innovation very well independently, give rise to the question of whether or not these financial resources could have been applied better. Instead of being used in innovation projects creating new knowledge, these resources could have been used to cover the documentation and consultancy costs which the firms meet once they involve TI. A suggestion is therefore to examine the effect of the 'resultatkontrakter' and the GTS-institutes innovation projects, and evaluate whether or not these initiatives are needed and provide value for firms in other industries. If not, an alternative could be to more or less freely distribute the DKK 850 million among the Danish firms who need it, or by making X amount of cost-free consultancy services available, which seem to be an appropriate approach for small manufacturers of facade windows. Why should application-oriented research be institutionalized and does the value of the conducted research supersede the value of the alternatives?

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<sup>13</sup> There exists 9 GTS-institutes as TI in Denmark.

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## Appendix 1: The Quantitative Study

Dette spørgeskema er udviklet i samarbejde med Danske Byggematerialer og specialestuderende ved Aalborg Universitet, Jesper Flackeberg (studieretning: Innovationsledelse og Værdikæder).

Det overordnede formål med projektet er, at undersøge udvikling og innovation i vinduesindustrien.

Det tager ca. 5-10 min. at gennemføre undersøgelsen, og alle besvarelser vil blive behandlet anonymt.

Du er naturligvis velkommen til at kontakte mig ved evt. spørgsmål eller generelle kommentarer.

På forhånd tak fordi du ønsker at deltage i undersøgelsen!

Mvh

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2721 7966

De fig. 4 spørgsmål er generelle spørgsmål om virksomheden.

Virksomheden skal i dette spørgeskema forstås som en separat enhed, uanset om den er en del af en større koncern el. lign.

### Virksomhedens navn

---

### Geografisk placering (vælg evt. flere)

- (1)  Region Nordjylland
- (2)  Region Midtjylland
- (3)  Region Syddanmark
- (4)  Region Sjælland
- (5)  Region Hovedstaden
- (6)  Udland
- (7)  Andet
- (8)  Ved ikke

### Antal ansatte i virksomheden

- (1)  1-24
- (2)  25-99
- (3)  100-199
- (4)  +200
- (5)  Ønsker ikke at oplyse
- (6)  Ved ikke

### Ejerforhold

- (1)  Familieejet
- (2)  Privatejet
- (3)  En del af en større national koncern
- (4)  En del af en større international koncern
- (5)  Ønsker ikke at oplyse
- (6)  Ved ikke
- (7)  Andet \_\_\_\_\_



**Årlig omsætning for virksomheden**

- (1)  0-9,9 mio. kr.
- (2)  10-24 mio. kr.
- (3)  25-74 mio. kr.
- (4)  75-149 mio. kr.
- (5)  +150 mio. kr.
- (6)  Ønsker ikke at oplyse
- (7)  Ved ikke

Der kan i visse tilfælde være forskel ift. hvem der betaler produktet (kunden), og hvem der beslutter hvilket produkt der skal indkøbes (beslutningstager). De næste 2 spørgsmål vedrører forskellen mellem virksomhedens kunder og beslutningstageren.

*Eksempel: Ved renoveringsopgaver kan kunden være en privat forbruger, mens beslutningen om hvilke vinduer der indkøbes er håndværkerens.*

**Hvem er virksomhedens typiske direkte kunde? (vælg gerne flere svar)**

- (1)  Private forbrugere
- (2)  Trælast eller anden grossist
- (3)  Håndværkere
- (4)  Arkitekter/entreprenører eller lign.
- (5)  Det offentlige
- (6)  Større entreprisopgaver
- (7)  Ønsker ikke at oplyse
- (8)  Ved ikke

**Du bedes vurdere den procentvise fordeling af, i hvor mange tilfælde beslutningstager er enten:**

Summen af tallene skal tilsammen udgøre 100%

- Privat forbruger \_\_\_\_\_
- Trælast eller anden grossist \_\_\_\_\_
- Håndværker \_\_\_\_\_
- Arkitekter, entreprenør el. lign. \_\_\_\_\_
- Det offentlige \_\_\_\_\_
- Andet \_\_\_\_\_

De næste 6 spørgsmål omhandler hvilke udviklings- og innovationsaktiviteter virksomheden har haft i gang indenfor de seneste 3 år.

Der tages udgangspunkt i flg. kategorier:  
 Produkter = vinduesprodukter  
 Processer = de aktiviteter der er forbundet med fremstillingen af produkterne  
 Produktionsfaciliteter = maskiner, lager, el. lign.

**Har virksomheden udviklet nye produkter indenfor de seneste 3 år (også selvom de ikke blev en kommerciel succes)?**

- (1)  Ja



- (2)  Nej  
(3)  Ved ikke

Har virksomheden introduceret væsentlige forbedringer på eksisterende produkter indenfor de seneste 3 år (også selvom de ikke blev en kommerciel succes)?

- (1)  Ja  
(2)  Nej  
(3)  Ved ikke

Har virksomheden udviklet nye processer og/eller købt nye produktionsfaciliteter indenfor de seneste 3 år?

- (1)  Ja  
(2)  Nej  
(3)  Ved ikke

Har virksomheden introduceret væsentlige forbedringer på eksisterende processer indenfor de seneste 3 år?

- (1)  Ja  
(2)  Nej  
(3)  Ved ikke

Er virksomheden indenfor de seneste 3 år begyndt på, eller har forsøgt, at sælge til nye markeder/kundesegmenter i Danmark (f.eks. direkte salg til kunder, håndværkere el. lign.)?

- (1)  Ja  
(2)  Nej  
(3)  Ved ikke

Har virksomheden eksporteret, eller forsøgt at eksportere, til nye udenlandske markeder indenfor de seneste 3 år?

- (1)  Ja  
(2)  Nej  
(3)  Ved ikke

Hvilke udenlandske markeder? (vælg gerne flere svar)

- (1)  Norge  
(2)  Sverige  
(3)  Tyskland  
(4)  England  
(5)  Resten af EU  
(6)  Resten af verden

Hvilke anledninger var udslagsgivende for forbedringen af eksisterende produkter? (vælg gerne flere svar)

- (1)  Nye markedsbehov  
(2)  Nye markedsmuligheder  
(3)  Nye tekniske muligheder  
(4)  Nye medarbejdere/ledere  
(5)  Det er sket som en naturlig forlængelse af virksomhedens specielle viden og kompetencer  
(6)  Nye offentlige reguleringer/krav



- (7)  Støtteordninger til udviklingsprojekter
- (8)  På grund af øget konkurrence
- (9)  Tilfældighed
- (10)  Andet \_\_\_\_\_
- (11)  Ved ikke

**Hvilke anledninger var udslagsgivende for udviklingen af nye produkter? (vælg gerne flere svar)**

- (1)  Nye markedsbehov
- (2)  Nye markedsmuligheder
- (3)  Nye tekniske muligheder
- (4)  Nye medarbejdere/ledere
- (5)  Det er sket som en naturlig forlængelse af virksomhedens specielle viden og kompetencer
- (6)  Nye offentlige reguleringer/krav
- (7)  Støtteordninger til udviklingsprojekter
- (8)  På grund af øget konkurrence
- (9)  Tilfældighed
- (10)  Andet \_\_\_\_\_
- (11)  Ved ikke

**Hvad har været årsag til udviklingen eller indkøbet af de forbedrede processer og/eller produktionsfaciliteter? (vælg gerne flere svar)**

- (1)  Et ønske om at nedbringe omkostninger
- (2)  Mulighed for at forbedre kvalitet eller producere nye produkter
- (3)  Et ønske om kontinuerlige forbedringer
- (4)  Det har været en forudsætning for fremtidig profit og overlevelse
- (5)  Tilfældighed
- (6)  Ved ikke

**Hvordan foregik udviklingsprocessen af det forbedrede eller nye produkt? (vælg gerne flere svar)**

- (1)  Vi stod selv for udviklingen
- (2)  Vi samarbejdede med vores leverandører
- (3)  Vi samarbejdede med vores kunder
- (10)  Vi samarbejdede med beslutningstager
- (4)  Vi samarbejdede med videninstitutioner (universiteter, Teknologisk Institut, konsulenter eller andre)
- (5)  Vi samarbejdede med konkurrenter
- (6)  Vi fandt nye samarbejdspartnere med de specifikke kompetencer og ressourcer vi havde brug for
- (7)  Andet \_\_\_\_\_
- (8)  Ønsker ikke at svare
- (9)  Ved ikke

**Hvordan foregik udviklingsprocessen af de forbedrede eller nye processer og/eller produktionsfaciliteter? (vælg gerne flere svar)**

- (1)  Vi stod selv for udviklingen
- (2)  Vi samarbejdede med vores leverandører
- (3)  Vi samarbejdede med vores kunder
- (11)  Vi samarbejdede med beslutningstager



- (4)  Vi samarbejdede med videninstitutioner (universiteter, Teknologisk Institut, konsulenter eller andre)
- (5)  Vi samarbejdede med konkurrenter
- (6)  Vi fandt nye samarbejdspartnere med de specifikke kompetencer og ressourcer vi havde brug for
- (7)  Vi indkøbte det vi havde brug for
- (8)  Andet \_\_\_\_\_
- (9)  Ønsker ikke at svare
- (10)  Ved ikke

I næste spørgsmål bedes du vurdere på en skala fra 1-5, i hvor høj grad forskellige aktører er relevante at samarbejde med i relation til udviklingsprojekter.

**I hvor høj grad er kunderne relevante/vigtige ift.:**

	1 (lidt)	2	3	4	5 (meget)	Ved ikke
At indhente ideer, inspiration eller viden til nye eller forbedrede produkter	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>	(5) <input type="checkbox"/>	(6) <input type="checkbox"/>
Som samarbejdspartner i forbindelse med forbedringer af eksisterende produkter	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>	(5) <input type="checkbox"/>	(6) <input type="checkbox"/>
Som samarbejdspartner i forbindelse med udviklingen af nye produkter	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>	(5) <input type="checkbox"/>	(6) <input type="checkbox"/>
I forbindelse med forbedring af processer og/eller produktionsfaciliteter	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>	(5) <input type="checkbox"/>	(6) <input type="checkbox"/>

**I hvor høj grad er beslutningstagere (f.eks. arkitekter, rådgivere, håndværkere) relevante/vigtige ift.:**

	1 (lidt)	2	3	4	5 (meget)	Ved ikke
At indhente ideer, inspiration eller viden til nye eller forbedrede produkter	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>	(5) <input type="checkbox"/>	(6) <input type="checkbox"/>
Som samarbejdspartner i forbindelse med forbedringer af eksisterende produkter:	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>	(5) <input type="checkbox"/>	(6) <input type="checkbox"/>
Som samarbejdspartner i forbindelse med udviklingen af nye produkter	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>	(5) <input type="checkbox"/>	(6) <input type="checkbox"/>
I forbindelse med forbedring af processer og/eller produktionsfaciliteter	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>	(5) <input type="checkbox"/>	(6) <input type="checkbox"/>

**I hvor høj grad er videninstitutioner (universiteter, Teknologisk Institut, konsulenter eller andre) relevante/vigtige ift.:**

	1 (lidt)	2	3	4	5 (meget)	Ved ikke
At indhente ideer, inspiration eller viden til nye eller forbedrede produkter	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>	(5) <input type="checkbox"/>	(6) <input type="checkbox"/>
Som samarbejdspartner i forbindelse med forbedringer af eksisterende produkter	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>	(5) <input type="checkbox"/>	(6) <input type="checkbox"/>
Som samarbejdspartner i forbindelse med udviklingen af nye produkter	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>	(5) <input type="checkbox"/>	(6) <input type="checkbox"/>
I forbindelse med forbedring af processer og/eller produktionsfaciliteter	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>	(5) <input type="checkbox"/>	(6) <input type="checkbox"/>
Indkøb af nødvendig teknologi og/eller viden	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>	(5) <input type="checkbox"/>	(6) <input type="checkbox"/>

**I hvor høj grad er konkurrerende virksomheder relevante/vigtige ift.:**

	1 (lidt)	2	3	4	5 (meget)	Ved ikke
At indhente ideer, inspiration eller viden til nye eller forbedrede produkter	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>	(5) <input type="checkbox"/>	(6) <input type="checkbox"/>
Som samarbejdspartner i forbindelse med forbedringer af eksisterende produkter	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>	(5) <input type="checkbox"/>	(6) <input type="checkbox"/>
Som samarbejdspartner i forbindelse med udviklingen af nye produkter	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>	(5) <input type="checkbox"/>	(6) <input type="checkbox"/>
I forbindelse med forbedring af processer og/eller produktionsfaciliteter	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>	(5) <input type="checkbox"/>	(6) <input type="checkbox"/>
Indkøb af nødvendig teknologi og/eller viden	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>	(5) <input type="checkbox"/>	(6) <input type="checkbox"/>

**I hvor høj grad er virksomheder eller organisationer fra andre brancher relevante/vigtige ift.:**

	1 (lidt)	2	3	4	5 (meget)	Ved ikke
At indhente ideer, inspiration eller viden til nye eller forbedrede produkter	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>	(5) <input type="checkbox"/>	(6) <input type="checkbox"/>

	1 (lidt)	2	3	4	5 (meget)	Ved ikke
produkter						
Som samarbejdspartner i forbindelse med forbedringer af eksisterende produkter	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>	(5) <input type="checkbox"/>	(6) <input type="checkbox"/>
Som samarbejdspartner i forbindelse med udviklingen af nye produkter	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>	(5) <input type="checkbox"/>	(6) <input type="checkbox"/>
I forbindelse med forbedring af processer og/eller produktionsfaciliteter	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>	(5) <input type="checkbox"/>	(6) <input type="checkbox"/>
Indkøb af nødvendig teknologi og/eller viden	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>	(5) <input type="checkbox"/>	(6) <input type="checkbox"/>

Næste spørgsmål omhandler oplevede udfordringer og muligheder for innovation.

**Hvilke udfordringer oplever du ift. innovation i virksomheden? (vælg gerne flere svar)**

- (1)  Usikkerhed om markedet
- (2)  Information om teknologier
- (3)  Økonomiske ressourcer
- (4)  Medarbejder ressourcer
- (5)  Manglende samarbejdspartnere
- (6)  En uklar proces og/eller rollefordeling
- (7)  Der mangler og nogle at dele viden og/eller ideer med
- (12)  Der mangler steder at finde samarbejdspartnere (f.eks. innovationsnetværk)
- (8)  Lovgivning
- (9)  Der er ikke behov for udvikling
- (10)  Andet \_\_\_\_\_
- (11)  Ved ikke

**Hvilke parametre bidrager til innovation og generelle udviklingsaktiviteter? (vælg gerne flere svar)**

- (1)  Markedet og virksomhedens kendskab til markedet
- (2)  Nye teknologier og tekniske muligheder
- (3)  Virksomhedens kompetencer
- (4)  Klar proces og rollefordeling
- (5)  Nye offentlige reguleringer/krav
- (6)  Støtteordninger til udviklingsprojekter
- (7)  Bygningsreglementet/lovkrav/standarder
- (8)  Andet \_\_\_\_\_
- (9)  Ved ikke

**Hvor mange konkurrenter har I på jeres primære produkter?**

- (1)  1-2
- (2)  3-5



- (3)  5-7
- (4)  8-10
- (5)  +11
- (6)  Ved ikke

**Hvor intens oplever du priskonkurrencen på en skala fra 1-5?**

- (1)  1 (lav)
- (2)  2
- (3)  3
- (4)  4
- (5)  5 (høj)
- (6)  Ved ikke

**Hvor store krav stiller kunderne til produkternes tekniske egenskaber (f.eks. energikrav)?**

- (1)  1 (lav)
- (2)  2
- (3)  3
- (4)  4
- (5)  5 (høj)
- (6)  Ved ikke

**Hvor store krav stiller kunderne til jeres produkts design og udseende?**

- (1)  1 (lav)
- (2)  2
- (3)  3
- (4)  4
- (5)  5 (høj)
- (6)  Ved ikke

Afslutningsvis bliver du bedt om at udfylde kontaktoplysninger samt tage stilling til, om jeg evt. må kontakte dig for yderligere oplysninger.

**Dit navn**

---

**Stilling**

---

**Må jeg kontakte dig for yderligere oplysninger?**

- (1)  Ja
- (2)  Nej

**Ønsker du at modtage en afrapportering over den statistiske undersøgelse tilsendt pr. e-mail som PDF?**

- (1)  Ja
- (2)  Nej



Ønsker du at modtage den endelige rapport tilsendt pr. e-mail som PDF?

- (1)  Ja  
(2)  Nej

## Introduction

The questionnaire is targeted firms within the facade window industry and was send out to members of the major Danish construction and building material industry organisation; Dansk Byggeri.

The questionnaire has been developed by Jesper Stentoft Flackeberg in collaboration with Dansk Byggeri. The design of the survey, hereunder questions and formulation of questions on innovation issues, correspond to the international standard for quantitative innovation surveys and methods described in the Oslo Manual.

The questionnaire was distributed via email on the 27/3 2014 followed by two reminders on respectively the 2/4 and the 8/4. In total, the questionnaire was distributed to 45 firms of which 15 completed the survey thereby constituting a response rate of 33%. It is estimated that there exist approximately 50-60 manufacturers of facade windows. This survey has therefore been distributed to the majority of firms in the industry. The survey does not take international firms somehow established in Denmark or exporting to Denmark into consideration.

The survey was ended the 11/4 with an email notification to all who received the initial distribution email. All respondents have been offered to receive either the results from the survey and the final report.

These pages will elaborate and discuss the results of the questionnaire based only on the firms who has filled out the questionnaire, subsequently referred to as the 'respondents'.

## Description of the respondents

The respondents represents the general industry demographic well as the majority of the manufactures of facade windows are geographically located in Jutland either being minor firms with less than 99 employees or major firms with more than 200 employees (Figure 36 & Figure 37). The size of the firm is categorised in four categories based on number of employees in the following intervals: 1-24, 25-99, 100-199, and +200. This categorisation differs from the 'SME'-categorisation which is based on three intervals where small firms are those with less than 25 employees, medium sized enterprises employs 25-250 while big firms employs more than 250 employees. Had the survey been based on this categorisation, the vast majority of the respondents, most likely would have been fallen under the medium sized category. In order to ensure more accurate data, the category is based on the four categories illustrated below.

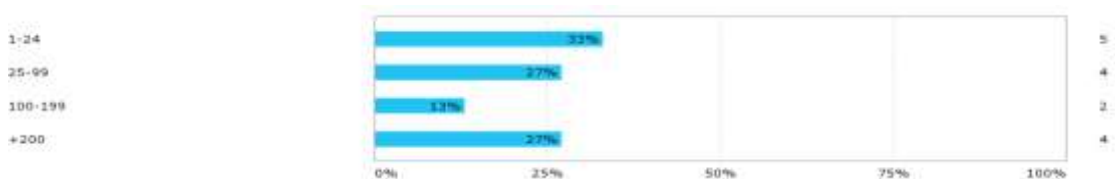


Figure 36 – Number of Employees

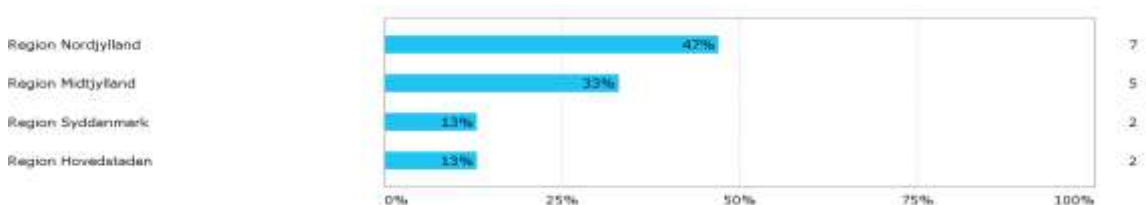


Figure 37 – Geographical Location of the Firm

As the figure below illustrates, the majority of the firms in Region Nordjylland are smaller firms with less than 25 employees (43%) or more than 200 (29%). The majority of the firms in Region Midtjylland are big firms with more than 200 employees (40%) while the rest is equally distributed between the other three categories. Region Syddanmark stands out as being the only region dominated by firms with between 25-99 employees. Firms in the capital region are similar as Region Nordjylland, and divided between small or big firms.

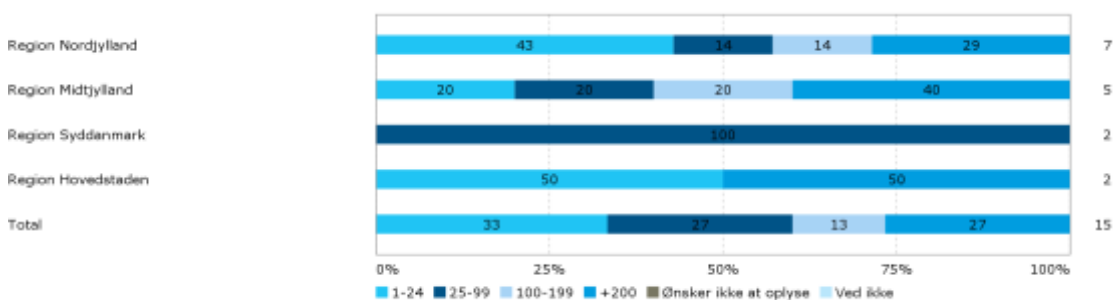


Figure 38 – Number of Employees Crossed with Geographical Location

The firms with the biggest averagely turnover is firms located in Region Midtjylland with the other regions being more or less homogeneous. The majority of firms in Region Midtjylland are firms with annual revenue of more than 150DKK million while the vast majority of firms in the other regions have an annual revenue below 74DKK million (Figure 39). By comparing Figure 38 and Figure 39, it seems that bigger firms with more than 100 employees earn more than

150DKK million a year while firms with less than 100 employees earn less than 74DKK million a year.

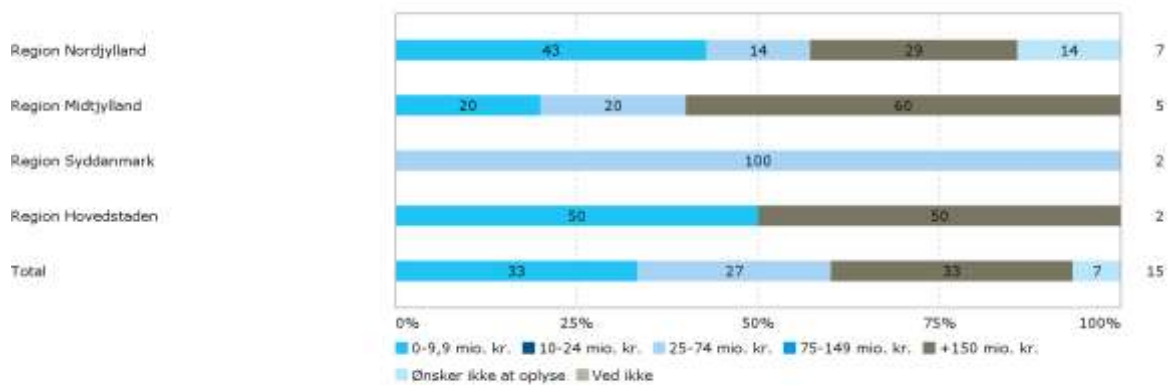


Figure 39 –Yearly Revenue Crossed with Geographical location

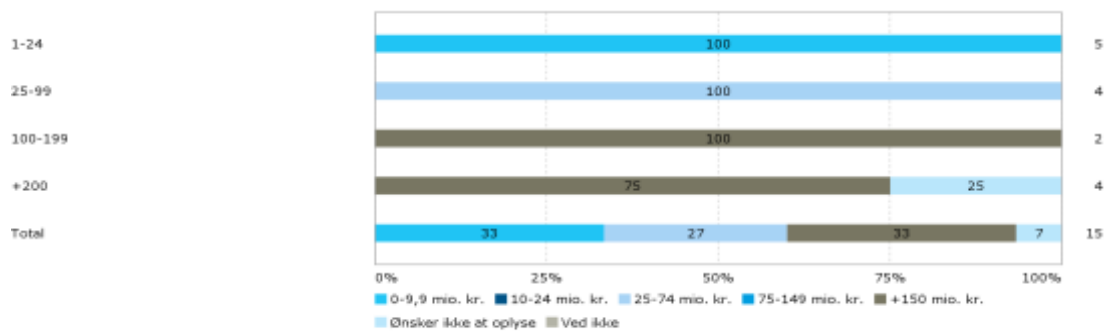


Figure 40 – Number of Employees Crossed with Yearly Revenue

It is obvious that the number of employees correspond to greater revenue which seems logical. In the facade window industry, there seems to be three groupings of companies;

1. Big firms with more than 100 employees earning more than 150DKK million a year.
2. Medium sized firms with 25-99 employees earning between 25-74 million a year.
3. Small sized firms with less than 24 employees earning less than 10 million a year.

The figure below illustrates, that the big firms are typically owned by an international concern while smaller firms are privately owned.

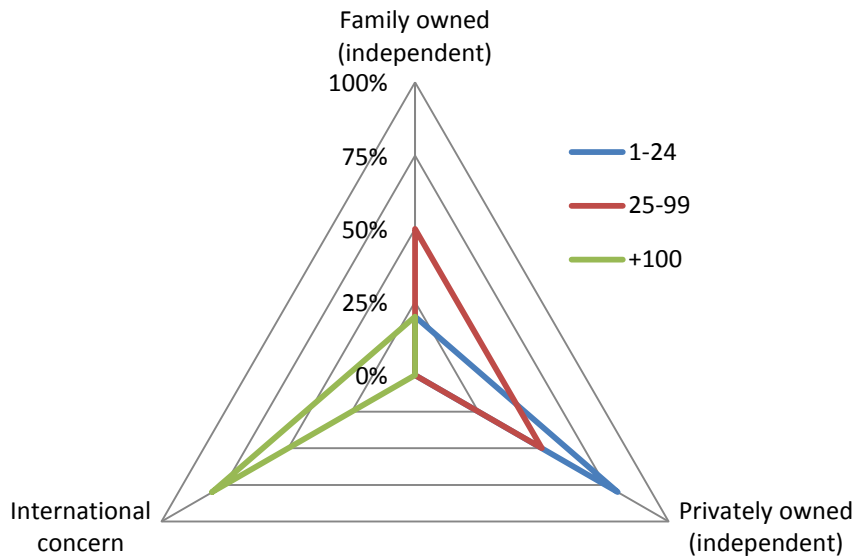


Figure 41 – Size and Ownership

By summarising geography, number of employees, ownership, and yearly revenue, the following categorization of the firms in the facade windows industry can be made:

Category 1 – Big firms	Category 2 – Medium sized firms	Category 3 – Small sized firms
<b>Ownership:</b> International concern. <b>Employees:</b> +100 <b>Yearly revenue:</b> >150DKK million. <b>Location:</b> North- and mid-Jutland and the capital region.	<b>Ownership:</b> Private or family owned. <b>Employees:</b> 25-99 <b>Yearly revenue:</b> 25-74 million. <b>Location:</b> Region South Denmark.	<b>Ownership:</b> Privately owned <b>Employees:</b> <24 <b>Yearly revenue:</b> <9,9 million. <b>Location:</b> North-Jutland and the capital region.

Table 16 – Categorisation of Firms in the Facade Window Industry

The following analysis will be based on the categorization of the firms presented in the table above (Table 16). The size of the firm will be the typical indicator and used to separate the different categories.

## The Respondents and the Market

When describing the market, there can be distinguished between customers and decision makers. It is not always the end customer who is the decision maker and opposite. As an example, a private house owner has decided to replace his facade windows. He can be considered as the customer. However, the carpenter might be the decision maker on which brand of windows to purchase, as he might have some business agreements or preferences. In





some cases it is the carpenters choice which windows the customer purchases. If the purchase of the windows goes through the carpenter, the carpenter will act as the decision maker.

The most frequent direct *customer* is carpenters and lumberyards/wholesalers. These two are the only customers who are applied by all firm-categories. The customers of the small firms are typically private consumers while carpenters and lumberyards/wholesalers are the medium sized firms' customers, and the customers of the big firms typically are architects, developers, project contracts, and the public sector with projects being the biggest customer (Figure 42).

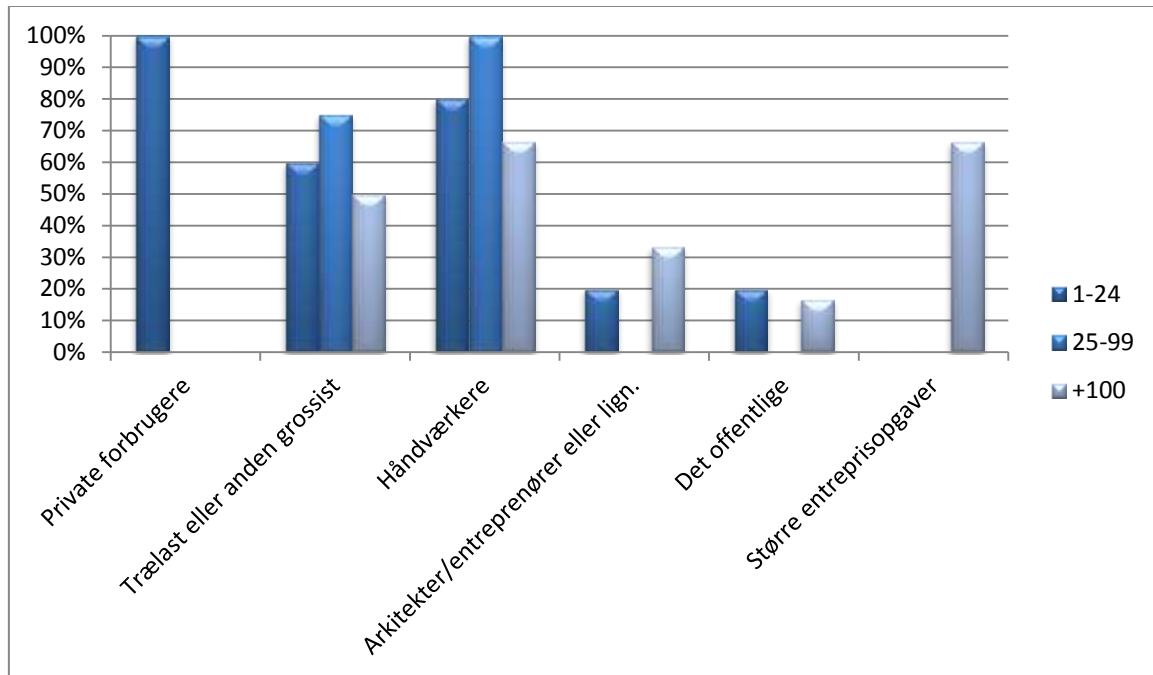


Figure 42 – Firm Category and Direct Customers

Decision makers:

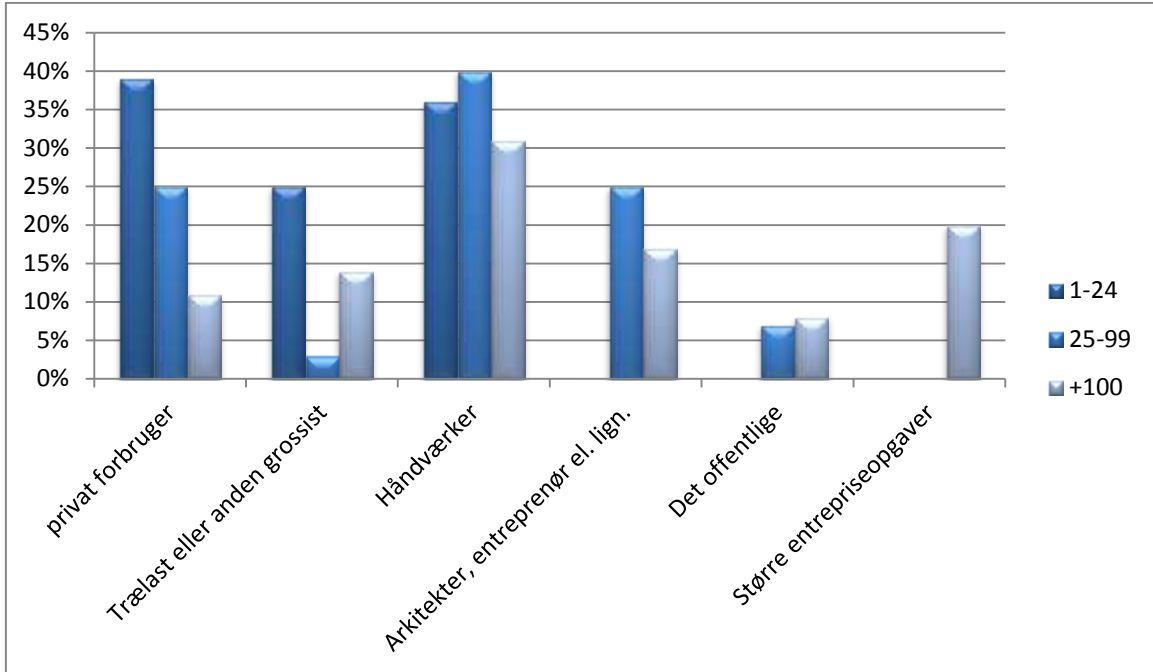


Figure 43 - Firm Category and Decision Makers

### Competitors

The vast majority of the firms have more than 11 direct competitors. No firms have less than three competitors why the amount of competitors in general can be evident of a competitive market.

