THE USE OF ECODESIGN STRATEGIES AND TOOLS: STATE OF THE ART IN INDUSTRIAL DESIGN PRAXIS

Comparing Australian and German consultancies

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Abstract

This paper assesses the use of ecologically sustainable design approaches by industrial design (ID) consultancies in Australia and Germany. Whilst much academic research has focussed on the development of ecodesign strategies and tools, it remains unclear to what extent these are actually applied by practitioners. This paper investigates the extent to which design consultancies integrate ecodesign into their services and portfolios and their proactive promotion of sustainable design tools and strategies to their clients. This was achieved through a content analysis of commercial websites of ID consultancies in Australia (n=96) and Germany (n=217). The review criteria included: their general awareness of environmental issues related to product design, the share of ecologically responsible products in their portfolio and the kinds of sustainable design expertise that they advertise.

The paper concludes that the majority of ID companies in Germany and in Australia do not appear to actively practice ecodesign. Nevertheless, amongst those that were found to practice ecodesign, a broad range of ecodesign strategies is visible; selection of low impact materials was the most prominent strategy used in Australia while reduction of impact during use was most common in Germany.

Industrial design consultancies have significant potential to foster ecodesign implementation. A major barrier for ecodesign appears to be the lack of marketing arguments for ecodesign on the behalf of the consultancies. The legislative framework in Germany, often seen as progressive for ecodesign appears to have minor impact on the extent ID consultancies take up ecodesign.

Keywords

Industrial design praxis, ecodesign strategies, Australian design consultancies, German design consultancies

1. Introduction

The ecological crisis can be viewed as a design crisis as it largely emerges from the properties of our designed, material world (Fry, 2008). Products are a major part of our material world, and the impact that they have on the environment mainly gets determined during the design process. Designing products with ecology in mind therefore offers high potential to help overcome this environmental crisis and to contribute to a more sustainable society (Papanek, 1995). To reduce the environmental impact of our material world by the right product design, various "ecodesign" strategies can be followed. Brezet and Van Hemel (1997) offer a categorisation of ecodesign strategies in 8 main strategies and 33 substrategies, listed in Table 1.

Table 1: Ecodesign strategies (Brezet and Van Hemel, 1997)

	Strategy	**Substrategies**
@	New concept development *(this strategy has been given the symbol '@' because it is much more innovative than the seven other strategies)*	Dematerialization, shared use of product, integration of functions, functional optimization of product components
Product component level		
1	Selection of low impact materials	Cleaner materials, renewable materials, lower energy content materials, recycled materials, recyclable materials
2	Reduction of materials usage	Reduction in weight, reduction in transport volume
Product structure level		
3	Optimization of production techniques	Alternative production techniques, fewer production steps, lower/cleaner energy consumption during production, less production waste, fewer/cleaner production consumables
4	Optimization of distribution system	Less/cleaner/reusable packaging, energy-efficient transport mode, energy-efficient logistics
5	Reduction of impact during use	Lower energy consumption during use, cleaner energy source, fewer consumables needed, cleaner consumables, no waste of energy/consumables
Product system level		
6	Optimization of initial lifetime	Reliability and durability, easier maintenance and repair, modular product structure, classic design, strong product-user relation
7	Optimization of end-of-life system	Reuse of product, remanufacturing/refurbishing, recycling of materials, safer incineration

The biggest influence on all the product's properties, including its environmental impact, is taken right in the beginning of the product development process (Giudice et al., 2006).

Therefore it is most progressive, when the ecodesign strategies are considered right in the beginning of the development process (Tischner et al., 2000). Some ecodesign strategies, especially the strategy "new concept development", are even impossible to implement at late phases of the product development process. Roozenburg and Eekels (1995) as well as Melgin (1991) both suggest that the product development process can be divided in two main stages:

1. The product planning or product concept phase, which clarifies the main idea that will be developed, and the drivers for doing so.
2. The strict development phase, which provides a plan for actually making the product.

Consequently it is important for ecodesign to be practiced at both the product planning and the strict development phase. The degree to which this occurs with the support of industrial design consultancies is explored later in this paper.

2. Industrial design and ecodesign

Some progressive industrial designers have called for increased awareness among design professionals regarding the environmental impact of their work as well as their potential influence on sustainability (Chochinov, 2009, Papanek, 1985, Papanek, 1995, Rams, 1995, Schmidt-Hellerau, 1912). This indicates sensitivity amongst some members of the discipline towards ecological issues related to design activities. Recent studies from Japan (Ueda et al., 2003) and the USA (Davis and White, 2004) also found a high level of personal environmental awareness amongst industrial designers. Wahl and Baxter (2008) demonstrated that the typical designer's approach to product development related issues offers great potential to include ecodesign in the product development process. Bakker (1995) finds that industrial designers can successfully contribute towards the incorporation of environmentally responsible solutions in the product planning phase as well as in the later strict development.

Which part of the product development process industrial designers influence in daily praxis is largely determined by their role. Bakker (1995) titles those industrial designers, contributing to the product planning phase as being "strategic" and those contributing to the strict development phase as being "operational". Despite clearly defining actions happening along the product development process, Roozenburg end Eekels (1995) stress that it is not determined which actors take over which roles in the product development process. Even though industrial designers are involved in most product developments, their role is not

clearly framed by design theory and can extend in various directions. Both Lofthouse (2004) and Sherwin (2000), after investigating in the role of industrial designers at Electrolux in the context of ecodesign, concluded that 95% of the tasks handled by industrial designers employed fulltime in manufacturing companies fall in the operational or strict development phase.

Therefore, the strategic share of industrial design in that context is rather small and might not allow industrial designers to integrate ecodesign early in the product development process. A study conducted in Japan by Ueda et al (2003) supports these findings. The study marginally included ID consultancies but mainly focussed on industrial designers employed in product development departments. It concludes that a major barrier for industrial designers to fully embrace ecodesign is their role in the product development process. The role of ID consultancies, small and medium sized companies that specifically offer design services, is likely to differ from the one those of industrial designers employed in the product development departments of manufacturing consultancies. ID consultancies come as external experts to the company and often have employees from various disciplines which enables them to offer a broad service portfolio. Weiss (2002) points out that they increasingly take over strategic roles. This would provide them good leverage points to implement ecodesign.

