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Motivations for and Barriers to Ecodesign in Industry

The European Network of Ecodesign Centres (ENEC) was founded in 2012.



The five founding members are:

- Ecodesign Centre (Wales)
- Effizienz-Agentur NRW (North Rhine-Westphalia)
- OVAM (Flanders/Belgium)
- Ihobe (Basque Country)
- Pôle Eco-Conception (Rhone-Alps, France)



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Introduction

Understanding motivations for and barriers to ecodesign practice can support its translation to wider industry. This can be achieved through the development of appropriate policy measures to overcome barriers and foster motivation within industry.

Numerous studies have addressed this topic and frequently the findings of these studies converge. Different studies may categorise motivations and barriers in different ways, considering them as push or pull, internal or external or clustered according to similar factors. Taking a wider perspective, there have also been studies that have identified the motivations for and barriers to environmental management in Small to Medium Sized Enterprises (SMEs) (see Chan 2008; Pimenova & Vorst 2004). There is also a large body of literature on the motivations for pro-environmental behaviour amongst the population at large (e.g. Kollmuss & Agyeman 2002; Lucas et al., 2008; Steg and Vlek 2009). Many of the motivations and barriers across these areas of research are the same or similar for businesses involved with design, innovation and ecodesign. While much of this literature is focused on Small to Medium Size Enterprises (SMEs) some factors are also relevant to larger companies.

This paper summarises the literature in this area as a baseline for future work of the European Network of Ecodesign Centres (ENEC). The review of academic literature is supported by (1) evidence gathered from past research activities and (2) insights from across Europe shared by ENEC partners.

The remainder of the paper will be structured into four main sections: Motivations; Insights from Europe; Barriers; Gaps with Current Literature; and Conclusions and Avenues for Future Research. A range of motivations for ecodesign in SMEs has been identified by past studies. Johansson (2002) through a comprehensive literature review, identifies six factors; management, customer relationships, supplier relationships, development process, competence and motivation. Other studies discuss factors in terms of internal or external stimuli (e.g. van Hemel & Cramer 2002; Gouvinhas & Costa 2002).

The data gathering activities that provide the evidence for this paper are: (1) a workshop conducted in 2011 with a manufacturing SME, actors from its supply chain and three ecodesign experts; (2) PhD research to develop a typology of barriers to ecodesign in SMEs; and (3) an in-depth case study of four Welsh SME



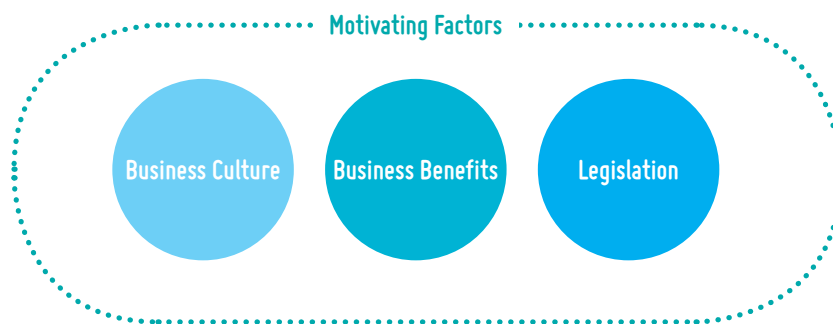
Motivations

Here, motivations identified during a workshop activity are classified according to three overarching factors:

- 1 | **business culture**
- 2 | **business benefits and**
- 3 | **legislation.**

This classification is displayed in Figure 1. In reality it is difficult to segment motivators into a clean classification. Some factors may potentially sit under more than one heading and factors are often inter-related.

Figure 1 Motivating Factors for Ecodesign in SMEs



Business Culture

Motivated SMEs often have a sense of ownership of environmental issues and undertake ecodesign projects due to a culture of social and environmental responsibility. These companies perceive benefits such as brand enhancement or potential for innovation associated with an ecodesign activity. A feeling of responsibility towards the environment and/or society is a common motivation identified in different studies. This may come from individuals, or from a number of staff members, and can greatly influence a business's strategy. Management staff may also be motivated to improve their business's environmental performance due to a feeling of responsibility towards their staff, customers and other relevant stakeholders. Other motivating factors related to business culture include a desire to build new and better business partnerships and a desire to take the lead in a certain market or area of technological development.