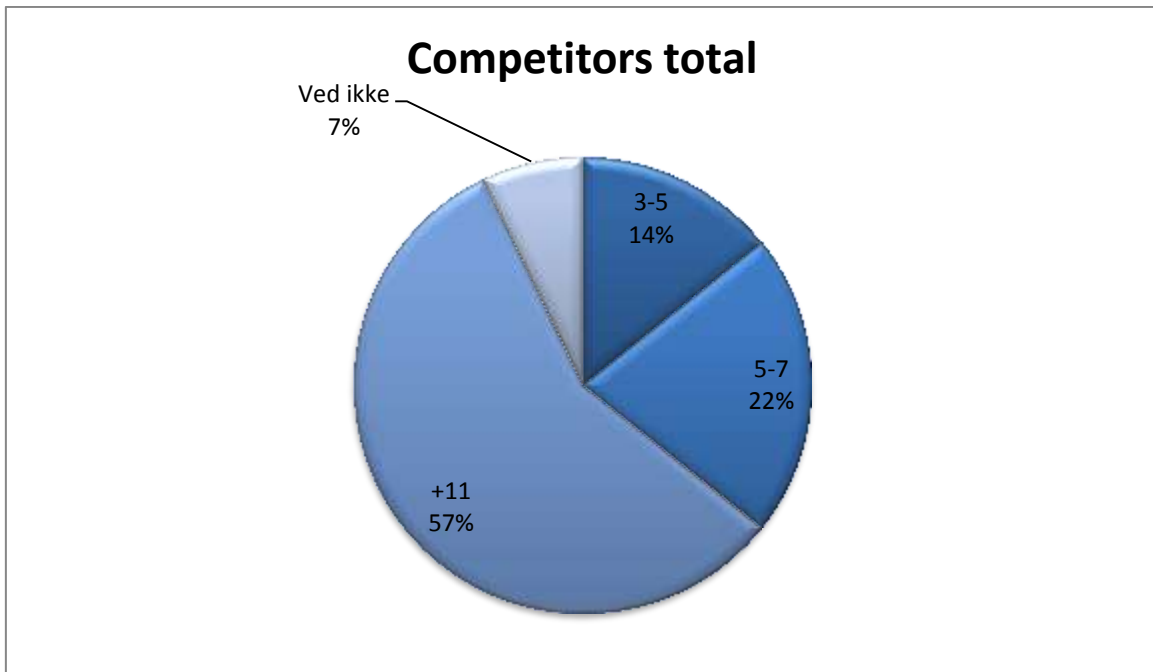


Figure 44 - Competitors In General

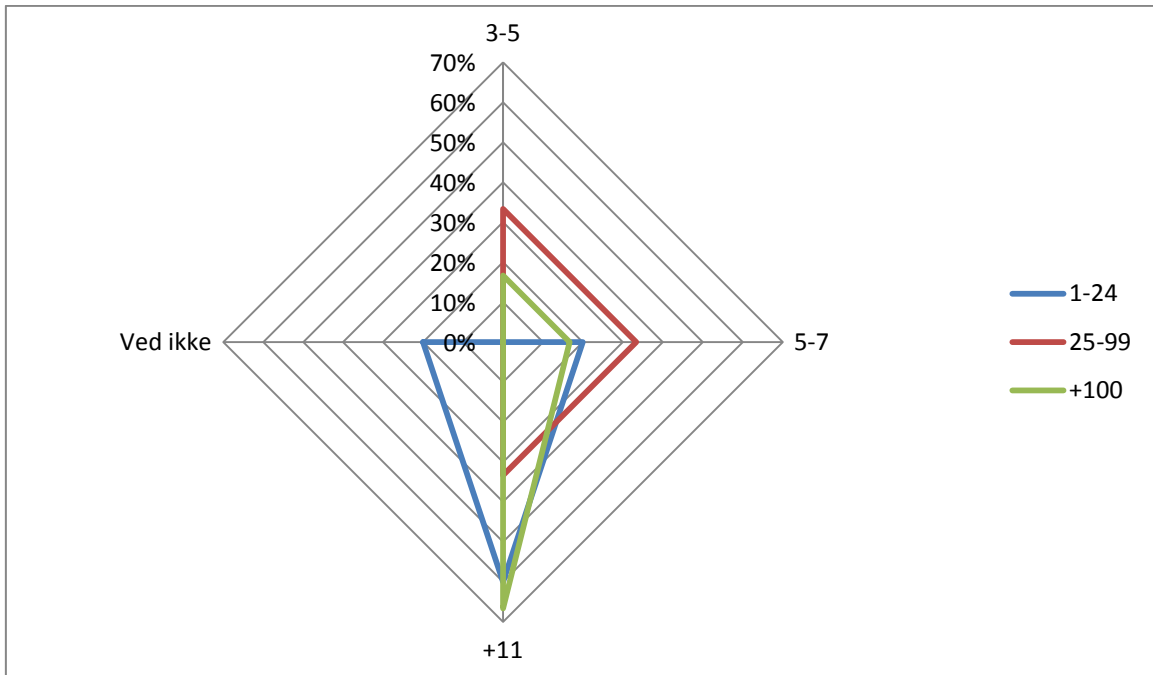


Figure 45 – Firm Category and Competitors

In general it is the big and small firms that have the most competitors and medium sized firms with fewest. In correspondence with the fact that most firms have carpenters and wholesalers/lumberyards as direct customers, these markets are also the ones with the most competitors.

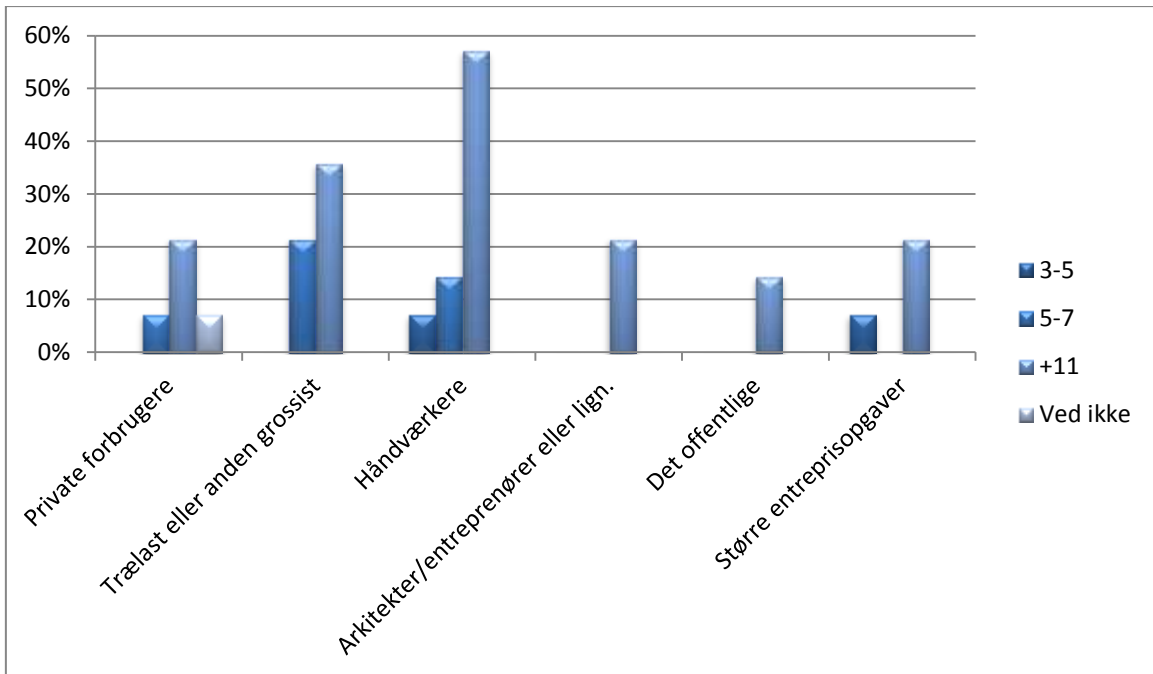


Figure 46 – Direct Customers and Competition

### Price competition

In general the price competition is extremely fierce. When assessing the price competition on a scale from 1-5 with the being the highest, no one answers below 3 while 93% of all

respondents answers 4 and 5 (Table 17). Furthermore, the data set reveals that price competition increases with the amount of competitors.

1 (low)	2	3	4	5 (high)
0%	0%	7%	14%	74%

Table 17 – Price Competition

Typically innovation can be seen as a way to escape price competition through better need satisfaction. This survey provides indications, that innovation actually can be a way out of the increased price competition. The 7% who has answered 3 in the intensity of price competition, are respondents who have developed new products. When concluding, that innovation is a method of escaping the price competition, one has to consider the scarce data set. The 7% only correspond to 1 respondent and this firm was a medium sized firm with carpenters as their primary customers which is interesting as that is the market with most competitors. This validates the argument, that innovation is a method of escaping competition.

### Market demand

When comparing market demand for technical features and aesthetic, it is obvious that aesthetic is typically the most important criteria (Figure 47). If combining the high points on the scale (4 + 5), 54% of the respondents believe that aesthetic and design is highly important compared to 46% who believe that technical features are the most important feature (Figure 48). As such, there is little difference between those two decision criteria. If combined with the conclusions on price competition, then it leads to the conclusion that price are by far the most important decision criteria.

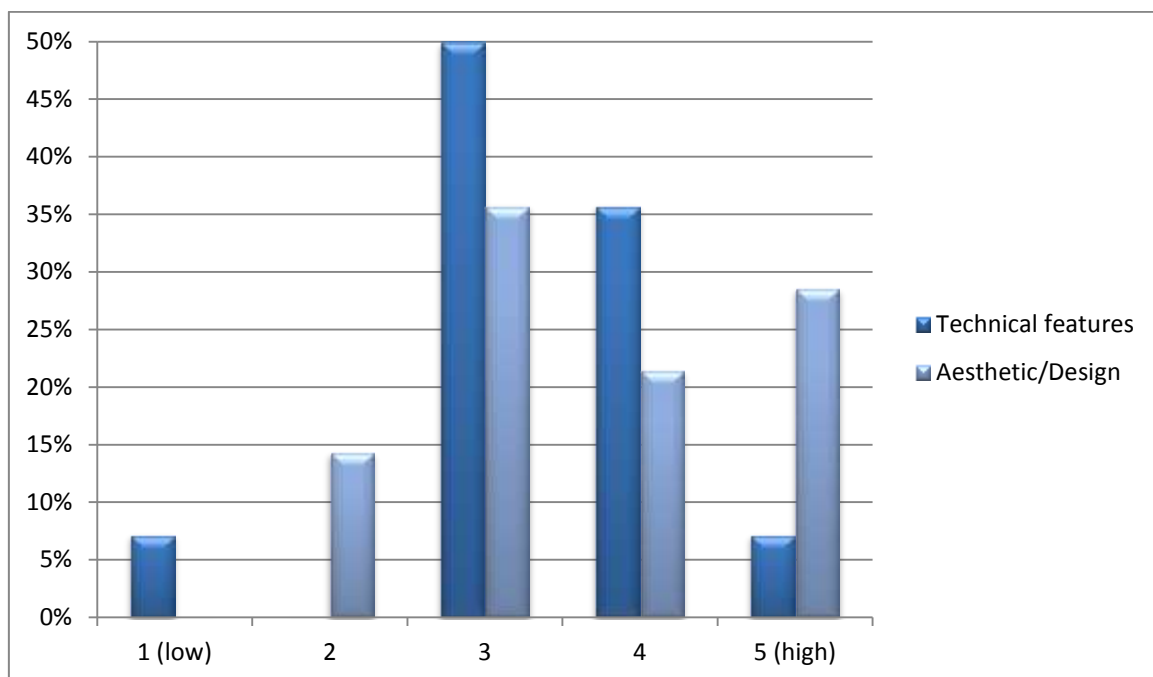


Figure 47 – Importance of Market Demand

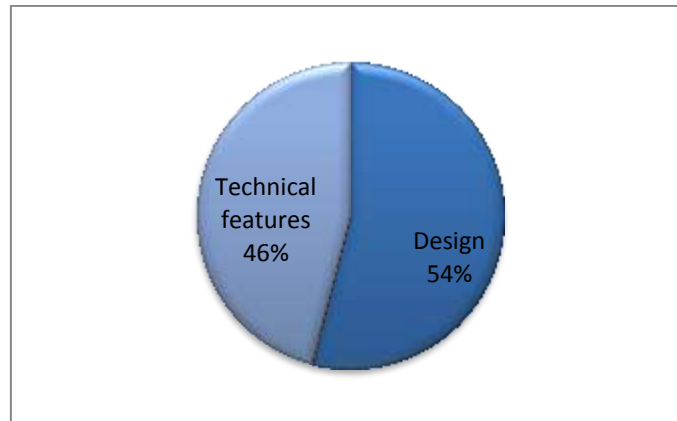


Figure 48 – The Most Important Decision Criteria

If related to product innovation, an interesting observation is that the majority of the firms have innovated. Only 21% has not developed new products. However, these firms are still experiencing relatively high demand on both products technical- and design features. It is not possible to prove that lack of market demand and pressure results in low product innovation activity. Actually the opposite occurs. Of firms that has developed new products, 18% has only had low incentives based on customers demand for design, and 9% has not had any incentives based on customers demand on products technical features.

	Design		Technical	
	Has developed new products	Has <u>not</u> developed new products	Has developed new products	Has <u>not</u> developed new products
<b>Low</b>	18%	0%	9%	0%
<b>Medium</b>	36%	33%	55%	33%
<b>High</b>	45%	67%	36%	67%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

Tabel 18 – Decision Criteria and Innovation

Based on the findings from the market, version 2 of the firm categorisation can be developed:

Category 1 – Big firms	Category 2 – Medium sized firms	Category 3 – Small sized firms
<p><b>Ownership:</b> International concern.</p> <p><b>Employees:</b> +100</p> <p><b>Yearly revenue:</b> &gt;150DKK million.</p> <p><b>Location:</b> North- and mid-Jutland and the capital region.</p> <p><b>Markets:</b> Primarily carpenters, wholesalers/lumberyards, architects, developers, and bigger projects.</p> <p><b>Nr. of competitors:</b> Typically more than 11.</p>	<p><b>Ownership:</b> Private or family owned.</p> <p><b>Employees:</b> 25-99</p> <p><b>Yearly revenue:</b> 25-74 million.</p> <p><b>Location:</b> Region South Denmark.</p> <p><b>Markets:</b> Primarily carpenters and wholesalers/lumberyards.</p> <p><b>Nr. of competitors:</b> An equal distribution of respectively 3-5, 5-7, and +11.</p>	<p><b>Ownership:</b> Privately owned</p> <p><b>Employees:</b> &lt;24</p> <p><b>Yearly revenue:</b> &lt;9,9 million.</p> <p><b>Location:</b> North-Jutland and the capital region.</p> <p><b>Markets:</b> Primarily private consumers, carpenters, and wholesalers/lumberyards.</p> <p><b>Nr. of competitors:</b> Typically more than 11.</p>

Tabel 19 – Firm Categorisation V.2.

## The respondents and Innovation

### Product Innovation & Improvements

In general 79% of the respondents have developed new products and/or improved current ones within the last three years. 21% have not. The only firms that have not developed new products are small firms (40%).

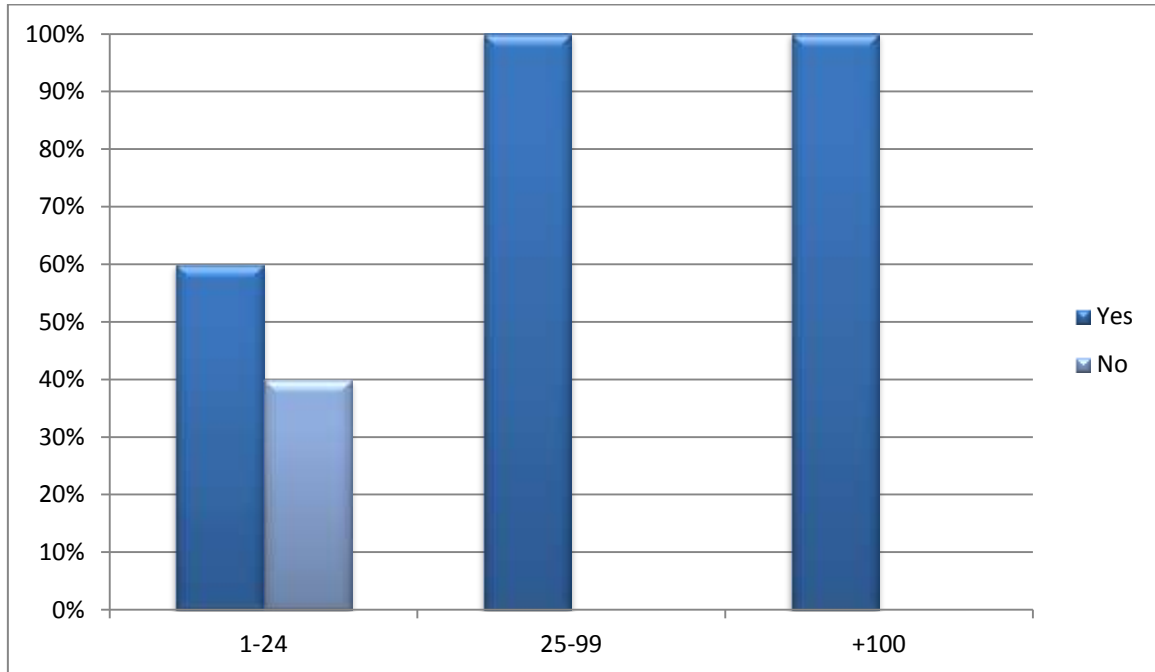


Figure 49 – Firms and Product Innovation

Almost the same figure as above can be applied when describing the firms who have improved current products. The only difference is that additionally 17% of the big companies have not improved current products (Figure 50).

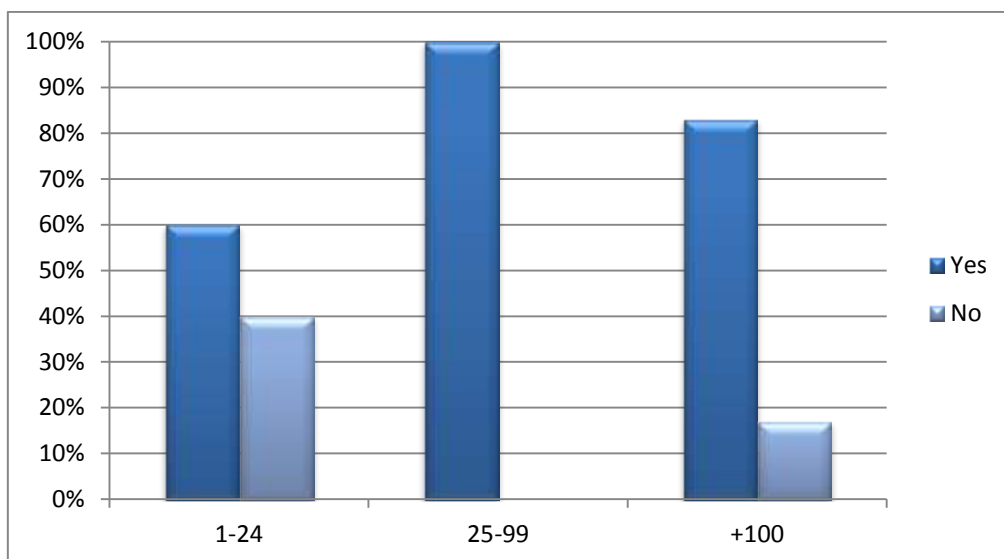


Figure 50 – Firms and Product Improvements

### Process Innovation & Improvements

When it comes to process innovations the same tendency is visible; the small firms are less involved in process innovation as the bigger firms. A stunning total of 80% of the small firms has not developed new processes or purchased new machinery within the last three years. Of the mid-size firms, 33% has likewise not developed or purchased new processes or purchased new machinery whereas all the big firms has done it (Figure 51).

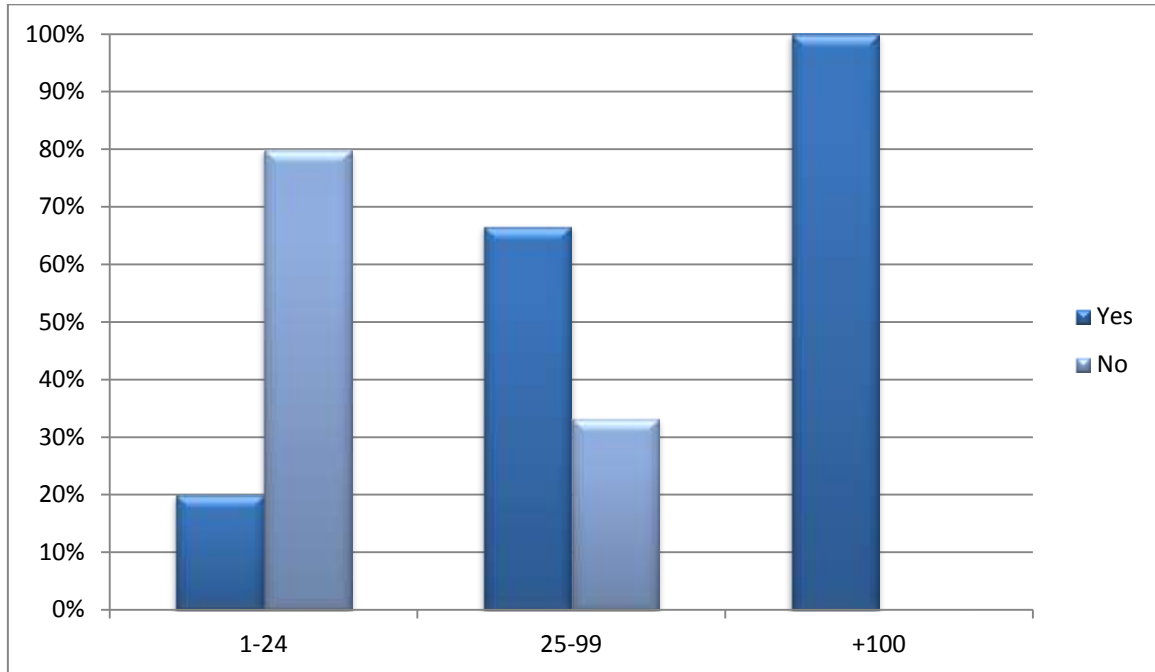


Figure 51 – Process Innovation

However, the majority of the firms have improved their processes significant within the last three years despite for 60% of the small firms. This indicates that generally there are focus how to improve processes but less for the small firms. Emphasis is on improving current equipment and processes instead of purchasing or developing new. Furthermore, it is often the same firms who are developing new products and processes which leads to the conclusion that the firms being innovative is generally innovating on more parameters. In only 14% of the cases, the firms' who has developed new products has not being involved in process innovation.

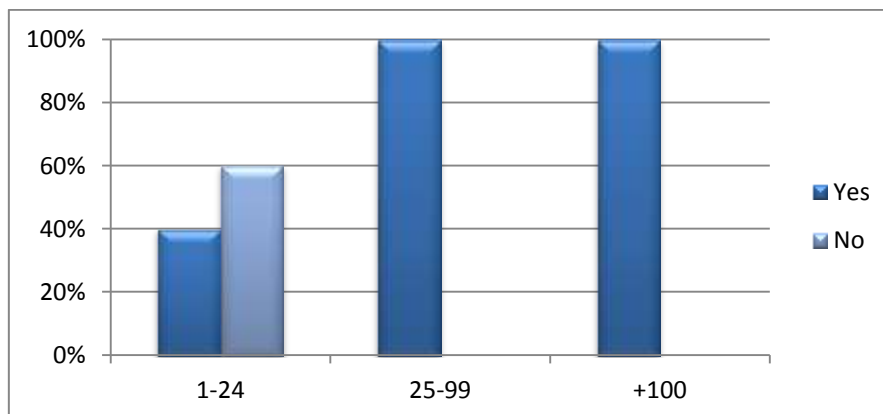


Figure 52 – Process Improvements

An interesting observation is it that the small firms in general seem to put more emphasis on product development & innovation than process development & innovation. This is interesting as price previously has been found to be the most important decision criteria for customers in general.

Small firms are generally approximately 50% less innovation active than bigger firms (Figure 54). The figures below clearly illustrate this general tendency, especially concerning processes. The difference between the small firms' innovation activity and the average between the two other categories reveals that they are 36% less active on product innovation, and 62% less active in process innovation.

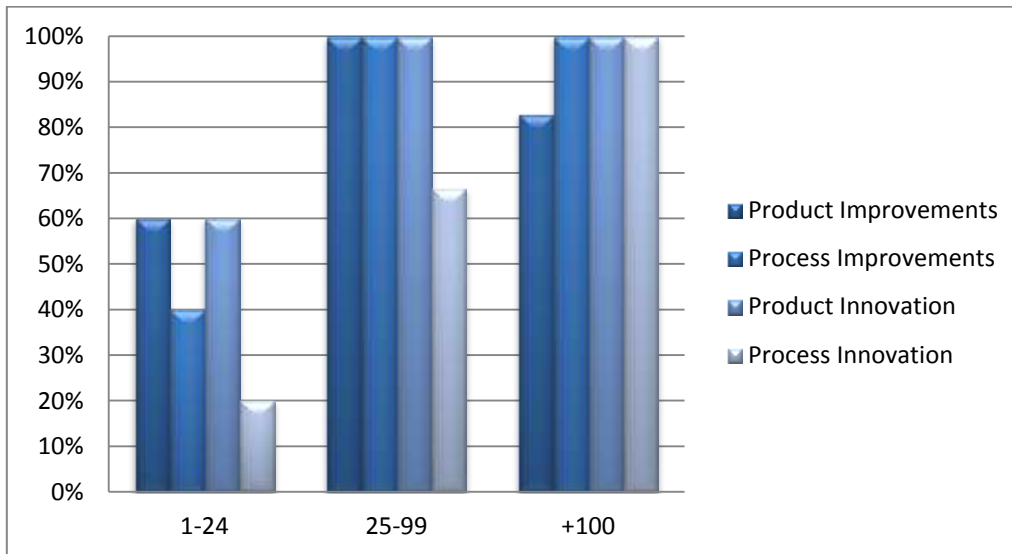


Figure 53 – Innovation Activities across Firm Size

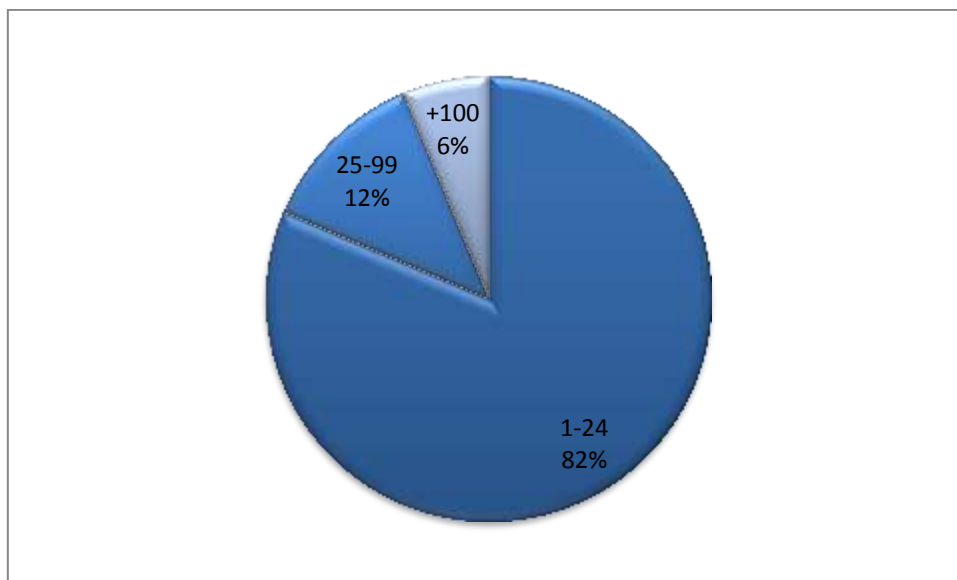


Figure 54 – Percentage of Firms that has not been Innovative

### Markets & Exports

The bigger the firm is, the more actively it is penetrating the total Danish market; 0% of the small firms have sought to market their products to new markets in Denmark opposite to



respectively 33% of the medium sized firms, and 50% of the big firms. The big firms are more aggressively seeking and competing for new markets in Denmark.

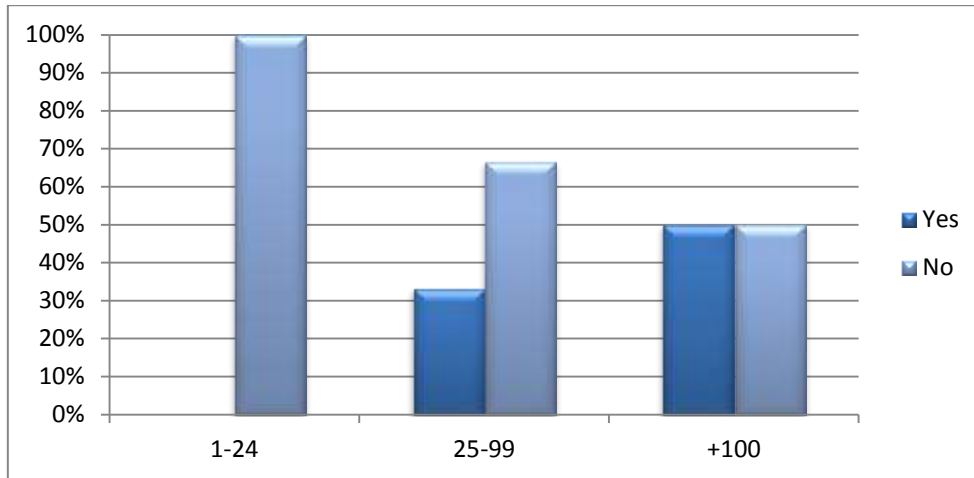


Figure 55 – New Markets in Denmark

An interesting observation is that the small firms are just as active in export adventures as big firms with 50% actively seeking foreign markets. All the medium sized firms have sought new foreign markets within the last three years.

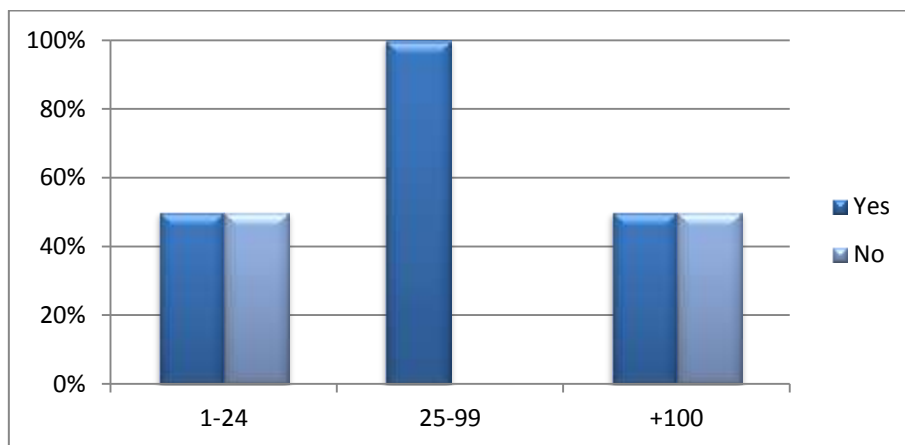


Figure 56 – New Export Markets

The most important export market which the companies have started export to within the last three years is Norway, with 61% above average followed by England with 15%. Norway is equally popular and important among all sizes of firms. None of the respondents have started export to our closest neighbor Germany.

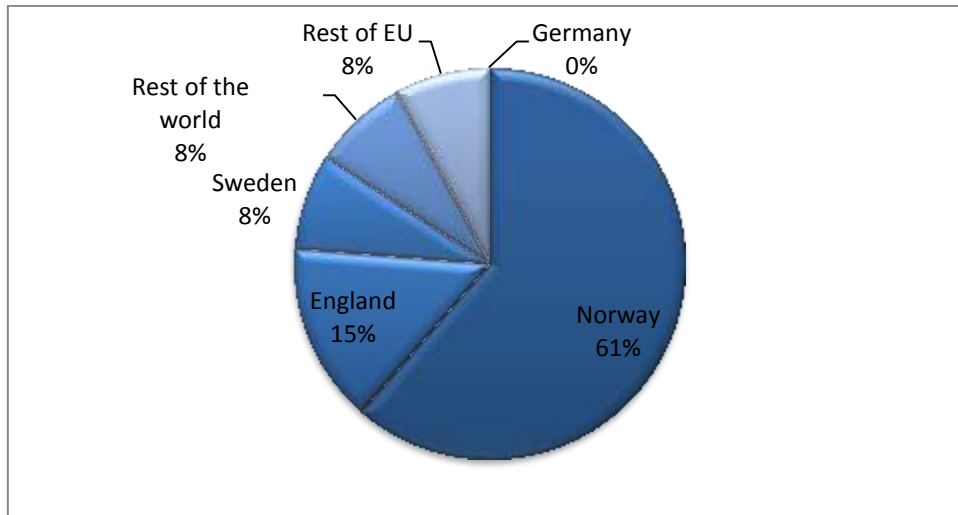


Figure 57 – The Most Important Export Markets

## Product & Process Innovation enablers and disablers

### Product and Market Innovation

There is little relation between the firms who are seeking new domestic markets and the firms who are developing new products, as 64% of the firms that have found new Danish markets within the last three years have developed new products.

Of all the firms who have exported to new markets, 23% of those firms have not developed or improved new products. This indicates, that it is not impossible to export with current products and that Danish products are suited for export as they are marketed at home.

### Innovation-initiation Factors

#### Factors that causes Innovation in General

The figure below illustrates the most important factors without considering firm size.

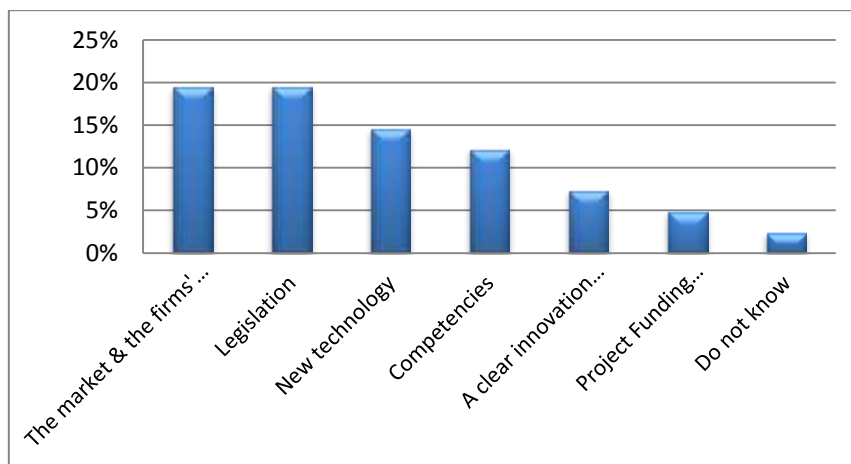
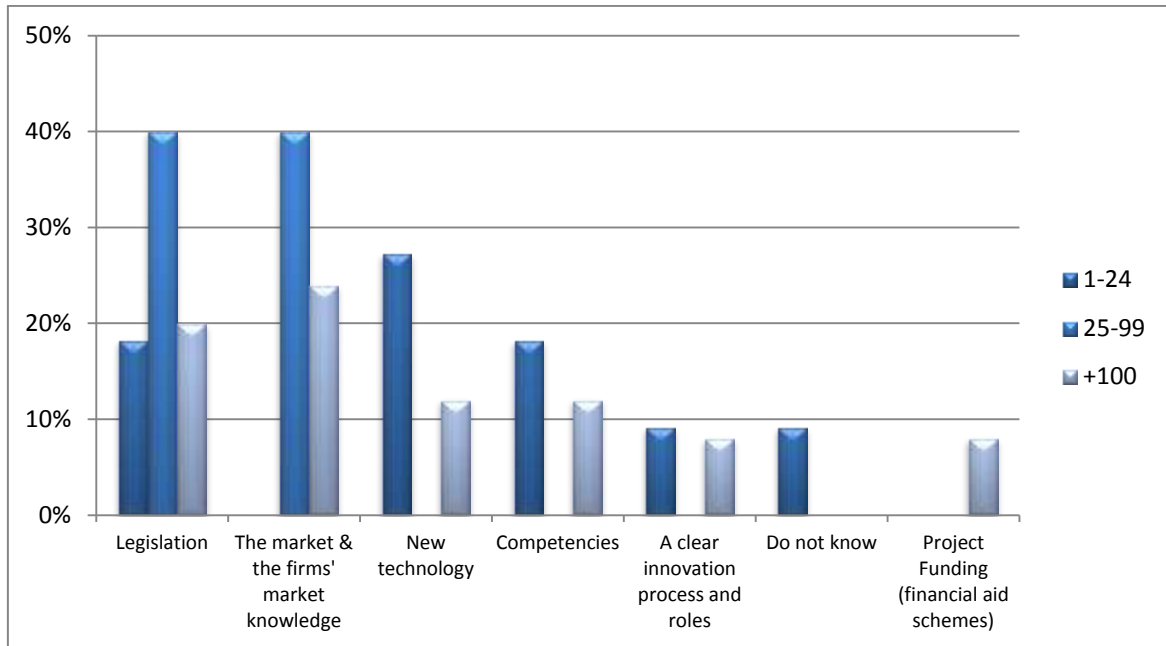


Figure 58 – Factors that causes Innovation in General

The figure below illustrates the most important factors categorized in firm size.



