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**Article**

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## **Lifestyle production: Transformation from manufacturing to knowledge based production using innovation**

**Mogens Dilling-Hansen<sup>1</sup> and Susanne Jensen<sup>2</sup>**

### **Abstract**

*During the last decades, traditional manufacturing firms in Western economies have undergone a rapid transformation. Two effects of the globalised economy prompting firms to outsource labour intensive production to low wage areas are the increased market size and the competition. Innovation is a prerequisite for a successful transformation process and this paper analyses this process within four Danish lifestyle production industries: textile and clothing and wood product and furniture, which are being developed from being traditional production-oriented industries to becoming much more oriented towards knowledge intensive production in the form of design and marketing aspects.*

*The analysis shows that the industries have experienced a decline in employment and a positive development in productivity while maintaining a significant contribution to export. A 2008 survey of Danish SMEs reveals that about two thirds of the firms carry out innovative activities. The decision to innovate is influenced by networking activities, access to financial resources, firm strategy, export orientation, growth potentials and age of the firm while a traditional characteristic like size does not influence the decision to innovate; innovation is a prerequisite for firm survival in the four industries.*

**Keywords:** Transformation, Lifestyle production, Innovation

**JEL Classification:** O3, L60

### **1. Introduction**

The industrial development in Western Europe has been notable during the last years. Many traditional manufacturing firms have outsourced their production to East European countries and the former Soviet nations in the first instance and later on to the

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East and the South Asian countries. In spite of this development, some firms succeeded in surviving and even expanding their activities.

The industrial change has been particularly pronounced within the textile and clothing industries and the wood product and furniture industries on account of the fact that the relatively labour intensive production of these four industries faces obvious challenges due to the globalisation; especially the traditional production within the wood product and furniture industries is subjected to increased competition from countries with a lower wage level. On the other hand, the globalisation seems to facilitate the cultivation of knowledge assets related to high knowledge activities such as design, commercialisation, marketing, branding, logistic and after sales services (Mudambi, 2008). This implies that the innovative process focuses less on the primary production technology, i.e. process innovation, to improve the middle stream activities in the value chain whereas innovation in both downstream and upstream activities becomes increasingly important. Value added is generated by enhancing the value of the extra and more intangible features of a product; therefore, we introduce 'lifestyle production' as a common denominator for production based on adding extra value by primarily designing, but also by branding and developing new materials, new sustainable production methods, etc. Thus, lifestyle industries replace traditional production and manufacturing industries. With extra spotlight on creating new and commercially valuable activities designed to develop the capabilities of the firm, knowledge becomes important and the innovativeness of the firm becomes particularly important.

The purpose of this paper is twofold. First, the objective is to describe and discuss the transformation of the main lifestyle production industries using Denmark as an example: The industrial structure is dominated by small and medium-sized enterprises (SMEs) and focus is on textile and clothing and wood product and furniture industries; all relatively labour intensive industries with a high level of outsourcing activities. At the same time, the four industries have a long tradition of focusing on craftsmanship and design and the works of some of the most well-known Danish designers date back to the 1950s and 1960s (among others, Arne Jacobsen, Hans Wegner and Werner Panton). Even though some of these designs are still in production, new streams of designers are continuously emerging and surveys conducted by the Danish Enterprise and Construction Authority (Erhvervsstyrelsen 2008; 2007; 2003) document an increased design focus among Danish firms and an increase in both internal and external use of designers. Second, the increased focus on a more knowledge intensive production model makes innovation an important driver for sustaining future competitiveness. Thus, by analysing whether or not firms innovate and which factors affect the innovative activities, this study may suggest areas which present challenges to the four industries if the transformation continues or even accelerates.

Measuring innovation by some of the classical and well-proven definitions, such as number of patents granted or Research and Development (R&D) investments, seems unsuitable for the purpose of this study because of the shift from a traditional production-oriented industry to an industry focusing more on lifestyle and the various aspects of

design. Instead, in this study, innovation is measured by indicators advanced in the Oslo Manual (OECD 1996; 2005) which to some extent shifts the focus from the input (R&D) to the output of inventive activities (OECD, 2001). According to the Oslo Manual, innovation is defined as the introduction of new or improved products and processes, new or improved marketing methods or as a substantial organisational change. This study includes all four types of innovation (see, section 3 for a more thorough discussion of the definition of innovation). Furthermore, the novelty degree of the innovation used in the paper is defined as “new to the firm”.

The analysis of what determines the innovation activities in the lifestyle industries takes as its point of departure the resource-based view of the firm focusing on the importance of internal resources and capabilities (Barney, 2001; Lockett and Thompson, 2001). The study, however, also includes elements from the network literature and highlights the importance of external resources available through the firms’ network (Zaheer and Bell, 2005). The analysis includes traditional arguments found in the total productivity models, see Nickell (1996), firm-specific determinants like governance, ownership and internal resources, industry-specific factors like export orientation and competition as well as network determinants like cooperation with public authorities and knowledge institutions. Furthermore, specific attention is given to whether firms’ view on themselves as either production-oriented or design-oriented has an influence on their innovativeness.