Johansson (2002) identifies that competence (for example education and training) and motivation (for example a new mindset) are very specific to ecodesign and its successful integration in companies. In comparison with Figure 1, the factor 'motivation' is similar to culture whereas 'capability' is identified here as a key barrier (Section 2 Figure 2). A lack of capability is also identified as a barrier to action in the wider environmental management literature (e.g. Vernon 2003; Hillary 2004; Chan 2008).

Business Benefits

Business benefits can broadly be considered in terms of (1) economic benefits and (2) product improvements.

Cost savings and increased sales are frequently claimed (by proponents of ecodesign) to be business benefits gained through ecodesign. While there are only a few studies evidencing clear financial benefits linked to ecodesign activity some studies have been identified (e.g. Plouffe et al 2011). In addition, it is the experience of the ENEC partners that best practice companies do attribute financial benefits to their ecodesign activity. This can include cost savings linked to improved material use or manufacturing efficiency on account of simplified products. This is also evidenced by the workshop data.

Improving product quality or reducing environmental impacts can achieve competitive advantage. This can refer to improved product design adding to a product's unique selling points leading to higher sales. Adopting ecodesign may also increase brand strength and client perceptions. However, not all product improvements are attributable to economic drivers. In some cases a moral decision to design better products is the overarching motivator.

Gouvinhas and Costa (2002) in a survey of 42 Brazilian SMEs established that a reduction in production costs is the main internal driver for SMEs participating in that study. Knight and Jenkins (2009) discuss opportunities for eco-efficiency, achievable through process improvements and which companies identified by using ecodesign tools. Knight and Jenkins (2009) also discuss the two different perspectives on ecodesign benefits from (1) prioritisation of cost reductions, for example through improved waste management practices, to (2) ecodesign as a vehicle for innovation, product quality improvements and new market penetration. In a more recent study, Bocken et al. (2014) in a survey of 42 SME eco-innovators, showed that the main drivers for these companies are (1) potential revenues and (2) technological advancements.

Legislation

Different pieces of legislation act to impose requirements for ecodesign in products, such as the European Ecodesign Directive and Waste Electrical Electronic Equipment (WEEE) Directive. Other pieces of legislation mean that ecodesign in products may lead to cost savings, such as savings on waste disposal to landfill by designing the product to be more easily reused or recycled.

Some companies that are environmentally active may sit within sectors that are legislated and thus obligated to reduce environmental impacts. Gouvinhas and Costa (2002) identify legislation and regulation as the most important external driver. However, it may be difficult to class legislation as a true motivating factor because the company does not have a choice and is reacting to enforced legislation.

Some issues have been discussed in relation to legislative targets. They may be underambitious, competing, poorly implemented at member state level or may not achieve its intended goals. For example, the WEEE Directive is understood to negatively impact reuse levels for electrical and electronic products. However, while reuse is generally considered to be socially and environmental beneficial, it is not unanimous that reuse of electrical and electronic products is the best approach for reducing environmental impacts of these types of products. Similarly, waste prevention targets for recycling and/or incineration may compete with targets for product reuse.

Table 1 compares the findings of nine studies assessing the motivations for ecodesign from a business perspective. This table is organised by clustering similar factors together into six groups. These are: regulatory; financial; brand; sector influences; stakeholder influences and cultural factors. However, sector influences could also be considered an economic factor and brand value is a business benefit. Similarly, stakeholder relationships and influences could be considered as a cultural factor. Therefore, at a high level of abstraction, our initial classification can still be considered representative.

Table 1 Summary of Motivating Factors identified in the Ecodesign Literature

	Regulation	Economic	Brand	Sector Influences	Stakeholder Influences	Cultural
Bocken et al. 2014 (In Press)		Potential revenues and technological advancements	Improved image			Personal reasons Positive experiences
Agan et al. 2013	Adjustment to the EU (Regulations)	Competitive Advantage	Brand Name Corporate Image			
Santaloria et al. 2011	Legislation	Cost reduction	Brand value			
O'Rafferty & O'Connor 2010		Internal (costs, competitiveness) Strategic (innovation, investment)	External (communications)			
van Hemel & Cramer 2006	Legislation	Improved product quality Opportunities for innovation Potential market opportunities		Sector behaviour	customer demands	
Reyes 2006	Regulation	Commercial Benefits		Sector behaviour	Stakeholder satisfaction	Internal Strategy
Gouvinhas & Costa 2004	Regulations and legislation	Cost reductions New markets				
Johansson 2002					Customer relationships Supplier relationships	Motivation Management
Vercalsteren 2001	Regulation	Innovation Competitiveness Market		Sector behaviour	Customers Suppliers	Motivation



Q1 – What motivates practitioner’s in your region’s companies to integrate ecodesign in day-to-day activities?