### Factors that causes product innovation

In general, the most important factors that influence product innovation are legislations, market needs, and competition. Furthermore, 30% of all the firms that have worked with product innovation have done it as a natural continuation of current business setup. An interesting observation is that 'coincidence' has not been a factor that has influenced product innovation. This might be because they do not seek coincidences.

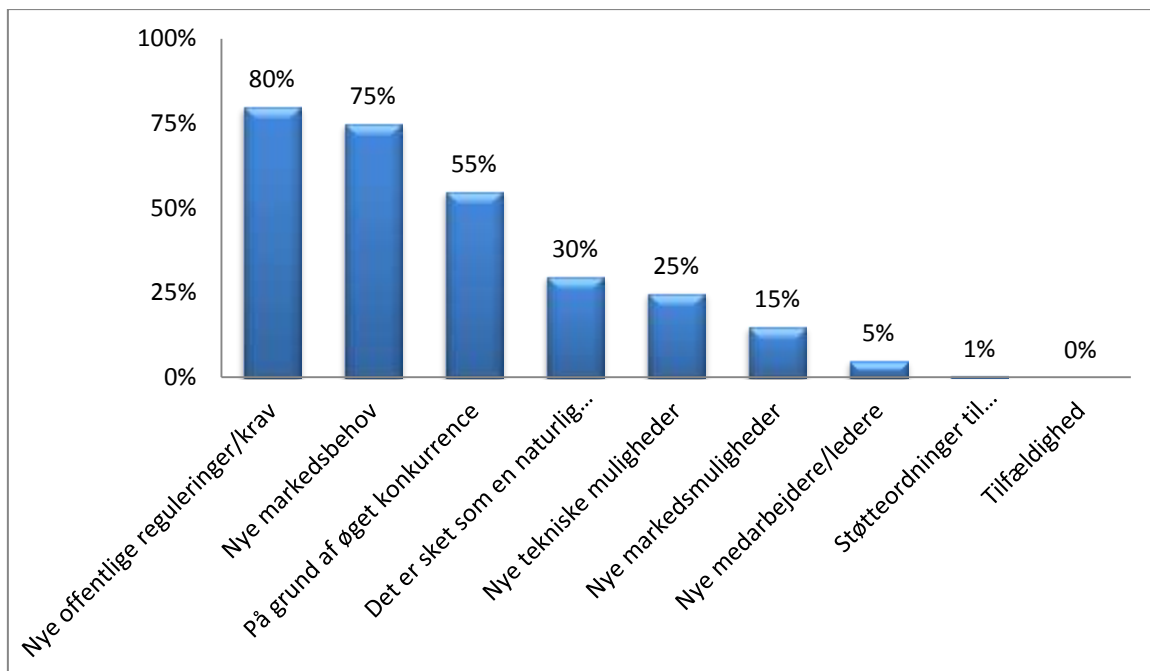


Figure 59 – Factors that causes Innovation

The figure below illustrates, that legislation have the biggest impact on small firms' innovation activity. If related to previous findings on firms' seeking new markets (Figure 55 & Figure 56), it is obvious that there is a correlation between market expansion and product innovation with

new market needs being the most important parameter. The big firms who are more engaged in domestic market penetration are experiencing competition as an important parameter for innovation is likely to be related with their increasing market expansion activities focused on actively seeking new market segments.

The factors that determine product innovation initiation in the small firms are legislation (100%), new technical opportunities (50%), new market needs (50%), and the natural continuation of current business setup (50%). Surprisingly, small firms are more often than the bigger firms inspired by new technical opportunities which seem to be less important the bigger the firm is.

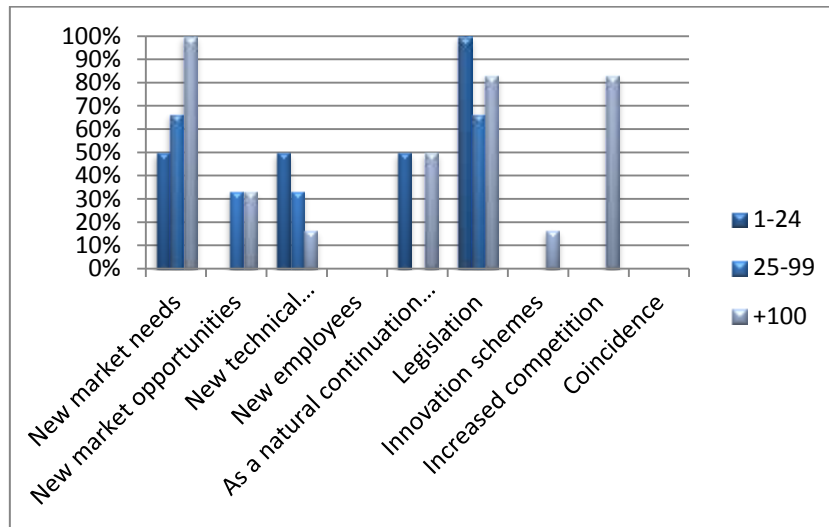


Figure 60 – Factors that causes Product Innovation and Firm Size

### Factors that causes Process Innovation

Not surprisingly is the most important factor for process innovation activities the need to lower costs (41%). More surprisingly is it however, that the second most important factor is the focus on continual improvements which is a proactive approach. Furthermore, the data supports the earlier finding that firms in general are highly engaged in process innovation by indicating that around 45% of all firms are applying this proactive approach.

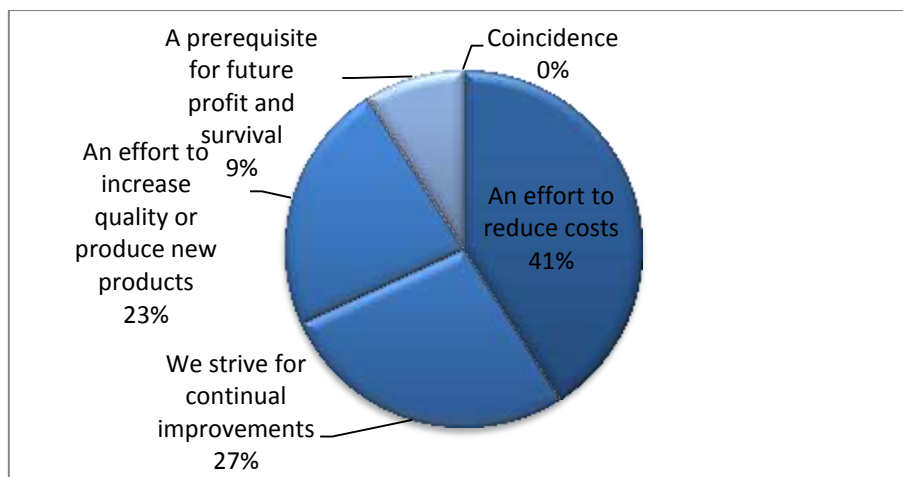


Figure 61 – The Importance of the Different Factors compared to each other

The figure below is an illustration of the most important factors resulting in process innovation divided between the process innovation active firms within each category. It clearly illustrates, that firms with more than 25 employees are more focused on cost reductions while especially the bigger firms proactively are working with process innovation to ensure cost reductions. Small firms on the other hand, are more focused on process innovation resulting in improved quality or innovations needed to develop new products. Based on prior findings, it is most likely that these firms' process innovation activities are focused on quality improvements on current products. This finding supports the previous indication that small firms especially are experiencing high competitive pressure focused on price.

If combining this finding, with the findings that bigger firms are seeking to penetrate the domestic market and find new market segments and the indications that they are more engaged in product and process innovation provides frightening outlooks for the small firms. If the trend continuous, the small firms will experience more competition on their current market shares and unfortunately for them, the competitors are more involved in product- and process innovation which makes it difficult for them to compete. It seems as they are aware of this as 50% of the small firms who are engaged in process innovation do it as they believe it is a prerequisite for future survival.

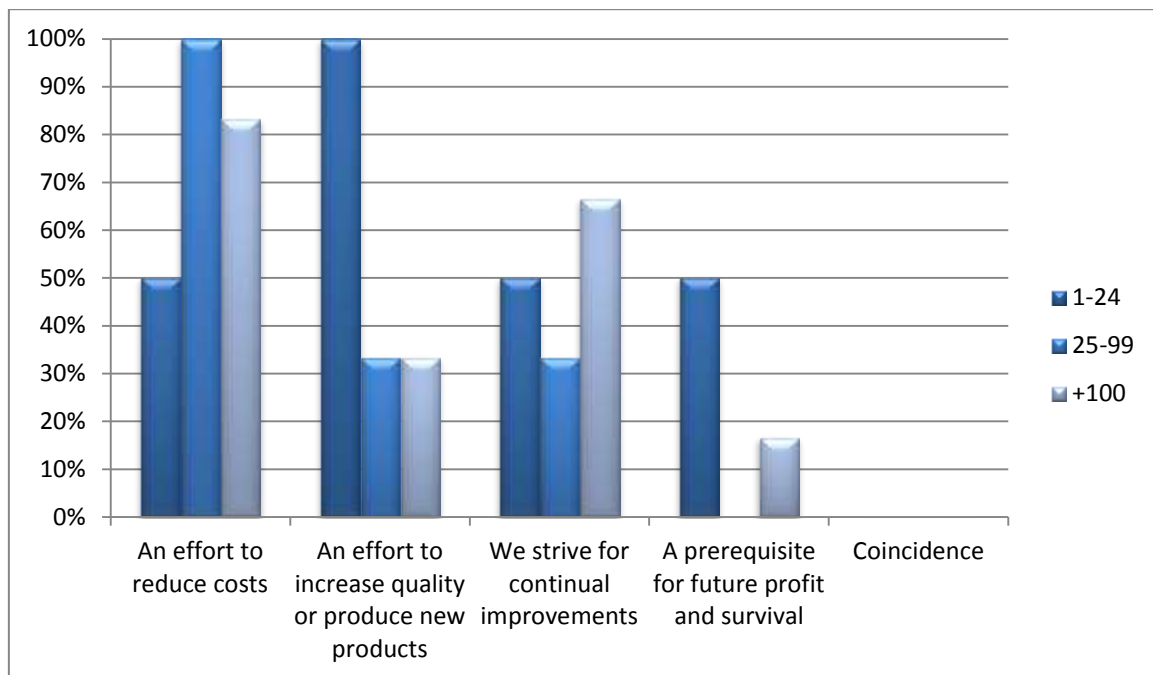


Figure 62 – Percentage of Firm Specific Categories and Process Innovation Factors

### Innovation Collaborations Partners in General

In general the firms' tend to develop new products alone that are the most widespread tendency which is synonymous with a closed innovation process. Firms openly collaborating with external partners are most frequently collaborating with current suppliers and with the upstream functions of the value chain. Only 13-10% are collaborating with the downstream functions like customers or decision makers which are very little. This correspond to previous findings, that customers are prioritizing price over other parameters which can be perceived as simple demand and needs. Only 10% are collaborating with knowledge institutes such as 'Teknologisk Institut' and other research organisations. Few firms are applying an explorative search process by seeking wide ties. Only 7% are actively seeking new partners with the

specific resources and competencies needed in each initiative which indicates that those firms are engaged in more novel product innovation.

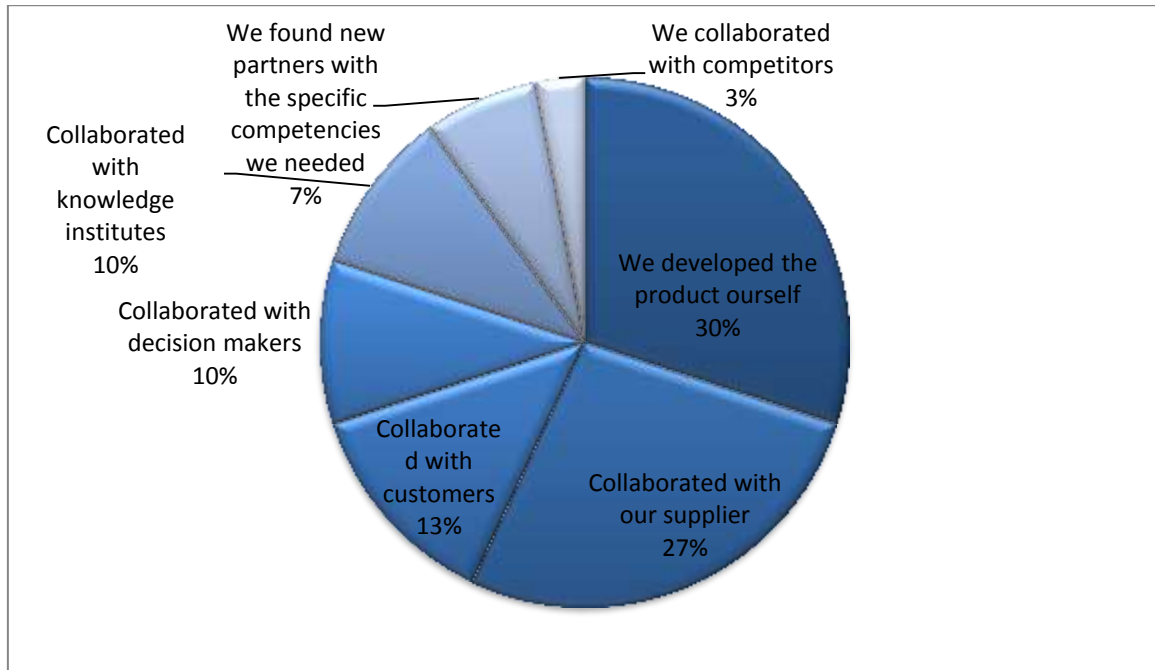


Figure 63 – Product Innovation Partners

The figure below illustrates the most important innovation partners in percentage within each firm category only considering the firms who has developed product innovations. It is interesting, that the bigger firms primarily are developing new products alone as more than 75% of the product innovation-active bigger firms are applying closed innovation processes which is 6-8%-points higher than the small firms.

A tendency is that small firms' innovation activities differ from both medium and big firms which seem to be similar. A tendency is that small firms primarily develop new products with their suppliers and competitors while bigger firms' innovation partners are more dispersed and varied. However, they differ greatly from small firms' by involving knowledge institutes and new partners with the specific resources and competencies needed. All three categories are applying customers at the same low magnitude.

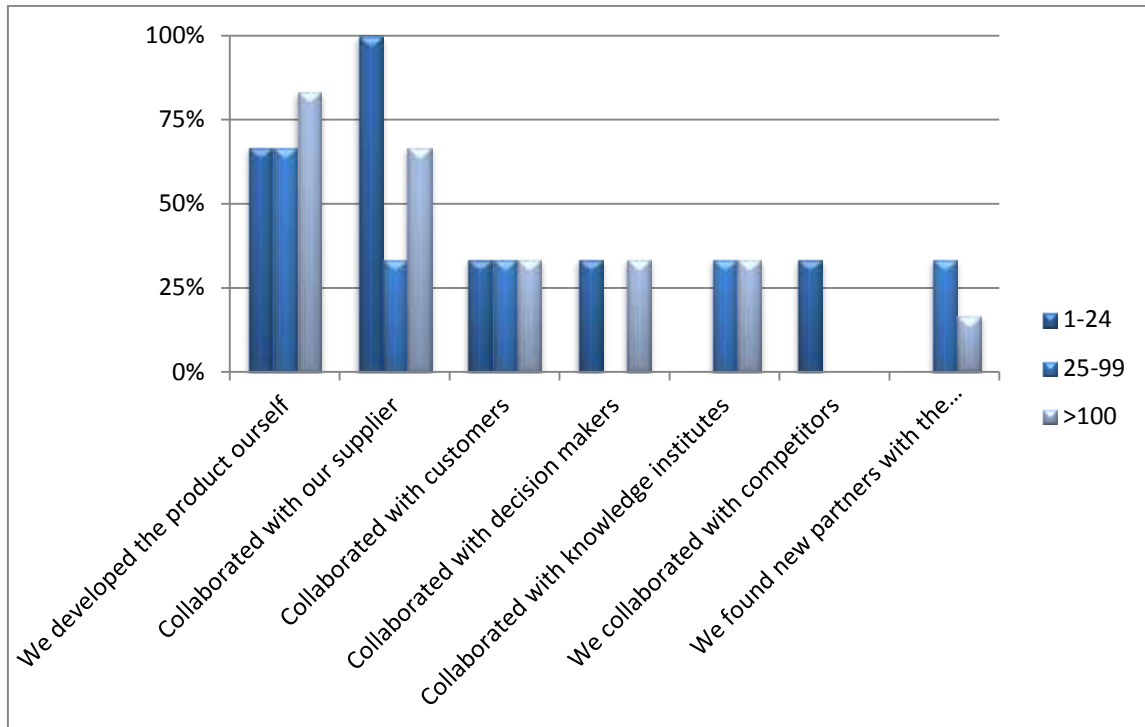


Figure 64 – Product Innovation Partners Categorized in Firms Size

## Product Innovation Collaboration Partners

In the following section the importance of respectively ... will be rated on a scale from 1-5 with 5 being the highest.

Scale	Ranking
1-2	Low
3	Medium
4-5	High

Tabel 20 – Scale and Ranking

### Customers

In general the customers are of rather low importance to firms' development activities which corresponds to the figure above. On a scale from 1-5 with 5 being the highest, customers importance as collaboration partners for innovation was averagedly scored **2,25** across firm size. The firm who found them to be of least importance was the big firms.

Customers	1-24	25-99	+100	Average
As a source of Ideas/inspiration for new product initiatives	2,5	3	1	<b>2,2</b>
As a source of collaboration on product improvements	2,5	3,5	1,5	<b>2,5</b>
As a source of collaboration on product innovation	2,5	3	2,5	<b>2,5</b>
As a source of process innovation/improvements	2,5	1,5	1	<b>1,5</b>
<b>Average</b>	<b>2,50</b>	<b>3</b>	<b>1,50</b>	<b>2,5</b>

Table 21 – Customers Importance to Innovation

Customers are most important when developing new products and less when it comes to improve processes. In general small firms thinks of customers to be of little importance on all innovation parameters but little more than the big firms does. The medium sized firms perceive that it will prove to have medium value to work with customers. They are likewise the ones that are applying this practice the most.

### Decision Makers

In general decision makers are of medium importance to firms' innovation activities. The medium sized firms are the only ones that perceive the decision makers to be of high value when involved in innovation projects, except when dealing with process innovation. Both the big and the small firms perceive them to be of medium value in general and low value concerning product improvements and process innovation.

Decision Makers	1-24	25-99	+100	Average
As a source of Ideas/inspiration for new product initiatives	4	4	4	4
As a source of collaboration on product improvements	2,5	4	2	3
As a source of collaboration on product innovation	3,5	4	3	3,5
As a source of process innovation/improvements	1	3	1,5	2
<b>Average</b>	<b>3</b>	<b>4</b>	<b>2,50</b>	<b>3,0</b>

Table 22 – Decision Makers Importance to Innovation

In general, decision makers are thought to be of high value when it comes to ideas and inspiration for new product initiatives and medium when it comes to execution of those initiatives while little concerning process innovation.

### Knowledge & Research Institutions

In general knowledge and research institutions are considered as being if little value to firms innovation activities still more than 33% of the bigger firms are collaborating with those institutes in product innovation initiatives. Among the bigger firms, knowledge institutes are primarily used for inspiration to new ideas, purchasing technology or knowledge, and in the actual execution of the project. However, it seems that the firms collaborating with the knowledge institutes are not satisfied.

The medium sized firms are the ones with the most positive attitude towards knowledge and research institutes especially related to inspiration for new products where they are perceived to be of high value.

Knowledge Institutions	1-24	25-99	+100	Average
As a source of Ideas/inspiration for new product initiatives	2,5	4	2	2,5
As a source of collaboration on product improvements	2	2,5	1,5	2,0
As a source of collaboration on product innovation	2	3,5	2	2,5
As a source of process innovation/improvements	2	3,5	1,5	2,3
As a source of purchasing of new knowledge/technology	2	3	2	2,4
<b>Average</b>	<b>2,5</b>	<b>4</b>	<b>2</b>	<b>2,5</b>

Table 23 – Knowledge Institutions Importance to Innovation

An interesting observation is that the small firms actually have a slight more positive attitude than the big firms but are not at all collaborating with them while the big firms are. A plausible



explanation can be, that the smaller firms lack resources to do so as it can be expensive to collaborate with research and knowledge institutes who often charge +1.000DKK an hour.

### Rival Enterprises

In general rival enterprises are considered to be of low value when it comes to innovation although all firms seem to get inspired by each other. Especially small firms are seeking the benefits of its rival to the extent they are able to. They are likewise the only ones collaborating with rival firms on product innovation. This might make up for the fact that they do not collaborate with other knowledge institutes which can be expensive – instead they seek to group and collaborate despite competition on product innovation matters. That is an interesting observation.

Rival Enterprises	1-24	25-99	+100	Average
As a source of Ideas/inspiration for new product initiatives	3	3	3	3
As a source of collaboration on product improvements	3	2	2	2
As a source of collaboration on product innovation	3,5	2	1,5	2,5
As a source of process innovation/improvements	2	1,5	2	2
As a source of purchasing of new knowledge/technology	2	1,5	1,5	2
<b>Average</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>2</b>

Table 24 – Rival Enterprises Importance to Innovation

### Organisations from alternative Industries and Fields

In general it is the bigger firms who see the most value in collaborating with partners outside current value system whom they are not regularly doing business with. Both small and medium sized firms do not perceive such partnerships to be of any value whereas big firms typically see medium value in such partnerships and of high value when it comes to process innovations. There might be a correlation between big firms ability to compete on price and their process innovation activities where they seek new partners which might be an indication of novel process innovation at big firms.

Organisations from alternative Industries	1-24	25-99	+100	Average
As a source of Ideas/inspiration for new product initiatives	1,5	2	3	2
As a source of collaboration on product improvements	1,5	1	2	1,5
As a source of collaboration on product innovation	1,5	2	3	2
As a source of process innovation/improvements	1,5	1	4	2
As a source of purchasing of new knowledge/technology	1	1	3	2
<b>Average</b>	<b>1,5</b>	<b>1</b>	<b>3</b>	<b>2</b>

Table 25 – Organisations from other Industries Importance to Innovation

The table below does not provide any indications that firms with less than 100 employees tend to search outside current value system or network in their efforts to find new partners.

### Innovation Disablers

The greatest barrier for innovation is clearly market uncertainty followed by both economic and employee resources which both are typical barriers for innovation and therefore not remarkable. However, the fact that more than 86% of all the respondents in total are experiencing the market and market uncertainty as a barrier for innovation is something to notice especially considering earlier figures indicating that there is a need for innovation in

general, especially product innovation. Market uncertainty is a vital and dominating barrier for innovation which needs to be understood closer as merely all firms are experiencing the market to be a barrier for innovation.

Furthermore, economic and employee resources also poses a challenge for the firms in their innovation efforts. This numbers needs to be supplemented with numbers from other industries in order to be able to say if they are remarkable or not.

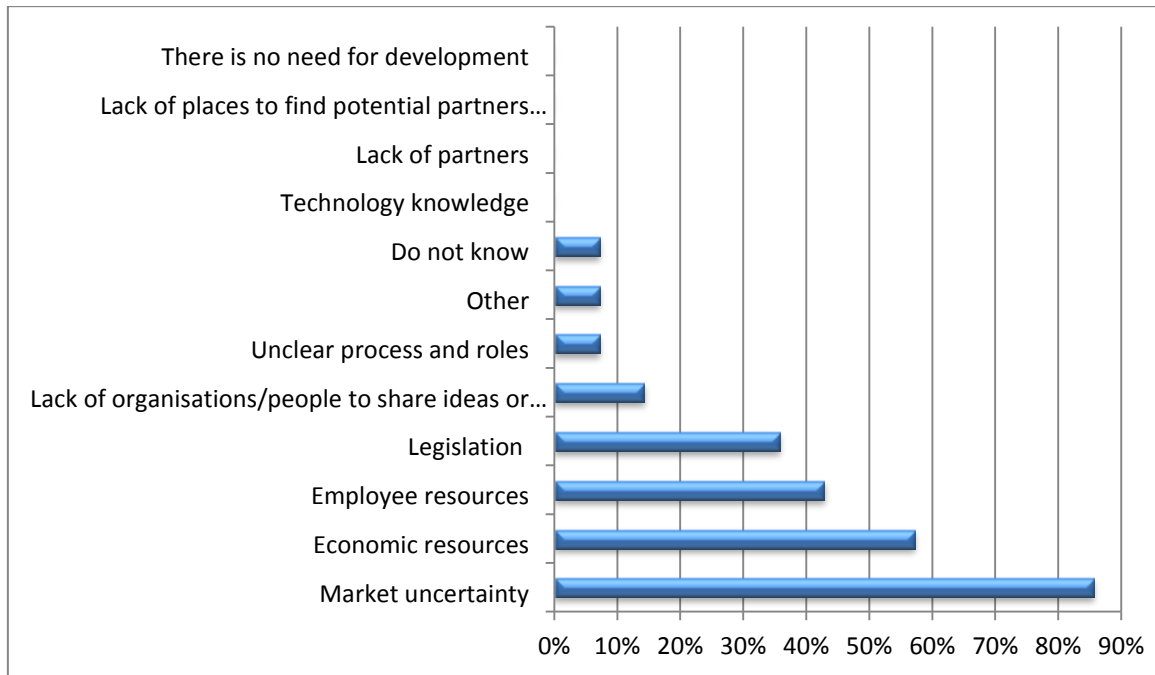


Figure 65 - Innovation Disablers in General

Especially the bigger firms (50-33%) and not so much the small firms (20%) are challenged by the legislation which is interesting. Furthermore, it is interesting that the bigger firms are the ones who are experiencing employee resources as a barrier for innovation over small firms which are highly surprising. However, the small firms differ by lacking people/organisations to share ideas with. This probably has to do with the configuration of the organisations where it is often the owner of the company who are responsible for developing products while all other employees have specific roles and tasks to do which takes up all their time. This might also be the reason why they do not see the innovation process and the distribution of roles as a barrier for innovation.

Economic resources are an important parameter for all firms, but big firms are the ones who this barrier constitutes the least problems.

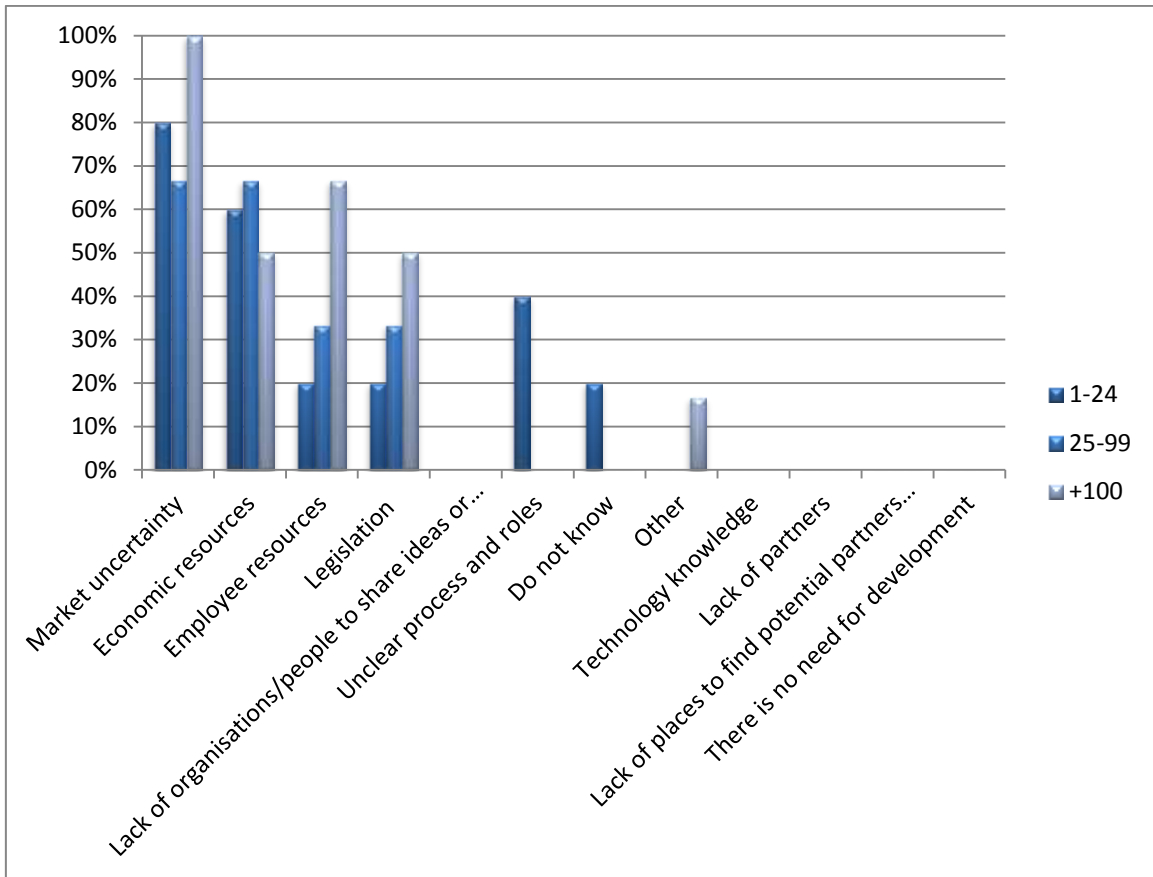


Figure 66 – Innovation Disablers Categorized in Firm Size

## Summarization

The table below summarizes the findings and conclusions made on each category:

Category 1 – Big firms	Category 2 – Medium sized firms	Category 3 – Small sized firms
<p><b>Ownership:</b> International concern.</p> <p><b>Employees:</b> +100</p> <p><b>Yearly revenue:</b> &gt;150DKK million.</p> <p><b>Location:</b> North- and mid-Jutland and the capital region.</p> <p><b>Markets:</b> Primarily carpenters, wholesalers/lumberyards, architects, developers, and bigger projects.</p> <p><b>Nr. of competitors:</b> Typically more than 11.</p> <p><b>Percentage that have developed new products:</b> 100%</p> <p><b>Percentage that have improved processes:</b> 100%</p> <p><b>Percentage of all firms that has not been either product or process innovative:</b> 12%</p> <p><b>Percentage actively seeking new domestic markets:</b> 50%</p> <p><b>Percentage actively seeking new foreign markets:</b> 50%</p> <p><b>Most important factor for innovation in general:</b></p> <ul style="list-style-type: none"> <li>- The firms market knowledge.</li> <li>- Legislation.</li> <li>- New technology.</li> <li>- Competencies.</li> </ul> <p><b>Factors that causes product innovation:</b></p> <ul style="list-style-type: none"> <li>- New market needs.</li> <li>- Competition.</li> </ul> <p><b>Factors that causes process innovation:</b></p> <ul style="list-style-type: none"> <li>- Cost reductions.</li> <li>- Strive for continual improvements.</li> </ul> <p><b>Typical innovation partners:</b></p> <ul style="list-style-type: none"> <li>- Suppliers.</li> <li>- None.</li> </ul>	<p><b>Ownership:</b> Private or family owned.</p> <p><b>Employees:</b> 25-99</p> <p><b>Yearly revenue:</b> 25-74 million.</p> <p><b>Location:</b> Region South Denmark.</p> <p><b>Markets:</b> Primarily carpenters and wholesalers/lumberyards.</p> <p><b>Nr. of competitors:</b> An equal distribution of respectively 3-5, 5-7, and +11.</p> <p><b>Percentage that have developed new products:</b> 100%</p> <p><b>Percentage that have improved processes:</b> 100%</p> <p><b>Percentage of all firms that has not been either product or process innovative:</b> 6%</p> <p><b>Percentage actively seeking new domestic markets:</b> 33%</p> <p><b>Percentage actively seeking new foreign markets:</b> 100%</p> <p><b>Most important factor for innovation in general:</b></p> <ul style="list-style-type: none"> <li>- The firms market knowledge.</li> <li>- Legislation.</li> </ul> <p><b>Factors that causes product innovation:</b></p> <ul style="list-style-type: none"> <li>- Legislation.</li> <li>- New technical opportunities.</li> <li>- New market opportunities.</li> </ul> <p><b>Factors that causes process innovation:</b></p> <ul style="list-style-type: none"> <li>- Cost reductions.</li> </ul> <p><b>Typical innovation partners:</b></p> <ul style="list-style-type: none"> <li>- None.</li> <li>- Suppliers</li> <li>- Knowledge/research institutes.</li> <li>- New partners with the</li> </ul>	<p><b>Ownership:</b> Privately owned</p> <p><b>Employees:</b> &lt;24</p> <p><b>Yearly revenue:</b> &lt;9,9 million.</p> <p><b>Location:</b> North-Jutland and the capital region.</p> <p><b>Markets:</b> Primarily private consumers, carpenters, and wholesalers/lumberyards.</p> <p><b>Nr. of competitors:</b> Typically more than 11.</p> <p><b>Percentage that have developed new products:</b> 60%</p> <p><b>Percentage that have improved processes:</b> 40%</p> <p><b>Percentage of all firms that has not been either product or process innovative:</b> 81%</p> <p><b>Percentage actively seeking new domestic markets:</b> 0%</p> <p><b>Percentage actively seeking new foreign markets:</b> 50%</p> <p><b>Most important factor for innovation in general:</b></p> <ul style="list-style-type: none"> <li>- New technology.</li> <li>- Legislation.</li> <li>- Competencies.</li> </ul> <p><b>Factors that causes product innovation:</b></p> <ul style="list-style-type: none"> <li>- Legislation</li> <li>- New technological opportunities.</li> <li>- Natural continuation of current business setup.</li> </ul> <p><b>Factors that causes process innovation:</b></p> <ul style="list-style-type: none"> <li>- Effort to increase</li> </ul>