2.1. The need for research into contemporary ecodesign praxis

Little research was found specifically addressing the role of the ID consultancy in the context of ecodesign. Most studies about the state of the art of ecodesign implementation focus on manufacturing companies and only some marginally include ID consultancies. Apart from the Japanese study by Ueda et al (2003), only two studies from the 1990s from the UK devoted attention to the attitude of ID consultancies towards ecodesign (Dewberry, 1996, Sherwin and Chick, 1997). The studies found that ID consultancies are not deeply involved in ecodesign. Other than that no contemporary attempt to identify the role ID consultancies take in the context of ecodesign or to quantify the extent to which they practice ecodesign was found. Furthermore, while there are extensive lists of drivers for ecodesign (Brezet and Van Hemel, 1997, Tischner et al., 2000, Wimmer et al., 2004) as well as comprehensive discussions on their impact on manufacturing companies, (Tukker et al., 2001, Van Hemel and Cramer, 2002) there is no clear understanding what role ecodesign plays in ID consultancies.

To contribute to addressing this research gap, this paper investigates the extent to which ID consultancies practice ecodesign. We will identify the most popular ecodesign

strategies and how they are communicated in the company profile. Furthermore arguments are identified which are used by design consultancies for advertising ecodesign to their clients. Special attention thereby is given, to whether the ID consultancy represents itself in an either strategic or operational role as this significantly impacts its capability to initiate ecodesign. To shed more light on how external stimuli for ecologically sustainable product design influence ID consultancies, the study covers two countries with different legislative frameworks and drivers for ecodesign: Australia and Germany. Below an overview over the two frameworks for Australia and Germany is provided.

2.2. Ecodesign context for German and Australian ID consultancies

Australia has a rather high environmental footprint per capita (Wackernagel et al., 2004) and has very few product oriented environmental policies (Brezet and Van Hemel, 1997). This lack of legislative drivers is seen as a major barrier for establishing a strong foothold for ecodesign in Australia (Ryan, 2003). A major initiative to foster ecodesign amongst Australian manufacturing and design companies was the EcoReDesign™ Program in the mid 1990s. This government funded program aimed at supporting the adoption of Life Cycle Assessment into product development. Coordinated by the Centre for Design at RMIT in Melbourne, the program demonstrated that considering the lifecycle impacts of products during the strategic phase is not only possible but also can lead to tangible economic benefits (Sweatman and Gertsakis, 1997). From the perspective of the participants, such as the home appliance manufacturer Kambrook, the program was perceived as being a success (Right from the Start, 1996). Blue Sky Design Group, an ID consultancy which participated in the EcoReDesign™ program still explicitly advertises ecodesign and the use of life cycle assessment (LCA) to its clients on its website (www.blueskycreative.com.au). More recent work in that area by RMIT has focussed on the development of the LCA tool "Greenfly" (www.greenflyonline.org) which is designed to help industrial designers understand the lifecycle environmental impacts of designed products. Apart from the Centre for Design at RMIT, the other groups that are active in promoting ecodesign in Australia include the Victorian Eco-Innovation Lab (VEIL: www.ecoinnovationlab.com), the Society for Responsible Design (SRD: www.srd.org.au), and the Australian node of the O2 Global Network (www.o2australia.org).

Germany's industrial design tradition reaches back to the Deutscher Werkbund, founded in 1907, and the influential Bauhaus school, which operated from 1919 to 1933. Some German industrial design consultancies that we investigated were founded back in the 1950s. Products designed and manufactured in Germany, are famous for engineering and

resource-efficient design. Early in the last century, in the inaugural yearbook of the Werbund Karl Schmidt-Hellerau (1912), one of the forefathers of German design, called for resource-cautious design. Several decades later, Dieter Rams, one of the most influential industrial designers of the 20th century, explicitly expressed responsible use of resources as being one of the 10 "commandments" for good design:

> "9. Gutes Design ist umweltfreundlich. Design kann einen wichtigen Beitrag zur Ressourcenschonung liefern und die von dem Produkt verursachte physische und visuelle Umweltverschmutzung minimieren." (9. Good design is concerned with the environment. Design must contribute towards a stable environment and a sensible use of raw materials. This means considering not only actual pollution, but also the visual pollution and destruction of our environment.) (Rams, 1995).

Germany often gets mentioned as an exemplar in waste management due to its progressive product-oriented environmental policies (Brezet and Van Hemel, 1997, Lindahl, 2007, Tukker et al., 2001). Some examples of these policies are the , the 1986 Abfallgesetz (AbfG: Waste Avoidance and Management Act), the 1991 Verpackungsverordnung (VerpackV: Packaging Ordinance), the 1996 Kreislaufwirtschaftgesetz (KrWG: Closed Loop Economy and Waste Management Act), and the 2005 Elektro- und Elektronikgerätegesetz (ElektroG: Electical and Electronic Equipment Act), which is the German compliance to the 2002 European Waste Electrical and Electronic Equipment (WEEE) directive. This directive not only demands certain standards for the collection and treatment of electronic waste but also promotes product stewardship through encouraging the design of less environmentally harmful electric and electronic products (Directive, 2002/96/EC)

German research organizations such as the Wuppertal Institute (www.wupperinst.org) and the Fraunhofer Gesellschaft (www.fraunhofer.de) acknowledge the potential contributions of industrial design towards ecologically sustainable development (Schmidt-Bleek, 1999); Fraunhofer has published various lists of recommended ecodesign tools and methodologies as a resource for product developers (Schischke, 2005, Schischke and Garaizar, 2009). However, these activities appear to be more engineering-focussed and thus linked to the operational rather than the strategic phase of the product development process.

3. Methodology

This study ran a thematic content analysis after Krippendorf (2004) of the websites of ID consultancies in Australia and in Germany. Websites are a major vehicle for communicating a company's profile (Capriotti and Moreno, 2007). They were therefore regarded as capable of providing a good insight into the services the ID consultancies offer and their attitudes

towards ecological issues. As the study focussed on ID consultancies, design teams employed in manufacturing, rapid prototyping or similar companies were excluded from the study.

Some ID consultancies had a mix of different design disciplines in their portfolio. Their services extended beyond product design into graphic design, web design, interior design or environmental design. In those cases, the consultancy projects that were not product design examples were excluded from the data collection. Also excluded were companies that did not have an active website or did not show a portfolio and some kind of capability statement on their website.