Michael Niemczyk, EFA

EFA

“The integration of ecodesign into day-to-day operational activities is strongly connected to successful pilot projects. Once a company realises through a pilot project that there is an advantage to ecodesign, they start to integrate ecodesign as a standard business activity.”



Evelyn Lafond, OVAM

OVAM

“Besides compliance with legislation, the choice for eco-innovation/ecodesign is strongly determined by company culture, personal and leadership attitudes.”



Ander Elgorriaga, IHOBE

IHOBE

“Our most recent Industrial Ecobarometer shows that environmental requests from customers on products will rise significantly for 49% of companies in 2014. This is even higher in sectors like white goods and electronics (70%), in research training and development intensive companies (69%) or in Integrated Pollution Prevention Control (IPPC) Directive affected companies (63%).

In our recent study (led by Pôle Eco-conception) on Profitability of Ecodesign drivers other than customers are identified as:

senior management commitment (28%) followed by anticipating legislation (21%) and competitor pressures (14%). The greatest perceived benefits are sales in existing or new markets (48%), followed by a better company image in 41% of the responses. In IHOBE’s projects we see the Ecodesign Directive playing a crucial role in integrating ecodesign in industry and green supply chain management is the best driving force for SMEs.”



Dr. Sharon Prendeville,
Ecodesign Centre (Wales)

Ecodesign Centre (Wales)

“Culture is key. Many companies are driven by well-intentioned senior figures that are willing to invest in ecodesign in the first place. These active companies see profits associated with ecodesign and proceed with this approach. Our recent study on profitability clearly shows there are profit-making opportunities from ecodesign. Simple costs savings are easily realised through ecodesign strategies like material reductions, product improvements, better waste management and resource efficiency.”



Samuel Mayer,
Pôle Eco-Conception

Pôle Eco-Conception

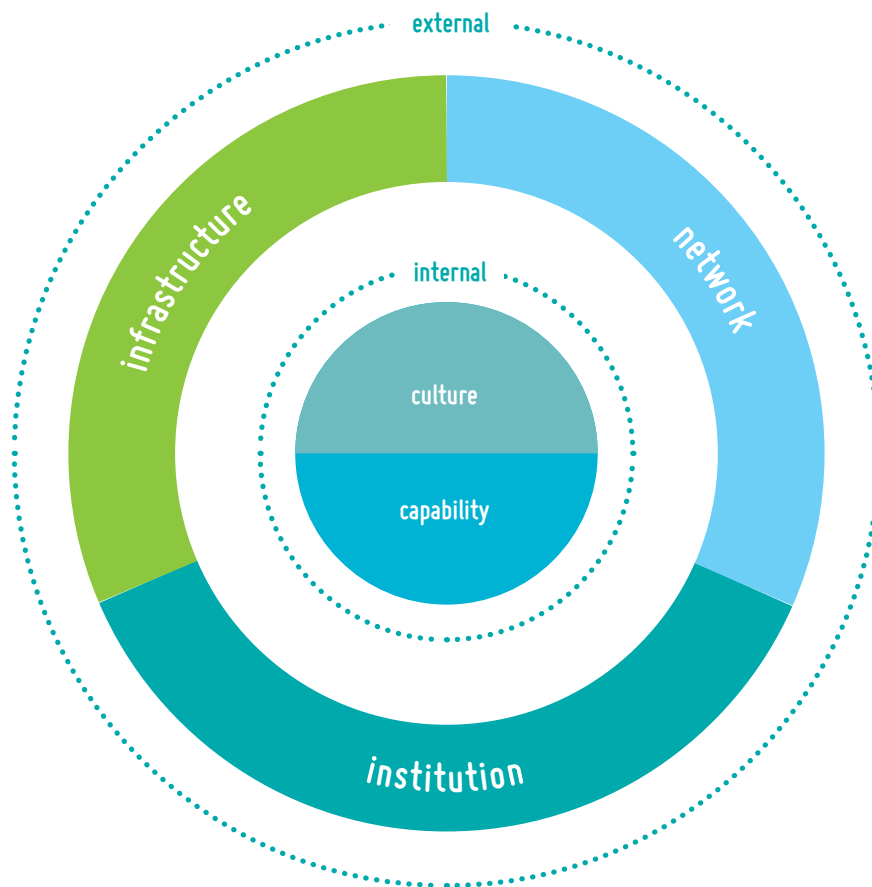
“Our recent study on Profitability of Ecodesign, conducted by IDP (Canada) and Pôle Eco-conception (France) with the support of ENEC, shows that the main motivations of French firms are firstly the personal convictions of senior executives, secondly the anticipation of future regulations equal to the search of savings, and thirdly the search of new markets.

