

# MAXIMIZING THE VALUE OF INDUSTRIAL DESIGN IN NEW PRODUCT DEVELOPMENT

*Most companies could benefit by integrating design into their new-product development processes, but design and traditional processes do not mesh easily. Recognizing and resolving the cultural and process barriers between design and other functional areas can make a significant difference in the effectiveness of design in these organizations.*

Keith Goffin and Pietro Micheli

**OVERVIEW:** *Industrial design is essential for the creation of products that satisfy user needs and aspirations and can be differentiated from the competition. However, most companies fail to reap the full benefits of design. This is often due to cultural and language barriers, between design and other functional areas, and barriers to the introduction of industrial design into new-product development (NPD) process. In this paper we show how designers and NPD managers have different perceptions of “good” design and the ways to achieve it. We also illustrate the challenges in attempting to introduce industrial design into a structured NPD approach. It is by identifying and tackling these issues that managers can exploit the full potential of design, thus making their companies more innovative and competitive.*

**KEY CONCEPTS:** *Innovation management, New product development, Industrial design, Design-driven innovation.*

Recent studies have shown that good design can lead to more successful products, stronger competitive advantage

(Beverland 2005), and better financial performance (Hertenstein, Platt, and Veryzer 2005). But too many companies are missing these opportunities, because industrial design is not as consistently incorporated into new-product development (NPD) processes as it should be (Gemser and Leenders 2001).

Although design is often thought of as relating solely to the aesthetics of a product, it can contribute at more fundamental levels. As the CEO of LG Electronics has said, “Design is not the exterior of a product that we simply see and feel, it is a cultural code that forms and changes our lives” (Qtd in Jang et al. 2009, 46). Consumers buy products not only because of their appearance and function, but also because they have symbolic value. Design is capable of creating that emotional and symbolic value (Verganti 2009). In its widest sense, industrial design leads to products that consumers aspire to own and that evoke pride in ownership.

Companies can introduce—and benefit from—industrial design in two major ways (Verganti 2009). In companies

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that are leaders in design-driven approaches to product development, design plays a fundamental role in enabling radical innovation. Design is positioned at the center of the innovation strategy in these firms (Verganti 2008) and is less tied to specific steps in the NPD process. Although this approach to design is powerful, it takes time and commitment for design to take such an influential role in a firm.

But design can also be incorporated into NPD in more traditional firms as one of the various functional areas required as part of a structured NPD process. When effectively aligned and connected with other functions such as R&D and marketing, design can play a major role in promoting innovation (Heskett 2002). However, design and traditional NPD processes do not mesh easily. This paper explores the issues around incorporating design into structured approaches such as Stage-Gate™, which are well known in the NPD literature but much less so in design research and practice. The introduction of industrial design into NPD must address both cultural and process barriers between design and other functional areas. Resolving these issues can make a significant difference to the effectiveness of design in these organizations and therefore to their competitive position and financial performance.

### Design and the NPD Process

The process of NPD consists of a number of key stages, including identifying customer requirements, developing a product concept, generating a detailed design, testing, and launching the product to market. At each of these stages, a number of functional areas are involved—R&D, marketing, and manufacturing, among others—and effective communication and collaboration is fundamental to the development of successful products. The most common way to manage the different stages and functions involved in NPD is the ubiquitous Stage-Gate™ methodology developed by Cooper and Kleinschmidt (1994), which specifies the responsibilities of each functional area at each step of the process. The main benefit of Stage-Gate™ is that it ensures that different perspectives are considered when key decisions are made, thus preventing oversights (for instance, failing to consider manufacturing at the concept stage can lead to production problems). Although several studies have emphasized the benefits of introducing Stage-Gate™ (see, for example, Curtis and Ellis 1998), some authors have criticized it for being too linear and inflexible, inhibiting companies from achieving radical innovation (Chhatpar 2007; Petrie 2008).

Most companies would benefit from integrating industrial design into their NPD processes. But in order to access the full benefits of design, they need first to understand the barriers to the adoption of design thinking in a typical NPD organization. However, little has been

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offered about how to integrate design into new-product innovation in practice. Few authors have discussed how to integrate industrial design into Stage-Gate™, and, although he stresses that NPD must be multifunctional, Cooper does not specifically mention the role of industrial design in his seminal texts (2001; 2005). Researchers have recognized that the way in which industrial design can best be integrated into NPD needs to be established (e.g., Verganti, 2008).

We investigated the barriers to the full integration of design into the NPD process via case studies at successful, design-oriented companies and through focus group discussions with designers with experience in corporate NPD processes. We identified two kinds of barriers to the successful introduction of design approaches in NPD teams: cultural barriers between design and other functional areas (Beverland 2005) and process barriers to the introduction of industrial design into NPD (Perks, Cooper, and Jones 2005; Lawson 2006).