The ID consultancies were collected from representative databases which are freely available in the internet. 96 valid websites of Australian ID consultancy firms were found from the lists of the Design Institute of Australia (www.dia.org.au) as well as the online portals of Core 77 (www.core77.com), Design Australia (www.australiandesign.org.au) and the yellow pages (www.yellowpages.com.au). The lists of the Verband Deutscher Industrie Designer eV (German Association of Industrial Designers, www.vdid.de) and Core 77 (www.core77.com) supplied us with 217 valid websites of German ID consultancies.

All websites were analysed with two main focus areas:

1. The ID consultancy's awareness of ecological aspects of product design, their actual practice of ecodesign, and their public promotion of their ecodesign services and activities. The investigation criteria for this are summed up in Table 2.

2. The "strategic" or "operational" role that the consultancy is likely to take in the product development process due to the services it offers.

Table 2 Investigation criteria for the websites

Criteria	**Measure**
Indication of awareness about ecological sustainability	Yes / No
Explicit mention of ecodesign strategies as a capability	Yes (Specify which) / No
Examples of work that have been designed using ecodesign strategies	Yes (Specify which) / No
Support/tools used for practising ecodesign	Yes (Specify which) / No
Ratio of conventional products to products designed according to ecodesign strategies	Ratio
Arguments for promoting ecodesign	Yes (Specify which) / No

As discussed earlier, industrial designers working in the product concept phase are considered to take a "strategic" role while those working in the strict development phase take on an "operational" role (Bakker, 1995). Building on this classification, we allocated the term "holistic" role for those ID consultancies that work in both product concept and strict development phases.

The role of the ID consultancy was determined as follows. Firstly the services, the design consultancy offered, such as "new concept development", "market research",

"product definition", "visualisation", or "CAD modelling" were identified from the website. Subsequently they were compared with the tasks along the product development process, as suggested by Roozenburg and Eekels (1995). If a consultancy offered services for tasks that are performed in the strict development phase, it was classified as operational. If it offered services for tasks in the product concept phase it was classified as strategic. Those offering services for both phases were classified as holistic.

We are aware that some risks are involved in the chosen methodology. A website might not exhaustively cover the full service portfolio of the company and it is not guaranteed that the advertised services are actually practiced. Furthermore some services may be seen as obligatory and therefore may not communicated via the website. Nevertheless, including environmental aspects into the design process is part of expressing corporate responsibility, which is highly likely to be communicated through the company's website, according to Capriotti and Moreno (2007). We consider our approach as valid to provide a preliminary overall picture of the involvement of ID consultancies in ecodesign.

4. Findings

We have published a detailed analysis of the application of ecodesign strategies amongst Australian ID consultancies in a previous paper (Behrisch et al., 2010). The results of that Australian study are compared in this paper with the analysis of the websites of the German ID firms.

4.1. Role of the industrial design consultancy

62% of Germany's industrial design firms were found to be promoting services for the strict development phase; these are categorised as being operational. 34% offered services in both phases of the product development process and are therefore termed holistic. The remaining 4% focus on the product concept phase and are considered strategic.

The profile of the roles of Australian industrial design consultancies looks almost identical. 60% of them are classified as operational, 33% as holistic and the remaining 7% as strategic. The two bars in Figure 1 demonstrate the resemblance of the role proportions in both countries.

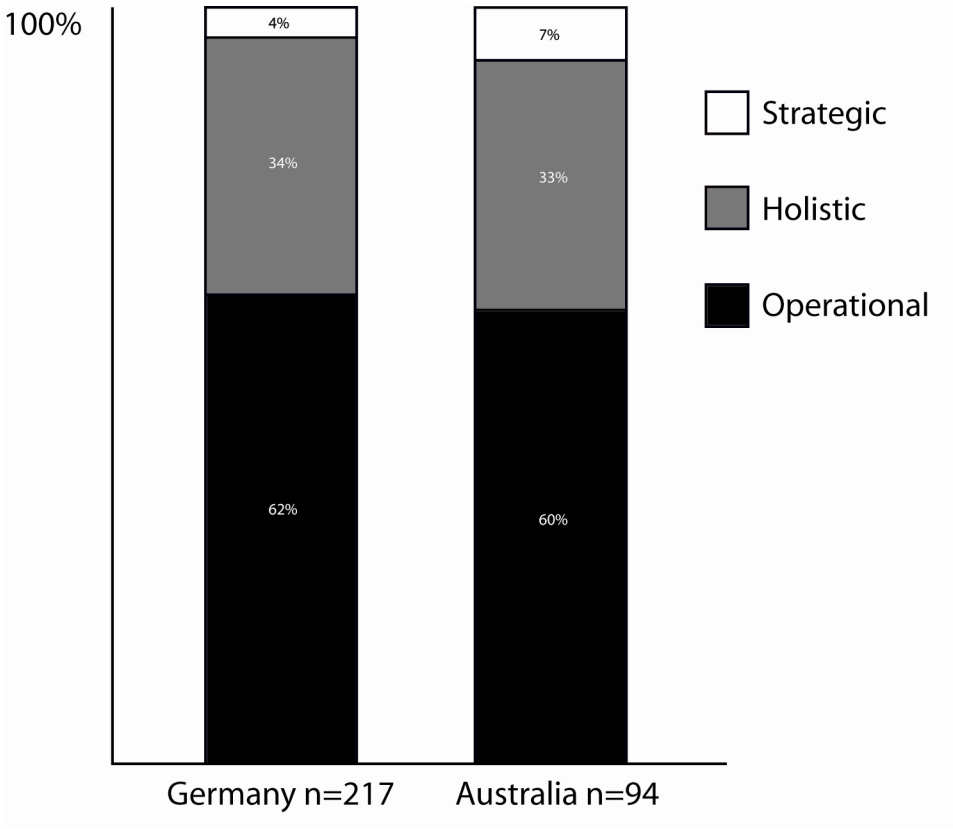

Figure 1: Role of industrial design consultancies in Australia and Germany

4.2. Environmental awareness

Surprisingly, the majority (74%) of the German industrial design consultancies show no sign of environmental awareness on their website. Neither referral to the omnipresent trend of sustainability nor design interventions aimed to reduce the environmental impact are visible. 6% express their environmental awareness and their goal to reduce the environmental impact of the products they design; however they do not detail the ecodesign strategies they use nor show in their portfolio any examples of projects that considered ecologically sustainable aspects. Even fewer (3%) list ecodesign strategies in their capability statement. Only 3% offer the comprehensive package of expressing their environmental awareness, listing ecodesign strategies in their capability statement and showing examples of ecodesign in their work. Overall 14% of all German ID firms have products in their portfolio that were ecodesigned to reduce their environmental impact. These make up the largest share of environmentally aware ID consultancies in Germany.