<ul style="list-style-type: none"> <li>- Customers.</li> <li>- Decision Makers.</li> <li>- Knowledge/research institutes</li> <li>- New partners with the specific resources/competencies needed.</li> </ul> <p><b>How they value customers in innovation activities:</b> Little.</p> <p><b>How they value decision makers in innovation activities:</b></p> <ul style="list-style-type: none"> <li>- Inspiration/ideas: High.</li> <li>- Product innovation: Medium.</li> </ul> <p><b>How they value knowledge/research institutes in innovation activities:</b> Little.</p> <p><b>How they value rival enterprises in innovation activities:</b> Little (medium on ideas/inspiration).</p> <p><b>How they value organisations/people from alternative industries in innovation activities:</b> Medium.</p> <p><b>Key innovation disablers:</b></p> <ul style="list-style-type: none"> <li>- Market uncertainty.</li> <li>- Employee resources.</li> <li>- Economic resources.</li> <li>- Legislation.</li> </ul>	<p>specific resources/competencies needed.</p> <ul style="list-style-type: none"> <li>- Customers.</li> </ul> <p><b>How they value customers in innovation activities:</b> Medium.</p> <p><b>How they value decision makers in innovation activities:</b> High.</p> <p><b>How they value knowledge/research institutes in innovation activities:</b> High (little in product improvements).</p> <p><b>How they value rival enterprises in innovation activities:</b> Little (medium on ideas/inspiration).</p> <p><b>How they value organisations/people from alternative industries in innovation activities:</b> Little.</p> <p><b>Key innovation disablers:</b></p> <ul style="list-style-type: none"> <li>- Market uncertainty.</li> <li>- Economic resources.</li> <li>- Unclear process and roles.</li> </ul>	<p>quality.</p> <ul style="list-style-type: none"> <li>- A prerequisite for future survival.</li> </ul> <p><b>Typical innovation partners:</b></p> <ul style="list-style-type: none"> <li>- None.</li> <li>- Suppliers.</li> <li>- Competitors.</li> <li>- Customers.</li> <li>- Decision Markers.</li> </ul> <p><b>How they value customers in innovation activities:</b> Little.</p> <p><b>How they value decision makers in innovation activities:</b></p> <ul style="list-style-type: none"> <li>- Inspiration/ideas: High.</li> <li>- Product innovation: Medium.</li> </ul> <p><b>How they value knowledge/research institutes in innovation activities:</b> Little.</p> <p><b>How they value rival enterprises in innovation activities:</b> Little (medium on ideas/inspiration).</p> <p><b>How they value organisations/people from alternative industries in innovation activities:</b> Little.</p> <p><b>Key innovation disablers:</b></p> <ul style="list-style-type: none"> <li>- Market uncertainty.</li> <li>- Economic resources.</li> </ul> <p>Lack of organisations/people to share ideas with.</p>
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Table 26 – Summarization of the Findings within each Category

## Appendix 2: List of Interviewed Persons

Organisation	Description	Respondent	Method
<b>Small firms</b>			
Frovin	A make-to-order manufacturer of facade windows of pinewood suitable for elder buildings worth preserving.	Sales Manager	Physical Interview
Modum Vinduer	A manufacturer of plastic facade windows and doors with less than 5 employees.	Director & Owner	Physical Interview
Jætte-Byg	A combined window/door and carpentry firm manufacturing customised facade windows tailored specific needs.	Director & Owner	Physical Interview
PT Vinduer	PT Vinduer manufacturer facade windows and doors out of pinewood, mahogany, and wood/alu.	Sales Manager	Physical Interview
FRBVinduet	A combined window/door and carpentry firm with less than 10 employees manufacturing double glazing windows specifically target elder apartments in Copenhagen.	Director & Owner	Physical Interview
Stevnsvinduet (this interviews was interrupted and not finished)	A one man combined window manufacturer and carpenter.	Owner	Telephone Interview
<b>Big Firms</b>			
Dovista	Dovista is an international concern that manages product development for the 10 individual brands owned by Dovista.	Concept Manager	Physical Interview
Inwido	Inwido is an international concern that owns more than 20 individual brands globally.	Development Manager	Telephone Interview
HSHansen	HSHansen is an aluminium facade contractor with more	Marketing & Development Manager	Telephone Interview



	than 200 employees.		
IdealCombi	IdealCombi is a Danish firm that manufacture wood/alu and composite facade windows	Sales Manager	Physical Interview
<b>Trade Organisations</b>			
Dansk Byggeri	The trade organisation for the Danish construction and building material industry.	Director, Building Material Division	Physical Interview
DI	Denmark's biggest trade organisation.	2xChief Innovation Consultants	Physical Interview
DI Byg	A branch under DI focusing on the Danish construction industry.	Consultant	Physical Interview
<b>Technical Experts</b>			
Århus University, DTU, Teknologisk Institut	AI experts in the facade window industry and facade window technicalities and have combined made several technical publications used as fundament for legislation	Researchers	Telephone conversation

## Appendix 3: Interviewguide

# Interviewguide

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This interviewguide was used in all the interviews with the facade window manufacturers firms.

I promised the respondents to summarise key points and present these to Dansk Byggeri and other relevant stakeholders.

### Introduction of the company

- Presentation of the company
- The company's products
- Production facilities

### The market

- The market (customers, decision makers, needs etc.)
- Market development (incl. the effect of the energy efficiency standards)
- Market competition

### Innovation

- (Product) Innovation opportunities in general
- Product development opportunities in relation to the new energy efficiency standards (BR15, BR20)
- Collaboration partners (innovation specific) (*How have you worked with product innovation and which partners do you normally involve*)
- The market incentives and innovation?
- Innovation and technical opportunities.
- Development of production facilities

The transcript of each interview is done based on these themes.



## Appendix 4: Interview Transcripts

### Trade Organisation & Expert Interview Transcripts

# Interview – Dansk Byggeri

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**Respondent:** Per Thomas Dahl, Industry Director, Danish Building Material.

**Interviewer:** Jesper Stentoft Flackeberg

**Date:** 11/3 2014

**Sted:** Dansk Byggeri, Copenhagen

### About the respondent and Dansk Byggeri

Per Thomas Dahl is the director for the Danish building material department of the professional organisation Dansk Byggeri. He has had that position for the last 2.5 years but has been working within the construction industry for more than 7 years. Per Thomas Dahl has in-depth knowledge of the construction industry and broad insights in the SME's innovation activity.

Previously he was CEO of a Danish SME but quitted that job to establish his own company producing module housing. He founded that company in 2006 and had at one point 120 employees. The financial crisis in 2008 ended the history of the company.

### Objective

The objective is to gain knowledge of the industry in general hereunder; characteristics of the companies, economic performance, and innovation activities. Inspiration on interesting case studies is likewise within the scope of this interview.

### Discussion about the study

The respondent validated my research question.

The respondent found my research question and –objective highly interesting. Especially the industry of building material suppliers constitutes of smaller companies that aren't highly innovative. This does not correspond to the general trend and demand for innovation from the consumers, political interests etc. In terms of this, it is highly interesting to understand how these companies innovate and with whom. Generally, the need for more innovative products to solve the environmental issues is not fulfilled, and does not seem to be fulfilled by Danish companies.

### Interesting case studies and industries

The facade window industry is interesting! First of all, the need for new products and innovations in general is intense within this industry - more than others. Secondly, this industry is over-represented by SME's who is not proactively seeking to innovate.

#### An intense need, demand, and pressure for innovation

- Public institutions enhance the energy requirements of especially facade windows.



- Facade windows are a vital factor to buildings energy efficiency both in terms of the heating/cooling absorption/captivation and the fact that they are able to ruin the ventilation culture of a room.
- The standards and requirements are enhanced and challenge the specifications of current facade windows.
- This field has attained especially attention from the 'Energistyrelsen'

#### **Firms' innovation capability**

- A lot of SME's – primarily smaller SME's.
- How do they survive?
- What are their innovation capabilities? Is it sufficient?

#### **The Industry**

- Determined by few international competitors.
- The choice of windows is to some extent culture contingent.
- A lot of family owned business that do not innovate or evolve.

#### **Case Companies**

- Rational, VKR, Inwido (Swedish conglomerate) – These companies even if owned by big conglomerates are continued as individual enterprises.
- Family owned companies:
  - o Obbekær, Thomas Jørgensen.
  - o UD Vinduer, Uffe Dalmose
- Store virksomheder:
  - o Inwido, Mads Storgaard Mehlsen, CEO. Active in Dansk Byggeri.

#### **Contacts/experts**

- Professional organisation: expert in the facade window industry: Johnny Jensen, 7220 1822, [jhj@vinduesindustrien.dk](mailto:jhj@vinduesindustrien.dk).
- Innovation opportunities in windows (technical):
  - o TI, Teknologisk Institut.
  - o Steffen Petersen, Århus University, [stp@iha.dk](mailto:stp@iha.dk)

## **Interview – DI + DI Byg**

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### **Innovationsproblemstillinger for danske SMV'er**

Respondents: Hanne Merete, Nicolas Boath  
Position: Chief Innovation Consultants, DI  
Date: 14/2 2014

### **Generic problems**

**The key challenge for the Danish economy and business sector**



In general the Danish economy and business sector is performing relatively well compared to the rest of the world. Overall Danish companies seem likewise to be performing well on the innovation parameter compared to the global competition.

There is no need to be frightened for the future and the competitiveness of Danish companies on the short term. However, the economy is very much driven by the large companies in Denmark. The vast majority of the companies in Denmark are SME's focused on a market/product/service-niche and there is a worrying tendency that these companies persist as SME's with marginal contribution to growth of the Danish economy. According to 'DI' it is clear that the large companies (MNE's) contribute more to the economy in form of job creation, taxes, innovative products etc. which creates a desire and need for those SME's to develop to MNE's. Based on this realization 'DI' expresses the need to understand the dynamics (or lack of) that determines if SME's develop to MNE's or not. How can this be explained?

### Topics of interest – *Research agendas*

The respondents explain that the problem for Danish SME's is the non-existing upscaling of the businesses. Danish companies' growth process is slow compared to our nearest competitors. Common accepted plausible explanations are:

- *Culture;*
  - The Mercedes effect: When an entrepreneur has earned a reasonable amount of money they do not feel the urge to expand the business.
  - *The Danish society is designed in a way that hinders the motivation for success. If we fail it is ok, we will get supported by the government. In the US entrepreneurs that has invested in something simply needs to succeed.*
  - *The mindset of the Danish people is not geared to it.*
- *Taxes; the Robin Hood principle does not motivate entrepreneurship.*
- *Framework conditions;*
  - Lack of a critical mass: In Denmark it is difficult to obtain a critical mass within a given business industry. DI hosts several network meetings with the aim of establishing innovation-partnerships focused on product/service innovations based on technological knowledge sharing and focus. However, it is difficult to obtain a critical mass of companies engaged in the same field with the same interests. The consequences of this is that the focus of these networks become on generic issues like outsourcing, and different process issues and in the best case process optimization/innovation topics. The result of this is that the objective of the network-workshops is not fulfilled – no partnerships based on technical and/or technological elements are developed.
- *Unwillingness to share know-how and technical features.*
  - Danish companies are very much focused on IP rights and patents and are therefore not willing to engage in product development projects/initiatives with external partners.
  - US is really good example of how to do it, they are much more engaged in networks with external partners, more eager to share technologies and know-how and their society is not designed with the same safety features for the individual.

**DI's innovationsundersøgelse 2012 understøtter til dels min påstand:**



- Primært interne ressourcer bliver anvendt – eksternt kun 3%
- Driver og udfordring = intern organisering (ressourcer, proces, prioritering)
- Man måler på produktudvikling men halvdelen er ikke tilfreds + 22% der ikke har taget stilling – de ved det simpelthen ikke.
  - *Man vil gerne produktudvikling men er ikke tilfreds => fokus på inkrementel udvikling?*
  - *Evt. løsning: kun 3% anser eksternt samarbejde som en driver. Ved at opprioritere dette kan man nedjustere ens afhængighed af interne ressourcer?*
- **Konklusion og spørgsmål?**
  - Virksomhederne har fokus på produktinnovation og over 50% giver udtryk for at de ikke er tilfredse hvilket betyder at de har taget stilling. De over 50% der er tilfredse, er det fordi de reelt har oplevet vækst på baggrund af produktinnovation eller synes de bare det går godt?
  - Man vil gerne udvikle produkter men det er man ikke så god til. Det bliver mere inkrementelle innovationer der forlænger det man gør i dag da man har fokus på intern innovation.
  - Hvad skaber innovationer (teknologi push eller need-pull?)

### Hypothesis development

Based on the interview with DI the following hypothesis can be developed:

1. Danish companies are focused and initiates activities based on process innovation and optimization instead of product innovation.
2. However, they are very interested in product development (also due to demand) but there are some structural issues that create a barrier.

Scalability.

De store virksomheder klarer sig rigtigt godt.

**Intern fokus vs. Eksternt behov og interesse vs. Produktudviklingsfokus og interesse dog manglende effekt.**

I USA

- Incitament
- Netværker i højere grad.
- Eksternt netværksfokus

Nicolas =

- IP rettigheder / Stanford – mere man fortæller mere man får igen.
  -

Marketing løsninger – nye markeder

- Tænk i nye systemer.
- Vi ser noget der cykler ud og ind – ud og kigge ind og analysere på det.



- Cykliske modeller for hvornår en løsning er bæredygtig. Modenhedsniveauet for ens produkt og kigge på andre markeder.

Godt eksempel på en eskalering:

- Palle med stande
- På 4 år er han oppe på 100 mennesker.
- Vi vil gerne have store virksomheder, små bliver bare ikke store fordi de fokuserer på det e gør bedre.

### **Kontakter**

AAU – Poul Hansen, scalability.

Professor: Stanford, centre of design and ?? =>jo mere man fortæller jo mere får man igen...

## Manufacturers of building material and products

Respondent: Bjarke Feldsted

Position: Consultant, DI Byg

Date: 14/2 2014

### Innovation in the industry

- Manufacturers want to be more active within product innovation
- Manufacturers are challenged by many challenges. It is difficult to introduce a new product to the market:
  - The extended value chain is extremely long and the process holds many different buyer needs (see the figure below)
  - Great distance between the manufacturer and the final buyer in the value chain.
  - The craftsmen who in the end is the ones that implements the product in the construction/building is not willing to apply new products.
  - Regulations, the construction legislation is complex and misunderstood.
  - The industry is protectionistic which means that new solutions and methods find it difficult to be obtained and integrated.

### The relevance of manufacturers of building material/products as research area and case topic

- The industry is highly important for the Danish economy. Around 5% of the BNP are directly related to this industry and around every 10<sup>th</sup> person are occupied in relation to the industry.
- The majority of the companies are SME's but a mix of Danish and foreign ownership. The companies with foreign ownership often have development activity in the country of origin.
- There is a great demand and focus on more sustainable materials and products in especially the construction sector. The incentives are there, but are they acted upon?
- A lot of different entities (universities, the GTS, etc.) has focused on new and more sustainable products which means that there must be technical elements and technology that is not applied in the industry today. Technology-push is a potential source of inventions.

## Interview T1

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- Rigtigt mange af de mindre producenters løsninger de ligner hinanden, bare samlet på en anden måde. Det skyldes, at de ikke selv har ressourcer til at varetage udviklingen, men det gør leverandørerne derimod. Leverandørerne er dem der udvikler f.eks. træ med indbygget isolering og plast med indbygget isoleringsmateriale. Det gør at vinduerne ligner hinanden og der sker i virkeligheden ikke noget udvikling blandt de mindre producenter.
- Dvs. producenter laver MÅSKE noget architectural innovation men bestemt ikke komponent innovation. Det sker hos leverandørerne. Hvordan samarbejder man så om innovation?

# Empirical fieldwork x

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## Expert interviews

18/3 2014

TI: Lars Thomsen, seniorkonsulent.

Århus Universitet: Steffen Petersen, Research manager

DTU: Svend Svendsen, professor

## The facade window industry in general

- The facade window industry is like the rest of the industry conservative and does not embrace the general development.
- They were lobbying heavily as opponents to the demand for more energy efficiency among construction materials and windows, when the initiatives were initiated in 2008.
- They are generally risk averse. This might have to do with the requirement of 10-20 years warranties.
- The categorization made in this report is adequate and represent the demography of the industry.

## Innovation in the industry

- In general the larger companies are frontrunners on innovation matters.
- The independent companies are more innovative.
- However, the major companies have internal R&D and apply more closed innovation activities. They do not to the same extent involve Århus – what about TI?
- The larger companies often focus on incremental innovations and inertia. They simply improve current products. The independent (but still large) companies develop new products and set the standards.
- The small companies seek simply to fulfill the technical requirements with minimum effort the larger companies seeks to go beyond (Idealcombi, protect) while the MNE's is second mover.
- There is a lot of technological knowledge and experiences which the manufacturers could apply or get inspired from. Only Idealcombi and Pro-tec seems to do this openly.
- The customers are not involved and do not possess innovation inspiration. They are not vital sources of innovation. Customers can be divided in architects, engineers, and private consumers:
  - o Architects just want a window that is easy to handle and looks good.
  - o Engineers want windows that are energy efficient.
  - o Private consumers want cheap windows that look similar to existing ones.
    - ⇒ Neither possesses innovation competencies related to the technological matters in order for the manufacturers to develop products which can fulfill the 2020 standards.
- The technological innovation inspiration is geographically located in primarily DTU, Århus University, and TI.

## Big Firm Interview Transcripts

# Interview - Dovista

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**Respondent: Eirik Bjørn**  
**Interviewer: Jesper Stentoft Flackeberg**  
**Dato: 8/4 2014**  
**Sted: Dovista Innovation Center, Ringkøbing**

### Præsentation af Dovista

Virksomhederne i vinduesbranchen er organiseret efter 3 principper:

1. Enkeltvirksomhed, 100% privatejet af virksomheden selv. (Idealcombi)
2. Koncern der består af flere virksomheder, privatejet, men støttet af fonde. Et holding selskab. (Dovista)
3. En investeringsfond, hvor en gruppe af investorer har investeret i koncernen og opkøbt virksomheder. (Inwido)

Der er forskel på Inwido og Dovista. Det er et svensk investeringsselskab der står bag Inwido mens Dovista er familieejet, men en koncern af flere virksomheder. I investeringsselskabet sidder der nogle investorer som har investeret i koncernen og har valgt at gå ind i vinduesbranchen. Dovista er et holding selskab med fonde osv. Bagved der støtter koncernen. Ejet af VKR Holding der består af flere dele; facadevinduer, ventilation, ovenlys og solvarme.

Dovista er et paraply selskab for alle facadevinduesproducenterne i VKR koncernen. Vi har produktudvikling for Velfac og Rationel primært. Vi er koncentreret om det danske og engelske marked.

### Virksomheder i Dovista

Vi har en lang række facadevinduer under os, i Danmark er det Velfac og Rationel og O.H Industri der er leverandør. Så har vi også facadevinduesproducenter i Norge, Sverige og andre lande.

#### Velfac

I 1960'erne købte Vidum Andersen en mindre facadevinduesproducent og tog et brand der hed Velfac og så i starten af 80'erne udvikler han sammen med et par ingeniører, det vi i dag kalder Velfac 200 vinduet. Dette vindue består af en karm og ramme hvilket er en meget forenkling af et vindue, men åbner op for lys og det hele. Det kæmpede en hård kamp i starten, fordi det ikke lignede et normalt vindue. I dag er dette vindue og den måde at forstå et vindue på. Det er så blevet lidt en trend i dag.

Fra den ene dag til den anden nedlagde man alt træ-produktion og det var hårdt i starten, men det gik godt til sidst. Siden da har vi sådan set arbejdet videre med den platform og forbedret den.

I de sidste par år har Velfac fået et træ-alu vindue.

#### Marked

Velfac har en hel del renovering, men tjener primært penge på nybyg.



## Rationel

Det er sådan set et ganske traditionelt vindue. Hvor man har en kam og en ramme der ligger oven på hinanden. På et tidspunkt i 80'erne indførte man alu som beskyttelse med vejrlig og det har stille og roligt arbejdet sig ind på markedet. Rationel er blevet et stort selskab i dag, ligesom Velfac.

Rationel har beholdt det vindue som de altid har haft – dog forbedret det.

## Marked

Rationel satser helt klart på renoveringsmarkedet. Alu-vinduet har stille og roligt arbejdet sig ind i markedet. Det er der deres kunder primært ligger, de har også nybyg men har fokus på renovering. Det er et udmærket vindue til en god pris.

## Betydningen af at være en vinduesproducent i Dovista

Virksomhederne varetager alt salg og markedsføring overfor kunderne. Produktion og udvikling sker i Dovista, udvikling i Ringkøbing og produktion i Polen. Rationel og Velfac er i princippet et salgskontor.

Produktionen er ejet af Dovista.

## Produkterne og energiklasser

For markederne er produkterne primært delt op på energisegmenter; c-, b- og a- klasser. C = BR10, B = BR15 og A = BR20.

I dag er C helt klart det største salg fordi det er det billigste salg. I 2015 vil mængden sandsynligvis komme på B, mens den i 2020 vil komme på A. Vi sælger naturligvis alle vinduer, men det er primært C produkterne der bliver solgt fordi det er billigst.

Men det har også noget med incitament at gøre og rentabilitet. Det kommer an på hvilket byggeri vi har med at gøre. Hvis man har et ældre hus hvor man bare gerne vil skifte vinduer, så kan det ikke betale sig at købe A. Men hvis man energirenoverer det, ekstra isolering osv., så kan det bedre betale sig at købe a. Det handler om helheden i byggeriet.

## Energikravene

Lovgivningsmæssigt, så skal man når man skifter vindue skifte til den energiklasse der er bestemt af lovgivningen. Det er alle. Derfor kan man ikke sælge produkter med energimærke der ligger under klasse C. Men det sker nogle gange hos private alligevel.

Den politiske målsætning er helt fin med os. Vi har en vision om at gøre noget godt for mennesker, vi arbejder med krav sætningen sådan vi får noget at måle på ift. hvad vi som mennesker gerne vil opnå. Det er det vi arbejder for. Og der påvirker vi lovgivningen. Vi vil gøre vores arbejde for at samfundet kommer så godt ud af det som muligt. Vi er heller ikke naive, samtidig møder vi kunderne der hvor de er. Vi vil meget gerne prøve at påvirke lovgivning og beslutningstagerne, men hvis folk gerne vil købe et C-vindue så leverer vi det, vi kan kun påvirke hvis vi har en forretning.

## Om facadevinduesindustrien og vinduer generelt

Typisk findes der 3 slags materialer man bruger til vinduer; træ, aluminium, PVC (plast). Det er sådan set det. Så hvis man afsøger hele markedet finder man de tre materialer som stort set alle vinduer består af.

Levetiden for at vindue er 40 år – og det skal et vindue holde som minimum.

### Træ

Hvis man forbedre træ, så propper man isolation/membran i det (eller i rammen) f.eks. kork, rockwool, skum eller sådan noget. Det er en membran man sætter ind. Men det har man nemt ved at bryde igennem ift. fugt og tyveri – dvs. der er nogle ting man virkelig skal have styr på for at få levetiden op.

### Aluminium

Aluminium er en god varmeleder, så derfor skal man have en termisk brydning og den skal være rimelig stor før den har en effekt.

### PVC, Plast

Det er billigt på nogle markeder, og derfor tager man ofte det. På andre markeder som f.eks. det danske, så er PVC et materiale der ikke er specielt løddigt.

### Alternative materialer

Det er en stor omgang at finde alternative materialer. Nuværende materialer har sine svagheder ift. nye konstruktioner. Arbejder man med træ, så skal det have en speciel mængde, tykkelse for at det kan holde. Går man ned på 2, 3, 5mm så skal man have et andet materiale. Og, man kan ikke bare lige erstatte med aluminium fordi det er termisk ledende, og PVC har en stivhed der ligger meget langt nede der gør det mindre fleksibelt. Når man så leder længe nok, finder man nogle der arbejder med polyester baseret materiale og de kommer lidt deropaf. De mangler noget stivhed, har ok termiske egenskaber, men der mangler nogle egenskaber. Så har vi arbejdet videre med det og fundet andre materialer og fandt frem til det her PUR skum, det har nogle rigtigt gode egenskaber.

*Hvad er forskellen på jeres PUR skum og Idealcombi's*

Idealcombis er noget opskummet PUR man støber det i. Vi hiver det ud igennem en form så det har en bestemt form og struktur.

Det har noget at gøre med hvad der giver fordele i produktionen, men også egenskaber.

## Udvikling i Dovista

Geografisk og fysisk er salg, produktion og udvikling splittet op. I vores arbejde med udvikling i Dovista har vi meget tæt samarbejde med salg og hele product management delen. Den arbejder vi meget tæt sammen med. Vi laver en fælles strategi for hvordan vi vil arbejde med produkterne, hvor vi vil hen og hvordan. Sammen med salg arbejder vi så med at udvikle produkter, prøve det af i test, og overfor markedet gennem salg.

Vi arbejder med en meget klart defineret proces, som i starten handler om at få ideer, teste dem, udvikle produkter og igen teste dem på markedet og produktets tekniske egenskaber.



Når det så er overstået, så går vi i gang med næste fase som handler om at forberede produktet til masseproduktion. I anden fase ift. masseproduktion, så er der en anden projektleder der tager over og sørger for at implementere det i Polen.

## Produktudviklingsinitiativer og portefølje

Vi har som minimum og konstant to spor i gang. Det ene projekt overtager det næste, og det er ud til produktionen. Vi arbejder indenfor nogle overordnede platforme hvor vi arbejder på hvordan vi kan gøre det bedre, og viderudvikle. Dvs. vores innovationsproces er delt op i nogle klare processer og steps. Der er aldrig dødvande.

### Komposit materialer i vinduet

For nogle år siden havde vi et projekt hvor vi prøvede at finde ud af hvilke materialer der evt. kunne bruges i fremtidens vindue. Der var rigtigt mange forskellige materialer oppe at vende. Det er ikke noget man lige gør, og det har kostet mange penge. Men vi fandt frem til et bestemt komposit materiale. Det koster en del at udvikle teknologien og materialet så det kan bruges i vores vinduer.

### Udvikling og produktion

Vi tænker rigtigt meget på hvordan det giver mening at producere, og hvordan man kan få omkostningerne ned i produktionen.

## Udviklingsamarbejde og partnere

Der er 5 meget store leverandører på glas, ikke af ruder, men af glas. De ejer stort set alt hvad der findes rundt omkring. De 5 er sådan set de største på markedet. Der arbejder vi med 4 af dem, som vi har som leverandører på glas, ikke ruder.

Glas producenterne sælger til verdensmarkedet, som Dovista er vi en meget stor spiller overfor dem. Det gør os mere attraktive. Glas leverandører udvikler til rudeleverandører på baggrund af deres marked hvilket er vinduesproducenter.

Vi har kontakter ind til glas virksomhederne og holder os opdateret på hvad der sker, og hvor udviklingen foregår og hvordan vi kan gøre glasset bedre overfor ruderne. Der har vi et mere eller mindre formaliseret samarbejde, vi har kontrakter med nogle og med andre bare et godt samarbejde.

Vores produkter har vi rettigheder til med patenter osv. Man kan godt kopiere, men ikke 1:1 og hvis man kopierer, er der altid et eller andet man misser. Det arbejder vi også på.

### Uformelt samarbejde

Vi holder os orienteret udviklingen indenfor glas. Vi har kontakter indenfor salg, og udviklingen og har en føler på udviklingen og samarbejde med dem om hvad der kunne være godt at have.

Glas-leverandør er interesseret i at have en god relation til os for at få salget op og afsætning hos Dovista. Vi vil gerne have en god relation for at finde ud af hvad der sker i udvikling, vi har nogle følere ude hos dem.

### Formelt samarbejde

Dem der har noget til en god pris osv. Dem laver vi kontrakter med. Men her er vi et skridt længere bagud end vores direkte leverandør.

### Samarbejde med 2 led *baqud* i værdikæden

Vi samarbejder ikke med vores direkte leverandør af ruder, men dem der leverer glas til dem. Vi arbejder med rude-leverandøren, men også glas leverandøren og samarbejder mht. udvikling og salg.

### Samarbejde med *kunder fremad* i værdikæden

Vores primære rolle er, at arbejde tæt sammen med salg og udvikling. Vi er hele tiden opmærksom på hvad de efterspørger og hvad vi leverer. Dvs. vi kører hele tiden strategien så den stemmer overens med markedet.

Samtidig skal den løsning vi laver ramme rigtigt ift. cost, pris og performance. Det skal gå hånd i hånd.

Måden vi samarbejder med dem er ved at involvere vores sælgere som løbende tester ideerne på markedet.

### Hvem i værdikæden udvikler hvad?

Materialer siden er en ting og det er en meget stor ting, det kræver en kæmpe organisatorisk ændring at ændre det pga. produktion faciliteter osv. Træ og alu er egentlig det drivende i Dovista. Det at få et andet materiale ind er virkelig en omvæltning for det hele, salg, produktion, udvikling osv. Der skal virkelig være nogle fordele, den største driver er pris.

Det som vi sidder og arbejder med det er at finde ud af hvad det er for nogle teknologier som rør sig i DK, EU og verden. Hvad er det for nogle teknologier der kommer ind, hvor kan vi se tingene bevæge sig, hvad er det der kommer som vi skal være opmærksom på.

En teknologi er både noget der kan øge vinduets performance (pris, egenskaber osv) samt produktion. Hvis vi tager ruder eksempelvis, så sker der hele tiden noget og glas bliver bedre ift. coatings og hvordan man bygger ruder op så de fungerer bedst. Det er noget vi aktivt deltager i, og arbejder med. Det med opbygningen, og hvordan vi kan bruge de byggestene de har og komme med ønsker til dem der laver coatings.

I Dovista, tager vi så de komponenter ned på vinduesplan. De indkøbte produkter er ikke vores primære opgaver, men det er selve vinduet vi fokuserer på, alt det som en normal forbruger ikke ligger mærke til. Derfor kigger vi på hvordan man kan få lyset ind, hvordan et vindue ser pænt, er attraktivt osv. Altså design og sammensætning af byggestene vi får fra leverandører.

Vi arbejder med hele den normsætning som der skal overholdes når det kommer til vinduer; levetid, energi, design, performance og pris. Der er en række parametre som vi sørger for at have med samtidig. Det er det vi laver.

## **Udvikling – forskel mellem store og mindre producenter**

**De mindre producenter** opererer primært på et nichemarked, kundegrundlaget er meget mindre. Det skal være kunder der har en form for relation mellem produktion, vindue og deres kunder. Der skal man finde et match. Men det har nødvendigvis ikke noget at gøre med energiklasser, men at der er et kendetegn ved vinduet som passer markedssegmentet.

**De større producenter** kan ikke fokusere på nichemarkeder, de skal have mængden. Derfor skal man have et all-round vindue der kan masseproduceres til store markeder.

# Interview HSHansen

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## Interview respondent

Søren Sørensen, Marketing, HansenProfile.

2141 1820

[shs@hansenprofile.dk](mailto:shs@hansenprofile.dk)

Date of interview: 19/3 2014

Telephonic interview

## Interview objective

HSHansen represents the large category of companies. They have

## Questions

**Fortælle lidt om jeres produkter og virksomhedshistorie – overordnet.**

Hshansen, tilsvarende firmaer.

### Primære kunder

Entreprenører. Byder ind på licitationer. Fagentreprises.

Facadelukninger.

Konkurrenter: 2. minder om dem.

De opfatter ikke vinduesproducenter. De

**Hvem arbejder i sammen med for at lave jeres produkter og sælge dem?**

Arkitekter. De er projektudviklere.

Udviklingsproces: de ved altid om de har noget. De får nogle tegninger. Nogle rammer der skal kunne noget specielt.

**Har I et behov for udvikling? Hvor stammer det fra?**

Vi følger med i lovkrav, markedskrav er længere fremme. De er langt fremme og bevæger sig over i cradle2cradle.

Eref energibegrænsning – hvor meget må et vindue slippe ud? Br10 må slippe +30kw ud og i 2020 = 0 kw.

Alle vinduer kan det.

De har mødt kravene før de blev til lov. Specielle bygninger i udbud og løsninger skal være gode og de systemer er udviklet før.

Aluminiumsvinduer => de er foran. Trævinduer er længere tilbage i udviklingen.

De offentlige bygger til sig selv og er interesseret i driftsomkostninger. Og til private var driftsomkostninger men det begynder at ændres nu. Indenfor de sidste 10 år gradvist mere og mere 5 år.

### **Innovation i virksomheden?**

#### **Samarbejdspartnere – eksisterende/nye**

Forskellige former uni + gts + søge midler. TI og aalborg universitet. Finansierede phd beløb.

De har haft gang i formelle samarbejdsaftaler med nogle videninstitutioner. Samtidig arbejder de meget med arkitekter om at udvikle nye facadelukninger der passer til de designs man gerne vil have.

## **Interview - Inwido**

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**Respondent: Henrik Søgaard**  
**Interviewer: Jesper Stentoft Flackeberg**  
**Dato: 7/4 2014**  
**Sted: Telefon-interview**

### **Noter og emner der kan formidles til interesseorganisationerne**

- BR15 osv. Har sat skub i udviklingen.
- Energikravene er der, produkterne er der, men hvordan får man kunderne derhen?
- Hvordan får vi slutbrugere til at bruge penge på disse løsninger?
- Tit har kunderne ikke behov for de bedste produkter: Vi oplever tit, at vi tilbyder for gode produkter ift. konkurrenterne og særligt ift. kravspecifikationerne der sælger vi et bedre produkt og bedre er dyrere. Når alle ved det, så tendere alle mod at skrue ned og lave produkter der er billigere og dermed skruer ned for produkternes egenskaber
- Det bliver bare sværere og sværere at udvikle nye produkter. Alle krav der bliver indstillet øger kompleksiteten. Men det sagde man også i 2010 og der snakkede man også om at de mindre producenter skulle op med noget mere.