The paper is structured as follows: Section 2 discusses the transformation from traditional production to design within the four industries: textile, clothing, wood product and furniture. Section 3 provides a definition of innovation and discusses how innovation can be measured and which determinants are important for innovation activities resulting in a number of hypotheses. In section 4, the method and data of the 2008 survey conducted in the four industries in Denmark are described while section 5 presents and discusses the empirical results. The sixth and final section provides the conclusion and implications of the study.

## **2. The transformation from traditional production to ‘life style’ design**

In this section, the transformation from traditional production to design in the period since 1995 is discussed based on aggregated industry level data. Table 1 provides information on employment and Table 2 shows the productivity defined as the relation between turnover and number of employees, while Table 3 illustrates the absolute and relative importance of export and import. In the last decades, the overall development in Denmark indicates that despite great changes in the industrial development, the textile and clothing industries and the wood product and furniture industries are still relatively important economic activities, especially when measured by the value of export.

Table 1 shows that almost 38,000 people were employed in the four industries in 2006; a decline of almost 18,000 employees since 1995. This reduction of about 32% is equivalent to a decrease of 2.9% per year and compared to the overall development in the

manufacturing industries, the speed of labour reduction has more than doubled. However, the decline in employees is not isolated to the four industries but is a common phenomenon within manufacturing in Denmark. In contrast, the number of employees within private service has increased dramatically (nearly 500%). The development in the number of employees also shows that the four industries have reduced their percentage of the total employment in the private sector from 7.9% in 1995 to 2.8% in 2006. Among the four industries, the decline in employees has been most distinct within the textile and clothing industries (49% and 73% respectively) and less so in the wood product industry (9%).

**Table 1: Employment in the private urban sector, full-time equivalent, 1995-2006**

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Textile	10234	9186	8775	8635	7930	7827	7491	6979	6341	5921	5552	5196
Clothing	7462	6571	5699	5197	4526	4124	3687	3199	2898	2585	2098	2049
Wood product	14576	13956	14515	15005	14433	14733	14081	13180	12829	13051	13125	13280
Furniture	22991	22677	22984	23366	22049	22924	21875	20167	19010	18161	17337	17078
All 4 industries	55263	52390	51973	52203	48938	49608	47134	43525	41078	39718	38112	37603
All 4 industries % of all	7.9	7.4	7.3	6.0	4.0	3.9	3.6	3.3	3.2	3.1	2.9	2.8
Manufacturing	432035	430325	424068	423936	415439	414336	411736	402652	388240	373652	363765	365108
Service	135142	136719	142740	295649	652953	683648	751415	750666	740122	754964	770424	796995
All firms	702180	705381	715867	869574	1220468	1262050	1323939	1307586	1280381	1283733	1298562	1338269

*Note: 'Industrial accounts statistics in the private urban sectors'. The statement is based on firms in the secondary and tertiary industries (NACE code over 150000). A few sectors have not published information due to confidentiality issues. The number of employees is defined as 'the number of full-time equivalent employees'. Absolute numbers of employees from 1998 to 1999 at an aggregated level must be interpreted with care due to changes in the statistics.*

*Source: Statistics Denmark and [www.statistikbanken.dk](http://www.statistikbanken.dk).*

This leaves us with an impression of a generally weakened manufacturing industry; however, analysing the related development in turnover (figures not shown here) softens the blow. For the four industries in the study, turnover has increased slightly from 43.8 billion Danish kroner in 1995 to 50.2 billion Danish kroner in 2006.<sup>1</sup> Although experiencing a decline in employment and a slowdown in turnover, the four industries have managed to perform better in respect of productivity than the rest of the

<sup>1</sup> The Danish currency is closely related to the EURO and the exchange value is approx. 1 € to 7.5 DKK.

manufacturing industries and they have almost managed to keep pace with the productivity of the service industries, see Table 2. Thus, the traditional manufacturing industries and especially the lifestyle industries have managed to stay competitive and keep export at a high level, see Table 3. This point is confirmed by results from two European Commission reports on development in, among others, the textile, clothing and furniture industries (Clutier 2007a; 2007b). The analysis shows that measures of the Danish productivity in an international perspective are very good; Denmark is actually the most productive nation within textile and, together with Sweden, it is the most productive country within clothing.