Econcept Agentur für Nachhaltiges Design (www.econcept.org) is an example of a German consultancy whose activities are focused on designing sustainable products and services. Most other German design firms offer a range of conventional industrial design services with some or a few projects showing their ecodesign capability. Some are regional

branches of transnational design corporations: for instance Lunar (www.lunar-europe.com), IDEO (www.ideo.com), and Frog Design (www.frogdesign.com) all have large branch offices in Munich but their headquarters are in California. When looking at the advertised ecodesign activities of these multinational design companies in greater detail it appears that most of these actually happen in the USA.

In Australia, a greater share of the ID consultancies shows various degrees of environmental awareness on their website. 20% show examples of applied ecodesign strategies without explicitly referring to ecodesign in their capability statement. 14% show ecodesign examples and have indicators for ecodesign included in their capability statement. 9% only put their ecodesign skills forward in their capability statement. 2% express environmental awareness without specifying any ecodesign strategies.

The ratio of ecodesigned products to conventionally designed products as they appeared on the websites is three times higher in Australian consultancies (3:25) than in German consultancies (1:25). Figure 2 shows the comparative results of the analysis of environmental awareness and ecodesign practice in the websites studied.

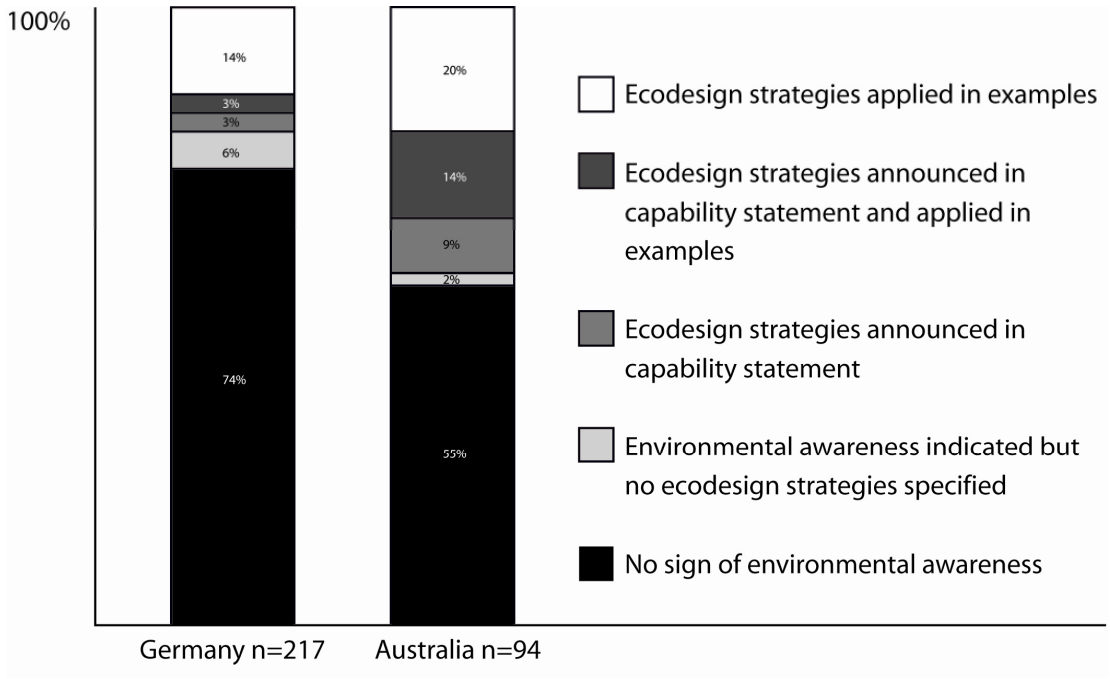

Figure 2: Expressions of environmental awareness by Australian and German industrial design consultancies

4.3. Ecodesign strategies

This section describes the specific application of the ecodesign strategies by the ID consultancies in both countries

Four German ID consultancies cover all ecodesign services in their capability statement. No ID consultancy shows examples for all ecodesign strategies. Keywords and

aspects related to the strategies "new concept development", "reduction of impact during use" and "optimisation of end of life system" were referred to in some capability statements and were visible in some portfolio examples. The strategy “reduction of impact during use” is the one communicated most frequently through examples in the portfolios. This strategy also is the most popular one overall. Most of the examples herein use energy saving components. Even though the strategy “reduction of impact during use” was most frequently applied in the examples, it gets mentioned least frequently in the capability statements. The strategies “reduction of materials usage”, and “optimisation of end of life system” are mentioned most frequently in the capability statements, followed by the strategies “optimization of production techniques” and “optimization of initial lifetime”. Examples how these strategies got communicated, using specific quotations from German websites, are shown in Table 3.

Table 3: Examples of ecodesign approaches amongst German industrial design consultancies