### **Interessante interesseorganisationer**

Disse interesseorganisationer vil jeg formidle projektet blandt og evt. præsentere for. Jeg har indledt samarbejde med DI Byg og Dansk Byggeri.

- Dansk Byggeri
- DI By
- VinduesIndustrien

Andre?? Tilføj gerne.

----- Noter fra samtalen -----

## Præsentation af respondent

Henrik Søgaard, udviklingschef. Har været i branchen i 5 år. Har før arbejdet med maskinbygning så har ikke lang erfaring i branchen, men har erfaring med hvordan man samarbejder med kunder og leverandører.

## Om Inwido

Det er en større koncern. Den ejer virksomheder der producere selv. Inwido består af bogholderi, økonomi, udvikling.

I vores koncern har vi ikke en stor udviklingsafdeling, dem vi sammenligner os med har større udviklingsafdeling end os.

Vi er 3 mand ca. og det er ikke noget der kan drive udviklingen. Derfor bruger vi vores leverandører der kommer med input og de andre lande i koncernen for at få de rigtige produkter og de produkter vi får har den rigtige profil.

Vi har en meget udadvendt tilgang og får andre til at hjælpe.

Vi har 4 producenter i DK:

- KPK – direkte henvendelse til slutbruger. De sælger direkte stadigvæk til slutbruger.
- KPK – sælger til tømmermester, et skridt fra slutbruger.
- Outline – 2 skridt fra slutbruger gennem tømmershandel.
- Pro-tech til entreprenører og bygherre, det er den professionelle verden.
- Frovin – også til bygherre til professionelle vinduer. Primært KBH.

## Om facadevinduesindustrien

Vinduesbranchen har været meget stationær, for 5 år siden havde vi næsten alle sammen de samme produkter.

BR15 har sat skub i udviklingen meget mere end man kunne forvente. Der er mange der har brugt TI, DTU til at finde nye anvendelser af nye materialer.

## Den politiske målsætning

### Den politiske målsætning

I november kom der en kommission der udvalgte nogle forslag til hvordan man kan udlede Co2 neutralitet i Danmark. Et af forslagene var faktisk at fremrykke kravene i vinduesindustrien. I EU kravene er det allerede i 2018 at det skal være 0-energi huse. Kravene er der, produkterne er der, men hvordan får man kunderne derhen? Vi har en branche der har det hårdt og siden 2008 er der gået stiltand i alt. Så man kan være bange for at hvis vi fremrykker de her krav, så stopper man markedet endnu og starter en "falsk" omsætning inden hvor folk hamstre vinduer inden de her krav så vil blive implementere. Dvs. man bruger nok lidt en glidende overgang. Og i 2015 vil kunderne opleve en prisstigning på 8-10% med implementeringen af BR15 og det kan folk bedre håndtere.

Men det er klart at der er andre der presser på på den anden side og der er et pres fra politisk side om at samfundet skal have co2 neutralitet og derfor sidder vi som klemmelus.



Det er kroner og øre spørgsmål. Folk har penge faktisk, men man bruger dem ikke. Der er kommet en nøjsomhed ind i samfundet – en reaktion på krisen, svært at få penge op af lommen. Vores branche er ikke anderledes end andre markeder. F.eks. bilbranchen i dag sælger man mikrobiler og ikke de større bedre biler. Og, det er måske ikke et problem....? Det er bare en langsom udvikling.

## Markedets rolle ift. udviklingen og innovation

### Frovin og de kan 2020 kravene, markedet hæmmer udviklingen

Det er korrekt at de mest solgte produkter er BR10 produkter, de er simpelthen bare billigere. Energivinduer.dk har en liste over vinduers a-klasse. Alle producenter har nærmest et a-klasse produkt. Der er altid nogle der ligger over gennemsnittet og det er sjældent der er nogen der går ud og siger at vi har et godt nok produkt der er billigt. Og, kunden skruer tit ned for ambitionerne da de køber de billigere produkter. Det har noget med konkurrencen at gøre, der er altid nogle der er billigere. Vi oplever tit, at vi tilbyder for gode produkter ift. konkurrenterne og særligt ift. kravspecifikationerne der sælger vi et bedre produkt og bedre er dyrere. Når alle ved det, så tendere alle mod at skrue ned og lave produkter der er billigere og dermed skrue ned for produkternes egenskaber. Prisen afspejler bare at det er bedre produkt, men det er ikke altid det bedste produkter der er behov for.

Man taler om at 70-80% af omsætningen er renovering og her er det private forbrugere der skal betale og her er der meget fokus på pris derfor bliver tilbudte produkt ikke altid det bedste. Der findes naturligvis nogle kunder der vil have de bedre og nye produkter – de er desværre bare ikke i overtal.

Når BR15 kommer, så sker der et lille hop opad.

### Konkurrencen og de mindre virksomheder

Men der er ingen tvivl om at de små producenter de har en udfordring fordi de skal have 3 produkter (Br10, 15 og 20) og hvordan. Mange af de mindre producenter har samarbejde med en teknologipartner som udvikler et produkt af en teknologi partner. Men det bliver ikke lettere fordi der kommer miljøkrav. Den nye byggevareforordning kommer med krav om genbrug, sikkerhed osv... Det vil sige, at det bliver bare sværere og sværere. Alle krav der bliver indstillet øger kompleksiteten. Men det sagde man også i 2010 og der snakkede man også om at de mindre producenter skulle op med noget mere.

## Udvikling i Inwido

### Det praktiske arbejde

Vi får ikke ideer fra DTU og TI men fra os selv og partnere.

Det er forskelligt om vi har kontrakter osv.

Vi kommer nogle gange med nogle ideer og sender det til vores leverandører. Vi kommer med oplæg leverandør forfiner. Andre gange er det omvendt. De kommer med oplæg til produktideer og de søger en kunde at udvikle sammen med. I det eksempel jeg tænkte på, var det en ny teknologi de kommer med. I andre tilfælde er det udvikling af eksisterende produkter.





Der er også eksempler hvor leverandøren kommer med nye ideer til materialer.

Branchen (virksomheder i værdikæden) er meget åben om at arbejde sammen. Og, branchen er leverandørkæden og typisk hans egne leverandører. Det er meget lidt der kommer fra kundesiden. Det meste udvikling der sker i branchen er baseret på udvikling med leverandører. Det er meget netværk og at man har et vindue, så har man tilføjet en ting der gør det lidt bedre eller anderledes.

## **Inwidos rolle overfor virksomhederne som er en del af koncernen**

Inwido rolle supportere de lokale afdelinger og styrer projekterne.

Den kendte teknologi og produkter og produktionsfaciliteter det sker hos virksomhederne selv. Når det bliver noget mere kompleks så bliver det os der styrer det. Vores produktionsvirksomheder står for driften og deres udviklingsaktiviteter er fokuseret på driften og omkostningseffektivisering, osv. Forbedringer på eksisterende ramme (tid og ramme).

## **Produktudvikling i koncernen og i de enkelte virksomheder**

Produkterne udvikles til pro-tech eller den specifikke virksomhed. Der skal være en sammenhæng mellem udvikling og produktion. Så vi udvikler ikke generisk.

### **Kunne virksomheden ikke gøre det selv?**

Jo, det er der også nogle der gør. Der er nogle der ikke laver nye produkter så de gør selv det hele. Vi hjælper dem der arbejder meget med udvikling.

Vi har enkelte produkter hvor vi bruger kunderne som sparringspartner, de er ikke en del af udviklingsprocessen men vi tester kundens opfattelse af det nye produkt. Det er typisk først i det øjeblik, at vi har lavet et produkt vi tester det blandt kunder.

## **Udviklingsamarbejde og partnere**

### **Samarbejde med andre leverandører som ikke er træ og de traditionelle produkter.**

Hvis man kigger på energivinduer.dk her er det i mindre omfang træ og de traditionelle produkter man bruger. Så vi kigger rigtigt meget i andre steder og f.eks. komposit osv. Det vil sige, disse leverandører de kan se at der sker noget i den her branche. Men når man sidder og får geniale ideer, så er der typisk en ude i verden der har udviklet dette produkt og der er nogle der har noget interessant. Der er også en del der ringer til os og spørger om vi vil være med.

Åben innovation hos os, det handler om at favne alt hvad der kommer ind som kunne være interessant.

For nogle år siden havde vi en åben innovationskonkurrence på Lund blandt folk der ikke lige tænker vinduesbranchen og hvor kan vi komme så hen her?

Glasbranchen rykker sig også rigtigt meget, og rudeproducenter de laver en masse ting fordi ruden er så vigtig i et vindue og de presser altså hinanden.

Den udviklingen der er skitseret presser hele branchen, og i 2010 efter BR10 implementeres var alle næsten klar med nye produkter dagen efter.

### **Samarbejde med leverandører – hvorfor?**



Nej, vi arbejder ikke kun sammen med leverandører der har noget at gøre med vinduer. Vi har også talt med andre leverandører der har med andre ting at gøre, f.eks. afskærmninger osv. Vi er en stor koncern med en stor omsætning, og det der driver leverandørerne er, at vi har stor omsætning i DK og de kan godt lide at vi får noget på markedet. Det er et økonomisk rationale.

Vi laver samarbejde med en partner og får eksklusivitet de første par år. Vi laver aftale om volumen, hvad får vi ud af det og hvad får de ud af det. Det handler om at få en aftale hvor begge er tilfredse. Der er et forretningspotentiale.

Vi har en stor volumen.

## Interviewguide

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### Idealcombi & the market

IdealCombi is a privately owned company with two business areas; doors & windows for vertical facades and 100% family owned. A generation shift are in place and will be carried out shortly.

The other companies are similar to us but part of a bigger group of companies owned by some funds and pengetanke.

Some years ago we had to make a choice of being a small company with a smaller revenue but profitable or if we should upscale and be a part of the bigger players in the industry. We could not just stay at the same level.

### The market

There are 2 fundamental markets and business areas:

1. renovations or
2. the building of new constructions.

IdealCombi is the Danish leader in replacements of windows and renovations. We have 7 windows and we have many chances of being able to sell a product to most renovations that look like current windows. We mass produce these 7 products but really want to be best and make the best quality.

You can not be the best performer on all parameters, we need to chose some and be market leaders on those. And we want to be at the forefront and in order to be that, we need to be at the forefront in development and to get the products to the customers. We compete on other things than price we need to otherwise it doesn't make sense.

The difference between the 2 markets:

1. Renovations:
  - a. Look and aesthetic
  - b. Legislations (fredet bygninger)
2. New building:

a. Energy more important

There are different afsætningskanaler for windows: Direct sales or through distributors. IdealCombi sell directly to our customers (professional customers). We are similar to Velfac. Rationel & Inwido sells to tømrehandler. We work with both the big entrepreneurs and smaller carpenters.

The smaller companies work with private consumers. Private consumers are annoying, they take too much time to sell to and this market is primarily served by smaller companies. We do not sell directly to customers.

- Direct at consumers
- Carpenters
- Trælast/grossists
- Entrepreneurs

## The industry and the legislations

If you look back 5 years the USPs were:

- Karndimensioner
- Overfladebehandling
- Beslag typer
- Glas typer osv.

This was the focus and of course design. Energy was about the glass you installed and that time has ended. Globally the trend is green. It is about recycling, C2C etc. and it will only be more. The bygningsreglement will be more increased and strict.

Our ambition is to develop new products that are of good quality while also take these new requirements into consideration. We want to be the Mercedes of the windows industry. At the same time the new parameter is energy and green thinking and we need to have that in mind in the development phase.

### How far are you in the omstilling into the 2020 regulations?

We are at the forefront in this development and can fulfil the 2020 regulations. And we need to take best advantage of this new situation while we have it. Because new competitors will come. But now the rest of our product portfolio need to get some lifts and be improved in order to be able to correspond to the 2020 regulations. Now we have developed our Futura + series with success that fulfil the requirements and the functionalities. Now we need to develop our old products in order to correspond to the development and modernize them.

### The demand

We sell surprisingly good. It is exciting to bring new products to markets and to sell new stuff. The biggest challenge is to get the products to market.

Furthermore we need to ensure that what we develop is something that can be sold. We screen the markets and pitch new products and collect a lot of feedback which we provide the back-end developers of the company so that they can develop the products they need.



Focus is to ask sales if products can be sold and then develop them not the other way around. The market kills technical ideas.

### **The competition**

It is difficult for us to compete with the capital funds who have finance to be able to have skilled people who are good. The thing that makes us good is that we are very passionate and fight for it.

We differentiate by being more passionate and want it some more. We have a good slipvind because we sell good. It is humans that realize projects and that is fruitful. Plus we need to meet the customers at their præmisser and we are very sale oriented.

### **The future**

We predict that a lot of companies will quit and others will enter. Things changes. And we think that competition might will be enforced in the new future.

## **Innovation process & organisation**

Innovations is what we can sell that thereby provides value for customers and that we can produce to the same market price. Still with the customers to have a positive attitude.

We have 3 departments in Denmark and then we have a product manager who is sales spokesman and facilitator. We tell him about our experiences and he sort these inputs and provide the developer those ideas. Then we have some meetings where we make some choices and the best way to go.

There is always one dark house and that is price. Fundamentally there is a optimum for how much it must costs which put string and limit the development. Then we provide ideas to customers who provide feedback which we go back to development with. This is a iterative process. And in the end we have a window.

At the same time there is the whole process of developing new machines, materials, weaknesses of materials etc. that can be able to produce the products to an affordable price. There is a lot of technical development which is being done in Hurup.

### **The variations of materials**

In '74 we had a wooden frame and then we saw that something with vedligeholdelsesfrie-vinduer with a wooden frame and aluminium. At that time focus was not on energy but on minimal vedligeholdelse og look. Then energy came and cold/heat which became a parameter.

### **Innovative companies**

Idealcombi and Outrup is the companies that develop new things and are at the forefront of the development. Outrup has to do with other materials than us.

### **The development of new products**

We developed based on what focus was on. At that time focus was on vedligehold and product life time. Here we relocated the wood in the frame and now others do that. And the only thing



that provide is lifetime. Now we developed a new core of PUR foam which is energy adequate. But new products are only focused and able to sell to new buildings and markets.

If products are to be replaced we need really to fit the product to the old design and the old dimensions and both focus on external look and feel, internal look and feel, and the colour. The smaller details is highly important for instance a small element such as the bending degree of external elements which are to be seen.

Cold/heat diffusion happens in the glass and the wood frames.

### **Where do we get inspiration**

The development team has been in Germany and big conferences and what kind of new materials do we have. At one time before we developed the PUR foam we worked with smelted granulated but they are using a lot of different materials. Its about abstract thinking.

**We need to prepare for the long term** therefore we develop new products. We could sell current products but we need to develop the new products. There are others that take that strategy to see what others develop and then they do it. But what they don't have is the experience and knowledge gained from production and development – that knowledge they will not have but we will and that creates sustainable advantages. The only problem they have is the problem that they do not fulfil the 2020 requirements.

### **Garanti**

We need to provide 5 years we guarantee 10 years.

### **Export and innovation**

Export and innovative products. Denmark is at the forefront of the development also international. The products we do not use in DK we could sell in UK but we don't. We want to sell the new and innovative products abroad but they do not need the same. But we have limited production facility and therefore need to focus on key products. Therefore we develop some products and then seek to mature markets. We have hired a guy who travel and host energy seminars and the performance of new windows. We teach them and try to establish a demand. That's a marketing method and we seek to establish new markets.

### **Fortælle lidt om jeres produkter og virksomhedshistorie – overordnet.**

- Idealcombi = resultatet af mennesker (pionerer), nyeste teknologi og innovation. Er anset som førende i branchen og trendsætter.
- Producerer dagligt over 700 vinduer, mennesker og automatiseret anlæg.
- Produktion i landet.
- 40 års erfaring
- Hvorfor produktion i Danmark?
- Den professionelle verden går op i energi og kondens.

## Hvad er jeres strategi?

- Fokuseret på produktudvikling. Udviklingen af specielt produkter vil være et kendetegn fremover.
- Produkterne: fokus på energirigtige produkter og arkitektoniske udtryk der passer til bygningerne.
- Løbende udviklet arbejdsgange og løsninger.
- Nybyg og renoveringer laver de produkter til med unikt finish. Det er finish der differentierer Idealcombi.

## Konklusion

1. Development of totally new windows (architectures) is only relevant in new buildings because there is no aesthetic stuff to take care for.
2. But older products focused on aesthetics needs to look like the old window and that is important and restrains innovation.
3. They constantly test ideas on markets and provide feedback to development.

## Small Firm Interview Transcripts

# Interview - FRBVinduet

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**Virksomhed: FRBVinduet**  
**Respondent: Bo Herskind**  
**Interviewer: Jesper Stentoft**  
**Flackeberg**  
**Dato: 10/4 2014**  
**Sted: FRBVinduet, Frederiksberg**

## Om virksomheden

FRBV forhandler og installere facade-vinduer af forskellige brands. De udfører renoveringer af private byggerier (boliger) og specielle fredede bygninger hvor der er særlige krav til æstetik og løsninger der er ens med eksisterende. FRBV producerer i samarbejde med leverandør forsatsvinduer. FRBV har specialiseret sig i et nichebaseret marked.

Der er 2 ansatte som primært arbejder med salg, markedsføring, bogholderi, administration og diverse. Derudover har de 3 ansatte "i marken" der udfører håndværkerarbejde. Virksomheden der producere forsatsvinduerne er 3 mand og producere primært, næste udelukkende, til FRBVinduet. Odretilgangen på forsatsvinduer er ca. 80-100 om måneden. Forsatsvinduerne har en Uw-værdi på 1,5 ca.

## Om markedet

De private kunder stoler på FRBV (fagmanden) i valget af vinduer. Dog er det primært det billigste tilbud der typisk vinder. De væsentligste kriterier er æstetik (farve), garanti og pris.



Energi er ikke som sådan et emne for den private forbruger i København. Nuværende løsningsers energiniveau er passende ift. eksisterende byggeri hvorfor mere energieffektive produkter vil have en længere tilbagebetalingstid og dermed ikke er attraktive.

Arkitekter derimod går mere op i energiprformance og sætter nogle mere specifikke krav. Sådanne krav møder vi ved ordrer over 15 vinduer typisk. Det er ofte en bestyrelse med en formand der skal have sat nye vinduer i en forening eller lignende.

## Energikravene og fremtiden

De skærpede EU krav gør, at det ikke giver mening at reparere enkelte vinduer pga. at de bliver nødt til at lægge flere glas i og dermed bliver de tungere. Derfor står de ved en skillevej og skal for fremtiden finde ud af hvad de skal gøre. Ved mindre opgaver og udskiftning af få antal vinduer bliver det en omkostning, at hyre ekstra udstyr til, at skifte vinduerne. Derfor frygtes det, at dette marked vil blive stoppet da det simpelthen vil blive for dyrt at få skiftet vinduer. Muligvis åbner det op for et brugt og sort marked.

Der mangler en sammenhæng ift. energikrav på bygninger. I dag er mange vinduer rigtigt energieffektive og der kan gøres rigtigt meget bare ved at skifte glasset. Dvs. vinduerne bliver meget bedre end hvad resten af huset er i stand til at opfylde. Der mangler en sammenhæng.

# Interview - Frovin

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**Virksomhed: Frovin Vinduer og Døre A/S**

**Respondent: Lars Have Christensen, salgschef**

**Interviewer: Jesper Stentoft Flackeberg**

**Dato: 02/04 2014**

**Sted: Frovin, Ugerløse**

## Øvrige noter og ting der kan formidles til interesseorganisationer

Jeg har deltaget i et seminar hvor temaet var hvordan man kunne lave nogle mere visionære ting og åbner op for markedet. Her samler man konkurrerende virksomheder og det synes jeg var en god ide.

Vi vil bakke op om initiativer der tænker længere frem. Vi forholder os til 2020 og vil egentlig gerne være mere visionære men det er markedet ikke. Vi har sådan set opfyldt 2015 kravene de sidste 4 år, men det er stadig ikke det vi primært bliver vurderet på.

Derfor vil vi gerne støtte op hvis der bliver lavet nogle netværk og sådan noget der er fokuseret på hvordan man kan lave noget visionært.

## Pointer der formidles til Dansk Byggeri

Jeg laver en præsentation for Dansk Byggeri hvor jeg vil lave et dokument hvor jeg mere udførligt gør rede for hvad det er jeg har mødt hos virksomhederne, deres ønsker, evt. ideer,



og generelle kommentarer som Dansk Byggeri kan tage til sig. Derudover har jeg også været i kontakt med DI Byg som jeg vil gøre det samme med. Derfor er du mere end velkommen til at tænke over om der er noget du vil formidle enten som Frovin talsmand eller gennem mig (du kan være anonym). Dette arbejde vil blive lavet i perioden d. 5 – 21 juni. Så der er lidt tid at tænke over det i.

- Der bør være fokus på dansk produktion. Derfor kræver det, at interesseorganisationerne (DI Byg, Dansk Byggeri osv.) ved hvad der rør sig for danske producenter. Hvilke kompetencer har de, hvad er deres situation osv.
- Der er nogle offentlige tilgængelige lister hvor udenlandske virksomheder er repræsenteret, men det virker ikke som om, at der er styr på hvad det er for nogle virksomheder. Nogle af dem er mindre seriøse salgskontor, men hvad er det egentlig de sælger? Er det noget vi kan stå inde for i DK?
- Hvad er kerneressourcerne og kompetencer i DK og hvordan får det til udlandet? Skal vi som producent til udlandet foregår det ikke gennem væksthuse men gennem større organisationer som DI og Dansk Byggeri. Vi vil gerne samarbejde med nogle forskellige aktører og indgår i dialog fælles i branchen og evt. også på tværs.
- Hvad er det der skaber danske arbejdspladser? Hvordan gør vi det bedre?
- Vi skal have fokus på 2020 og ikke bagudrettet. Vi kan sagtens opfylde BR15 kravene og også BR20. Markedet efterspørger ikke løsningerne og er ikke visionære. Det hindrer vores udvikling, vi kan og vi vil. Vi mangler bare incitamentet og en efterspørgsel der følger med.
- Der er gang i hjulene, men udviklingen hæmmes af manglende efterspørgsel. Underligt når incitamentet er der (offentligt fokus på energi osv. Danmark og København som europæisk/globalt forgangsløst ift. Co2 og energineutralitet)
- Hvordan får vi skabt større visioner? Hvem skal indgå i denne dialog?

### Interessante interesseorganisationer

Disse interesseorganisationer vil jeg formidle projektet blandt og evt. præsentere for. Jeg har indledt samarbejde med DI Byg og Dansk Byggeri.

- Dansk Byggeri
- DI By
- VinduesIndustrien

Andre?? Tilføj gerne.

----- **Interview noter** -----

### Om virksomheden

Har været selvstændigt ejet de sidste 13 år, ejeren har haft solgt firmaet over 2 gange i 2006 og 2011. Fra primo 2014 har Inwido fuldstændigt overtaget ejerskabet af virksomheden og den gamle ejer har trukket sig tilbage.

Men Inwido som koncern fungerer udelukkende som en paraply organisation og lader virksomhederne køre deres eget løb mere eller mindre – så længe det går godt naturligvis.



## Om virksomhedens produkt(er)

Frovin producere og markedsføre 2 produkter, foldedøre og koblede vinduer. Dette interview er baseret udelukkende på koblede vinduer.

Vi producerer ca. 350-400 vinduer om ugen ved egne produktionsfaciliteter.

Vinduet som det ser ud i dag har stort set ikke ændret sig siden virksomheden startede. Vi har dog løbende forbedret på det. Det har set sådan her ud de sidste 13 år. Vi har kun det her vindue og ændrer sådan set ikke noget, det fungerer og det overholder kravene. Alle kender os fuldstændig og kender vores produkt. Det er en fordel.

Vi giver 10 års garanti på vores produkter og kravet er 5 år.

## Hvad er et koblet vindue?

Det er hvor man har en yderramme og en indvendig ramme slået sammen. Man har to forskellige typer/størrelse glas i den indvendige og udvendige ramme. Selve tykkelsen af glasset kan variere alt afhængig af ønsker til energieffektivitet, lyd, varme, lys osv.

Produktet består af flg. Komponenter:

- Træramme
- Glas/termoruder
- Kit
- En hvid liste indvendig
- Beslag så det kan åbne og lukke

Vinduet består af termoruder (4, 5, 6 – op til 22mm), kernetræ som ramme, kittet vinduer og evt. en installeret ventilation hvis det bliver nødvendigt. I dag anvender man typisk træ-alu vinduer som er en træramme der er beklædt med alu.

Den inderste ruder kan komme op på en størrelse på 22mm i den konstruktion vi har på vinduet. Dvs. at vi kan have en 4mm rude udvendig og den 22mm rude kan vi komme op på en A-klassificeret rude. Med det produkt vi har i dag opfylder vi bygningsreglementet 2015. Vi er klar til at arbejde med at lave 2020 vinduer – vinduer der kan opfylde 2020 kravene.

Allerede i 2011 opfyldte vi kravene for 2015. Det har vi papirer på og vi tester løbende så vi kan dokumentere det.

Dette produkt er atypisk og differentierer sig fra andre produkter ved, at være designet med særlige forbehold for æstetik – som hænger sammen med virksomhedens primære marked. Det specielle ved produktet er bl.a., at glasset er kittet i, der er to vinduer og rammer som kan skilles ad med et koblingsbeslag indvendig. Derudover er det også lydisolerende – alt sammen uden at gå på kompromis med æstetikken.

## Tilpasningsmuligheder af produktet

Vi kan få forskellige glas-løsninger som bidrager med forskellige egenskaber. F.eks. kan vi få glasset med en folio bagpå (usynlig) sådan så den lukker alt lyset ind men ikke ud igen. Dette bidrager til at holde på varmen. Derudover kan vi få forskellige løsninger og har bl.a. arbejdet med strukket glas for at bevare bygningens udtryk.

Hvis vi skal opfylde 2020 kravene så ændrer vi igen på glasset. Vinduet bliver det samme.

Tidligere brugte vi f.eks. linolie det gør vi ikke i dag. Det giver ikke mening for miljøet og produktionsmæssigt. Der maler vi med noget maling der er godkendt af DVV.

Vi har også optimeret vores kit sådan så vi kan give garanti på 10 år. Blandt andet har vi lavet Georg Jensen i 2003 hvor der er over 80.000 samlinger og der har ikke været nogle reklamationer endnu.

De tilpasninger af produktet som vi laver det koster faktisk ikke ret meget mere, måske 10%. Men det er ikke noget der betyder synderligt.

### Om yderligere udvikling

Der er nogle der arbejder med forskellige materialer som f.eks. skum og andre ting, bruger Rockwool osv. Men det har ingen betydning for vores konstruktion – måske har det for andre – men ikke for os. Den konstruktion vi har kan opfylde BR20 ved at ændre ruderne.

Vi kan derfor ikke se værdien i at tænke mere visionært da markedet ikke efterspørger det.

### Samarbejdspartnere

Glasset kommer fra en leverandør i Tyskland – en kæmpe kæmpe leverandør der leverer til hele Europa.

Træet kommer fra leverandører der leverer de her træ-profiler. De kan sådan set levere hvad som helst.

Leverandørerne har en kæmpe produktportefølje som vi kan benytte os af.

De krav vi møder videregiver vi til vores leverandører som arbejder på at opfylde disse normer og krav.

Vi har samarbejdet med eksisterende leverandører igennem mange år – over 12 år.

Vi laver ikke om på vores vindue, derfor er vi også i stand til at samarbejde med eksisterende leverandører. Vi ved hvad vi kan, og hvad vi gør rigtigt godt og det bliver vi ved med. Derfor kender leverandørerne også vores produkter hvilket gør, at de nemmere kan udvikle og optimere produkterne som vi har brug for.

Kittet er blevet forbedret løbende og arbejder med hvordan man kan arbejde med fyldningsmassen.

Vi ændrer ikke på vores produkter og derfor kan vi samarbejde med de samme partnere. Det gør vi løbende og har løbende en dialog om hvordan vi kan gøre noget bedre – og hvad vi kan gøre bedre.

### Produktionsfaciliteter

Vi vandt automatiseringsprisen i 2006. Vi automatiserede kitningen af vores vinduer hvor vi fik udviklet nogle robotter der efterligner hvordan en af vores ansatte kitter. Der er blevet taget billeder af hvordan han arbejder og det er blevet programmeret i en robot samt tryk osv. Vi har løbende en dialog med de her mennesker om hvad vi kan gøre bedre.

## Udviklingen af produktion setuppet

Vi har kun investeret i nye produktionsfaciliteter for at frigøre det manuelle i produktionen og for at sørge for ensartet produkt. Alt andet har sådan set ikke ændret sig.

Derudover er der nogle små detaljer som foregår manuelt da det er rigtigt vigtigt for funktionaliteten af vinduet. Vi har folk hernede i produktionen som producere vinduerne og er rigtigt gode til det. Vi får løbende folk ind som rigtigt gerne vil det her stykke arbejde og som er dygtige til det. Det er vi glade for og har nogle dygtige folk der er motiveret og kan lave det vi producere.

## Virksomhedens marked

I forhold til markedsopdelingen befinder vi os i renoveringer og med særligt fokus på energidelen. Renoveringsmarkedet er stort set kun København pga. eksisterende bygninger.

Vi sælger specielt til København til renoveringer af eksisterende boligbyggeri primært. Her er det ofte særligt vigtigt, at æstetikken bibeholdes. Det er et vigtigt parameter. Særligt er dette gældende for gadevendte facader og mindre for de indvendige facader i gården. Der er ofte lavet nogle klare retningslinier fra kommunen der diktere, at æstetikken skal bibeholdes. Og, det er dette vores produkt er udviklet til.

Vi har altid lavet dette produkt lige siden vi startede, også før det blev et så udtalt krav om æstetik. Det er noget man går mere op i fremover specielt i København hvor der i en del byggerier ikke bliver installeret andre vinduer.

Vi sætter pris på, at man sætter krav om at man skal bevare nuværende æstetik i hvert fald ud til gaden. Så slås vi så om ikke også at blive installeret indvendig til gården.

Renoveringsmarkedet er betragtet som værende indenfor KBH kommune hvor man har bygninger der skal energirenoveres-optimeres.

## Den økonomiske udvikling

Vi har ikke haft en nedgang i markedet. Vi skal også være innovative på salgsområdet og har arbejdet med markedsudvikling. F.eks. havde vi nok ikke overlevet i dag havde vi kun fokuseret på rådhusene. Vi har hele tiden bevæget os ift. markedet.

”Vi har hele tiden holdt os orienteret om hvor markedet har flyttet sig hen. Vi har hele tiden vurderet hvor vi kunne sætte ind med dette produkt.”

## Eksport

Igennem vores samarbejde med Inwido har vi åbnet for markedet til særligt Norge og Sverige. Særligt er vores foldedøre store i Sverige og Norge – her er et kæmpe marked. Der sker noget mere her. Vores vinduessalg er ikke så stort i norden men vi sælger der og det går godt.

Som virksomhed er vi ikke typen der beslutter os for at eksportere til et marked og så gør vi det. Det bliver mere hånd i hånd med vores søstervirksomheder indenfor Inwido. Inwido er broen til de andre markeder hvor de andre virksomheder hjælper os ind på markedet.

Vi kigger sydpå nu og hvordan vi kan sælge til specielt Tyskland.

## Kunder

Er primært andelsforeninger og almene boligbyggerier som får finansiering gennem kommunen til at renovere bygningsmassen. Her sidder der en bestyrelse der bestemmer hvad pengene skal bruges på. De laver så nogle kravspecifikationer og laver et udbud.

Kommunerne og det offentlige sætter krav til tætheden og sætter fokus på gipsplader, isolering osv. Der er også fokus på lydisolering osv.

## Beslutningstagere

Er ofte arkitekter, entreprenører, rådgivere som samarbejder i forbindelse med de her renoveringsopgaver. De byder på udbuddet og vinderen skal så løse opgaven.

## Markedsprocessen

Typisk står man med en ejerforening der skal energirenovere og det kan være vand/varme, døre, vinduer, ventilations, elektricitet hvad som helst. Denne forening går til en entreprenør og spørger om de vil løse opgaven. Entreprenør sammensætter et hold af arkitekter, rådgivere, entreprenører osv. Der i samarbejde vil løse opgaven. De snakker så med foreningerne om der er noget de vil have fokus på og deres ønsker. F.eks. kan de have brug for nye vinduer. Så er der nogle midler foreningerne kan søge men de stiller nogle krav. Når foreningerne opnår støtte fra kommunen stiller kommunen nogle krav om at bibeholde æstetik og sætter krav til energi ligeså.

Disse krav bliver så videreføret til producenter f.eks. os selv vinduesproducenter.

Arkitekterne, rådgiverne, entreprenørerne sender projekterne rundt til de forskellige producenter som byder på opgaven. Det er så op til producenterne at komme med løsningsforslag.

Arkitekter, entreprenør, rådgivere osv. Stiller nogle krav til os producenter som f.eks. kunne være at der er i stueetagen skal være særligt lydisolerende vinduer og det betyder ikke så meget i de øvre etager. Så må vi jo så arbejde med det og komme med nogle løsninger. F.eks. kan de komme med modstridende krav om f.eks. ventilation og lyd i stue – 1. sal. Men det er modstridende da ventilen lukker lyd igennem og så går vi tilbage og siger at man kan ikke få det hele, så arbejder entreprenør, arkitekter, rådgivere videre med det og måske ændrer noget andet. Det er en iterativ proces.

1. Finansieringskilde – Det offentlige
  - a. Kommunen har fra staten fået tildelt nogle offentlige midler som de administrerer.
  - b. Kommunen fordeler pengene til forskellige "problemejere"
2. Problemejer – Bestyrelse af bolig forening.
  - a. En bestyrelse af en almen bolig forening får en pose penge og bestemmer hvad pengene skal bruges på.
  - b. Der bliver lavet et udbud af renoveringsopgaven.
3. Tilbudsgiver - Et hold af entreprenør, arkitekter, rådgivere
  - a. De samler et hold (eller samarbejder med sædvanlige) og byder på opgaven.
  - b. Rådgiverne og arkitekterne definerer hvordan de vil løse opgaven og ift. hvilke lovkrav. Pt. Er BR10 gældende hvorfor disse standarder ofte er anvendt. Dette er ofte bestemt af rådgivere og arkitekter.
4. Problemejer vælger tilbudsgiver til at løse opgaven.