**Table 2: Productivity growth in the private urban sector, index (1995=100), 1995-2006**

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Textile	100	104.7	110.6	117.6	129.2	138.3	134.8	139.3	145.2	151.8	165.3	180.4
Clothing	100	115.5	124.7	139.9	154.4	164.3	180.5	187.2	183.8	195.2	204.1	213.6
Wood product	100	100.1	106.1	109.1	112.1	118.5	119.6	123.8	131.1	134.6	142.7	152.6
Furniture	100	100.4	104.4	111.6	120.9	128.8	141.4	138.3	143.4	155.0	166.0	173.1
All 4 industries	100	102.9	108.0	114.6	122.6	129.9	136.5	137.4	142.4	150.0	159.6	168.7
Manufacturing	100	101.6	107.9	111.2	115.8	122.0	131.1	136.8	133.0	138.9	150.4	163.7
Service	100	100.1	98.6	187.0	142.8	146.2	145.3	149.1	152.9	157.2	168.1	179.1

*Note: 'Industrial accounts statistics in the private urban sectors'. The statement is based on firms in the secondary and tertiary industries (NACE code over 150000). A few sectors have not published information due to confidentiality issues.*

*Source: Statistics Denmark and [www.statistikbanken.dk](http://www.statistikbanken.dk).*

Table 3 provides information about the development in export and import. The figures show that the value of export in the four industries has increased from 18.6 billion Danish kroner in 1988 to 47.4 billion Danish kroner in 2006 while import has increased with a similar amount. The four industries' percentage of the overall import has been quite stable while there has been a relatively small decrease in the percentage of overall export. Thus, even though employment has declined and the increase in turnover has been modest, the four industries have managed to maintain their importance to Danish export. Looking separately at the four industries, clothing is the only one that has managed to improve its position. This seems to be followed by an increase in import which suggests that the increase is not a result of increased production in Denmark but based on resale of imported items (intra-industry trade).

**Table 3: Import and export, 1988 and 2006, Value in DKK**

		<i>Import</i>		<i>Export</i>	
		<i>1988</i>	<i>2006</i>	<i>1988</i>	<i>2006</i>
<i>Wood products</i>	<i>Value</i>	<b>2.6</b>	<b>5.8</b>	<b>2.3</b>	<b>5.2</b>
	<i>billion</i>	27	29	28	31
	<i>Rank</i>	1.4%	1.1%	1.2%	1.0%
	<i>Percentage</i>				
<i>Furniture</i>	<i>Value</i>	<b>1.8</b>	<b>8.2</b>	<b>7.0</b>	<b>16.0</b>
	<i>billion</i>	37	21	6	12
	<i>Rank</i>	1.0%	1.6%	3.7%	2.9%
	<i>Percentage</i>				
<i>Textile</i>	<i>Value</i>	<b>5.9</b>	<b>8.1</b>	<b>4.2</b>	<b>6.9</b>
	<i>billion</i>	11	22	17	26
	<i>Rank</i>	3.3%	1.6%	2.2%	1.3%
	<i>Percentage</i>				
<i>Clothing</i>	<i>Value</i>	<b>6.5</b>	<b>22.8</b>	<b>5.1</b>	<b>19.3</b>
	<i>billion</i>	10	6	11	8
	<i>Rank</i>	3.6%	4.5%	2.6%	3.6%
	<i>Percentage</i>				
<i>All 4 sectors</i>	<i>Value</i>	<b>16.8</b>	<b>44.9</b>	<b>18.6</b>	<b>47.4</b>
	<i>billion</i>				
	<i>Percentage</i>	9.2%	8.9%	9.7%	8.7%
<i>Denmark</i>	<i>Value</i>	<b>181.8</b>	<b>506.5</b>	<b>191.6</b>	<b>543.8</b>
	<i>billion</i>				
	<i>Percentage</i>	100%	100%	100%	100%

*Note: The first row shows the value of import and export in billion Danish kroner. 1 DKK equals 0.13 €. The centre row shows the relative rank in terms of significance (for instance, the value 27 means that the wood product industry is ranked 27 out of 66 with regard to import). The last row is the sectors' percentage of the overall import and export. The value of import and export is measured in current prices. SITC main groups (66 groups).*

*Source: www.statistikbanken.dk.*

This resale aspect actually pinpoints a problem in the making of the statistics and the industrial codes. Tables 1, 2 and 3 are based only on the numbers from the manufacturing parts of the four industries while firms solely focusing on wholesale do not form part of this specific statistic. A part of the development within the four industries may be prompted by the fact that firms have become wholesalers and the statistics may thus describe a more severe decline than is actually the case owing to the fact that firms move from one industrial code in the statistics to another. In the official figures from Statistics Denmark, it is not possible to identify wholesale within textile, clothing, wood products and furniture; only more general categories are identifiable. The two relevant categories are wholesale of textiles and household goods and wholesale of wood and construction materials. For wholesale of textiles and household goods, there has been an

increase in employment from 30,000 in 1998 to 35,800 in 2006 (19% or on average 2.4% per year) and a 50% increase in turnover (from 10.5 billion Danish kroner to 15.6 billion Danish kroner). For the wholesale of wood and construction materials, employment has increased from 12,000 in 1998 to 16,000 in 2006 (34% or 4.2% per year) while turnover has increased by 58% (from 43.1 billion Danish kroner to 68.2 billion Danish kroner). These figures can be compared with a decline in employees per year in the textile, clothing, wood product and furniture industries ranging from 0.8% to 6.6% and an even lower development in turnover. Although the numbers for wholesale include elements that obviously do not form part of textile, clothing, wood products or furniture, these numbers indicate that there has been a more positive development than seen when solely focusing on the manufacturing parts of the four industries. In the survey presented in Section 4, not only manufacturing firms are included but also wholesale traders within the area.