Ecodesign strategy	**Example Source**	**Examples of quotations**
Reduction of impact during use	Portfolio examples	“(die Küchenarmatur) besitzt darüber hinaus eine spezielle Kartusche, mit der Wasser und Energie gespart werden kann ((the kitchen tap) has an additional special cartridge which allows saving energy and water)“
		“The xxx a diesel-electric hybrid, boasts the lowest rates of fuel consumption and CO2 emissions in its class”
		“concept of a super slim, energy saving light”
Optimisation of end of life system	Capability statements	“Minimize fasteners“
		„Ist das Produkt gut recycelbar oder gar abbaubar? Designmanagement hat die Aufgabe, all diese und noch viele weitere Fragen zu stellen“ (Is the product recyclable or even biodegradable? It is the task of designmanagement to pose these and many other questions)”
		„Bei der Entwicklung von Produkten wägen wir ab: (…) Demotagegerechtheit (…) (When developing products we balance: (…) design for disassembly (…))”
Reduction of materials usage	Capability statements	*„Ressourcenschonende Produktion und Verpackung freuen die Umwelt* (Reduced resource use for production and pacaging benefit the environment)“
		„Kriterien für nachhaltiges und somit umweltverträgliches Design sind unter anderem: (…) Material-Effizienz und materialgerechte Gestaltung, (…) Abfallvermeidung (…) (Criteria for sustainable and therefore environmentally responsible design are, amongst others: Material efficiency and material cautious design (…) avoidance of waste (…))”
		“*Eine ökologische Gesamtbilanz lässt erkennen, ob Ressourcen sinnvoll oder verschwenderisch eingesetzt werden. Wir sind uns dieser Verantwortung bewusst und handeln beim Entscheidungsprozess entsprechend.* (An ecological balance sheet provides insight if the resources are allocated wise or dissipative. We are aware of this responsibility and act accordingly.)”
Optimization of production techniques	Capability statements	“Modern organizations are increasingly seeking substantive social and environmental improvement – (…) we strive to identify universal principles and best practices for design, engineering, manufacturing (…)”
		„(Wir stellen in Frage:) Wie hoch ist der Material- und Energieverbrauch in der Produktion? ((We question:) How high is the material and energy demand during production?)”
		“Optimize manufacturing processes: Powder coat vs. paint. Pressure form vs. RIM, Talk to your manufacturers about low energy, low waste alternatives”
Optimization of initial life time	Capability statements	*„Produkte von heute sollen auch morgen noch Gültigkeit besitzen. Und so müssen sie auch gestaltet sein.* (Today’s products have to keep their validity tomorrow and have to be designed accordingly)”
		„Servicefreundlichkeit sowie lange Lebensdauer (…) sind die Kriterien, an denen sich unsere Entwürfe messen lassen. (…) Serviceability and a long life span (…) are criteria that have to be fulfilled by our designs”
		“Create durable and high quality designs: Make products people want, to keep…and make them last”

The strategy least mentioned on the German websites is “optimization of distribution system”. Three ID consultancies advertised capabilities to find new formal expressions for environmental friendly products in order to make them aesthetically pleasing and increase their acceptance by the final user. Frog Design illustrated these considerations with an LED light bulb they designed. As the improved environmental impact in this case results from a reduced impact during use, this example could also be allocated to the strategy “reduced impact during use”. However the focus of the actual activity of the design consultancy is a different one, namely “increasing the acceptance of an eco friendly solution”. This is why we consider this as an additional strategy to reduce the environmental impact of products through design.

Amongst the Australian ID consultancies, more overlap was found amongst the ecodesign strategies advertised in the capability statement and in the portfolio examples. The most popular strategy is “selection of low impact materials” followed by the strategies “reduction of impact during use”, “optimization of end of life system, “optimization of initial lifetime” and “optimization of production techniques”. The strategy “new concept development” is completely absent from the capability statements but, in the portfolios, some examples of new product concepts that fulfil consumer needs with a reduced environmental impact were found. Table 4 shows some examples how these ecodesign strategies are communicated via the Australian ID consultancy websites.

Table 4: Examples of communicating ecodesign strategies amongst Australian ID consultancies (Behrisch et al., 2010)

Ecodesign strategy	**Example Source**	**Examples of quotations**
Selection of low impact material	Portfolio examples	“made of bioplastics from a variety of renewable resources”
		“made from virgin and recycled wool”
		“made from 100% recyclable polymer”
		“created from 100% post consumer recycled content”
		“made from recycled cardboard”
Reduction of impact during use	Portfolio examples	“solar powered LED light”
		“inbuilt solar panel for extraordinary battery life”
		“uses an energy efficient fuel cell”
		“uses a halogen energy saver”
		“the burner was designed to burn efficiently”
Optimization of end-of-life system	Portfolio examples	“designed for disassembly”
		“will degrade once you put it on a landfill”
		“can be broken down into raw materials for recycling quickly and efficiently”
		“made from 100% recyclable polymer”
		“using high quality poly carbonate makes the glasses... 100% recyclable”
Optimization of initial life time	Portfolio examples	“stainless steel, being a durable material”
		“components are repairable rather than replaceable”
		“scratch resistant”
		“physically durable”
		“personalising ... would encourage people to ‘own’ and re-use”

Figure 3 provides an overview of the how frequently each ecodesign strategy was communicated In Germany and Australia. The structure of the bars furthermore provides insight in the way the strategies were communicated. 100% represents those industrial design consultancies that show environmental awareness on their websites (45% of the Australian industrial design consultancies and 26% of the German industrial design consultancies).