### Our Research

In order to investigate the role of industrial design in NPD and the cultural differences between designers and managers, we carried out two phases of data collection.

In the first phase, we conducted detailed case studies in five companies where design has traditionally had a strong role in the NPD process. Two companies were selected in the UK, where growing emphasis has been put on product design as a way to ensure business success (Cox 2005). The other three participating organizations

were selected in Italy, a nation traditionally famous for its influence on fashion and product design; numerous Italian companies, operating in different sectors, have considered industrial design as a key success factor. The participating companies were deliberately chosen to reflect a range of sectors: furniture, flooring, household decorative products, and household appliances. At each company, we collected confidential documents on the NPD process and products and conducted interviews with managers and industrial designers. A technique from psychology, repertory grid (Goffin 2002), was utilized to capture interviewees' perceptions on the role of design in managers' and designers' own language. We conducted a total of 19 separate interviews with designers and managers actively involved in NPD, each lasting between two and three hours (Table 1). All of the interviews were recorded, transcribed, and coded.

In the second phase of the research, a focus group was held in the UK with six experienced designers to gather their views on how design could be integrated into the NPD process. In this focus group, using Stage-Gate™ as a template, each designer was asked to write down how industrial design could contribute to each stage of NPD and also to identify potential tensions that could arise with other functional areas or management at each stage. After the individual ideas had been collected, the designers discussed in open forum their experiences working on NPD, the need for design to work closely with other functions, and issues in cross-functional communication.

## Cultural Barriers to Design Thinking

Design is a profession with its own culture, and designers often perceive that their creativity sets them apart from other colleagues in the NPD process. As the founder of Frog Design has said, "Business people are from Mars, and designers are from Venus" (Qtd. in Lockwood 2007, 90). The culture of designers emerges from their education (Walker 1990), but it may arise from more fundamental elements. It has been argued that designers have a particular personality profile (Brown 2008), and their values, behaviors, and attitudes differ from those of managers. As one of our interviewees stated, "You need a certain cultural background to have this emotional spark. You, as a designer . . . can then express yourself. . . And people have to read the emotion you want to convey as a designer" (Designer 2, ElectricCo.). These cultural differences can lead to tensions within NPD teams. Indeed, in our interviews, we found that designers and managers have very different perceptions of the design process and different understandings of what constitutes "good" design, and they use different language to communicate those concepts (Table 2).

We found several key differences in how managers and designers perceived the role of design and designers in NPD. Designers perceive their work to be absolutely central to product development, whereas managers perceive industrial design as one of a number of functional inputs to the process. To better understand how these issues could be effectively addressed, we probed deeper, asking about perceptions about design and the definition of "good" design.

The first important finding was in the perceived basis of good design. Designers perceived that the right materials, technology, and manufacturing capabilities are required for good design. In contrast, managers described good design in terms of traditionally valued product attributes, such as "functionality" and "aesthetics" in a general way, but without acknowledging the specifics of how functional, aesthetically pleasing products can be achieved. The inherent danger here is that managers may not realize that decisions about materials, made, for example, to reduce cost, can have a negative impact on the overall design of the product and consequently on the way it will be perceived by customers.

Managers and designers also differed radically in their understanding of what constitutes good design, and what the goal of design is. In describing their understanding of good design, designers talked of products that were "original", that made a "provocative design statement", and that evoked "emotion" in consumers. As one designer said, a well-designed product "is provocative in the way when I see it, I want to touch it. All your five senses get involved. It's not only the sight. It's beyond it" (Designer 2, ElectricCo.). In contrast, managers perceived

Table 1. — Interviewees at case companies

	Company	Sector	Interviewees
1	CeramicCo., UK	Decorative products	1 range manager 2 internal industrial designers
2	FloorCo., UK	Decorative flooring products	Marketing Director 1 product manager 2 internal industrial designers
3	ElectricCo., Italy	Electrical appliances	Deputy Managing Director 3 internal industrial designers
4	LampCo., Italy	Lighting systems	R&D Manager 1 technical officer 2 external industrial designers
5	FurnitureCo., Italy	Furniture	R&D Director Sales Director 2 external industrial designers

Table 2. — Differences in managers' and designers' perceptions of the role of design in NPD