### **3. Innovation as an instrument for staying competitive**

As shown in Section 2, the industrial structure in the textile and clothing industries and the wood product and furniture industries has undergone substantial changes in the last 10 years. For firms trying to meet the pressure from globalisation on the one side and ever faster changes in customer needs on the other, a focus on innovation is necessary (Tidd and Bessant, 2009). Thus, the innovative effort may in the long run be what distinguishes competitive firms from other firms. Consequently, it becomes important for the industries in general and for the individual firm in particular to ask the questions: Do we have the necessary focus on innovation and what are the factors that may influence our innovative activities? To answer these questions from an industry perspective, a survey was conducted among firms in the four investigated industries. Before turning to the analysis of the survey, the next subsections include a discussion of which determinants are important for innovation activities from a theoretical point of view. The discussion results in a number of hypotheses. The subsections, however, are preceded by a definition of innovation and a discussion of how innovation can be measured.

#### **3.1. Defining and measuring innovation**

As stated in the introduction, measuring innovation by means of some of the classical definitions of innovation, like the number of patents granted or R&D investments, seems unsuitable because of the transition from a traditional production-oriented industry to an industry focusing much more on lifestyle and design. Instead, the innovation concept should reflect these changes and include the output of inventive activities like new products or processes. Thus, this will shift the focus from the input side (R&D) to the output of inventive activities (OECD, 2001; Greenhalgh and Rogers, 2010). Fittingly, the Oslo Manual makes a virtue of measuring innovation as an output of inventive activities and this is the approach to innovation that has been used for collecting data to this study. In the Oslo Manual, innovation is defined as “*the implementation of a new or significantly improved product (good or service), or process, a new marketing*



*method or a new organisational method in business practice, workplace organisation or external relations*” (OECD, 2005). The guidelines in the Oslo Manual have been used in the Community Innovation Surveys (CIS) conducted on a regular basis since the mid-1990s in most European countries, Canada (Therrien and Mohnen, 2003), Japan, Australia and a number of other countries (OECD, 2009) – in terms of the EU countries, 2008 saw the sixth CIS round. For the first many years, focus was mainly on technological products and processes (reflected in the second edition of the Manual from 1996 (OECD, 1996) but in the latest edition, marketing and organisational innovation have been included as well and focus is not only on technological products and processes but all types of product and process innovations. Innovation implies change which makes it natural to talk about the degree of novelty of the innovation. The Oslo Manual uses ‘new to the firm’ as the minimum definition of innovation novelty and this is also the definition used in this paper although it may make firms seem overly innovative (Greenhalgh and Rogers, 2010).

Even though many studies employ the Oslo Manual definition of innovation, the focus is still mainly on product and process innovations. Some recent research, however, has contributed with a broader use of the definition (Nielsen et al., 2008; OECD, 2009; Smith, 2005). The present study also includes all four types of innovation.

### **3.2. Determinants of innovation**

As mentioned in the introduction, one of the objectives of the study is to analyse which factors determine innovation activities in the lifestyle industries. This discussion takes as its point of departure the resource-based view of the firm focusing on the importance of internal resources and capabilities (Barney, 2001; Lockett and Thompson, 2001). However, it also includes elements from the network literature and highlights the importance of external resources available through the firms’ network (Zaheer and Bell, 2005; Ouimet, Landry, and Amara, 2004; Powell and Grodal, 2005). The following subsections advance a number of hypotheses to be tested in the empirical section.

#### **3.2.1. Resource-based determinants of innovation**

In the resource-based view of the firm, the importance of internal resources and capabilities is the focal point. In this study of the determinants of the innovative activities in a firm, the following three types of resource-based explanations are included:

- i. General characteristics of a firm (age, size etc.)
- ii. Corporate governance
- iii. Level of competition in the industry, approach to the market

Looking at the general characteristics of a firm, the literature continuously debates which is the most innovative; the mature or the new entrepreneurial firm (Timmons and Spinelli, 2007). It is argued that as firms grow older, their focus shifts to be more on

consolidation and expansion within existing markets with existing products than on contriving new innovations. On the other hand, new firms may lack resources and experience difficulties in accessing the necessary financial, human or social resources; this may cause them to innovate in a less systematic, organised and rational way than older firms (Greenhalgh and Rogers, 2010).

In a 2001 study based on CIS data, Mairesse and Mohnen found that firm size (among a number of other factors) influences innovativeness positively (Mairesse and Mohnen, 2001; OECD, 2001). The scale argument (measured by size) is also supported by Crepon, Duguet and Kabla (1996), while Tidd, Bessant and Pavitt (2005) argue that innovativeness in small firms depends on the product and technology; in other words, it is dependent on the industry not the size. Thus, both age and size may influence the innovativeness of firms and according to Audretsch and Thurik (2001), entrepreneurial firms – young in age and small in size – may play an increasingly important role in today's knowledge-based economy. Accordingly, it is hypothesised that:

*Hypothesis 1: Younger firms innovate more than older firms.*

*Hypothesis 2: Small firms innovate more than medium-sized or large firms.*

The ability to govern a firm properly may be important for the innovative activities. One aspect of governance is whether managers and leaders are committed to and support innovation. This may be reflected in whether the firm places emphasis on strategic considerations in general and on innovation strategies in particular (Tidd, Bessant, and Pavitt, 2005; Lazonick, 2004). For Teece, Pisano and Shuen (1997), attaching great importance to the strategic aspect reflects a long-term commitment to competency development necessary for innovation.