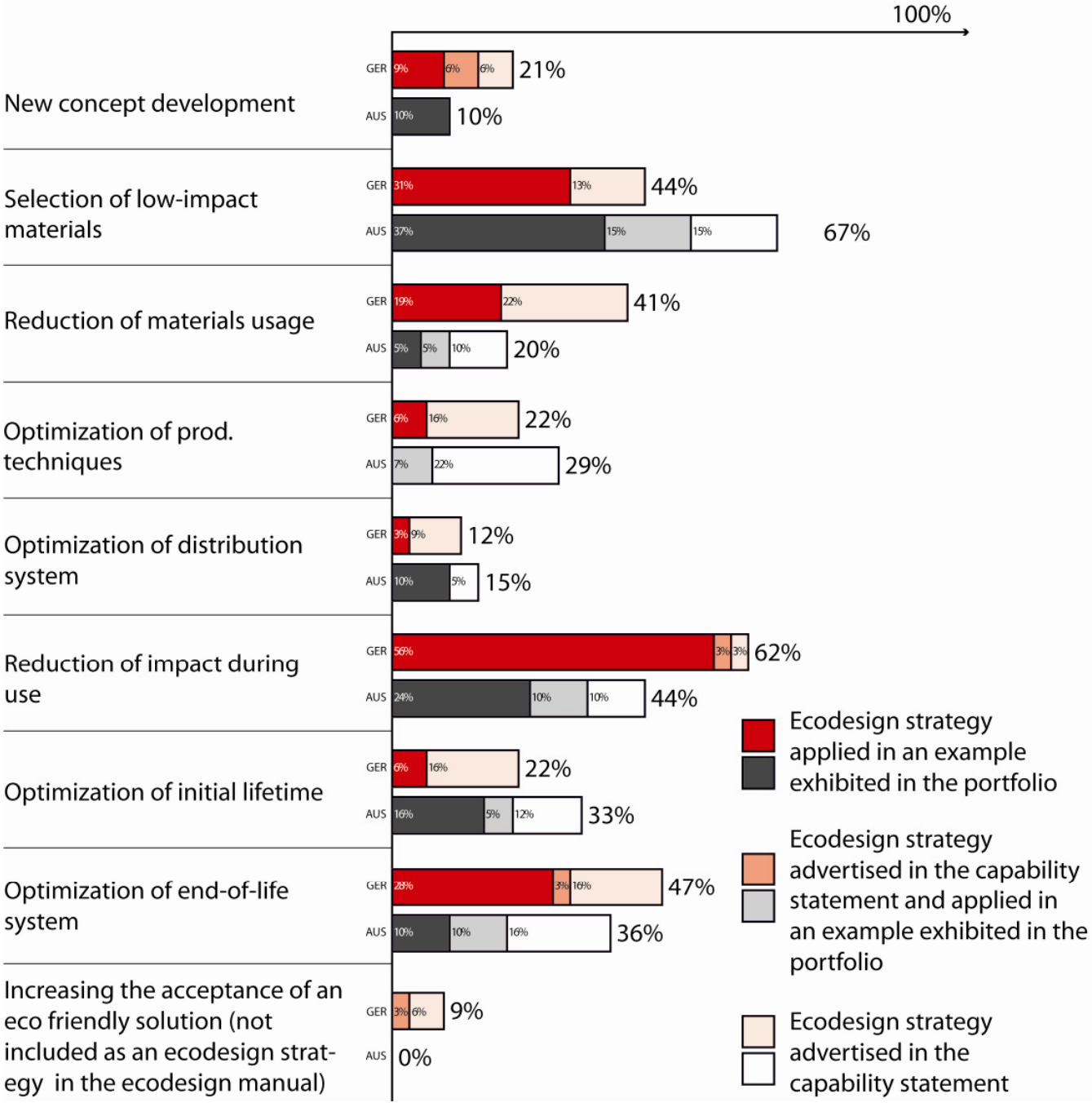

Figure 3: Ecodesign strategies used by Australian and German ID consultancies.

4.4. Ecodesign support

On those websites where ecodesign was promoted in the capability statements of the ID consultancies, the study also investigated if any kind of support used for ecodesign was specified.

Evidence for five different kinds of support tools was found on websites of German ID consultancies:

1. “life cycle assessment (LCA)”
2. “own rules of thumb”
3. “compliance with external requirements”
4. “educated ecodesign staff”
5. “ecological balance sheet”

Amongst the German firms which mentioned ecodesign as one of their services, the majority (76%) do not specify the support tools they use to practice ecodesign. With the rest (24%) that specified their ecodesign support tools, “own rules of thumb” and “life cycle assessment” were found to be the most popular The consultancy Lunar (2008), with offices in the USA, Europe and Asia developed a “designer’s field guide to sustainability”, which is a highly graphical collection of “rules of thumb” and ecodesign strategies made freely available on their website as a resource to other industrial designers.

Compared to the Germans, a bigger percentage (45%) of the Australian ID consultancies with ecodesign service offerings explicitly mentioned the support tools they used. The most popular Australian ecodesign tool was “life cycle assessment” to calculate the environmental impact of their designs. Also a broader variety of ecodesign support was found on websites of Australian ID consultancies.

The popularity of the different support/tools for ecodesign for the two countries is visualised in Figure 4. There, 100% represents only the industrial design consultancies in each country that list ecodesign as one of their services. The results for Australia are represented in white and the results for Germany are represented in grey.

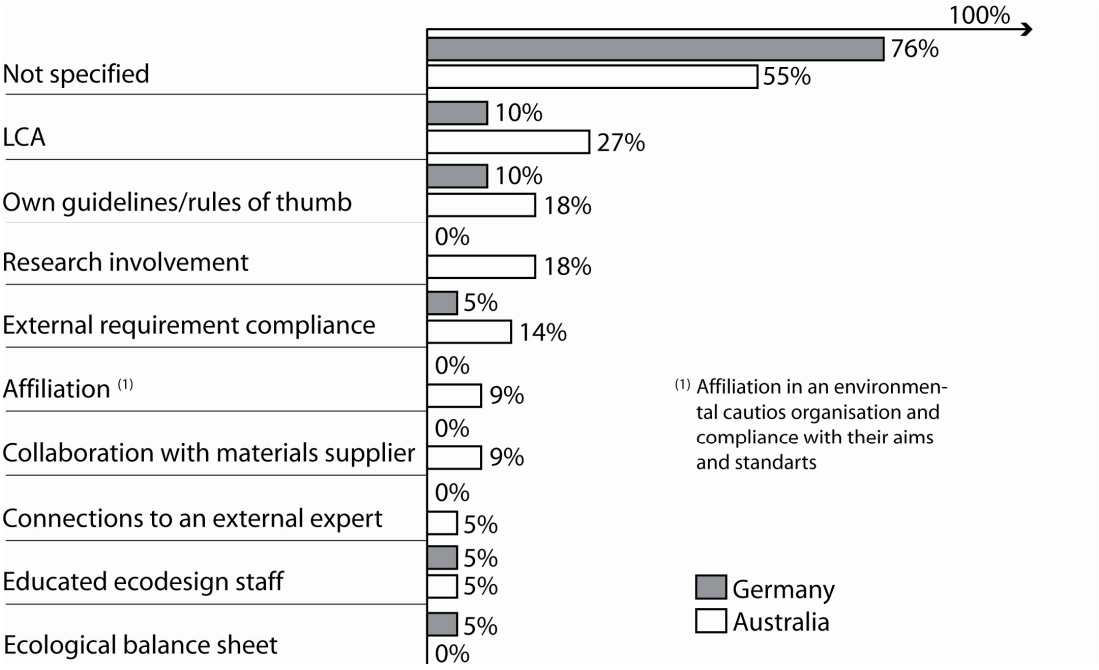

Figure 4: Ecodesign support used in Australian and German industrial design consultancies

4.5. Reasons for Ecodesign

Amongst those ID consultancies who offered ecodesign services, an investigation was carried out on the various reasons which drive them to consider environmental aspects in their design activities. The literature on sustainable product design provides extensive lists of drivers for ecodesign (Brezet and Van Hemel, 1997, Datschefski, 2001, Tischner et al., 2000, Wimmer et al., 2004). Surprisingly, 38% of the German ID firms that offer ecodesign do not mention any of these drivers or other arguments that would have made their ecodesign services more attractive to potential clients. Most of the arguments that were found appeared to be very general, as listed in Table 5. As they all relate to general concerns about the sustainability of our society, they are summed up under “sustainability as a trend”. Twenty nine per cent of the German ID consultancies state this as an argument for ecodesign on their website. Table 5 also contains quotations of Australian websites that were allocated to “sustainability as a trend”. Explicit statements of their own sense of responsibility like “We draft sustainable products driven by social and economic responsibility”, “We are cautious of our responsibility” or “driven by our own sense of responsibility” is the second most frequently mentioned driver for ecodesign brought forward by German ID consultancies; among the Australian firms this was the number one driver.