5. Løbende i denne proces samarbejder tilbudsgiver med producenter af byggevarematerialer (herunder vinduesproducenter) og i samarbejde finder ud af hvordan man vil løse opgaven og hvordan man vil opfylde de forskellige krav. I denne proces bliver det individuelle produkt der skal indgå i renoveringen endeligt defineret (kravene for det) samt at tilbudsgivers planer bliver tilpasset summen af de enkelte produkters muligheder for at opfylde de samlede krav.
6. Step 4 og 5 er en iterativ proces hvor tilbudsgiver og producenter løbende indgår dialog mens tilbudsgiver og problemejer ligeledes indgår i dialog?

I mange projekter (renoveringsopgaver) beskriver man, at vinduerne skal opfylde BR10 hvilket vi synes er noget sludder. Fordi hvis man virkelig vil det her, så er det åndsvagt at man hele tiden kigger bagud og bruger 2010 krav selvom de egentlig stadig er gældende. Men man bør bruge 2015.

”Det er fuldstændigt sindssygt at man i en boligforening der skal istandsættes til 15-20 millioner, så går man ud og køber 2010 løsninger” (7:50 min)

### Kendetegn ved markedet/kommunernes behov

- Der bliver gået mere op i;
  - Lydisolering
  - Energikrav
  - Tæthed
  - Miljø
  - Æstetik og bevaring af bygningsmassens udtryk.
- Der er lavet en renoverpris som Frovin vandt i 2013. Denne renoverpris bliver årligt uddelt og kører for fuld drøn.
- Frovin vandt i 2013 hvor man havde fokus på æstetik, energi osv. Her havde vi også brugt trukket glas som ligner de gamle vinduer.

### Konkurrencen

Enhver tømrer/snedker mester kan egentlig lave disse vinduer hvis det skulle være.

Vi møder f.eks. også Velfac, Rationel, Idealcombi derude. Nybyggeri står stille og derfor mødes vi alle sammen indenfor renoveringer. Men i de større offentlige erhvervsbyggerier det marked er vi ikke i, de arbejder ofte med store facadevindues partier og det har vi ikke noget at gøre med.

# Interview – Modum Vinduer

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**Virksomhed: Modum Vinduer**  
**Respondent: Lars Hassing**  
**Interviewer: Jesper Stentoft**  
**Flackeberg**  
**Dato: 8/4 2014**  
**Sted: Modum Vinduer, Hobro**

## Om virksomheden

Vi laver plast-komposit og er afhængig af årstiden 3-5 mand. Vores bedste tid er juli til jul. Vi sælger hovedsageligt til tømrermestre og sælger 1 til mange elementer af gangen.

Jeg har været i virksomheden i 18 år og ejer 50% og har en medsponsor som sponsorere rent økonomisk.

Vi forsøger at komme ud på nogle andre markeder om at få lov at lave noget. Vi arbejder på at få lov til at lave en boligforening i Århus og noget i Grønland. Hvis det lykkedes i Grønland vil der være et kæmpe marked deroppe.

## Produktion

Jeg får en stand af plast profil på 6 meter som vi skærer op og laver vinduer af. Langt størstedelen af Modums maskiner er manuelt betjente og laver enkelte processer. Der er en automatisk maskine der forfiner hjørne samlinger og gør dem pæne. Ellers bliver alt andet lavet i hånden.

Det tager os 1,5 time at lave et vindue.

Når vi får nogle nye løsninger skal vi altid sørge for at vi har det rette værktøj og maskiner. Jeg køber alle maskinerne brugt og vi kan som regel selv finde ud af hvordan vi kan løse problemer når de går i stykker.

Alle producenter har et reference ramme på en standard størrelse. Der er vores Uw-værdi på 0,8.

Energikravene betyder, at produkterne bliver dyrere og tungere hvilket gør, at vi skal have noget nyt produktionsudstyr.

## Om virksomhedens produkt(er)

Vi har altid lavet plast vinduer. Jeg kommer fra træ-industrien og har været på en træ-vindues fabrik og vælger at sige nej til aluminium. Markedet for ren aluminium er ikke ret stort. Det har noget at gøre med traditioner. I DK er vi vant til at have træ vinduer, men så kommer der noget der er smartere, fordi man vil ikke male udvendig. Så kommer træ-alu som er vedligeholdelses fri. Derimellem er plasten, den kommer fra Tyskland hvor man har plast. Plastvinduet kommer herop engang i 1970'erne. Men problemet med plast er, at alle vinduer i



Tyskland åbner indad. Det gør vi ikke i DK, der åbner vi udad. I 90'erne finder vi ud af, at det holder ikke. I dag har vi så et vindue der åbner udad og er på nøjagtig samme niveau som et træ-vindue.

Vi har udviklet et produkt der opfylder 2020 kravene i perioden fra 2009/10 og var færdige med produktet i 2012.

## Produktudvikling

Vi skal have en masse kamre ind i profilen, det er det der isolere. Derfor skal vi optimere på den front. Det kan man ikke på samme måde som træ. Derfor laver de isolatorer.

Vi er ikke færdige med udviklingen og kravene bliver større og større. Det er der ingen tvivl om. I 2020 er der nogle træ-producenter der forsøger på alle mulige måder at få Uw-værdien ned.

Vi har allerede et 2020 produkt hvor vi bruger en 3-lags rude uden stål overhovedet. Der er vi så langt nede at vi overholder 2020.

## Udvikling

Det er os som producenter der har stået for udviklingen af plast vinduer. Vi får nogle profiler hjem i lange baner som vi skærer op. Vi gjorde det, at vi købte et træ vindue, sendte det til leverandøren som skar vinduet op og kopierede vinduet. Det har betydet alt, havde man ikke gjort det, havde vi ikke haft plastvindue i dag.

Sidenhen har vi så lavet nogle forskellige ting, f.eks. satte vi stål i for at stabilisere produktet. Men så kommer energikravene og det bliver sværere og sværere at overholde kravene for de ting. I 2010 finder vi ud af, at vores system ikke kan overholde 2015 kravene. Vi har så valgt at nedsætte en arbejdsgruppe mellem mig, Hvidbjerg vinduet, kastrup vinduet og samarbejder med profil leverandør og beslag leverandør. Vi sætter os sammen i 2009 og der bliver designet et helt nyt profil system og en hel ny måde at lave vinduer på. Det bliver så lavet i komposit (glasfiber armeret komposit materialer). Man laver hele kernen i komposit og ligger plastic udover. Det er det produkt vi sælger 90% af.

Udfordringer i udviklingen var, at vi ville have stålet væk da det var kulde og varmeledende. Det har Rehau så udviklet med komposit.

## Om samarbejdet

Rehau er en kæmpe profil leverandør med 12.000 ansatte. De laver alt indenfor komposit til forskellige markeder. De havde brug for os, fordi de gerne ville sælge vindues profiler og ville gerne sælge i Danmark og Skandinavien.

Os der var konkurrenter gik sammen fordi vi har det rigtigt godt sammen, virksomhederne imellem er der ingen onde ord eller noget. Selvfølgelig er vi konkurrenter, men vi samarbejder for at udvikle de bedste vinduer vi kan komme til.

Rehau har altid brugt vores værksted til at lave test, prøver og udvikling. Jeg repræsenterer alle de små/mellemstore virksomheder. Vi fokuserer kun på dette materiale og derfor har jeg nogle muligheder for at teste det på vores værksted. Jeg er den mindste virksomhed, hvor Hvidbjerg og Kastrup er dem der tager fra og har en større volume.

Fordelingen i samarbejdet var som følger:



- Rehau stod for udviklingen af profilerne som skæres op og bruges som ramme.
- Beslagleverandøren har stået får udviklingen af beslaget der passer til profilerne.
- Vinduesproducenterne har stået for at teste profilerne og udvikle/skabe konstruktionen og dermed videreformidle komplikationer/forbedringer til profil leverandøren.

Vi har haft indflydelse på hvordan profilet skal se ud ift. hvad der giver mening for os at producere og hvordan kanalerne skal sammensættes, f.eks. skrue-huller, anverfer ift. transport, og sådan nogle ting som de ikke lige havde tænkt på fra producenternes side. Det sker, når vi sammensætter profilerne til et færdigt vindues produkt. Luk af vinduer, mulighed for pudsning og alle de forskellige features et vindue skal have, det er det vi bidrager med.

Andre i branchen siger, at det kan ikke gå det der med samarbejde på den måde (de konkurrerende DK vinduer, de tyske producenter) men vi har en ens mentalitet og samarbejdet har foregået fint.

### Ressourcer i udviklingen

Jeg har brugt tid på udviklingen af 2020 produktet, jeg har ikke investeret i det eller fået penge for det, det har de andre heller ikke. Det har Rehau. Vi havde en formel aftale, en kontrakt, men den indeholdt ikke økonomi. Man lavede en kontrakt hvor der var forbehold ift. tavshedspligt. Det var vigtigt for Rehau, at de andre profil leverandører ikke fik kendskab til udviklingen. Beslag leverandøren har også brugt mange ressourcer på at udvikle beslag systemet til de profiler der skulle udvikles. Beslag leverandøren har også en interesse i at kunne sælge deres beslag til andre virksomheder som hyldevare.

Dette produkt var set som en måde at skabe konkurrencefordel overfor de andre plast leverandører, ikke så meget træ, træ-alu.

### Hvem sætter udviklingen i gang og hvad er markedets rolle?

Vi bliver bare hele tiden nødt til at udvikle nye produkter for at være et skridt foran. Os der laver vinduer i plast har en fordel af, at vi har en profil der er opbygget ved ekstrudering (man skubber det ud) og jo flere luft kamre der er i profilen, jo mere isolerer det. Der er udfordringen, at lave vinduet så det fylder så lidt som muligt.

Udviklingen af plast er nemmere end udvikling af træ. Ved træ har man indtil nu ikke haft de samme muligheder for at lave luft kamre i træ. Derfor har de været nødt til at bruge en isolering som f.eks. kork, rokcwool eller lignende. Det har indtil videre været den eneste måde at gøre det på i dag.

### Efter 2020 – hvordan opfylder man øgede krav?

Allerede nu er mine leverandører i gang med at udvikle plast profilerne og systemerne samt hvordan de kan forbedre det. Der er ingen tvivl om, at der kommer noget indenfor de næste 4-5 år der er bedre end det her.

Der bliver vores rolle forhåbentlig igen at tilpasse produktet og videreudvikle på det. Det siger jeg ja til, hvis jeg får muligheden for det.

### Forskel mellem mindre producenter og større producenter i udvikling

De større producenter kan godt få lavet beslag der kun passer på deres vinduer. Det gør sådan nogle som Idealcombi og Velfac. Det gør vi mindre virksomheder ikke. Vi bruger leverandørernes "hyldevarer" og tilpasser dem.





Lidt specielt i vores tilfælde er, at vi har været med til at udvikle beslaget. Det har de andre virksomheder ikke.

## Test af løsninger, certifikater og dokumentation

Det er sådan, at hver gang vi udvikler noget nyt eller modificeret, så skal vi have en underskrift/dokumentation fra Teknologisk Institut. Vi kan godt få det testet hos Rehau, men de har ikke underskriften. Det vil koste os, 5.000-15.000 at få dokumenteret vores produkter hos TI.

Uanset hvilken type test man vil have lavet, skal man være akkrediteret. Og TI er underlagt ekstern audit og der kommer folk ind og kontrollerer dem om de laver det rigtigt. Vi laver nogle gange selv nogle test hvor vi tester på vores egen måde. Vi laver vores egne "håndværkertests" hvor vi f.eks. prøver at bryde ind i vinduet, det er sådan noget vi kan gøre.

Vi har klassificeret vores produkter, det er et krav. Jeg har ikke tilmeldt mig ordningen hvor man kan sætte sin værdi på, men det kostede en del. Jeg har ikke ment at det har været nødvendigt.

F.eks. et beslag for sikring ved pudsning af vinduer, har vi lavet og har testet hos TI og det har kostet 15-20.000 tusind.

Klassificering kommer af den værdi som vinduerne har. C = 2010, B = 2015, A = 2020. Man bruger primært stadigvæk Uw-værdi. Men når der sidder arkitekter og ingeniører, så vil der være nogle mere udpenslede krav ift. energi.

## Virksomhedens marked

Primært private og tømrermestre. Vi prøver også at sælge til almene byggerier og det grønlandske marked. Vi siger ja til alt.

## Konkurrencen

Hvis man er ude og konkurrere på større byggesager, så er man ude og konkurrere på 3 decimal (f.eks. Uw-værdi 0,795) som er meget kompleks. Arkitekter og ingeniører går meget op i de her decimaler.

Hos de private forbrugere, så er der mere fokus på rentabilitet og om et produkt kan betale sig hjem, ikke de bedste vinduer.

Samtidig er der en bagdel ved 3 lags ruder, de er en del tungere og det sætter krav til produktionen.

## Energikravene

Jeg synes de er skrappe og at de ikke er rimelige. Men når jeg arbejder ved Rehau som jeg har beskrevet, så har jeg nemmere ved at overholde kravene fordi de er fleksible.

Der er sket nogle ting som har gjort det mere besværligt. Tidligere brugte man Uw-værdier og det har man altid gjort. Så er der nogle som f.eks. Velfac der er så store, de har placeret nogle mennesker så de påvirker beslutningstageren. De har så indført at tykkelsen på selve vinduet



også er vigtigt. Så er man gået hen til at bruge noget der hedder eref sådan så man tager hensyn til hvor meget varme der kommer ind. Tidligere har vi arbejdet med tætning (Uv-værdi) men nu begynder man så at bruge eref værdier hvor man supplerer eller erstatter noget af vigtigheden ved tætning ift. hvor meget sol der kommer ind. Det har gjort at f.eks. Velfac har en fordel fordi de har større rudeflade.

De er steget gradvist over de sidste 10-20 år.

## Interview – Jætte-Byg A/S

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**Virksomhed: Jætte-Byg A/S**

**Respondent: Bent Søgaard**

**Interviewer: Jesper Stentoft  
Flackeberg**

**Dato: 8/4 2014**

**Sted: Jætte-Byg, Suldrup.**

### Præsentation af Jætte byg

Jeg hedder Bent Søgaard og arbejder her ved Jætte-Byg A/S som er en kombineret håndværker og vinduesfabrik. Vi renoverer og bygger huse. Vi er den klassiske gamle virksomhed som er begge dele endnu og som ikke kun er blevet en vinduesfabrik. Vi har 10 tømrere og så har vi 6 mand på værksted til at lave vinduer og døre. I højsæsonen kan vi komme op på 30 mand samlet fordelt mellem tømrere og folk der laver vinduer. Vi har et snedkerværksted så vi tilbyder specielle produkter til vores kunder som ikke selv har et værksted. Vi kan lave skab sommetider, tilhører til slot. Vi er fleksible og kan sælge specialløsninger ved siden af standard vinduer og døre.

### Om virksomhedens produkt(er)

Vi har vores standard 2 lags system som vi har kørt med i mange år. Det skal opdateres til 15 reglerne og det har vi styr på hvordan vi gør. Så kan vi køre 3 lags systemer også de opfylder 15 kravene. Så laver vi 3 lags systemer hvor kork er brugt til at forbedre isoleringsevnen. Det er den vi sælger til Norge. Så pusler vi lidt med vinduer med skum imellem i stedet for kork (pirskum). Vi er også i gang med at udvikle de nye 2020 vinduer.

Produktet med kork er opstået da det var et konkret kundekrav vi mødte som vi skulle opfylde. Kork er et grønt produkt og hvis kunden vil have det så kan vi lave det. Det er modsat andre virksomheder som vælger et bestemt produkt, eller løsning og producere dem, vi kan sådan set det hele. Vi spørger kunden hvad vil du have, og så putter vi det i.

Vi har ikke klassificeret vores produkter, vi har sparet klassificeringen væk. Vi går efter U-værdi og eref ifølge vinduesindustrien. Det har vi simpelthen sparet væk.

### Virksomhedens marked

Vi laver alt det de store ikke gider eller kan lave. Vi har så et problem ift. at man skal dokumentere alt hvad vi kan lave og når man laver forskellige ting af mindre mængder, så



bliver det dyrere at lave fordi man skal have dokumentation for hver enkel ting. Så det er lidt en kunst at prøve og holde det nede, altså udgifter til dokumentation. Det bliver svære for os små, der gerne vil sælge, og for os er de de små mængder og forskellige ordre der bliver store i længden. Men i takt med stigende dokumentationkrav, garantier osv. Begynder os små, at lade være med lave vinduer. Det bliver simpelthen for dyrt.

Vi sælger til alle både byggemarked, tømmermester og privat kunde. Men mest privat kunder via tømrere eller via os selv, eller privat kunden der henvender sig til os og får en tømmer til at sætte vinduet i.

Vi har også lidt eksport til Norge hvor vi har forbindelse til en tømmermester der bygger nogle huse ifb. Med en by. Igennem en anden professionel kollega sender vi byggematerialer til Norge også.

Vi har ikke særligt meget nybyg fordi det er typisk de tunge drenge der sidder på det. Så det er typisk renoveringer vi sælger til. Når vi sælger noget til nogen er det ikke fordi vi er de billigste eller bedste men fordi kunderne vil have os til at lave det, fordi de har hørt om os, har en forbindelse til os, eller sådan noget lignende. Det er loyale kunder. Det er faktisk mest den vej vi får kunder, gennem jungletrommer.

### Privat forbrugernes holdning til energikrav og pris

De går meget op i energikrav men de spørger selvfølgelig om hvad de koster og hvordan de forrenter sig. De skal naturligvis overholde lovgivningen, men ofte giver det ikke ret meget at bruge de bedste og dyre vinduer.

Vi bruger ikke c,b,a klassificering men spørger mere om ruderne. De spørger f.eks. hvad er standard er hvad er det der er bedre og hvad koster det mere inkl. Besparelse. Den uvidende kunde vil gerne kunne holde sig til klassificeringen men personligt synes jeg ikke den er god. Det handler om at hele byggeriet skal opfylde nogle energikrav, hvis man bruger det bedste vinduer vil der stadig være energitab pga. f.eks. manglende isolering eller lignende. Derfor skal vinduet tilpasses det enkelte byggeri.

*Skaber det forvirring at bruge klassificeringen?*

Det skaber ingen sammenhæng, det hele hænger sammen i et byggeri og det bør klassificeringen også tage højde for. Det vil sige, at besparelsen ikke opnås hvis ikke byggeriet samlet er energieffektivt.

### Energikravene

Der er tre måder at overholde BR10 kravene:

- Eref
- Klassificering
- Eller u-værdi

### Samarbejdspartnere

- Kortlæg værdikæden

## Produktudvikling

Vores 2010 vindue kan opgraderes til et 2015 vindue. Med fyrretræ gør vi det med glasset, med mahogni skal vi lige beslutte hvad vi gør. Vi kan gøre det med glasset men det er bare dyrt for mahogni at gøre det med glasset. Det fordyrer produktet, så det kan være at vi kan gøre noget på konstruktionen.

Vi har også produkter der kan bruges til passiv-huse. Der har vi faktisk haft noget med på en messe for nyligt.

Videreudvikling af mahogni-produktet: måske en dobbelttætning som ikke er nødvendig på de andre. Det foregår på papiret og i teorien og ved at beregne hvad den dobbelte tætning vil give. Det bliver udregnet af eksterne ingeniører eller Teknologisk Institut. De udregner ca. hvor man rammer henne ift. energi, eref og u-værdi. Den beregning skal vi også have inden vi får klassificeret det.

*Hvor kommer ideerne fra?*

Vi ved at når vi opgraderer en trækonstruktion uden at ændre ruden, så ved vi at når man laver tætning så får vi noget stillestående luft som isolere lidt. Alternativer er kork og skum som isolere i rammen. Der er også nogle der laver isolering i karmen. Vi beregner så på hvad den billigste er så prisen bliver konkurrencedygtig.

*Hvor ville i lave ændringerne i kork f.eks.*

Det er lidt forskelligt, vi skal helst have det igennem en leverandør for de har certifikaterne. Vi kan også selv gøre det, men så skal vi have certifikaterne – og det koster. Kunderne forventer ikke at prisen stiger med 2015 kravene.

*Prisen på produkterne*

Vi er typisk dyrere end de større virksomheder. Vi laver mere manuelt og har ikke større automatiserede anlæg. Det har de større virksomheder. Vi er lidt dyrere, men har også en større fleksibilitet som vi kan udnytte. Vi kan producere flere ting.

*Udvikling ift. energikrav – hvordan kan I opfylde 2020 kravene*

Vi regner med at vi ikke skal have isolaterer i 2020 vinduet for lige at komme over 0.

Vi regner med at vi kan nå i mål med 2020 kravene ved at bruge 3-lags glas og har udviklet en ny konstruktion. Vi vil prøve at lave en konstruktion der er mere enkel end den vi laver i dag. Det bliver en dyrere løsning, derfor arbejder vi på at forenkle konstruktionen så vi kan hente noget af prisen hjem ved at lave produktet billigere. Det er vigtigt at vi finder ud af hvordan det er enklere at lave så prisen falder, men produktet bliver stadigvæk uden tvivl dyrere.

## Udvikling

Vi kan i løbet i år levere produkter der lever op til 2020 kravene. Der er nogle løse ender endnu, men generelt er vi godt på vej. Vi har samarbejdet med en beslag-leverandøren og har udviklet en ny type beslag som kan holde til vægten med større vinduer og 3-lags glas. Den nye konstruktion og så nogle tilvalg kan gøre, at vi kan agere bredt i markedet og har et fornuftigt produkt.



Man kan komme rigtigt langt ved det rigtige glas og glas-producenterne har udviklet nogle gode løsninger. Så når vi skal lave 2020 produktet, så spørger vi leverandøren hvilken type glas han tror på, hvad han synes, og hvad de kommer til at køre med så vælger vi det.

Vi har sammen med beslag leverandøren udviklet en ny type beslag som de så forventer at kunne sælge i en større mængde. I det samarbejde har vi lagt vores viden til rådighed til at udvikle beslaget. Og, det har gjort, at vi ikke skulle betale for udviklingen af beslaget men blot hjælpe med at udvikle det, og så har de udviklet det og forventer at sælge det til andre. Vi sætter ikke copyright på vores, nogle af ideerne er lånt her og der fra, og det at lave et vindue er ikke revolutionerende og vi er blevet inspireret af ideer fra forskellige steder og stykket det sammen så vi synes det gav mening.

Det handler om, at der er en masse små ting der bliver sat sammen (f.eks. træ der indeholder kamre med stillestående luft (isolation)) og hvordan man kan forbedre enkelte ting. Den udvikling er ikke færdig endnu, og der sker løbende noget. Os små virksomheder, vi afventer typisk de større virksomheder og ser hvor de trækker markedet hen. Det nytter ikke noget at vi udvikler noget med isolering i hvis de større virksomheder ikke gør det, og det viser sig at det ikke er nødvendigt og at det bliver for dyrt. De større virksomheder sætter standarden for hvad der bliver solgt og prisen. Så nytter det ikke noget at vi opfinder noget der er alt for dyrt og som er meget bedre end de andre produkter. Timingen er rigtigt vigtigt, vi skal altid time den rigtig. Selvfølgelig skal vi følge med på hvad der sker, men vi har kun et forsøg. De større virksomheder kører nogle gange på 3,4,5 generation af træ-alu produkter som danner grundlag for hvor langt de er i dag. Det betyder så, at vi får mulighed for at købe nogle produkter af vores leverandører som ligner de større virksomheders og som er den måde man vil gøre det på. Den køber vi så. Det bliver billigere for os, at købe deres hyldevarer, og det bliver vi nødt til og det vil vi gerne. Så kan vi så lave nogle mindre justeringer og tilpasse disse produkter. Vi (os små) skal ikke tænke på noget copyright.

## Videnkupon

Vi har tænkt, at vil lave et brandvindue og har tænkt, at lave en videnkupon på en branddør og arbejder på at få lavet et BD60 vindue. Det har vi fået mange henvendelser på, så det kunne være interessant for os at have et sådan vindue.

I den videnkupon skal jeg samarbejde med Vetrotech som sætter mig sammen med en tekniker der regner ud hvordan vi kan få et brandsikkert vindue. Til sidst skal det så ende ud i en brandtest. Glas-leverandørerne kan allerede levere brandsikkert glas.

## Virksomhedens leverandører

Vi har primært to leverandører; glas og træ.

### Træ:

Vi laver vinduer af forskellig slags træ og har ikke nogen faste leverandører. Det kommer lidt an på hvad type træ vi har brug for. Men det er typisk trælast osv. Der leverer træ til os.

De fleste af vores leverandører er ikke specielt tilknyttet vinduesindustrien, men levere til tømmerhandler og andre ting. Men de kender lidt til branchen.

### Glas:



Vores leverandører af glas har et specielt kendskab til industrien og har nogle rådgivere, og vindueseksperter som vi kan benytte os af.

### Kork og PIR skum

Vi har underleverandører der kan levere disse løsninger. Vi bruger dem da de har certifikaterne. Vi ville også selv kunne lave dem, men det ville kræve at vi havde certifikaterne og det koster. Derfor køber vi gennem leverandører.

Der stiller vi vores viden til rådighed og vender tilbage med nogle konkrete forslag. Leverandørerne er ret interesseret i det her produkt og vil gerne vide hvad Uw-værdi produktet har så han kan sælge det videre til andre producenter. Beslaget indgår i en konstruktion og derfor skal den vindues-producent der evt. skal bruge dette beslag vælge om han vil vælge den konstruktion som det beslag er en del af. De vindues-producenter som beslag-leverandøren skal sælge er meget interesseret i Uw-værdien og det vil han kunne formidle.

## Energikravene

For standard renoveringsmarkedet (det private marked) er det ikke de helt store tiltag der skal til for at udvikle et produkt der opfylder kravene. Og, vi kommer ikke til at gøre os gældende på de større nybyg sager, men her er det meget aktuelt med energikrav. Men vi kan være dem der stiller sig til rådighed når der skal laves noget helt specielt.

*Hvordan oplever du kravene, er de meget skrappe?*

Nej, det er de ikke. Det har været usædvanligt let for os at komme til at overholde kravene. Men du skulle ikke have spurgt mig i 2008, da troede jeg ikke på det. Det er faktisk en god proces.

Men egentlig synes jeg at kravene har været visionære, de handler om at sætte et mål om at nedsætte energiforbruget og det er jo den rigtige vej. I 2008 troede jeg ikke på det, men med den udvikling der sker indenfor rude-branchen og blandt glas-producenter, der er virkelig sket meget. Men i vores branche er der også sket meget, i dag er der blevet implementeret rockwool, kork, og forskellige isolaterer og tænkt tanken med forskellige konstruktioner. Også i træ-industrien er der sket meget. Plastic-vinduer har i mange år bestået af løsninger med kamre i hvor der er stillestående luft der isolere, det begynder træ-producenterne nu at kunne lave også. Så der sker virkelig meget.

## Ressourceforbrug ift. udvikling

Det er mig der gør det ved siden af de andre opgaver jeg har. Det skal jeg ikke have noget for, det er bare min tid. Når vi er så små som vi er, er det ejeren der sidder og laver det.

Jeg har så betalt mig fra at få lavet nogle beregninger på de forskellige løsninger jeg nu engang troede på. Jeg har sendt specifikt tegningsmaterialer til eksterne ingeniører, Teknologisk institut eller sådan noget. Dvs., hver gang jeg ændrer lidt på noget så sender jeg det til ingeniørerne der regner på det.

## Certifikater

Vi skal have CE-mærkninger og skal kende Uw-værdien – den skal beregnes hos TI. Man behøver ikke DVV-godkendelse og en klassificering. Vi har DVV certifikatet.

# Interview – PT vinduer

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**Virksomhed: PT vinduer**  
**Respondent: Niels Mortensen,**  
**ekstern salg**  
**Interviewer: Jesper Stentoft**  
**Flackeberg**  
**Dato: 7/4 2014**  
**Sted: PT vinduer, Aabybro**

## Noter og emner der kan formidles til interesseorganisationerne

- Det er ikke så meget de her klassificeringer (c,b,a) der er vigtig, men mere energiberegningerne og at vinduet passer til huset.
- Markedet vil ofte ikke investere i energirigtige vinduer. Der er for stort fokus på pris.
- Det er svært for mindre virksomheder at konkurrere med de større virksomheder lobbyarbejde. F.eks. har Velfac fået indført EREF systemet grundet deres produkter dengang ikke havde de bedste UV-værdier. Så hvad skal standarden være og hvem skal definere den?
- Det er svært for de mindre virksomheder at udvikle nye produkter da det koster tid, penge og generelt bare ressourcer som man ikke besidder.
- Dog, er leverandørerne af glas og aluminium f.eks. rigtig gode til at udvikle produkter som vi kan bruge i forbedre ift. produktion sådan så det giver mening og de kan sælges til en fornuftig pris.
- I vores udvikling har vi primært fokus på at nedbringe omkostninger da vi konkurrere på pris.

## Interessante interesseorganisationer

Disse interesseorganisationer vil jeg formidle projektet blandt og evt. præsentere for. Jeg har indledt samarbejde med DI Byg og Dansk Byggeri.

- Dansk Byggeri
- DI By
- VinduesIndustrien

Andre?? Tilføj gerne.

## Om virksomheden

PT Vinduer er ikke på nuværende tidspunkt medlem af Dansk Byggeri men forventer at bliver det inden længe.

PT vinduer er en lille virksomhed som blev grundlagt i 1976 og har 25-50 ansatte. Virksomheden producerer og markedsfører vinduer af træ og træ/alu og er en sammenlægning



mellem AHL vinduer, Scandia Windows og X. Gennem denne sammenlægning har PT Vinduer opnået en bredere produktportefølje og mulighed for at lave nogle mere energirigtige vinduer. Det har PT Vinduer alene ikke rigtigt kunne tidligere og det ser de frem til med stor optimisme. Derudover har sammenlægningen givet PT Vinduer adgang til en bredere kundekreds.

### De forskellige virksomheder i PT Vinduer

AHL: har aldrig lavet træ-alu vinduer, så alle deres kunder kan vi jo nu tilbyde træ-alu vinduer. På den måde kan vi så udvide produktporteføljen lidt.

Scandia Windows: Har aldrig været dem her der kan lave de almindelige type vinduer i store mængde. Det kan PT. Samtidig har Scandia Windows noget viden de kan supplere PT. Scandia Windows har leveret energirigtige vinduer til Norge og det kan være, at det kan åbne et marked for os i Norge. Scandia Windows har udviklet et meget energirigtigt vindue hvor der bliver brugt kork i mellem træ-rammen hvilket isolere rigtigt godt. Men de har ikke kunnet sælge det fordi det er for dyrt.

PT Vinduer: Det hele kommer til at hedde PT Vinduer og produktionen vil blive flyttet hened. Vi har en produktion der er strømlinet. Produktionen af produkterne foregår ret smart og er strømlinet sådan så der ikke er nogle tilbageløb i produktionen. Det hele foregår strømlinet. De samme faciliteter har de andre virksomheder ikke. Grunden til at det hedder PT Vinduer er, at håndværkerne kender PT og det er et kvalitetsstempel.

### Produkterne og konkurrencefordel

Vi laver mange specielle vinduer der ikke lige passer ind i de typiske modeller. Vi har nogle gamle håndsnedkere ude på fabrikken stadigvæk og her har vi muligheden for at hjælpe nogle kunder hvor alle andre næsten siger nej. Og det har vi ekspertise indenfor. F.eks. hvis man har en facade hvor man ønsker nogle gamle kassetter på, så kan vi lave det. Vi laver også Mahogni og det er der ikke så mange der vil og kan. Men det arbejder vi med.

Vi har muligheder for at stå stærkt fremover når vi nu har et vindue der nok hedder A++ og dermed opfylder de næste krav i 2020 og 2030. Vi er langt over kravene.

Vi har C-klasse og B-klasse vinduer, men det har Scandia Windows og det regner vi med at kunne præsentere indenfor 1 måned.

Det er i vores interesse fremadrettet, at vi møder nogle stærkere krav fordi nu har vi noget at tilbyde.

Vores nye vindue sidder i verdens tætteste hus nede i Vejle og er Damstadt certificeret hvilket er rigtigt godt og det er der ikke mange der har.

### Markedet

Det er mange gange renoveringer vi sidder med. Mange gange hvis du kommer op større sager (+1,2,5 mio. kr.) så har de større virksomheder et ekstra gear og kan give af. De kan producere til en billigere pris. De kan simpelthen tage en ordre der er skruet helt i bund og sige den får du 20% ekstra på. Men de er også medlem af en meget større koncern og selvom de skulle præsentere et underskud, så gør det ikke så meget bare koncernen kan præsentere et overskud. I virkeligheden har de magten til, hvis de ville, skrue markedet helt ned sådan så vi ikke kunne konkurrere med dem. Det gælder Inwido, VKR fonden – der er næsten kun



Idealcombi tilbage der kun kæmpe mod dem. Og her kommer de mindre virksomheder altså lidt i klemme.

## Produktion

Det er vigtigt at have en strømlinet produktion, sekunder bliver til penge og vi har en behård konkurrence fra de større virksomheder der producere i udlandet. Hvis vi skal være med, så er det sekunder vi tæller ude på fabrikken og det er vi meget bevidste om. Vi har gjort nogle forskellige tiltag for at øge tiden. Vi går helt ned i detaljen. Vi har et eksempel på skruer som tog længere tid at skrue i samtidig med, at det var en hårdere fysisk belastning. Vi måler på detaljerne som f.eks. det med skruerne, hvor lang tid de tager at skrue i. Det kan lyde meget banalt, men det bliver bare til penge sådan noget der og det bliver vi nødt til at for at kunne følge med konkurrencen. **Hvordan gør I det?** Det er en sparring mellem folkene derude i produktionen, tillidsmanden, direktøren som har købt virksomheden. Det har været godt med nogle nye øjne på det og de bliver brugt til at stille spørgsmålstejn ved det. Det er nogle af de ting vi arbejder på hele tiden. Vi har hele tiden fokus på kvalitet og produktionstid.

Der er kommet en direktør som har købt Scandia Windows og os alle sammen. Han kunne se, at han kunne udvide forretningen ved at købe de her forskellige virksomheder. Og her er der tænkt på markeder, maskiner og viden når der er blevet købt virksomhederne.