Another aspect of governance is the ownership structure. The ownership structure is important because it may reflect to what extent firms are managed in a good and professional manner. Indicators of ownership are whether the firm is part of a group, ownership concentration<sup>2</sup> and type of owner (for instance whether the firm is family-owned, family-managed or foreign-owned). Mairesse and Mohnen (2001), for instance, find that belonging to a group is positively correlated to firm innovativeness.

Access to financial resources may also be a prerequisite for undertaking innovation. This could be either internal financial resources in the form of equities or external resources in the form of bank loans, venture capital, money from other private investors, etc. Thus, in the present study, variables measuring owner concentration, whether the firm has strategy plans and whether the firm has access to financial support are included. Accordingly, it is hypothesised that:

*Hypothesis 3: Concentration of ownership diminishes firm innovativeness.*

*Hypothesis 4: Having a strategy plan enhances firm innovativeness.*

*Hypothesis 5: Access to external financial support enhances firm innovativeness.*

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<sup>2</sup> To what extent ownership is concentrated in one owner.

Regarding the level of competition in the industry and the approach to the market, two dimensions are included. In terms of approach to the market, this paper claims that the textile and clothing industries and the wood product and furniture industries have developed from being predominantly traditional production-oriented into becoming more lifestyle and design-oriented; i.e. into employing the upstream and downstream value chain knowledge activities to create value (Mudambi, 2008). Thus, differentiation from competitors and reacting to ever faster changing user demands (either businesses or customers) by boosting innovation within intangible assets like design or other special features become essential to the firms and this entails that being innovative is even more urgent than before. Therefore, the study also includes an analysis of whether or not design-orientation affects the innovative performance. Accordingly:

*Hypothesis 6: Being design-oriented enhances firm innovativeness.*

Finally, in an increasingly globalised world, firms are subjected to competition not only from local competitors but also from global markets. This may especially be the case for firms which aim at exporting their products and services. Thus, firms that are export-oriented are expected to focus more on innovation as a means to stay competitive. For instance, the results from Mairesse and Mohnen's 2001 study support this correlation and found that the export to sales ratio influences firm innovativeness positively (Mairesse and Mohnen, 2001). Therefore, firms' export intensity is included in this study resulting in the following hypothesis:

*Hypothesis 7: Being exposed to competition at the export markets enhances firm innovativeness.*

### **3.2.2. Network determinants**

As stated earlier, not only the internal capabilities of a firm are important for its innovativeness but also its access to external capabilities. This is reflected in the extensive body of literature on the relationship between networking and innovation (see for instance Powell and Grodal (2005), Tidd and Bessant (2009)) but the role played by networking in terms of innovation is also reflected in the innovation system approach where systems made up of components, relationships and attributes work towards the common objective of innovation (Carlsson et al., 2002; Edquist, 2005). Recently, the role of external networking has been emphasised in the concept of open innovation developed by Chesbrough (2003; 2006). Through networking, firms gain access to valuable financial, human or social resources. The forms of collaboration and networking and the types of actors involved may be very different from situation to situation (Tidd, Bessant, and Pavitt, 2005). Firms may gain access to valuable external resources through collaboration with actors who form part of their supply chain, i.e. suppliers, customers etc., but also collaboration with competitors, public authorities, knowledge institutions, etc. may play a part in the firms' ability to undertake innovative activities. The Oslo Manual emphasises that innovation activity investigations should incorporate questions about the influence of networking on innovation (OECD, 2005). In this study, an analysis

of whether firms' cooperation with external partners has contributed to the firms' innovativeness has been included. Thus, it is hypothesised that:

*Hypothesis 8: Network activities with external organisations enhance the firm innovativeness.*

#### **4. Empirical approach and data**

The empirical analysis is based on a mail based survey conducted in the textile and clothing industries and the wood product and furniture industries in Denmark in 2008. Information on firm performance and innovative activities are available at the micro-level (e.g. CIS data for Denmark), but the survey is incentivised by the need for more qualitative information about governance structure, strategy implementation, networking activity, etc. In order to include the dynamic aspects of innovation, firms also provide information about past performance and their expectations for future developments.

The relevant population includes 929 firms with 5 or more employees – for firms that are solely wholesale traders, the limit was 20 employees. The delimitation of employee number reflects delimitations used in other studies; for instance, CIS normally target firms with more than 10 employees and the Danish Centre for Studies in Research and Research Policy uses 6 employees as the minimum threshold in their innovation statistics. As indicated in Table 4, 222 firms answered the questionnaire equalling a response rate of 24%. The response rate was somewhat higher in the clothing and furniture industry but a  $\chi^2$ -test reveals that the distribution of the respondents is comparable to the distribution of the population.