Table 5 Examples of quotations for the driver “sustainability as a trend”

Germany	Australia
“We aim at having a positive impact on the world and make it more sustainable” “Worries about climate change, over-population, poverty, disease, depleted resources, and energy issues are attracting exponential attention” “The social and environmental aspects of design have become as important as the functional attributes of modern products.”	“The media keeps saying that sustainability is a buzz word.” “It will become standard.” “It is the future” “Sustainability is one aspect of temporary design.” “It is no longer acceptable to act differently, Sustainability is an emerging trend.”

This aligns well with the findings of Van Hemel and Cramer (2002), who studied how prominent and successful different drivers are for stimulating small and mediums sized enterprises in the Netherlands to take up ecodesign. They conclude that internal drivers, like a sense of responsibility are more prominent for mediums sized enterprises than external ones. Other studies, investigating medium-sized enterprises as well as large companies find external drivers such as customer demand and the legislative framework as most influential to support ecodesign (Charter, 2003, Lindahl, 2007, Mathieux et al., 2001, Tukker et al., 2001). Surprisingly, the driver “legislative demand” doesn’t appear to be very prominent for both German and Australian ID consultancies. Winning awards

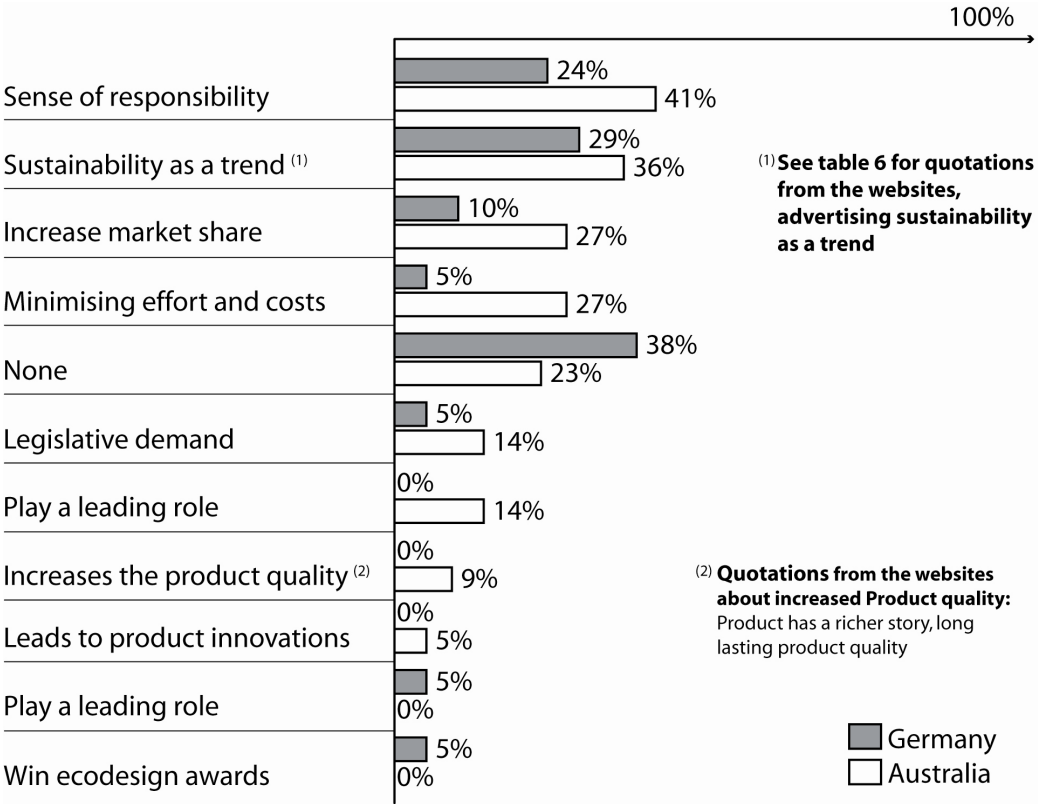

Figure 5 reasons for persuading ecodesign

5. Discussion

5.1. Role of the industrial design consultancy

Despite different frameworks for industrial design, the operational, strategic and holitstic roles that ID consultancies perform appear to be highly similar in Australia and Germany. This may be rooted in the circumstance that the industrial design consultancies in Germany as well as in Australia often work for international clients. Their role might therefore be shaped more by the international market for design services than by local circumstances. With more than one-third of the industrial design consultancies offering services for the product planning phase it is to be assumed that they can have significant impact on the development of new product concepts. When comparing industrial design consultancies with employed industrial designers, they appear to be more prominent in a strategic role. However, as almost all ID consultancies offer services for the strict development phase, this still appears to be the core business of the industrial design discipline.

5.2. Ecodesign in Australia and Germany

When looking at the different country specific frameworks, one could assume that the German framework, especially the legislation, guarantees a minimum standard that assures some uptake of ecodesign in all product development processes. A broad number of German ID consultancies therefore are likely to adopt ecodesign. Furthermore the long tradition in resource-cautious design, reaching back to the very beginning of German design, raises high expectations on the environmental friendliness of German design. Surprisingly, our findings show quite the opposite. Australian ID consultancies put significantly more momentum in promoting ecodesign. They not only show more examples of ecodesign on their websites, they also are more likely to explicitly announce it on their website as a service.