Business support services promoting ecodesign should account for the level of maturity of businesses. This is because several steps must be taken before companies are able to implement ecodesign in the development of their products, such as identifying company specific-issues and relevant tools to use.”



Past studies have also identified many possible barriers to ecodesign in SMEs. Apart from O'Rafferty & O'Connor (2010 p.166) many studies do not systematically organise barriers. They also lack context such as which stage of the product development process specific barriers are evident. O'Rafferty & O'Connor (2010 pg.166) classify barriers according to internal and external factors. Internal factors include (1) SME culture and (2) SME capability. External factors include (3) networks (4) institutional barriers and (5) infrastructural barriers. This classification is based on a framework presented by Woolthius et al. (2005). The following sections discuss some of the potential barriers in more detail and according to this framework.

Figure 2 Classification of Barriers



Culture

Certain cultural aspects of business practice are important in determining why SMEs fail to act. This may include: an absence of management commitment; poor supply chain relationships; poor attitudes; a lack of concern for the environment and scepticism about the return on investments linked to environmental initiatives. Low demand-side pull may also be considered a cultural factor (external to business practice) that can contribute to poor uptake of ecodesign activity.

Many authors propose that these cultural barriers are the most important (e.g. Agan et al, 2013; Boks, 2006; Horbach et al., 2012; Johansson, 2002; O' Rafferty et al., 2008; O'Rafferty & O'Connor, 2010; van Hemel & Cramer, 2002). In response to this, Verhulst (2012) suggests that human factors (increasing employee participation, improving responsiveness to training and overcoming resistance to change) can be addressed through structured change management programmes.

Perceptions around ecodesign are important as they are linked to attitudes and therefore business culture. For example, despite cost savings being found to be a motivating factor for SMEs, short-term investment costs can often be important barriers. A Eurobarometer survey (2011) of 5,222 SME managers from across the EU showed that uncertain demand and uncertain return on investment are two strong deterrents for potential investment in eco-innovation. This perspective has also been identified in closely related areas. For example, perceived costs associated with environmental management practices are frequently cited as important barriers in many studies (e.g. Revell et al., 2010, Revell & Blackburn, 2007, Revell & Blackburn, 2004 Pimenova & Vorst, 2004).

Capability

The term capability refers to a company's power or ability to develop ecodesign products and may refer to factors including knowledge, skills and decision-making power.

Knowledge barriers vary from poor awareness of environmental issues, a lack of relevant information, confusing information or limited access to required expertise to support ecodesign actions. These issues can be attributed to the complexity of the agenda, a lack of coherent tools and ecodesign methods and poor signposting to useful information for SMEs. There are opposing views in the academic literature on recommendations for future ecodesign research. Some authors suggest there is not enough systematic research targeting specific products and sectors (e.g. Pigosso 2012; Prendeville 2014). Other authors suggest that there is an abundance of research on how to operationalise ecodesign (e.g. Boks 2006).

However, it is the experience of the ENEC partners that limited access to required expertise and poor dissemination of information (overly general, technical or irrelevant) is often a barrier for ecodesign implementation. Many tools remain excessively complex, lack practical decision-making support and fail to simplify or tailor ecodesign approaches to business needs. To support this, Byggeth & Hochschorner (2006) conducted a study that assessed 15 ecodesign tools for decision-making support and found that none of the tools sufficiently support decision-making in trade-off situations. However, Boks (2006) also states that ecodesign research has focused excessively on tool development with a lack of studies that bridge the gap between tool developers and tool implementation. Johansson (2002) stresses that product development processes need to be well managed to increase the likelihood of effective integration of ecodesign tools. This is supported by Knight and Jenkins (2009) whose study concludes that it is the need for 'process-specific customisation' that is a key barrier to the use of certain ecodesign tools. That high levels of customisation activities require well-managed processes is logical. This point has been supported through discussions with service providers from across ENEC regions and it is certain that a well managed product development processes is the first step to embedding ecodesign.