**Table 4: Population, respondents, response rate and type of industry**

Industry	Population N	Population %	Responden ts N	Responden ts %	Response rate
Textile	157	16.9	32	14.4	20.4
Clothing	193	20.7	51	23.0	26.4
Wood product	282	30.4	62	27.9	22.0
Furniture	297	32.0	77	34.7	25.9
<b>Total</b>	<b>929</b>	<b>100.0</b>	<b>222</b>	<b>100.0</b>	<b>23.9</b>

*Notes: Textile is defined as a NACE 2007 code 1300, 4641; Clothing is defined as NACE 1400, 4642; Wood product is defined as NACE 1600; Furniture is defined as NACE 3100, 4647, 4665, 4666. The survey includes firms with 5 or more employees and for firms which are solely wholesale traders, only firms with more than 20 employees are included. Firms can be registered with more than one NACE code. The population is based on information from Experian.*

Based on the results found in Table 4 and several tests for stability of the results, it is concluded that the sample is a representative sample of the four industries.

Data was collected by means of a questionnaire sent to the firms in May 2008 and the data collection was concluded in August 2008. The questionnaire included four main groups of questions: Background information, governance structure and resources, collaboration or networking activities and innovation.

#### 4.1. The innovative firm

According to the definition of innovation in the Oslo Manual (see, discussion in a previous section), the innovative activities of a firm are divided into four categories: Product (product or service), process, marketing or organisational. A firm is considered product innovative if it has introduced a new or significantly improved product or service within the last 2 years and process innovative if it has introduced a new production process. A firm has embarked on marketing innovation if it has implemented new marketing strategies targeting new groups of customers or new market segments within the last 2 years. Finally, a firm implementing a new organisational method in the firm's business practices, for instance by using new methods for organising routines and procedures for the conduct of work, is considered innovative in the organisational field. The level of innovation and the connection between the four types are shown in Table 5 using a simple test for partial correlation between the types of innovation. Innovative firms are defined as firms having innovative activities within at least two of the four types of innovation and according to Table 5 this implies that about two thirds of all firms in the 4 industries are innovative. The relative share of innovative firms is in keeping with the findings in several OECD reports, e.g. 47% of all Danish firms have engaged in either product or process innovation and 63% of all firms have introduced a non-technological (marketing or organisational) innovation (OECD, 2009).

Table 5 indicates that product innovation is the dominant type of innovation and the answers to the questionnaire leave us with the general impression that product innovation is also the type of innovation which is most easily grasped. Even though the overall innovative level is relatively high, it is evident that there is a trade-off between the types.

**Table 5: Share of innovative firms and correlation between types**

<i>Type of Innovation</i>	Share %	Product/ service	Process	Marketing	Organisational
<i>Product/ service</i>	62.2	1.00	0.26	0.17	0.21
<i>Process</i>	60.4		1.00	0.27	0.28
<i>Marketing</i>	50.5			1.00	0.28
<i>Organisational</i>	47.7				1.00
<i>Innovation</i>	66.7	0.59	0.56	0.58	0.41

*Notes: Correlation is based on partial correlation (Pearson). All correlations are significant at a 1% level. Minor differences between the results in this table and the following tables may occur due to missing observations in the disaggregated data on innovation.*

The relation between product innovation and process innovation illustrates this point. The correlation (0.26) is shown in detail in Table 6. Almost the same number of firms (134 and 138) is active in the field of the two types of innovation but not the same firms are active in the two categories: 41 out of 138 (or 30%) active product innovators are not active in process innovation. However, the overall picture is dominated by the relatively large number of firms in the diagonal of the correlation matrix and the test for independence between the four types of innovation is highly significant.

**Table 6: Relation between product/service innovation and process innovation**

	<i>No process</i>	<i>Process</i>	Total
<i>No product/service</i>	47 (33.3)	37 (50.7)	84
<i>Product/service</i>	41 (54.7)	97 (83.3)	138
<i>Total</i>	88	134	222

*Notes: The numbers indicated in brackets are expected numbers given independency between product/service innovation and process innovation. A formal chi-square test of independency rejects independency:  $P(\chi^2(1)=15.03) < 0.0001$ .*

#### **4.2. Data definitions and descriptive statistics**

The theoretical background for explaining the innovative behaviour was discussed in section 3 which also advances the hypotheses to be tested. The explanatory variables are defined below along with a presentation of some descriptive statistics (Table 7).

As mentioned in the previous subsection, innovative firms are defined as firms with innovative activities within at least two of the four types of innovation; however, the results presented in the following sections are not dependent on this definition as other definitions have been tested.

In terms of *firm characteristics*, two measures are used: firm size and age. “Firm size” is measured by the number of full-time employees and the variable is log-transformed in the analysis. Other types of transformations have also been tested (dummy-implementation, quadratic expressions with and without log-transformation) but the results remain unaffected by these changes.