Topic	Designers	Managers	Implications
1 Role of design in NPD	Design plays a central role in NPD.	Design is just one aspect of NPD.	Designers might consider their function as more important than that of other NPD professionals. This could create tensions throughout the NPD process.
2 The basis of good design	Technology, materials, and manufacturing capabilities are important factors in good design.	Good design is functional and aesthetically pleasing, but little attention is given to how it is achieved through careful choice of, for example, materials.	Designers will regard technology and materials as essential features of good design and as sources of innovation. Managers might underplay such aspects and so make decisions that inadvertently penalize the overall design product.
3 What is good design?	A well-designed product is original, it makes a provocative design statement, and it evokes emotions in consumers and users.	Exclusivity is a key feature of good designs; this can be achieved also through the "signature" of famous designers.	These different views could lead to tensions, for example, when external designers are used mostly for branding purposes or when designers overstate the role of design as the source of innovation.
4 Goal of good design	The characteristics and the means for achieving good design are stepping stones toward achieving an iconic design.	The results of design are perceived mainly in terms of price and brand.	Attempts to create universally recognizable, archetypical designs can clash with pricing and branding strategies, which might favor options that match competitors' product offerings.
5 Changes made to initial designs	Several designers denied that substantial changes are to be expected in the NPD process.	The characteristics of a product will inevitably change during NPD as trade-off decisions are made.	Designers might perceive changes to initial designs as unnecessary, inappropriate, or even counterproductive, resulting in tension between design and other teams.
6 Language (See also Table 3)	Designers tended to use a richer vocabulary to express what constitutes "good" design, for example, differentiating between unique (meaning "inimitable") and original (meaning "innovative") products	Managers used a more limited set of terms to explain the essence of "good" design; for example, they used the word "original" to express both inimitability and novelty.	Managers might perceive differences in vocabulary as irrelevant linguistic nuances, while designers consider them essential in conveying the meaning and significance of a design. This mismatch could lead to misunderstandings in the process.

design to be mostly about the exclusivity or novelty of a product; they also saw good design in the "signature" of famous designers. The goal of good industrial design was perceived by designers to be the creation of an "iconic" product—one that would become famous and instantly recognizable. By contrast, managers perceived design as a means to build brand and achieve the right price.

Our analysis also revealed different attitudes toward the NPD process itself, especially with regard to changes to the product design during the NPD process. Several designers we interviewed denied that changes were to be expected in NPD. In contrast, managers perceived change as an integral part of product development. Manager interviewees told us that "there can be a real change" (Manager 1, ElectricCo.) and that initial designs "can change quite a lot for many reasons" (Manager 1, CeramicCo.).

Communication problems can be caused by the language that industrial designers use, which some have described as completely different from the vocabulary of managers (von Stamm 2004), although no empirical evidence has been presented to support the claim. Our interviews revealed something different. While industrial designers and managers do use distinctly different terms in describing design, they also have a shared vocabulary (Table 3). Seven terms were used by both managers and designers, including "form and function," "aesthetics," and "functionality." This indicates domains where designers and managers are likely to be able to communicate effectively, as they are using terms that are mutually understood.

Conversely, the areas of difference are those that are likely to cause misunderstanding and misalignment, leading to tension. For example, designers talk about using technology to create a provocative design statement

# Differences in the use of language can lead to substantial misunderstandings between designers and managers.

leading to emotional value and, ultimately, to an iconic design. Managers, instead, talk about good design more in the terms of the commercial success that results from achieving exclusivity, brand recognition, and the right price point. As one designer in our focus group said when our findings were explained to him, "Now I understand . . . I was always looking to create a design icon and it was so stressful . . . you can't always achieve an iconic design [working in an NPD team]." From our in-depth interviews it was clear that designers tended to use a richer vocabulary to express what constitutes "good" design and to apply their terminology in a more precise way. For example, most designers we interviewed perceived the "originality" of a product to be an important characteristic distinct from "uniqueness." For these designers, "originality" refers to innovative products that are not exactly matched by the competition, while "unique" products are inimitable, archetypical offerings. Most managers only differentiated between "original" and "not-original" products.

Although this may seem a subtle point, such differences in the use of language can lead to substantial misunderstandings when designers are aiming to create unique products (which may require significant extra investment), but managers only perceive that a degree of originality is important. Also, previous research (Eckert and Stacy 2000) has shown that designers use many references to previous products in their discussions and this could lead to misunderstandings, as well.

This analysis shows that managers must take account of the different perceptions among team members and take

steps to avoid the misunderstandings that can arise when industrial designers join NPD teams.

## The Process Barrier

The second barrier to the successful adoption of design thinking is a process barrier. Designers work in a specific way that is often unclear to the other functions involved in NPD. Designers' explanations of how they work may appear chaotic and in stark contrast to structured management processes. However, studies of industrial design show that there is a process behind good design (Lawson 2006), although it may not be a linear one.