In contrast to a lack of knowledge, Tilley (1999) highlights a 'knowledge action gap' in SMEs. Where, despite companies being aware of their environmental impacts and the importance of environmental management, they still take little action due to other types of constraints.

International Markets and Networks

Networks may refer to business partnerships or knowledge networks. Networks are important because stakeholder and value chain engagement can be indicative of advanced levels of ecodesign implementation and effective ecodesign requires input and cooperation with a broad range of stakeholders both internal and external to the company (O'Connor 2000; Aschehoug et al. 2012). Stakeholders play a key role in ecodesign, often acting as access points for environmental information required for decision-making during NPD activities (Aschehoug et al. 2012; Pedgley 2009). On the other hand, other authors identify that poor awareness amongst stakeholders, or stakeholder inaction, is a barrier to ecodesign implementation (Sharma & Henriques 2005). For example, Chick & Micklethwaite (2004) through a survey approach, highlight issues around the accuracy of quoted recycled content percentages by material suppliers. More detailed information, such as material composition data, may be more difficult to access and can require non-disclosure agreements to protect Intellectual Property (IP) rights of suppliers. In addition, some firms may not be willing to share information with other stakeholders in the value chain for proprietary reasons (Waage 2007). On account of these reasons, access to required ecodesign knowledge often exists outside of traditional business partnerships (e.g. supply chains actors) and therefore new partnerships (e.g. with universities, training providers or knowledge support services) are often required to develop ecodesign knowledge.

SMEs are typically poor at developing export markets, identifying or capitalising on market opportunities beyond their immediate remit. Focusing on domestic markets restricts opportunities because local markets are often small and stimulate low expenditure. The majority of SMEs tend to operate in national markets with very few European SMEs selling outside of their own national markets into the EU (Eurobarometer, 2012). Fostering new business partnerships can potentially provide a route to new markets, beyond the SMEs own domestic market.

Infrastructure

Infrastructure is the physical, scientific or technological infrastructure which actors need to function. This can range from; participation in research and development knowledge exchange programmes; ecodesign literacy of business support providers; embeddedness of sustainability in design education; and physical aspects such as waste infrastructure.

One example relates to the procurement of waste processing capacity. For example, Eunomia's recent report (2013) on residual waste treatment capacity in the UK highlights the significance of what they term a constrained recycling rate. This constrained rate is attributed to long-term contractual obligations between local authorities and waste management providers. This in turn makes it difficult for local authorities to increase recycling rates, which has a direct impact on market creation of a steady supply of quality recycle. This directly impacts industry where limited availability of high-quality substitutable materials (virgin or recycle) is known to be a barrier for businesses seeking to adopt an ecodesign approach.

There are also important infrastructure issues to consider that make it challenging to design environmentally preferable products for the single European market. For example, Germany has one of the highest recycling rates in Europe and has an increasing rate of production of renewable energy, making the cost of energy in Germany and another member state quite different. This is challenging for German export companies because consumer perceptions of the cost of energy efficiency benefits (and the resulting surcharges accepted by the customer) can be quite different from country to country.

Institutions

Woolthuis et al. (2005) discuss innovation from a system's perspective and the importance of the interaction between actors (firms, research groups and other organisations) and institutions (regulations, intellectual property, culture). Institutional barriers may be considered soft or hard. These types of barriers are also applicable to ecodesign and eco-innovation.

Soft institutional barriers are socio-political cultural barriers and are often considered informal. Examples of soft institutional barriers include the inflexibility and resistance to change of regulators.

On the other hand, hard institutional barriers are formal and often related to failures in the general policy framework or legal system. One example is that of competing innovation and environment policy. Another is a lack of resources to fully implement regulations. This point has been discussed in a report by Ecofys (2012) highlighting missed opportunities resulting from only partial implementation of the Ecodesign Directive. Ecofys suggest that a fully implemented Ecodesign Directive could lead to energy savings the equivalent of 17% and 10% of total EU electricity and heat consumption annually.

Information asymmetries are also hard institutional barriers to ecodesign. This happens when consumers, firms and government procurement staff fail to understand the full life cycle cost of a purchase and make choices on upfront price, when an environmentally superior option would be cheaper in the long term.