However it is not certain to what extent the expressed ecodesign activities are not just green washing by both Australian and German design firms. In particular the strategies “selection of low impact material” and "optimisation of end of life system” may be questionable in some cases. Australian consultancies frequently mentioned the use of “recyclable material” in their designs. Theoretically, almost any waste material can be recycled and recovered, if enough energy is put into the effort (Ayres, 1999). In practice, however, the cost of processing and sorting mixed waste into different material fractions can become so prohibitive that most materials do not get salvaged from the solid waste stream that ends up in landfill. Therefore, claims of “recyclable material” in a design are meaningless unless the products are designed for optimized disassembly with minimum

expenditure of time, effort and infrastructure, and unless a recycling program is actually in place locally to facilitate recovery from end-users. For instance, take-back and trade-in programs for mobile phones, batteries, car tires, laser toners and some other appliances ensure that these products can be recycled in the most efficient manner and without contamination from household garbage.

One possible explanation for the rare mentioning of ecodesign on websites of German ID consultancies could be that including environmental aspects into product design is so deeply rooted in German design that it is seen as obligatory and therefore did not need to be explicitly expressed. However our findings do not support this assumption. When looking in detail at those websites that communicate ecodesign, it does not appear to be a core competency of the consultancies and far from being an obligation. German ID consultancies appear to be mostly unfamiliar with important tools like life cycle assessments. Most of the time there is no match between the advertised ecodesign strategies in the capability statements and the ecodesign examples from the portfolios; comparably few examples of applied ecodesign strategies are visible at all. Supporting arguments for ecodesign are frequently not listed and the supporting arguments that are visible often appear to be very vague.

Resource efficiency, especially during the use phase of the products appears to play a major role in Germany. This strategy, also popular amongst Australian ID consultancies, was mainly followed by using efficient functional components like energy-saving lights, fuel cells or water-saving cartridges. Nevertheless it is unlikely that industrial designers actually develop these internal components as research has shown that they only have minor influence on these (Davis and White, 2004). The development of more efficient internal components appears to be more in the core competency of engineering. It is possible that the majority of ecodesign activities in Germany are actually undertaken by engineers. As we did not investigate the application of ecodesign in this discipline, it may very well be that German engineers follow ecodesign strategies more often than industrial designers and therefore contribute more to the positive reputation of environmental sensitivity of German products.

A reduced impact during use can also result from a changed user pattern (Tischner et al., 2000, Brezet and Van Hemel, 1997) and early obsolescence of a product can be avoided by supporting a long term emotional attachment between the user and the product (Chapman, 2005). Planning and influencing the necessary products properties can be allocated to considering the so called “human factors” (Fletcher and Goggin, 2001). Especially for industrial design consultancies, this may well be regarded as one of their core

competencies (Weiss, 2002). With some exceptions, human factors rarely appear to be considered, especially for the ecodesign strategies “reduced impact during use” and “optimisation of initial life time”. Referrals to timeless aesthetics or changed user behaviour in relation to a reduced environmental impact were not often found on the websites. This matches the statements expressed by Fletcher and Goggin (2001) who point out that most current approaches to ecodesign miss out on embracing the potential of taking human factors into account. However, the use of human factors for ecodesign is not completely absent from the websites of the industrial design consultancies. Especially the identified strategy “Increasing the acceptance of eco friendly solutions”, which is not listed by Brezet et al. (1997) is hinged on them. Thereby the design interventions are mainly targeting the product aesthetics, which is one of the main influence areas of industrial design (Davis and White, 2004).

With 74% of the German and 55% of the Australian ID consultancies showing no environmental awareness at all, ecodesign currently appears not to be widely taken up by the majority of industrial design consultancies. Nevertheless it has to be noted that all ecodesign strategies and sub strategies were covered at least in one capability statement and in one example on a German and/or an Australian website. Furthermore, an additional ecodesign strategy (“increasing the acceptance of eco friendly solutions”) was identified. The obvious capability of industrial design consultancies to apply the various ecodesign strategies shows that they have high potential to contribute to implement ecodesign.

Despite a weak legislative framework for ecodesign in Australia and a strong one in Germany, a bigger proportion of Australian industrial design consultancies appear to promote ecodesign than German ones. This may indicate that the legislative framework in Germany does not have a major impact on industrial design; this concurs with the conclusions of Mayers (2007) that the European legislative framework largely fails to encourage the inclusion of extended producer responsibility considerations into product design. The bigger popularity of ecodesign amongst Australian ID consultancies may be influenced by the positive examples that emerged from the EcoReDesign™ program. This could indicate the importance of such programs to stimulate ecodesign uptake by industrial designers.

However, for both Germany and Australia, ecodesign does not currently appear to represent a core element of the business of industrial design consultancies. The arguments brought forward to promote ecodesign appear rather vague for the majority of Australian and German industrial design consultancies.

6. Conclusion

This paper identified the extent to which industrial design consultancies take up ecodesign in Germany and in Australia. The legislative framework in Germany appears to have less positive influence on ecodesign practiced by industrial design consultancies than encouraging interventions such as the EcoReDesign™ program at the RMIT in Melbourne. Industrial design consultancies show significant potential for implementing ecodesign. Despite this, Australian and German design firms do not seem to take up ecodesign fully.

Investigating the drivers for ecodesign which are listed on the websites of industrial design consultancies, the ones most popular amongst industrial design consultancies are not tangible in an economic sense. “Sense of responsibility” or “sustainability as a trend” appear to be very vague statements for convincing clients and potential clients of industrial design consultancies to make use of ecodesign. However we did not investigate if these arguments worked among clients in this paper. The probable lack of supporting arguments for ecodesign, together with the fact that ecodesign apparently has not become a core competency of ID consultancies may lead to the assumption that the market for ecodesign either is rather limited or hard to access. Due to global environmental issues and an increasing public awareness for these it is likely that there is a rather big market for ecodesign services which currently largely is untapped. The highly probable existence of such a market suggests further research in developing a more detailed picture of this market and a better understanding how ID consultancies can participate in it.

7. Further research

This paper is part of a larger research project at the Institute for Sustainable Futures, which aims to develop approaches for industrial design consultancies to better market and practice ecodesign. The next steps of this research will develop a more detailed picture of the market for ecodesign services as well as of the leverage points that industrial design consultancies can use to positively influence this market. To achieve that, a survey will be conducted and interviews will be held with selected industrial design consultancies.

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