“Firm age” is measured by the time elapsed since the legal formation of the firm and it has not been possible to correct for any type of mergers and acquisitions. The age is also log-transformed based on the same arguments as for transforming firm size.

**Table 7: Descriptive statistics**

<i>Variable</i>	<i>All firms</i>	<i>Innovative firms</i>	<i>Non-innovative firms</i>
<i>Percentage of innovative firms</i>	66.7	100.0	0.0
<u><i>Firm characteristics</i></u>			
<i>Firm size – number of employees</i>	86.6	105.4	47.9
<i>Firm age (years)</i>	41.3	43.4	36.9
<u><i>Corporate governance</i></u>			
<i>Percentage of firms with foreign owner</i>	4.1	4.7	2.7
<i>Percentage of family run and owner concentrated firms</i>	84.2	85.1	82.4
<i>Percentage of firms with strategy plan</i>	70.0	79.5	50.7
<i>Percentage of firms with need for skills</i>	54.1	58.8	44.6
<i>Percentage of firms with external financing</i>	31.5	39.2	16.2
<i>Percentage of firms with growth potential</i>	55.4	62.2	41.9
<u><i>Competition, market</i></u>			
<i>Percentage of export-oriented firms</i>	73.9	79.7	62.2
<i>Percentage of lifestyle firms</i>	57.7	60.1	52.7
<i>Percentage of firms in textile &amp; clothing industries</i>	37.4	39.2	33.8
<u><i>External resources</i></u>			
<i>Percentage of firms with networking activities</i>	49.1	59.2	28.6
<i>Number of firms</i>	222	148	74

*Corporate governance* includes 6 explanatory variables: “Foreign ownership” encompasses firms with a non-Danish owner and “family run or owner concentrated firms (50%)” are firms with either family-owned (private firms) or a concentrated (more than 50%) ownership structure (Ltds). “Firms with strategy plan” is an indicator for the use of a formal strategy plan and, as is evident from Table 7, only 50.7% of the non-innovative firms are actually using a strategy plan while 79.5% of innovative firms do so. The “need for skills” category comprises firms that have specified a lack of knowledge such as lack of skilled labour force, need for technological progress or need for better

market insight. “External financing” identifies the firms that have used external funding for their innovative activities during the previous two years. “Growth potential” identifies those firms that expect a general increase in growth of the firm.

*Competition and market* includes 3 variables which focus on the approach to the market, market potential and the level of competition: “Export orientation” designates firms with export activities (at least 5% of annual turnover) and thus firms exposed to globalised competition. The market approach in terms of whether firms are design-oriented or not may be measured in several ways: One is based on the NACE codes defining the furniture and clothing industries as “lifestyle production” while another is based on firms describing themselves as design-oriented. Both definitions have been tested with the same results. An industry dummy for “firms in textiles and clothing” may be seen as a measure of differences in competition and market potential.

Finally, *external resources* in the form of “network activities” are comprised of firms which have collaborated with other firms or organisations during the last two years. Here, collaboration does not include traditional transactions with firms in the value chain but is restricted to relations established for the purpose of creating innovation.

The summary statistics in Table 7 show that innovative firms score higher within all dimensions and as reported earlier, this is in keeping with the general findings in other industries; see, OECD (2009).

## **5. Empirical results**

The results are presented in Table 8. The innovation variable is binary scaled and accordingly, the models estimated in Table 8 are based on logistic regression. The models are estimated by STATA using a robust estimator of the variance. The first and third columns present the estimated models and the second and fourth columns depict the *average marginal effect (partial effect)* of the variables. Instead of estimating the marginal effects using the means of the explanatory variables, the average marginal effects reported in the paper can be interpreted as the explanatory variables’ relative importance to innovation.

The first column represents the full model and as it appears, firm size has a very limited impact on the decision to innovate. Several linear as well as non-linear formulations of firm size have been tested but the hypothesis of a positive relation between size and innovation is rejected; the relation remains very weak and only the dummy representing small firms (less than 10 employees) and large firms (more than 100 employees) is stable and negative albeit insignificant; interpretation of this result is somewhat contra-intuitive because the concepts of innovation and new venture are closely related. However, there are very few large firms in the lifestyle industries and the argument for the negative relation may be found in the fact that a younger firm is much more focused on short-term problems (survival) than activities with a longer time horizon. Among the large firms in the sample are a number of traditional wood industry firms, e.g. sawmills, and these firms are in general less innovative.



Older firms are more innovative than younger firms and this relation is strong and significant; once more, this finding is not the expected outcome but again, the explanation is to be found in the industries investigated. The established firms in the lifestyle segment are able to devote themselves to design free of the survival focus which younger firms are compelled to employ. Furthermore, older firms are in general financially consolidated and aware of the important bearing that innovation has on survival.

Resources in general and financial resources in particular are a prerequisite for conducting innovative activities and these findings correlate with the theory. These conclusions also apply to the corporate governance dimension; that is, firms with external monitoring (foreign ownership), firms with ownership control (low ownership concentration), firms with a specified strategy plan and firms with high market potentials are in general more innovative.