Table 2: Barriers to Ecodesign in SMEs (from O’Rafferty & O’Connor 2010)

Category	Barrier	
Culture in SME	Lack of top management commitment and leadership	
	Lack of awareness, training and motivation of employees	
	Sustainability viewed as periphery to core business	
	Poor perception of ecodesign by investors	
	Risk adverse attitudes and resistance to engaging in new business opportunities through ecodesign	
	Low levels of trust in intermediary and business support organisations	
	Focus on short-term investments	
	Fear on unknown	
	Costs of ecodesign measure perceived as high	
	Perceived lack of customer demand	
	SME Capability	Fragmented product development process in SMEs
		Lack of managerial and operation resources (time, money, skills)
		Failure of managers to harness strategic considerations
		Lack of viable technology options or alternatives
Lack of awareness of viable technology options		
Lack of clear internal ecodesign or innovation strategies		
Sunk investments		
Lack of technical knowledge (material substitutability)		
Supply chain position and relationships		
International Markets and Networks	Little coordination of public private partnerships or triple helix networks	
	Lack of external support (training, advisory services etc) to develop ecodesign innovations.	
	Organisational thinness in innovation and ecodesign support	
	Lack of information on potential markets (niches)	
	Limitation of local markets (too small, low expenditure)	
	Fragmented value chain structures	
	Low levels of collaboration between technology commercialisers, international partners and R&D providers.	

Institutions	Actors cannot act or will not act due to uncertainty or poor appropriability
	Competing policy rationales (e.g. environment and innovation).
	Government information asymmetries.
	Public good' nature of investment
	Lack of policy supply and demand coherence leading to uncertainty and investment inefficiencies
	Regulators inflexible and too slow to change
	Regulators lack resources and expertise to address ecodesign issues
	Time lag between R&D intervention and commercialisation
Infrastructure	Low representation of ecodesign indicators in government R+D programmes.
	Low levels of investment in ecodesign related R+D
	Inadequate number of ecodesign support providers
	Low awareness of firms of emerging ecodesign related issues in key markets
	Lack of exposure to ecodesign education and training
	Lack of alignment between ecodesign educators and industry
	Low utilisation of external knowledge providers
	Lack of support for intermediary organisations to build capacity in ecodesign.
	Unclear market signals and demands
	Conflicting advice from support organisations
	Suitable materials not available
	No suitable end-of-life infrastructure



Q2 — From a practitioner’s perspective, what are the main barriers to implementing ecodesign in your region’s companies?



Michael Niemczyk, EFA

EFA

“The first barrier is the issue of awareness. In a lot of companies there is not yet the awareness that such a thing like ecodesign does exist. Even though the owner and employees see eco-products for sale, they do not know that there is a structured process to design such products. The next barrier is the expectation of high costs. Owners expect ecodesign to be very expensive and to require a lot of effort from within the company, as they do not have any idea how ecodesign could be realised in their company. The third most relevant barrier is the absence of product development processes within the company. When the product development process is very chaotic, people do not know when to start acting to reduce the environmental impacts of their design. These points make it very difficult to convince companies to actively participate in ecodesign.”



Evelyn Lafond, OVAM

OVAM

“Implementing sustainability in business is steadily gaining more attention. A growing number of companies currently work on the implementation of sustainable criteria in design related departments and their design processes. Although theory and methods are available, practice shows that integrating sustainability criteria is not straightforward or easy. Perceived constraints in time and money are the main barriers. Despite the importance that companies attribute to ecodesign or sustainability, it’s not their priority. The benefits to applying ecodesign are sometimes under discussion and not clear for companies. They sometimes lack sustained efforts that give adequate support and incentives that reward them for ecodesign initiatives.

PhD-research from Dr. Elli Verhulst, puts the emphasis on human factors that can influence the implementation process of (eco-)innovation in firms. The four constructs of human factors are: resistance against change, empowerment and involvement, internal communication of the changes and organisational culture.”



Ander Elgorriaga, IHOB

IHOB

“The first is the need to survive in the market through the financial crisis. This supports a short-term view, the opposite to Life Cycle Thinking, which looks for benefits for users and end of life. But nevertheless, the real barrier to ecodesign is that the demand is still limited. This is exacerbated because the actual crisis leads Business-to-Consumers (B2C) to work solely in only some markets. Effective Green Public Procurement is yet to happen and only affects some products. Business-to-Business (B2B), which has the largest potential, has still a limited capacity to determine the design of the product.