## Virksomhedens marked

Kunderne er ikke loyale, det er de ikke! Ikke på det danske marked. De lader sig bukke rundt med hvad slutkunden siger. Vores konkurrerende virksomheder er ude og præge arkitekterne og hvad der skal stå i krav og tilbud. Det gør vi ikke, vi har ikke ressourcerne til det. Vi har 3 eksterne sælgere der kan tage ud og snakke med kunder. Indtil for 5 år siden har vi slet ikke haft nogle sælgere. Det har så gjort, at PT måske har været lidt usynlige i markedet. Og det har vi så gjort op med ved, at bruge forskellige medier som vi ikke har brugt før; radio spots, building supply, bannere, facebook, nyhedsbreve osv. Og det kan vi se virker. Besøgene på hjemmesiden stiger hele tiden det kan vi se. Og det bliver godt når vi kan kæde det sammen med de energirigtige vinduer.

Vi har en del fra Århus og op og så sjælland, ikke så meget i mellem. Vi har et rigtigt godt marked på Sjælland. Og det hænger sammen med, at den gamle direktør som nu er produktionsdirektør, havde et godt samarbejde med en salgsorganisation derovre. Dvs. der var en på sjælland der solgte produkterne og vi producerede dem. Vi har et langt kundeforhold til mange tømrermester, tømrerhandler, glarmestre osv. Men i sidste ende sælger vi til privatforbrugere gennem tømrerne.

## Konkurrencen

### Markedssegmenter og konkurrencen

Vi har eksempler på, at arkitekterne har skrevet, at de vil have keponitræ som vi producere vinduer i, men så kommer de andre producenter og siger, at de kan spare op til 20% hvis de laver det i træ-alu og det gør de så. På nogle af projekterne handler det om 3,4,5 mio. kr. og der bliver 20% rigtigt meget, og det er sådan noget vi er oppe i mod, at det er prisen der er vigtig.



## Markedets forhold til pris og energieffektivitet

Min erfaring er at i langt langt de fleste tilfælde er det pris. Der kommer selvfølgelig nogle gange (renoveringer + nybyg) kommer an på hvor store sagerne er, og i nogle tilfælde vil der være nogle krav til UV-værdier som de skal overholde og opfylde. Har de ikke sådan en er det ligemeget.

Det er faktisk også ligemeget, om man bruger energirigtige vinduer i ældre huse der ikke er energi rigtige i sig selv. Dvs. vinduet bliver meget bedre end resten af byggeriet.

Hvis man kigger på energistyrelsen hjemmeside på det man kan spare kroner og øre på at gå fra C-klasse til henh. B- og A-klasse vinduer kan man stort set ikke spare noget. Det man kan sparre er ikke ret meget. Jeg blev lidt chokeret over det. Jeg mener det var sådan noget som 400,- i mellem dem. Prisen bliver ca. 10-20% ekstra. Spændet mellem de forskellige vinduer er ikke særlig stort mellem de forskellige klasser. Og når man laver udregningen over tid og økonomi, så giver det sjældent mening at købe de bedre produkter.

Oppe i Norge får man højere tilskud til produkterne som er mere energirigtige. Det gør man ikke i DK, i DK gør man det kun på håndværkerregningen. I Norge var energikravet 0,8 i UV-værdi og det kan mere end 80-90% af de danske producenter ikke overholde. Så de er langt længere fremme end os.

Vi har ikke set en velvilje fra danskerne til at ville investere i det her (red. Energirigtige vinduer). Hvis man gik ind fra regeringen og sagde, at hvis man bygger energirigtigt, så ville der være et større tilskud til tingene. Det mener jeg er en god ide, at der skal lægges mere fokus på at gøre det rigtige. Det handler om at være mere målrettet i investeringer ift. energi og miljøet. Det ville gøre os mindre afhængig – dog vil det være en stor regning. 10-15% af energiforbruget herhjemme er husene.

### Om energikravene

Det med de øgede energikrav er vand på de stores møller, de har udviklingsfolk og ressourcer og har mulighed for at udvikle nye produkter. Det har de mindre virksomheder ikke. Hos os f.eks. har vi flere kasketter på. Det er folk der har et job i dag der skal sidde og udvikle ved siden af jobbet. Vi har ikke en udviklingsafdeling.

Jeg tror vi fremover vil blive mødt ikke af de her klassificeringer, men derimod på energiberegningerne og hvad der passer til huset. Dvs. det handler ikke om altid bare at have den bedste løsning men en der passer til huset. Det er sjældent at de bedste løsninger er rentable over tid.

Der er mange virksomheder vi kender til, der vil stå i en svækket situation med indførslen af de øgede energikrav og som bliver nødt til at investere. Nogle vi kender til med en omsætning på 10-15 mio. kr. hvordan kan de være i stand til at investere det det kræver – hvor skal de finde pengene?

## Produktudvikling

Det er nok en af de store udfordringer for os som en mindre virksomhed, at investere tid, penge og mandskab til at udvikle efter de strammere og strammere krav. Om man er en lille eller stor virksomhed, så er det stadigvæk det samme man skal investere, om man er en stor eller lille virksomhed. Derfor rammer de øgede krav de mindre virksomheder hårdere mens de større virksomheder lever godt af det. Det er ret voldsomt for os, med en omsætning på 35



millioner, at investere 1-2 millioner i udvikling og ansætte folk til det osv. Det er en stor omkostning for en mindre virksomhed. Derfor har PT også gået lidt og tænkt over hvad vi skulle gøre fremadrettet. Nu er vi så så heldige, at være gået sammen med Scandia Windows som har en energirigtig løsning. Det har de sandsynligvis investeret en vis millionbeløb i for at få det udviklet, kørt igennem og sådan nogle ting der. Dette produkt har vi så taget ind til os hvor vi forsøger at få produktionsomkostningerne ned og det giver mening at producere det. Scandia Windows har ikke haft et så stort produktionsapparat som vi har her, dvs. det skulle være lavet af mange gange og forskellige processer, her vil vi gerne have at vi tager det hele og propper det ned i den store maskine som laver det hele for os. Det er der vi er i udviklingen, nemlig at skal til at forberede det til produktion så det kommer ned i omkostninger. Det forventer vi at være klar med indenfor 14 dage. Vi har produktet men det er ikke klart endnu. Det bliver et rigtigt stærkt produkt som kommer med måske Danmarks laveste UV værdi og have alle certificeringerne; Svane, Damstadt (til passiv huse), FSC. Men det ville vi ikke kunne uden Scandia Windows så hver for sig ville de her 4 virksomheder have det rigtigt svært, men i og med at vi har taget det bedste fra dem alle sammen har det gjort, at vi står i en stærkere situation.

Vi har et tæt samarbejde med vores leverandører, specielt af glas.

Det fungere ved, at vi kigger på markedet og vurdere hvad der skal til. Her er der sket en udvikling ift. UV-værdier som er blevet forbedret ved tykkelsen på ruden. Og det har hele tiden været deres udvikling. Glas er et stort punkt rent energimæssigt.

Og så samarbejder vi med dem der producere værktøj og når man ændrer i størrelsen på ruden så passer vores udstyr ikke så der skal vi have nyt eller tilpasse det.

Når det kommer til træ-alu, så samarbejder vi med DAFA som er en sammenslutning af større danske alu-producenter. Dem bruger vi og det gør Outline, Pro-tec, og de andre virksomheder der arbejder med træ-alu. Her tilbyder DAFA naturligvis nogle løsninger som de også udvikler på.

Vi køber delene af vores leverandører og dem sørger vi for at vi praktisk kan producere og laver nogle mindre forbedringer som f.eks. tætningslister. Her bruger vi eksterne rådgivere (TI) som sidder og regner på energi niveauet. TI hjælper med at få de rigtige tal, vi skal jo gerne kunne producere det her. Men vi sørger for at de løsninger vi indkøber, kan produceres fornuftigt og sælge til en fin pris.

## Videreudvikling

Vi har et produkt klart der kan erstatte 2020 kravene når vi finder ud af, at det kan produceres fornuftigt. Hvordan propper vi det i maskinen og sådan noget.

*Hvis ikke I havde haft et godt vindue nu (Scandias)?*

Så havde vi haft et B klasse vindue indtil 2020 hvor vi så måtte blive nødt til at investere i udviklingen af et nyt vindue. Og, det havde højst sandsynligt blevet DAFA's løsning vi var gået med. Det havde været et traditionelt vindue som vi ser i dag men med tykkere glas. Og det er typisk det vi ser hos vores konkurrenter i dag. Det ville være et traditionelt vindue hvor DAFA har lavet en løsning ift. aluen og hvordan det skal sammensættes.

*Samarbejde med leverandører*



Vi har en tæt dialog med dem hvor leverandørerne kommer og siger hvordan vi sørger for at den kan tilpasses så det giver mening at producere produktet.

Vi har været igennem processen med leverandørerne hvor de har været oppe og finde ud af hvordan vi tilpasser maskinerne.

### Om markedet hæmmer udviklingen

Ja, vi bliver hæmmet i vores udvikling af markedet. Vi kan ikke være med på de helt store sager men kan være med på de halvstore på 0,5-1 mio. kr. og i de store sager kan vi ikke følge med på prisen. Der har vi svært ved at være med når det er sådan.

Ved nybyg er det et krav med energirigtige vinduer. Men det er ikke så tit vi hører folk sige, at de skal have et A eller B vindue. Det ser vi ikke tit. Men vi ser eref værdier der bliver spurgt til og det er velfac der har fået indført dem regneregler og det at måle op imod. Det har de gjort via lobbyarbejde da de havde nogle dårlige UV værdier pga. de havde for meget alu i deres løsninger. Velfac havde dårlig UV værdi så de ville have indført, at det ikke kun var ventilation men også hvor meget lys og varme der kommer ind og her havde de nogle bedre forudsætninger for det (f.eks. smalle rammer så der kom mere lys ind).

I dag er det ikke så meget et spørgsmål om et konkret tal, men en energiberegning på huset. Dvs. vinduerne skal passe til huset fordi huset må ikke blive for varmt, så skal man køle huset og dermed bliver man presset. Dvs. at der skal leveres vinduer der passer til huset. Og der skal helst være en balance og derfor kommer de ofte med en helt præcis tal for UV-værdi eller EREF. Det er typisk sådan et scenario vi ser. I offentlig byggeri skal man dog typisk levere A-klasse vinduer.

# Stevnsvinduer

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Respondent: Direktør

Interviewer: Jesper Flackeberg

Date: 28/3 2014

Method: Telephone interview. Not recorded, but transcribed.

Om firmaet. De laver både døre og vinduer. Deres produktion ligger i Litauen hvor også udviklingen foregår – dog i samarbejde med Stevnsvinduet ApS.

## Marked – renoveringer.

Deres primære marked er renoveringer og har specialiseret sig i specielle løsninger som f.eks. fredede og offentlige bygninger (museer osv.). Sådanne salg foregår primært gennem kommuner eller lignende. Her har de særligt et stort salg i Grønland og Norge hvor de er kommet op mere eller mindre tilfældigt gennem nogle større samarbejdspartnere som har fået øjnene op for dem.

Derudover har de et stort salg til private forbrugere der skal have renoveret og nye vinduer. Her foregår salget enten gennem den private forbrug, en trælast, eller en håndværker.

Til nybyg er det et mindre marked blandt tømrere, arkitekter og lignende der opfører enkelte huse eller et par – ikke større entrepriseopgaver.

## Energikrav

Der blev udtrykt stor irritation og undren over nuværende krav. Det handler om tæthed i bygninger men det er simpelthen blevet for tæt. De forsøger at justere lidt på nuværende komponenter ift. at kunne indfri kravene. Eksempelvis har de for 3-5 år siden introduceret 3-lags glas som er mere effektivt.

Men der er et problem ift. de med tæthed. Nogle mindre befolkningsgrupper er glemt. Eksempelvis kan tingene blive så tætte at de simpelthen bliver svære at lukke for folk med allergi og vi kommer til at udvikle allergi osv. Der er så store tæthedsgrad og –fokus, men med tiden bliver vi nødt til at lave ventilation i det for at det giver mening. Det er ligesom at leve i en plasticpose. Der skal være plads til gamle byggemetoder og tæthedskrav.

Der hvor vi har udviklet er i forbindelse med tyveri. Vi er gået hen til at have limet glasset i rammen i stedet for at have gummibånd. Det betyder at tyvene skal smadre glasset og det vil de helst ikke.

## Konklusion

Der er her tale om en modvilje til udviklingen. Jeg vil ikke diskutere om den er berettiget blot konstatere det. Denne modvilje er baseret på, at gamle byggetraditioner skal der være plads til. Derudover forsøger man at lave mindre inkrementelle innovationer på komponenter. Men de er en balance ift. markedet som man skal tage højde for ift. funktionalitet. Dette område bliver set som en begrænsning.

## Appendix 5: Analysis of Empirical Data

### Experts

#### Assumptions & hypothesis presented by each respondent

The study is based on experts' views of current problems for firms within the facade window industry.

Below is listed the most interesting of the different respondents (experts) assumptions and hypothesis which this study initially is based on:

Dansk Byggeri:

- Smaller firms are not innovative which does not correspond to the demand from the legislation, consumers, political actors, etc. Therefore it is interesting to get insights on how they innovate and with whom.
- Generally (not only the facade window industry), the need for more innovative products to solve the environmental issues is not fulfilled, and does not seem to be fulfilled by Danish companies.
- Problems in the facade window industry:
  - The need for new products and innovations in general is intense within this industry - more than in other industries.
  - This industry is over-represented by SME's who is not proactively seeking to innovate.
  - New standards and requirements are enhanced and challenge the specifications of current facade windows.
  - A lot of family owned and SMV businesses that do not innovate or evolve. How will they survive in the future with the new legislation (BR15, BR20)?

DI – general issues for DK firms:

- Lack of upscaling of SME's – the economy is very much driven by the large companies in Denmark. The vast majority of the companies in Denmark are SME's focused on a market/product/service-niche and there is a worrying tendency that these companies persist as SME's with marginal contribution to growth of the Danish economy. That is a problem.
- According to their innovation survey 2012, half of the companies are not satisfied with their product innovation efforts.
- Focus on incremental innovation and inertia in their innovation efforts. Furthermore, process innovation is getting more attention than product innovation.

DI Byg – issues in the industry of building material:

- There is a need for more product innovation and firms want it – but not satisfied with their efforts.
- The industry is protectionistic which means that new solutions and methods find it difficult to be obtained and integrated and they do not develop new products due to traditional mind set.
- Value chains are a problem due to different needs from the different actors in the value chain.
- Regulations, the construction legislation is complex and misunderstood.

- There is a great demand and focus on more sustainable materials and products in especially the construction sector. The incentives are there, but are they acted upon?

Teknologisk Institut + Århus University – the facade window industry:

- The facade window industry is like the rest of the industry conservative and does not embrace the general development.
- They are generally risk averse. This might have to do with the requirement of 10-20 years warranties.
- In general the larger companies are frontrunners on innovation matters.
- The small companies seek simply to fulfill the technical requirements with minimum effort the larger companies seeks to go beyond (Idealcombi, protect) while the MNE's is second mover.
- There is a lot of technological knowledge and experiences which the manufacturers could apply or get inspired from. Only Idealcombi and Pro-tec seems to do this openly.
- The value chain: customers are not applied as inspiration sources. Their needs differ and are heterogeneous throughout the value chain.

### Analysis of the assumptions & hypothesis of the key problems

After having counted and weighted the mentioned problems based on the amount of respondents who refer to the respective issue as a problem, following key problems appear:

Nr.	Problem	Weighting
1	The SME's are not working with product innovation sufficiently. This means that there must be an unrealised growth potential which they do not seek.	75% (3/4)
2	There is an intense need and requirement for new (sustainable) products in the building material industry (especially the facade window industry) which is not reacted upon. This is an obstacle for the sustainable development sought/wanted by consumers and political actors formulated in new legislations.	75% (3/4)
3	The building material industry is protectionistic, traditional, and risk averse which hinders product innovation and the sustainable transition.	75% (3/4)
4	There is a problem with the value chain. Different actors in the same value chain are having different needs which are a problem when working with product innovation.	50% (2/4)
5	The firms do want product innovation but are not doing it. They are not satisfied with own efforts.	50% (2/4)
6	Firms within the facade window industry are not inspired from technological opportunities and new research.	50% (2/4)
7	Lack of upscaling of Danish SME's. Big firms are creating economic growth. Danish SME's are often servicing market niches and upscaling does not seem to happen.	25% (1/4)

Table 27 – Analysis and Weighting of Key Problems

The problems listed in the table above can be grouped in three themes;

1. Issues related specifically to the SME's (nr. 1, 3, 5, 7).
2. Issues related to the market (nr. 2, 4).
3. Issues related to innovation (nr. 2, 6, 5).

If considering the themes and issues listed above and in Table 27, it gives an expression that in general the market incentives and demand combined with innovation opportunities seems to be present while also, firms in general seems to be oriented towards product innovation although not satisfied with their own efforts. This shows that the basic fundamentals for



product innovation are present (incentives and opportunities) but still not acted upon – especially by SME’s.

The SME’s in the facade window industry are not engaged in product innovation sufficiently according to the experts. As the market are characterised as an evolving market which requires and demands new sustainable products, it causes concern on the future ability for those SME’s to fulfil market needs. According to the assumptions presented by the experts, it is caused by SME’s attitude towards development, they are reluctant to change and develop new products. This seems controversial if it is true, that the market incentives and innovation opportunities are present especially concerning the fact, that new standards concerning energy efficiency will be implemented with the BR15 and BR20. It would be paradoxical for the SME’s to resist this change. If considering the issues from Table 27 again, it indicates that problems derives from the market structure as SME’s are primarily servicing market niches and problems within the value chain. Furthermore, the SME’s are not embracing the technological development which is a prerequisite for innovation within this industry and development of current products as product innovation is getting more complex.

Pros/Enablers	Cons/disablers
Market incentives and demand	Value chain issues
Innovation opportunities	Firm attitude and especially SME “unwillingness”
-	The market structure
-	SME’s do not seek to benefit from especially new technology and opportunities.

**Analysis tactic**

- Noting patterns
- Themes
- Counting tactics
- Seeing plausibility

**The quantitative survey**

What has been investigated?

The quantitative survey is representative for the total facade window industry. The questionnaire has been distributed electronically to 45 firms which is equivalent to 80% of the sum of all firms in the facade window industry. In total 15 firms have replied constituting a response rate of 33%. Fortunately, the distribution of the respondents represent the actual distribution of firm size in the industry primarily dominated by firms with less than 25 employees and big firms with more than 100 employees.

Listed below are the themes addressed and asked about in the questionnaire:

- Indledende:
  - Geografi
  - Ansatte
  - Ejerforhold
  - Omsætning
- Markedet:
  - Direkte kunder (multi)





- Beslutningstager (%-vis fordeling)
- Konkurrenter
- Priskonkurrence
- Krav til tekniske egenskaber
- Krav til æstetik
- Innovation
  - Nye produkter/produktinnovation (single)
  - Forbedringer på eksisterende/produktforbedringer (single)
  - Proces innovation (single)
  - Proces forbedringer(single)
  - Nye markeder i DK (single)
  - Eksport (single)
    - Hvilke lande (multiple)
- Produktinnovation/forbedring
  - Anledning (multiple)
  - Samarbejde (multiple)
- Procesinnovation/forbedring
  - Anledning (multiple)
  - Samarbejde (multiple)
- Vigtighed af eksterne parter (ift. ideer, samarbejde, process/product, inspiration)
  - Kunder
  - Beslutningstagere
  - Videninstitutioner
  - Konkurrerende virksomheder
  - Fra andre brancher
- Barrierer
  - I virksomheden (interne)
- Eksterne ting

### How can I use data from the quantitative survey?

The quantitative data material can be used as a descriptive tool providing insights into how the facade window industry can be categorised in firm sizes and describe the general difference between those firm categories.

The quantitative data material can be used to answer the following:

1. Description of the difference firm categories.
2. How the different categories of firms perceive the market, customer needs and decision making criteria, competition, legislation.
3. How and why the different categories of firms work with innovation in general.
  - a. Process innovation
  - b. Product innovation
  - c. Market innovation
4. What is their (product) innovation value chain
  - a. Collaborators
  - b. Who provide valuable input
  - c. What is the difference between customers and decision markers?
5. General innovation disablers/enablers (internal/external)

### Description of the difference between the different categories of firm sizes



Category 1 – Big firms	Category 2 – Medium sized firms	Category 3 – Small sized firms
<b>Ownership</b>		
International concern.	Private or family owned.	Privately owned
<b>Employees</b>		
>100	25-99	<24
<b>Yearly revenue</b>		
>150DKK million.	25-74 million.	<10 million.
<b>Location</b>		
North- and mid-Jutland and the capital region.	Region South Denmark.	North-Jutland and the capital region.
<b>Primary markets</b>		
<ul style="list-style-type: none"> <li>- Carpenters</li> <li>- Wholesalers/lumberyards</li> <li>- Architects, developers</li> <li>- Bigger projects.</li> </ul>	<ul style="list-style-type: none"> <li>- Carpenters</li> <li>- Wholesalers/lumberyards.</li> </ul>	<ul style="list-style-type: none"> <li>- Private consumers</li> <li>- Carpenters</li> <li>- Wholesalers/lumberyards</li> </ul>
<b>Number of direct competitors</b>		
Typically more than 11.	An equal distribution of respectively 3-5, 5-7, and +11.	Typically more than 11.
<b>Percentage that have developed new products within the last 3 years</b>		
100%	100%	60%
<b>Percentage that have improved processes within the last 3 years</b>		
100%	100%	40%
<b>Percentage of all firms that has not developed new products nor processes simultaneous</b>		
12%	6%	81%
<b>Percentage actively seeking new domestic markets</b>		
50%	33%	0%
<b>Percentage actively seeking new foreign markets (export)</b>		
50%	100%	50%
<b>Most important factor for innovation in general</b>		
<ul style="list-style-type: none"> <li>- The firms market knowledge.</li> <li>- Legislation.</li> <li>- New technology.</li> <li>- Competencies.</li> </ul>	<ul style="list-style-type: none"> <li>- The firms market knowledge.</li> <li>- Legislation.</li> </ul>	<ul style="list-style-type: none"> <li>- New technology.</li> <li>- Legislation.</li> <li>- Competencies.</li> </ul>
<b>Most important factors for product innovation</b>		
<ul style="list-style-type: none"> <li>- New market needs.</li> <li>- Competition.</li> </ul>	<ul style="list-style-type: none"> <li>- Legislation.</li> <li>- New technical opportunities.</li> <li>- New market opportunities.</li> </ul>	<ul style="list-style-type: none"> <li>- Legislation</li> <li>- New technological opportunities.</li> <li>- Natural continuation of current business setup.</li> </ul>
<b>Most important factors for process innovation</b>		
<ul style="list-style-type: none"> <li>- Cost reductions.</li> <li>- Strive for continual improvements.</li> </ul>	<ul style="list-style-type: none"> <li>Cost reductions.</li> </ul>	<ul style="list-style-type: none"> <li>- Effort to increase quality.</li> <li>- A prerequisite for future survival.</li> </ul>

<b>Typical innovation partners</b>		
- Suppliers. - None. - Customers. - Decision Makers. - Knowledge/research institutes - New partners with the specific resources/competencies needed.	- None. - Suppliers - Knowledge/research institutes. - New partners with the specific resources/competencies needed. - Customers.	- None. - Suppliers. - Competitors. - Customers. - Decision Markers.
<b>How they value customers in innovation activities</b>		
Little.	Medium.	Little.
<b>How they value decision makers in innovation activities</b>		
Only valuable for: - Inspiration/ideas: High. - Product innovation: Medium.	Generally high on all measured parameters.	Only valuable for: - Inspiration/ideas: High. - Product innovation: Medium.
<b>How they value knowledge/research institutes in innovation activities</b>		
Little.	High (little in product improvements).	Little.
<b>How they value rival enterprises in innovation activities</b>		
Little (medium on ideas/inspiration).	Little (medium on ideas/inspiration).	Little (medium on ideas/inspiration).
<b>How they value organisations/people from alternative industries in innovation activities</b>		
Medium.	Little.	Little.
<b>Key innovation disablers</b>		
- Market uncertainty. - Employee resources. - Economic resources. - Legislation.	- Market uncertainty. - Economic resources. - Unclear process and roles.	- Market uncertainty. - Economic resources. - Lack of organisations/people to share ideas with.

**Analysis tactic**

- Noting patterns
- Counting tactics
- Seeing plausibility

**The qualitative study**

What has been investigated?

The interviews have been focused on primarily product innovation, whether or not the firm is able to fulfil the new energy efficiency standards on the new products, how they perceive the legislation, what their role is in the market now.

The interview themes are listed below. The transcript of each interview is done based on these themes.



- Introduction of the company
  - Presentation of the company
  - The company's products
  - Production facilities
- The market
  - The market (customers, decision makers, needs etc.)
  - Market development (incl. the effect of the energy efficiency standards)
  - Market competition
- Innovation
  - Product development opportunities in relation to the new energy efficiency standards (BR15, BR20)
  - (Product) Innovation opportunities in general
  - Collaboration partners (innovation specific) (*How they have worked with product innovation and which partners they have involved*)
  - Development of production facilities

### How can I use data from the qualitative survey?

The results from the qualitative data can be used to:

1. Discuss how the SME's are ready to fulfil the new market standards and demand especially focused on the new energy efficiency standards (Q2 in the new RQ)
2. How they perceive their role in the market competition against the big firms.
3. Their future role in the industry based on the actions of the big firms and the legislation.
4. How the increased legislation is affecting their niche markets (which is negative)
5. How they are able to compete against the big firms (which basically is not on price but on "obscure" and not standards market needs and maybe B2C (will have to look into that)).

### SME problems identified (what they have expressed implicitly and explicitly (analysed)):

1. The market demand does not correspond to the increased legislation.
2. The manufacturers actually wants to develop new products but are hindered due to;
  - a. Their customers do not request the new energy efficiency standard products (they are too expensive and too good. Lang tilbagebetalingstid (urentabelt)).
  - b. The market/customers do not share the same visions for sustainable products (direct opposite to the experts assumptions)
3. Future markets and export
  - a. Cannot compete with the big firms on big cases.
  - b. They need support in their export activities. Export is a key determinant of future profitability but the SME's needs support from big players like Dansk Byggeri etc.
4. The industry infrastructure
  - a. The industry structure is hindering innovation at the SME's. Need for certificates, tests, Teknologisk institute, forskellige mærkningsordninger osv. Er dyre.
  - b. Selve klassificering taler til fordel for nogle leverandører.  
⇒ Andre organisationer (GTS, mærkningsordningerne osv) prøver at lave penge på den her udvikling og det koster altså for de mindre producenter. Det har en indflydelse på deres udvikling.

Thematic Analysis of SME interviews

The table below is based on the following themes:

- Markedsniche
- Eksport
- Energikrav
- Produkter klar til krav?
- Produktinnovation
- Markedet ift. energikrav
- Eksternt involveret (søgeprocess)
- Prod. Portefølje
- Strategi
- Andet

	Stevnsvinduet	Frovin	PT Vinduer	Modum Vinduer	Jætte-Byg
<b>Market niche</b>	Yes. Preserved buildings and museums.	Yes. They have 1 type of windows which is highly focusing on aesthetic and retention of old-fashion look and feel.	Ja. Laver mange vinduer udenfor standard mål og typer.  Forsøger også entreprenere men kan ikke konkurrere på større projekter. De store virksomheder har ekstra gear	No. Selling to whoever.	Ja. Har snedkerværksted og laver specielle løsninger.  De spørger kunderne hvad de vil have og putter det i.  "vi laver det de store ikke gider".
<b>Product portfolio</b>		1.	Bred (flere virksomheder slået sammen)	Narrow. But able to customise products.	They make whatever the customers wants.
<b>Export</b>	Yes to Norway and Greenland. As a coincidence.	They are members of Inwido (an international concern) and export will happen through the other companies in the concern.	Not really.	Forsøger at komme til Grønland.	Some to Norway.
<b>Perception on</b>	Irritation Wonders if	Positive. It is a good	They favour big firms due	Kan godt opfylde dem	Positive. It has



<p><b>energy demand</b></p>	<p>they are applicable. There is no connection with the building in general with the energy efficiency standards and current building stock on renovations.</p>	<p>development and they would like to be more visionary. But the market disables this by not wanting more energy efficient windows. The new windows are (often) not profitable.</p>	<p>to big firms' lobbyism.  Their market often focus more on 'energiberegninger' and not actual classification.</p>	<p>(08-09). Problemet er at ting bliver dyrere og tungere som gør at vi skal have nye ting og tænke arbejdssikkerhed. De gør det gennem ruden. De er skrappe og ikke rimelige.</p>	<p>accelerated development . But was negative when they were introduced.  De hænger ikke sammen. De giver kun mening hvis man tænker bygningshelhed.</p>
<p><b>Products ready for new demand?</b></p>	<p>Yes. By using a different type of glass.</p>	<p>Yes. Already in 2011 were they ready for BR15 by using a different type of glass.</p>	<p>Yes. Ready for 2020</p>	<p>Ja pga. leverandør af glas og plastprofiler.</p>	<p>Yes. By using glass or isolators which is typical.</p>
<p><b>Product Innovation</b></p>	<p>Glass is important and he buys the glass from a supplier. Incremental product innovation . With the increasing energy efficient windows there will be an issue with ventilation .</p>	<p>The product has basically not changed the last 13 years. It is the same as look and feel can't change (aesthetic). But they have improved it. De er begrænset af markedet. Fovin sælger et produkt til et bestemt marked med fokus på æstetik. Derfor ingen værdi i at være mere visionær på produktinnovation. Det vil kræve markedsinnovation. Inerti (og det samme produkt) er forudsætning for</p>	<p>Sket af dem der er der nu. De har ingen udviklingsafdeling så det foregår blandt dem der har tid. Det er en af de helt store udfordringer.</p>	<p>Køber nye løsninger hos leverandør. Stiller krav til udstyret (nye maskiner etc.).  Kompositmateriale er vinduet lavet af med plast udenpå.</p>	<p>Arbejder med kork og pir skum i trærammen. Det får de fra leverandør . Men de skal tilpasse produktet.  Foregår på papir. Vi får TI til at regne på det.  Vores rolle er at vælge den løsning der er billigst.  Vil gerne lave en branddør - tror der er et marked. God ide.</p>



		leverandørsamarbejdet.			
<b>Market and energy standards</b>	No coherence.	No coherence.	No coherence. B2C focus on tilbagebetaling stadig ikke rentabel.	No coherence.	Private kunder går op i energikrav. Men økonomi er vigtigst og oftest er de mest energirigtige vinduer ikke rentable.
<b>External involvement</b>	-	Has been involved in seminars on the future of the industry. Found it very interesting. They want to be more visionary.	Uses suppliers to optimise production setup.	Samarbejder med konkurrenter og leverandører. Konkurrenterne gik sammen og formulerede krav til nyt vindue. Leverandøren lavede det. Virksomhederne testede det og gav feedback til leverandøren.	Har samarbejdet med beslag leverandør om udviklingen af nyt beslag. Leverandøren vil bruge det som hyldevare fremad.
<b>Strategy</b>	-	fokus på 1 produkt som man kan fokusere på og gøre rigtigt godt. Markedsudvikling baseret på dette produkt. (at finde nye markeder hvor dette product kan sælges)	Opkøb og sammenlægning af virksomheder.		Differentiering customisering fleksibilitet
<b>Other</b>	-	Ret langt fremme og innovativ virksomhed. Også opkøbt af Inwido. Virker interessant.			

		Oplever de store er begyndt at komme ind på deres markeder.			
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**Thematic Analysis of MNE interviews**

The table below is based on the same themes as the one before.

	<b>IdealCombi</b>	<b>Dovista</b>	<b>Inwido</b>
<b>Market niche</b>	No, serving all markets with mass produced windows. Do not sell direct to consumers – to much a hassle.		
<b>Product portfolio</b>	7 window products.		
<b>Export</b>	Yes. Are challenged as the same market needs a not required. They do not focus on energy efficiency. We have therefore hired a guy who travels and educate buyers on energy issues and window performance.		
<b>Perception on energy demand</b>	Positive – they will only be stricter. Goes beyond energy to cover also recycling etc.	Positive. We want to do something good for humans and develop attractive indoor climates. That is our vision.  We seek to affect the legislation and policy markers.	Positive. 5 years ago all windows was practically the same.  Customers and markets is a barrier they do not focus on energy efficiency.
<b>Products ready for new demand?</b>	Yes. Have developed new products. Needs to modify old products.		Yes. But the innovation potential is lowered by the markets.
<b>Product Innovation</b>	We have a clear process that is very much market based. We test solutions to our customers throughout the process. The market kills technical ideas, that is why we do it.	Foregår hos Dovista mens salg foregår I virksomhederne.  It is a really big issue and difficult to find alternative materials. We do that but it is	



		difficult.  Tænker meget over fremtidig production og salg i udviklingen.	
<b>Market and energy standards</b>	Our new products are only targeted new constructions and those markets. Not renovations.	Rentabilitet er en udfordring ved renoveringer. Derfor er C-klassen (BR11) nu det mest solgte product.	
<b>External involvement</b>		Har både formelle og uformelle samarbejdsrelationer med universiteter og leverandører og andre.	Very open innovation process is applied.  Har både formelle og uformelle relationer.
<b>Strategy</b>			
<b>Other</b>	Some years ago they were at a cross-road and had to decide whether or not to invest and upscale or stay at the same level. They choose the first and has become very succesful.  Mass production and quality.  Strategy = to be the innovative frontrunner.		

**Analysis tactic**

- Noting patterns
- Seeing plausibility
- Clustering (given attention to how they have reacted when talked about the legislation (irritation or what?).

## Appendix 6: Innovation Typologies & Examples

	Process Innovation	Product Innovation	Value Innovation
<b>Incremental Innovation</b>	Improvements in the processing of current components.	Smaller technological improvements on current products.	Smaller improvements on current products based on market needs (e.g. new packaging).
<b>Modular Innovation</b>	The development of processes that increase the performance on current components.	The development of new components based on technology (e.g. new versions of current products)	The development of new components based on market needs (e.g. a phone in a new color)
<b>Architectural Innovation</b>	The development of processes that that enables the development of new architectures (e.g. if it prior has not been possible to produce with a specific component etc.)	The combination and configuration of different components into new architectures and systems which forms new products based on new technology (e.g. the launch of a new product genre for instance the hybrid car – a technical opportunity based not so much on market needs)	The combination and configuration of different components into new architectures and systems which forms new products based on market needs (e.g. for instance smart phones which were a result of people wanted to have mobile access to emails etc.)
<b>Radical Innovation</b>	The development of new processes or production facilities that prompt a quantum leap in processing of components.	The same as architectural product innovation but with a significant more newsworthiness and with greater impact on markets.	The same as architectural value innovation but with a significant more newsworthiness and with greater impact on markets.