Only the dummy for lifestyle production fails to be significant but this result is primarily ascribable to two factors. The first is the simple fact that the categorisation of traditional and design-oriented industries is inexpedient (NACE codes are not reliable at this sub-level). The second is that firms in the selected industries represent two types of firms; one type focusing on optimising production of traditional goods and one type specifically focusing on design. The firm's self-concept (perceiving itself as either a design firm or a production firm) will affect the probability of future survival but the results do not offer support to the expected positive relation between innovation and design orientation.

As expected when looking at the effect of the market, a more positive relation is found among the firms operating on markets with a higher level of competition (measured by export intensity) than among firms operating primarily on home markets. Similarly, innovation is performed in close contact with external agents entailing a clearly positive and significant networking variable coefficient.

**Table 8: Determinants for innovative activities, logistic regression**

	(1) Full Model	Average marginal effect	(2) Reduced model	Average marginal effect
<i><u>Firm characteristics</u></i>				
Firm age (log-transformed)	0.540*** (0.210)	0.083	0.461** (0.194)	0.075
Small firms ( $< 10$ employees)	-0.264 (0.529)	-0.041		
Large firms ( $> 100$ employees)	-0.704 (0.521)	-0.108		
<i><u>Corporate governance</u></i>				
Foreign ownership	1.471** (0.740)	0.226		
Family run or owner concentrated firms (50%)	-0.391 (0.521)	-0.060		

*Lifestyle production: Transformation from manufacturing  
to knowledge based production using innovation*

Firms with strategy plan	1.187 <sup>***</sup> (0.377)	0.182	1.029 <sup>***</sup> (0.356)	0.166
Need for skills	0.672 <sup>*</sup> (0.372)	0.103		
External financing	1.504 <sup>***</sup> (0.557)	0.231	1.486 <sup>***</sup> (0.519)	0.240
Growth potential	0.791 <sup>**</sup> (0.392)	0.121	0.813 <sup>**</sup> (0.370)	0.131
<u>Competition, market</u>				
Export orientation	0.911 <sup>**</sup> (0.422)	0.140	0.906 <sup>**</sup> (0.386)	0.146
Lifestyle production	0.197 (0.381)	0.030		
Textile or clothing industries	0.649 <sup>*</sup> (0.375)	0.100		
<u>External resources</u>				
Network activity	1.127 <sup>***</sup> (0.404)	0.173	1.000 <sup>***</sup> (0.371)	0.162
N	204		204	
Pseudo R <sup>2</sup>	25.0%		21.6%	
P(Log-LR)	< 0.0001		< 0.0001	

Notes: Standard errors are presented in brackets. \* indicates significance at a 10% level, \*\* at a 5% level and \*\*\* at a 1% level. Intercept is not shown.

The reduced model is identified as a model with robust, stable and significant factors influencing innovation. The model (2) shows the main results with the average marginal effects presented in the last column. A high marginal effect is interpreted as a substantial increase in the probability of being innovative given an increase of one unit of the explanatory variable. The net impact from firm age is relatively uninteresting seen from a policy perspective; however, better financial support, increased networking activities with other firms and organisations and a positive strategy formulation positively affect the decision to innovate. Several models with interaction between financial support, networking and strategy formulation have been tested but no significant interaction effect is found, i.e. there is no evidence of any interdependency between the three types of resources. Finally, it is demonstrated that firms operating on competitive markets are forced to use innovation to maintain competitiveness.

## 6. Conclusion

Despite the considerable changes in the Danish industrial development in the last 10 years, the textile and clothing industries and the wood product and furniture industries have managed to successfully maintain a high level of productivity and importance with

regard to economic activities; at least when looking at the value of export. This implies that traditional production-oriented industries have become increasingly oriented towards various aspects of knowledge activities such as design, marketing, branding, etc., as for example upstream and downstream value chain activities. An effect of this transformation may also be that firms should intensify their focus on innovation.

The paper also analysed and discussed the innovative effort in the four lifestyle production industries in Denmark. Measuring innovation in accordance with the guidelines in the Oslo Manual, the paper found that two thirds of the firms carried out innovative activities. The overall conclusion of the estimated models is that it is possible to explain innovative activities by factors representing firm resources in the lifestyle industry. Tangible resources, i.e. suitable financial resources, influence the innovative activities positively. The positive result is also found for firms with a formal strategy plan. Finally, even though the interaction with agents in the markets (suppliers, competitors and customers) is normally considered a rough indicator for information seeking, the positive effect is significant and the coefficient is similar to that for financial resources. The expected negative relation between age and innovation cannot be verified, nor can a significant relation between size and innovation.

The analysis also included a variable for measuring whether design-oriented firms in contrast to production-oriented firms are more focused on innovation. This effect, however, failed to prove significant. A possible explanation for the lack of significance may be that the manner in which innovation is measured at present does not take into account the new forms of innovation that the focus on design may represent. Thus, conducting investigations into the innovation processes and what innovation is about in those firms may be a highly relevant issue for future research.

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