A second barrier is the limited interaction between sales and marketing departments with the design departments of companies. If companies do not sell more well ecodesigned products, the top management will not invest in it. The third barrier is the extensive new knowledge and capacity any given company has to acquire. Ecodesign is a complex issue and cultural change requires anywhere between 2-5 years.”



Dr. Sharon Prendeville,
Ecodesign Centre (Wales)

Ecodesign Centre (Wales)

“Lack of education is a barrier. While ecodesign is embedded in some education courses, it is not consistent and many design students are emerging from university without necessary ecodesign competencies. This translates to a lack of skills and know-how in industry. Therefore right now, industry needs business service providers that are properly equipped with knowledge and tools. But the education issue must be addressed.

Infrastructure and technology also need more investment. For those companies trying to do the right thing, barriers include developing and implementing reverse logistics, accessing better materials, reuse, remanufacturing or recycling facilities.”



Samuel Mayer,
Pôle Eco-Conception

Pôle Eco-Conception

“The first barrier on the integration of ecodesign in companies is the knowledge of the concept. Companies must be made aware that ecodesign is complex and often requires external capacities. Once aware, companies have difficulty identifying what the ecodesign issues are specific to their products. In parallel, consultants offer advice or support that does not clarify decisions because they are often too focused on environmental analysis. When it comes time for the implementation on a specific project, the main difficulties lie in the acquisition of skills among project teams. That said, the more the company undertakes projects, the more skills are integrated into teams. The last main barrier is the difficulty with identifying sub-contractors that supply materials with good environmental information or sub-assemblies that are ecodesigned. The entire value chain must be able to identify business opportunities.”

Overly general literature

Many studies present a very general picture of the motivations for and barriers to ecodesign in SMEs. This is also true for studies that aim to identify these factors for environmental management in general. Identifying general barriers such as cost and a lack of time may be helpful to understand why SMEs don't act. However, without more in-depth information it may be difficult to develop suitable interventions. For example, financial incentive is identified in some studies as an external motivator, but a lack of financial incentives can also be an external barrier. More detailed explanations of why this intervention is perceived differently in different scenarios would be beneficial.

Using a barriers and motivators approach

Although many studies aim to identify factors that act as motivators and factors that act as barriers, Parker et al. (2009) criticize taking this 'factor' approach. This is because many studies do not differentiate between internal factors that govern the characteristics of an SME such as environmental commitment and external factors that come as a result of an intervention (normally from the government) such as financial incentives. This may be an important point because some external factors may be difficult to class as true motivating factors. For example, for factors such as legislation, the SME has no choice as to whether or not to act and therefore this cannot really be classed as a motivation.

Parker et al., also note that the factor approach does not result in a framework that researchers can use to guide further studies, or that policy makers can develop into programmes (with consideration of possible interventions and SME characteristics) which encourage SMEs to take action. Instead Parker et al., suggest a typology of SMEs based on environmental and business commitment to aid in the delivery of suitable policy options. Pigosso et al (2012) present another approach, an ecodesign maturity model to assess the propensity of individual companies for ecodesign.

Limited Perspectives

Much of the literature on motivations for and barriers to ecodesign is written from the perspective of manufacturing SMEs with fewer studies on design consultancies and larger companies. Considering the perspective from which this literature is written is important as different people may identify different barriers as significant. In particular, the design consultant's perspective is crucial. Dewberry (1996) discussed the significance of equipping design consultants through knowledge guidance. More recently authors still identify the need to address this knowledge gap (Behrisch 2012, Stevenson, 2013).

In addition the majority of these studies take a supply-side company perspective with the focus on developing new products and/or services. There is little consideration of wider demand-side policies, the importance of the market and client requests.

Avenues for Future Research

- Conduct in-depth case studies to clearly identify business benefits
- Conduct in-depth case studies to determine casual links between specific circumstances (or company specific factors) and barriers in relation to an observed outcome
- Conduct in-depth studies to identify contributing factors that are important to lead companies to identify a barrier or motivator
- Conduct in-depth studies to improve understanding on how to aid SMEs with uptake of design and development processes
- Develop and test lists of actions to remove specific barriers from a business and policy perspective
- Develop and test methods that evaluate and monitor ecodesign interventions to identify successful examples
- Explore segmentation models of businesses to develop a typology of SMEs in relation to specific interventions
- Conduct additional research to incorporate a greater diversity of and beneficial research areas (in particular the change management literature)



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