## Appendix 7: Market Analysis

The activity and constellation of the facade window industry is a mirror projection of the construction and building material industry. The aim of this section is to provide insights in the configuration of the industry and the market in general. Furthermore, an analysis of expected market development will be presented.

### Introduction to the Market

The market for facade windows consist of both a B2C market with the customer being private consumers, and a B2B market which can be divided in the public- and private business sector. The market activities can be divided in two categories; (1) renovations of current building stock and (2) development of new buildings (Figure 67).

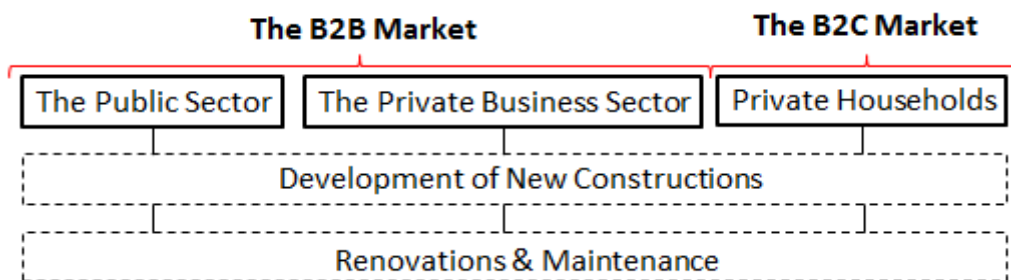


Figure 67 – Market Sectors in the Industry

The public sector (hereunder the government) is by far the largest developer of new constructions and renovations followed by the private business sector and last the private households (Danish Ministry of Climate, Energy and Building 2014).

The activity of the industry is heavily affected by the economy and general state of the market and as such subject to periodic variations (Dansk Byggeri 2014). Prior 2008 and the financial crisis, the economy was booming - so was the construction activity (Figure 68). The financial crisis was followed by an economic recession which imposed severe consequences for the construction industry. Unfortunately, the domestic activity seems to have stagnated at a general low level (Danmarks Statistik 2014).

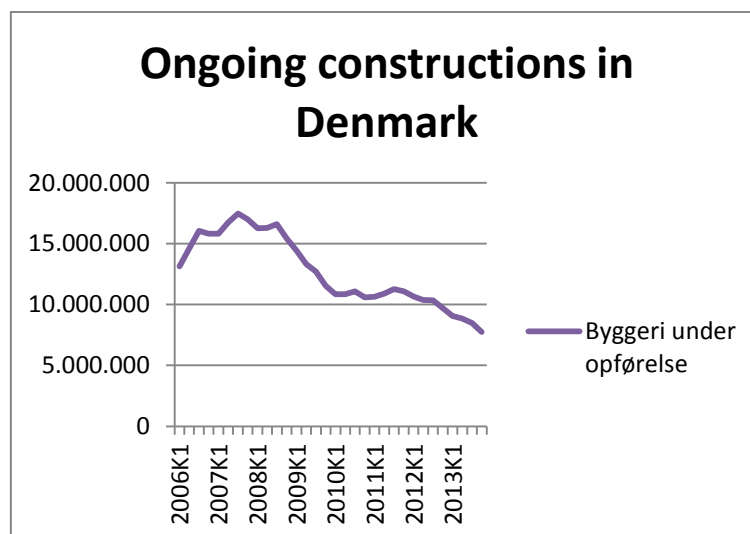


Figure 68 - The construction activity (Danmarks Statistik 2014)



The general outlook for economic progress is moderate with domestic economic growth rate percentages expected to be 1,5% in 2014 and 1,8% in 2015. Those growth rates are not expected as sufficient to create upturn in the construction activity alone (Dansk Byggeri 2014, 5-8). As illustrated in the figure below, the developments of new buildings is still decreasing. Since 2011 commenced activity has decreased with 47% while new activity initiatives have decreased with 24%. Fewer buildings have simply been developed from 2011-2013 why the amount of completed constructions likewise decreases (Danmarks Statistik 2014). This indicates that especially the development market is stagnated – and if considering the figure below, even declining (Figure 69). As even new initiatives are declining, there is no reason to believe that the market for development of new buildings will improve over the next couple of years. It often takes long time from development projects are approved to commencement. This also explains the rapid declining amount of commenced activity (Figure 69). The major interest- and professional associations acknowledge this trend, and argues that renovation currently is the most attractive market with more activity than development (3F 2013), (DI Byg 2013), (Dansk Byggeri 2014).

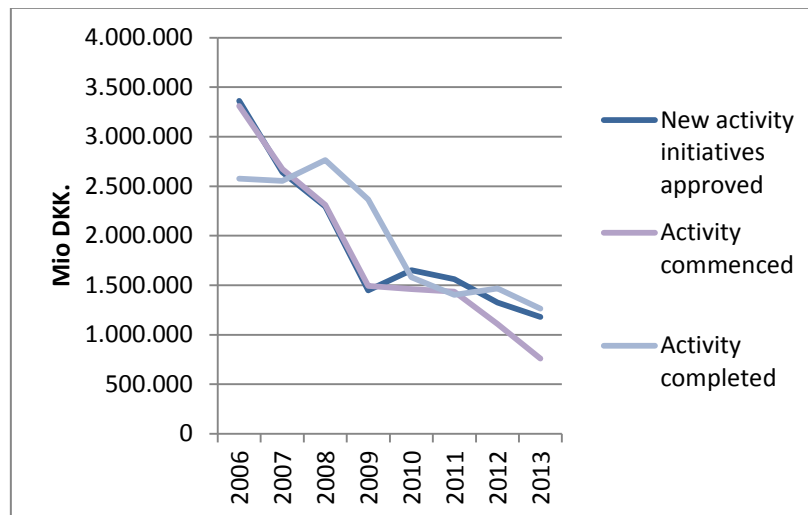


Figure 69 - The Total Construction Activity in Denmark (Danmarks Statistik 2014)

The facade window business industry is a relative small industry. In Denmark there exist approximately 60 FW-manufacturers who employ close to 6000 people combined, and generate close to 4,5bn DKK in turnover yearly (VinduesIndustrien 2013). According to Johnny Jensen CEO of the industry association ‘VinduesIndustrien’, the conditions of the construction industry in general can be mirrored to the facade window industry. Current market conditions give rise to fierce domestic competition and reductions in firm turnover while the export markets seem to experience growth leading to market opportunities which firms seem to utilize from. The figure below illustrates the allocation of firms’ turnover between domestic and export markets (Figure 70).

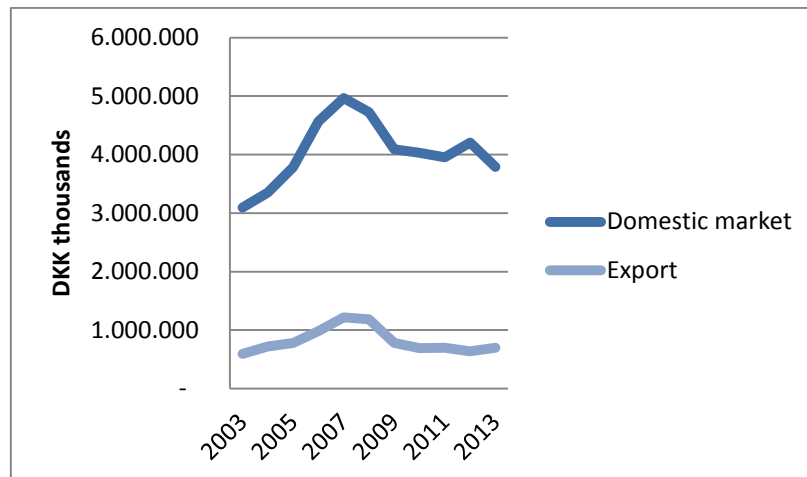


Figure 70 - Facade Window Industry Revenue (Vinduesindustrien 2013)

Despite the limited activity in the construction industry, the larger manufacturers of facade windows are performing well, although not at the same level as before the financial crisis (Berlingske Business 2013). The explanation for the financial prosperity of the most successful FW-manufacturers is explained partly by increased activity due to public investments in renovations and financial aid schemes and tax deductions opportunities stimulating renovations in the private sector. Furthermore, a review on articles describing the most successful FW-manufacturers clearly leads to the conclusion that exports combined with efficiency initiatives targeted cost reductions, rationalisation, investments in innovation are important determinant for success (Berlingske Business 2013), (Børsen 2014), (TVmidtvest 2014). However, there is a general reluctance to investments due to uncertain market conditions. But the successful firms are those that do invest, and those firms are primarily the larger firms of the industry (Børsen 2014). Furthermore, even though export is a possible growth opportunity, export success is not a simple straightforward task. Competition on these markets is often as fierce as in Denmark and vast resources needs to be applied when seeking new export markets (Børsen 2014).

In the following, an analysis of the future market prognosis will be presented. The analysis is divided in market categories illustrated in Figure 67 (page 183).

### The Public Sector

The public sector is the market with the greatest economic magnitude related to the activity, especially developments. The current government pursue an expansive economic policy in order to provoke growth. The government acknowledge the construction industry as an important industry to Denmark and addresses the challenge of decreasing markets, through the introduction of different economic aid schemes, legislations, and investments in the development of new public buildings, renovations, and (energy) improvement of current ones (Ministry of Finance 2012). The public development activity will increase in the coming years due to heavy future investments in the development of especially universities and hospitals, but also renovations and maintenance of current building stock in relation to the green transition described previous. In general the investments of the public sector are expected to increase yearly until 2015, and subsequently gradually ease off until 2020 (Dansk Byggeri 2014). Investments in hospitals, universities, prisons, police, etc. will top in 2015 with approximately 13bn DKK. The public sectors share of the development of new buildings will within the next couple of years, increase to 35% compared to an average of 24% from 1990 –

2013 (Dansk Byggeri 2014). According to DI Byg and Dansk Byggeri, these investments in developments will only lead to a flattening (stagnation) of the declining line of new initiatives approved (Figure 69 - The Total Construction Activity in Denmark Figure 69), and thereby ensure the current activity level of the firms and not induce growth (DI Byg 2013), (Dansk Byggeri 2014).

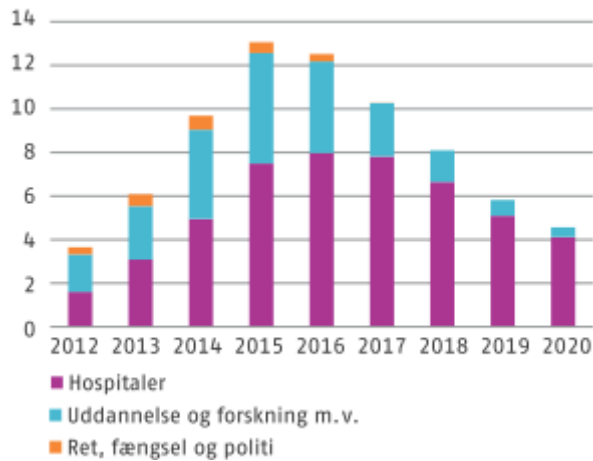


Figure 71 – Bigger public Investments in billions 2012 - 2020

Besides investments illustrated in the figure above, the government will invest broadly in renovations and maintenance of public building stock as part of the national growth plan; 'Vækstplan DK' (Ministry of Finance 2012). As part of the growth plan and the finance act of 2014, more than 24bn DKK are allocated renovations of current council housings. This tantamount to an annual increase of 0,5-0,6bn DKK available for renovations of current building stock (Ministry of Finance 2014). These investments will be administrated the 'Landsbyggefonden' which is a governmental institution who administer the available funds. This organisation will distribute the funds among different councils and (housing) associations. The national allocation of these funds is especially targeted initiatives in the Copenhagen area (Figure 72) partly due to the fact that the building stock of housing buildings is bigger in Copenhagen than elsewhere (Ministry of Finance 2012).

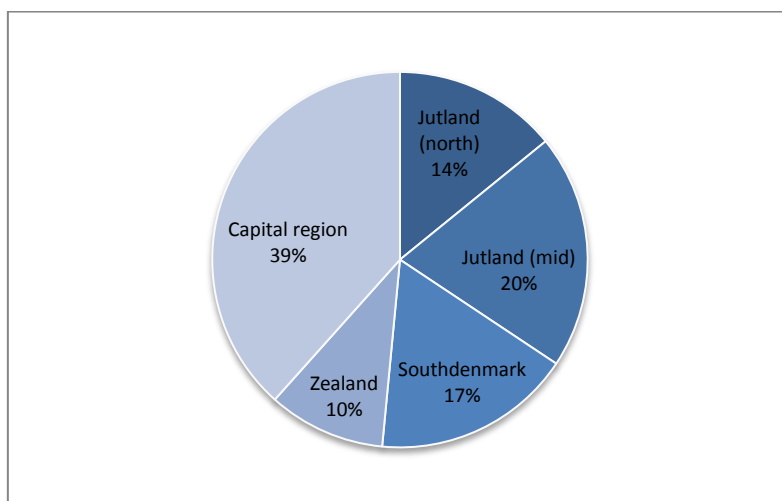


Figure 72 – Allocation of Renovation Funds (Ministry of Finance 2014)

The Private Business Sector



The construction activity (renovations and developments) in the private business sector market is at the lowest level since the 1940's (Dansk Byggeri 2014). Renovations and maintenance investments are not expected to increase or decrease in the coming years and will continue to be at a very low level. In Denmark there has generally not been tradition for renovations among firms and their corporate buildings; they seem to be reluctant to invest in such initiatives (Dansk Byggeri 2014). A study conducted by DTU Management clearly concludes, that Danish firms does not see any value in renovations why it often will be given a low priority (DTU Management 2009, 41). However, the development of new buildings is expected to increase slightly in 2014 and 2015 from 4DKK million m<sup>2</sup> in 2013 to 4,5DKK million m<sup>2</sup> in 2015. However, if compared to the 1985-2012 average of 7,6DKK million m<sup>2</sup> these numbers are likewise strong indicators of low development activity (Danmarks Statistik 2014), (Dansk Byggeri 2014). The expectations for the increasing investments until 2015 are based on estimates and as such subject to discussion. As an example does DI Byg not estimate and expect an increasing amount of investments from the private business sector (DI Byg 2013). However, a common opinion seems to be that the investments of the business sectors in development of new buildings will not decline.

One method of assessing the potential and future need for corporate developments can be done by looking at the general market development. The business sectors investments in new buildings and/or renovations are determined by the economic development of the markets as that is what determines the businesses need for capacity. The prior years has been affected by the economic downturn which has reduced the capacity need<sup>14</sup> of Danish firms in general. The latest statistics of available business square meters in Denmark provides a less optimistic view of the future need for new commercial buildings. The availability of office square meters is at the highest point since 2003 with approximately 11% available of current building mass, and has steadily increased since 2008. The availability of non-occupied retail square meters is likewise above the average, and has increased since 2007 from 2% to more than 6% of current building mass. On the positive side is it, that the availability of stock-, warehouse-, and production facilities seems to have stagnated, and even dropped with marginal 0,1% points. This means that the current availability of such industry facilities is 4% in total compared to 2% in 2008 (Oline-ED statistikken 2014). These numbers illustrates that since the financial crisis in 2008, the available square meters of office-, retail-, production-, and warehouse space has increased. This indicates that current firms in general will have available square meters and capacity flexibility in order to respond to increased activity. The figures simply indicate that current firms will have available space to correspond to market upturns and thereby capacity need. Another factor that might prove to have influence on firms capacity need is the increasing opportunity of new technologies.

However, Dansk Byggeri's positive attitude can be justified if considering the increasing expectations of future orders and performance of especially the industrial-business in Denmark. Numbers from 'Danmarks Statistik' indicates an increase in the industry's orders and production activity over the past 11 months (Danmarks Statistik 2014). Considering the available square meters (Table 28) and the increasing activity of especially the industry (**Fejl! Henvisningskilde ikke fundet.**), it is not utopia to be optimistic of a future need of developments of new industrial buildings – assuming that current trend continues. However, there is reason to scepticism within the two other business segments, as the activity of the service and retail industry has been declining since November 2013 (Danmarks Statistik 2014).

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<sup>14</sup> Incl. square meters and general building capacity

Available m <sup>2</sup> in existing building mass	
Industry	4%
Office	11%
Retail	6%

Table 28 – Available sqm

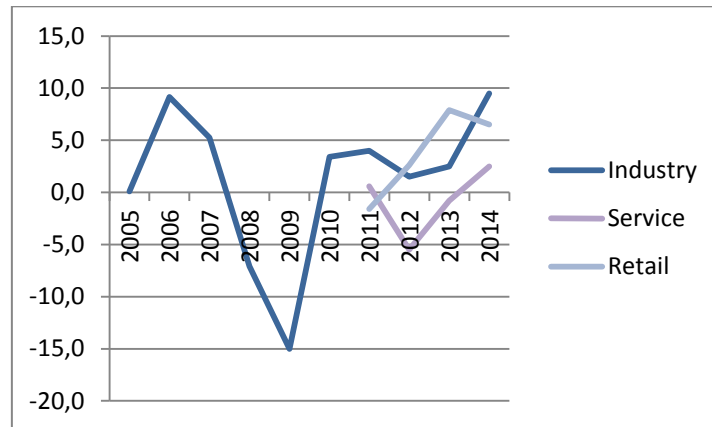


Figure 73 – Business Sector Activity (Danmarks Statistik 2014)

This analysis is conducted by applying to different data sets from respectively ‘Danmarks Statistik’ and ‘Dansk Ejendomsmæglerforening’. These data sets are built on individual industry-categorisations which make it difficult to directly transfer statistical statements and build correlations. However, there seems to be harmony among the industry and retail categorization while I have assumed that the service industry is what requires office buildings. Therefore this analysis must be read with caution but definitely provides valuable points.

### The Private Household Sector

The private households market is similar neutral and stagnated as the private business sector market. The development of new private buildings is challenged by the relatively low house prices that make it difficult for house developers to compete on price. The supply is simply greater than demand which theoretically always will have an effect on price. Since 2010 price cuts of single-family and terraced houses has been steady at 11%. The average price cuts of owner occupied flats from 2010 – 2013 has been 8% and but has dropped to 6% in 2013 (Realkreditrådet 2014). The selling period of single-family houses and terraced houses is averagely more than 10 months, and 6,5 months for owner-occupied flats (Realkreditrådet 2014). Therefore it is not expected that the development of new private houses will increase as the current available housing stock is sufficient to cover demand, while development of new housing is unable to compete on price thereby making it an unattractive alternative. Even though the price cuts of single-family & terraced houses are decreasing, the tendency is that the selling period of these objects increases which is unlikely to trigger stability in the prices and lower price cuts.

Renovations and maintenance among the private households are withheld at the same low levels as 2012 caused primarily by the stimulation of the financial aid scheme called ‘BoligJobordningen’ (Dansk Byggeri 2014). Through this scheme households are able to obtain economic contributions to renovation, maintenance, etc., and it is perceived as a vital stimulus in order to ensure that private households are commencing renovations initiatives (BoligJobordningen 2014). This agreement (the aid scheme) will expire by the end of 2014 why



private households' investments in renovations are expected to decrease by 2015 (Dansk Byggeri 2014).

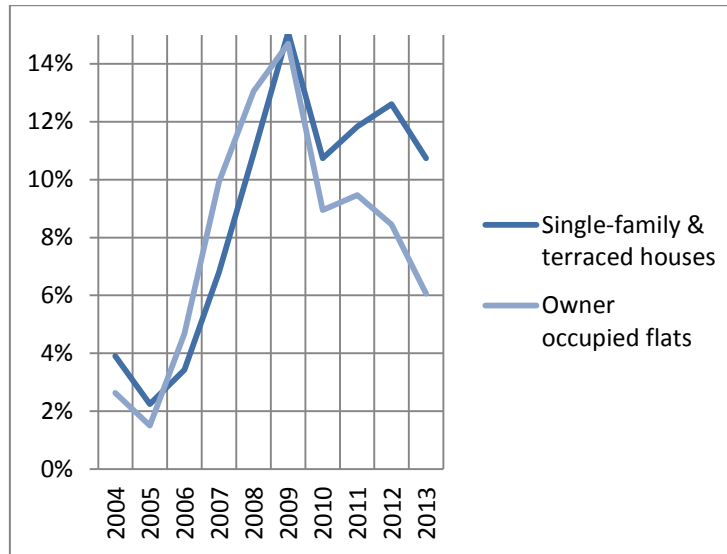


Figure 74 – Price Cuts in Percentage

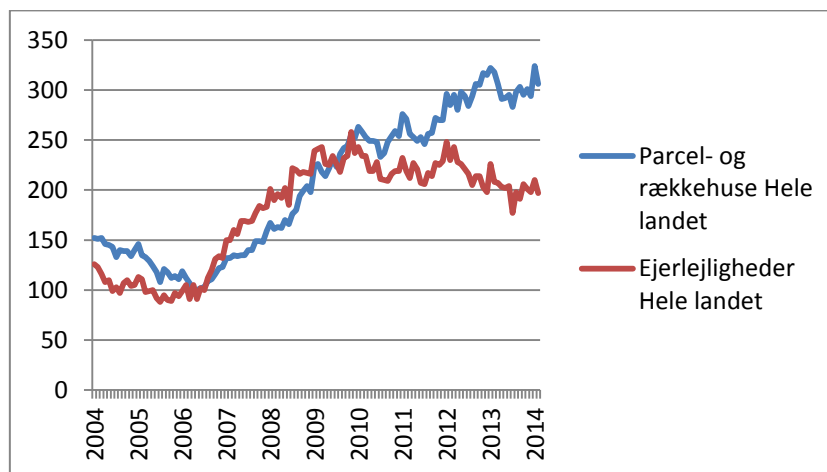


Figure 75 – Sales Period (Realkreditrådet 2014)

Export Opportunities

The general construction industry and activity level greatly affects the FW-manufacturers as suppliers to the construction industry. A FW-manufacturer supplies facade windows as building material to activities in the construction industry. The facade window industry is part of the building material industry which likewise is a part of the overall construction industry.

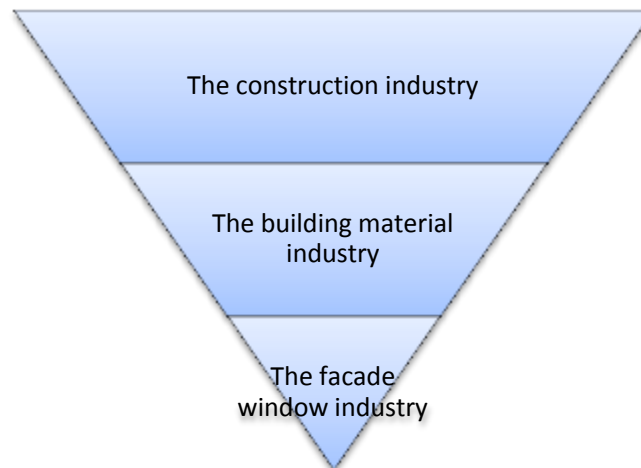


Figure 76 – Industry Hierarchy

The export opportunity of FW-manufacturers is assessed by an analysis of the export opportunities of building materials. Traditionally the construction industry and especially building material has been bound to the domestic market. Buildings and the choice of building material are greatly affected by culture, norms, and traditions which traditionally have been seen as a barrier for export. As an example facade windows in Germany often open inwards while Danish windows open outwards. However, it seems that this barrier gradually has been diminished partly due to the work and export activities of big Danish firms<sup>15</sup> (Danske Byggematerialer 2012). It is possible that smaller Danish firms, especially suppliers of building material, can benefit from this an increase their export activities. Figures and numbers from both DI Byg and Dansk Byggeri validate this and indicates, that Danish firms' export activities has increased followed by economic growth.

In spite of the economic stagnation of the market, and low domestic construction activity, the average revenue of Danish manufacturers of building materials have generally increased with 6,6% by ultimo 2013. This is primarily caused by increased export of 7.6%, while the domestic market merely increased with 0.9% (DI Byg 2013). Greater focus on export is a general trend among manufacturers of building material (Dansk Byggeri 2013). An analysis performed by DI Byg in 2013 revealed that ever since the beginning of 2010, the average turnover among firms have increased caused by increased export primarily to Norway, Sweden, United Kingdom, and Germany (DI Byg 2013, 1-3), (Danmarks Statistik 2014). Experts suggest that firms should continue to seek economic growth and increased turnover via export. The typical export markets of Danish manufacturers of building material will experience increased growth in the forthcoming years (DI Byg 2013), (Dansk Byggeri 2014).

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<sup>15</sup> Especially Velux, Danfoss, Rockwool and Grundfos.

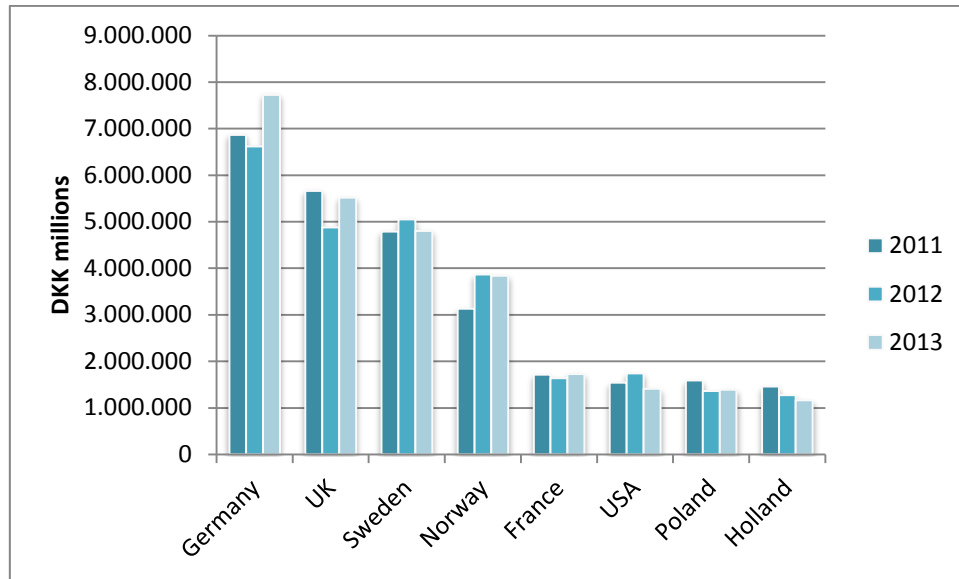


Figure 77 – Export of Building Material

When considering Danish construction firms competitiveness in the different export countries, it is obvious that they are strongest in Norway and Sweden (Danmarks Statistik 2014), which are also the two major export markets, incl. Germany, for Danish firms (Dansk Byggeri 2013). In general, the nearest export markets are perceived as being highly attractive with general economic growth in the coming years. By referring to an analysis conducted by Dansk Byggeri in 2013, it is estimated that especially Germany, Norway, Sweden, and United Kingdom could be fruitful export markets. Especially Germany is highly interesting as the domestic market is very big and growing. Norway and Sweden can be compared with each other, and are almost similar attractive. The market of Norway is not as big as the Swedish but represent a greater growth which compensate for the minor market.

	Germany	Sweden	Norway	United Kingdom
<b>Potential export growth</b>	+4%	+3,5%	+5%	0%
<b>DKK Billions</b>	8	5	4	5,5

Tabel 29 – Export Market Attractiveness (Dansk Byggeri 2013)

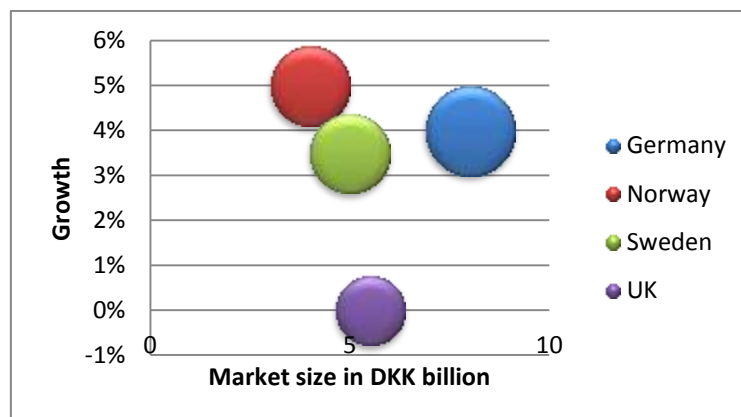


Figure 78 – Export Market Attractiveness Illustrated

If combining the export market attractiveness (Tabel 29 & Figure 78) with the figure below, it indicates that there is an economic potential in all four markets but especially Germany,

Sweden, and Norway. Based on these information Danish firms ought to establish and increase the export activities to especially Germany and consolidate and expand their positions in Norway and Sweden. United Kingdom is not experiencing growth while it is reasonable to assume that the UK market is characterized by fierce competition and fight over current market shares why it might be difficult to win market shares. Therefore, an increased export to that specific market ought to be based on a thorough market analysis and competitor-benchmark in order to identify potential market opportunities where Danish manufacturers differentiate from current offerings. However, in order to be able to make that assessment, a thorough analysis of entry barriers, market competitiveness, customers, and different products ought to be conducted. This is beyond the scope of this report.

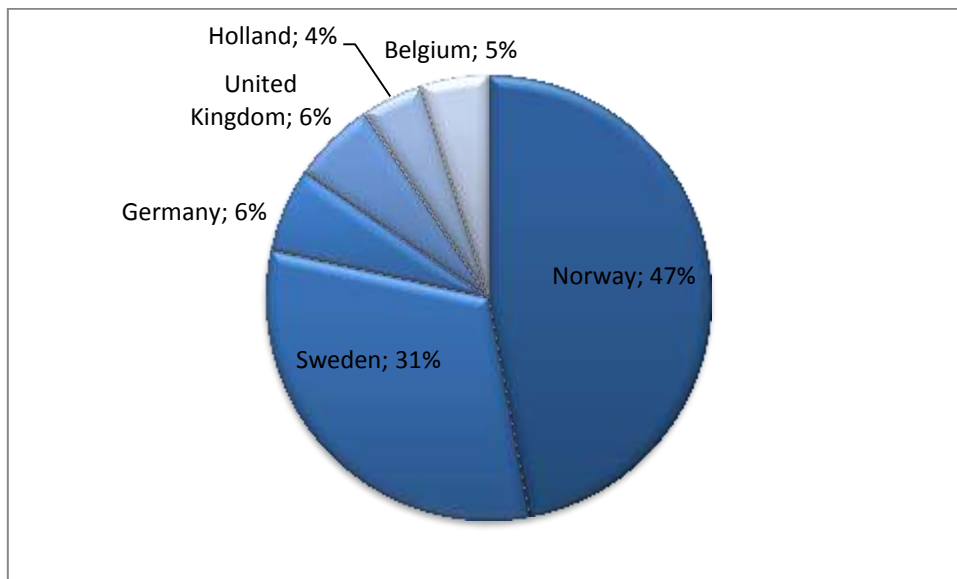


Figure 79 – DKK pr. capita in the different export countries (Danmarks Statistik 2014)

The figures presented in this section clearly illustrates that Danish firms' export adventures are based on countries with considerable similarities in culture and norms. This is what G. Morgan et. al. refers to as 'psychic distance', which often is an important parameter in firms' internationalization strategies and therefore not sensational (Morgan, Kristensen and Whitley 2003). However, the effect which culture, norms, and traditions have on the choice of building materials and how buildings are understood and perceived, might hinder export to countries and geographical regions with a significant difference to firms' domestic market. Therefore the scope of export as a substitute for competitive and low-growth domestic markets might be limited. Even successful export to similar markets might prove difficult as these markets will attract more firms which might increase competition further. Export markets that are not subject to growth might even prove to be highly difficult to enter as the available market shares already are allocated among the domestic firms. Such locked positions and markets necessitate intense marketing and sales efforts.

## Appendix 8: Energy Cost Saving Calculation

House	Class	kWh/year	Yearly savings	diff price	diff kwh
1900-1960	C	10061	6640	392	594
	B	10655	7032	417	632
	A	11287	7449		
House	Class	kWh/year	Yearly savings	Diff	
1961-71	C	5349	3530	392	594
	B	5943	3922	417	632
	A	6575	4339		
House	Class	kWh/year	Yearly savings	Diff	
1972-1995	C	4677	3087	392	594
	B	5271	3479	417	632
	A	5903	3896		
House	Class	kWh/year	Yearly savings	Diff	
1996-	C	1262	833	392	595
	B	1857	1225	417	631
	A	2488	1642		
Average yearly saving C-B			costs	392	
			Kwh	594	
Average yearly saving B-A			costs	417	
			Kwh	632	
Average yearly saving C-A			costs	809	
			Kwh	1226	
Cost increase		Price	Saving	Payback time years	
C-B		25.000	400		
B-A	20%	30.000		13	
C-A	20%	36.000		15	

## Appendix 9: Small & Big Firms' use of Public Innovation Schemes

Virkemiddel	type	projektititel	tilsagn	år	Organisationstype	CVR	Navn	region	Antal ansatte	Hovedbranche_kode	Fulde branchekode
Innovationsagenterne	Force	Innovationstjek	Tilsagn	2009	Danske private			Region	25-99	ICJ	222300
Innovationsagenterne	Teknologi	Innovationstjek	Tilsagn	2010	Danske private			Region	25-99	16,31 Fremstilling af træ	162300
Innovationsagenterne	Teknologi	Innovationstjek	Tilsagn	2011	Danske private			Region	<24	16,31 Fremstilling af træ	162300
Innovationsnetværk	Innsbyg		Tilsagn	2011	Danske private			Central	>100	70	701010
Innovationsnetværk	Innovatio		Tilsagn		Danske private			Southern	25-99	16	162300
Innovationsnetværk	Innovatio		Tilsagn		Danske private			Central	25-99	16	162300
Innovationsnetværk	Innovatio		Tilsagn	2009	Danske private			Southern	25-99	16	162300
Innovationsnetværk	Innovatio		Tilsagn	2009	Danske private			Capital	<24	64	649900
Innovationsnetværk	Innovatio		Tilsagn	2010	Danske private			Central	>100	70	701010
Innovationsnetværk	Innovatio		Tilsagn	2012	Danske private			Central	>100	70	701010
Videnskupon	basiss	Indførelse af	afslutte	2009	Danske private			Southern	25-99	22	222300
Enhverstype	Alm	Sustainable	Tilsagn	2009	Danske private			Capital	>100	64	649900
Videnskupon	basiss	Visualisering af	afslutte	2009	Danske private			Central	25-99	16	162300
Enhverstype	Alm	The	Tilsagn	2010	Danske private			Central	>100	70	701010