Table 3. — The different languages of designers and managers

	Designers	Managers
Common terms	<ul style="list-style-type: none"> <li>■ <i>Form and function</i></li> <li>■ <i>Aesthetics</i></li> <li>■ <i>Functionality and usability</i></li> <li>■ <i>Temporal</i></li> <li>■ <i>Simplicity of design</i></li> <li>■ <i>Purchase decision</i></li> <li>■ <i>Consumer experience</i></li> </ul>	
Different terms	<ul style="list-style-type: none"> <li>■ <i>Originality</i></li> <li>■ <i>Iconic designs</i></li> <li>■ <i>Emotion</i></li> <li>■ <i>Provocative design statement</i></li> <li>■ <i>Technology</i></li> <li>■ <i>Materials</i></li> <li>■ <i>Manufacturing capabilities</i></li> </ul>	<ul style="list-style-type: none"> <li>■ <i>Price</i></li> <li>■ <i>Brand</i></li> <li>■ <i>Exclusivity</i></li> <li>■ <i>Design signature</i></li> </ul>

The reality of NPD is that different functional areas will have different objectives, and it is management's responsibility to make decisions on what is best for the overall project. This may be particularly challenging for design, with its nonlinear processes. Additionally, managers have little guidance on how to integrate design into a structured NPD process, and designers themselves have not considered how their work could be integrated into such an NPD framework. This is illustrated by the lack of attention to Stage-Gate™ methodology in the design journals; we found only six articles that mentioned Stage-Gate™ in the five leading design journals over the last ten years, compared to over 80 mentions in this journal alone during the same period. The failure of the design world to engage with structured approaches to NPD and define the role of industrial design within such frameworks represents a significant barrier to the widespread adoption of design thinking, as it leaves designers shut out of the managerial conversation. This circumstance partly explains a key source of frustration expressed in the design literature—that designers do not have enough influence over NPD (Keinonen 2008).

To understand how design thinking could be better integrated into the NPD process, we conducted a focus group with six designers who had experience working in NPD teams. The designers were relatively familiar with structured NPD processes, but, revealingly, the majority of them had not been taught about it during their formal studies. In the focus group, we first asked individual designers to complete a single-sheet form that asked them to think about both the key design issues and the potential conflicts at each stage of a Stage-Gate™ NPD process. After the designers had completed their forms individually, they discussed their views as a group; the results of the discussion were summarized, coded, and analyzed (Figure 1).

Although all six designers in the focus group had significant NPD experience and had been working mostly in companies where design was considered an important function, none of them felt that those companies were making the most of design expertise. Similarly, none of the six designers had ever been asked what they could contribute to NPD at each stage, although they had concrete ideas on that topic.

At the discovery stage, the designers felt that they could contribute to the generation of ideas and the exploration of user needs (whether known or hidden) and provide inspiration from their knowledge of other products. The designers in our group felt that the typical conflicts that can arise at this stage include managers playing down the role of design, or design being excluded from the decision-making process, because, as one designer in the group put it, the "CEO has no idea what 'design' is."

In the scoping phase, our focus group participants perceived that they could support the process of filtering

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ideas (rating alternative designs and considering customers' needs) and help refine the analysis of user needs while keeping the focus on creative solutions. The typical challenges that our participants identified at this stage are making the right project decisions when opposing views are present, thus making the collaboration between industrial design, engineering, manufacturing, and marketing more effective.

As the business case is developed, our focus group felt that design can contribute to producing cost estimates, further refining the options, and elaborating design specifications. Conflicts arise when specific designs are rejected because of their cost without consideration of the value a more expensive design can bring. In the words of one participant, projects might be "shot down because they are too expensive" or "killed off because of corporate hierarchy despite it being justified [in terms of] cost."

In the development stage, our focus group designers thought their expertise could be of assistance in the production of CAD models and prototypes and in collaborating with other functions within the organization. However, difficulties in this phase may arise from changes in users' or clients' requirements, tight time-scales, and difficulties in establishing those collaborations. Therefore, our participants suggested, designers might take a rather defensive position, in an effort "to keep design 'on track.'"

Interestingly, several designers who participated in the focus group said that, in their experience, industrial design had very little input in the final stages of NPD. During the

testing and validation stage, they felt that industrial design thinking could help, for example, in further refining the design and in presenting designs and prototypes to clients. However, the limited involvement of designers at these stages and the possibility that major changes in design specifications could be made without the designers being aware of them were perceived as significant problems.

Finally, at the launch stage, industrial design seemed to our group to be completely excluded, although design could play a key role in ensuring that the product is presented in the most effective way (to generate the right emotion) in brochures and at exhibitions. The focus group talked about the need to consider every detail of how a product was presented, from branding and use of materials to lighting and layout. The potential conflict was perceived, once again, as a lack of willingness by marketing to welcome design's involvement at this stage.

Our model of the potential contributions of the industrial design function at each stage of NPD should make companies more aware of the possibilities and also of the potential conflicts that need to be addressed. Otherwise, the value of design will be missed.

## Discussion

From our results, it is clear that industrial designers perceive their work in a significantly different way than managers do. Designers have a different culture, use different

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language, and think that they can contribute more to NPD than they are usually asked to. In contrast, managers responsible for product development perceive design as

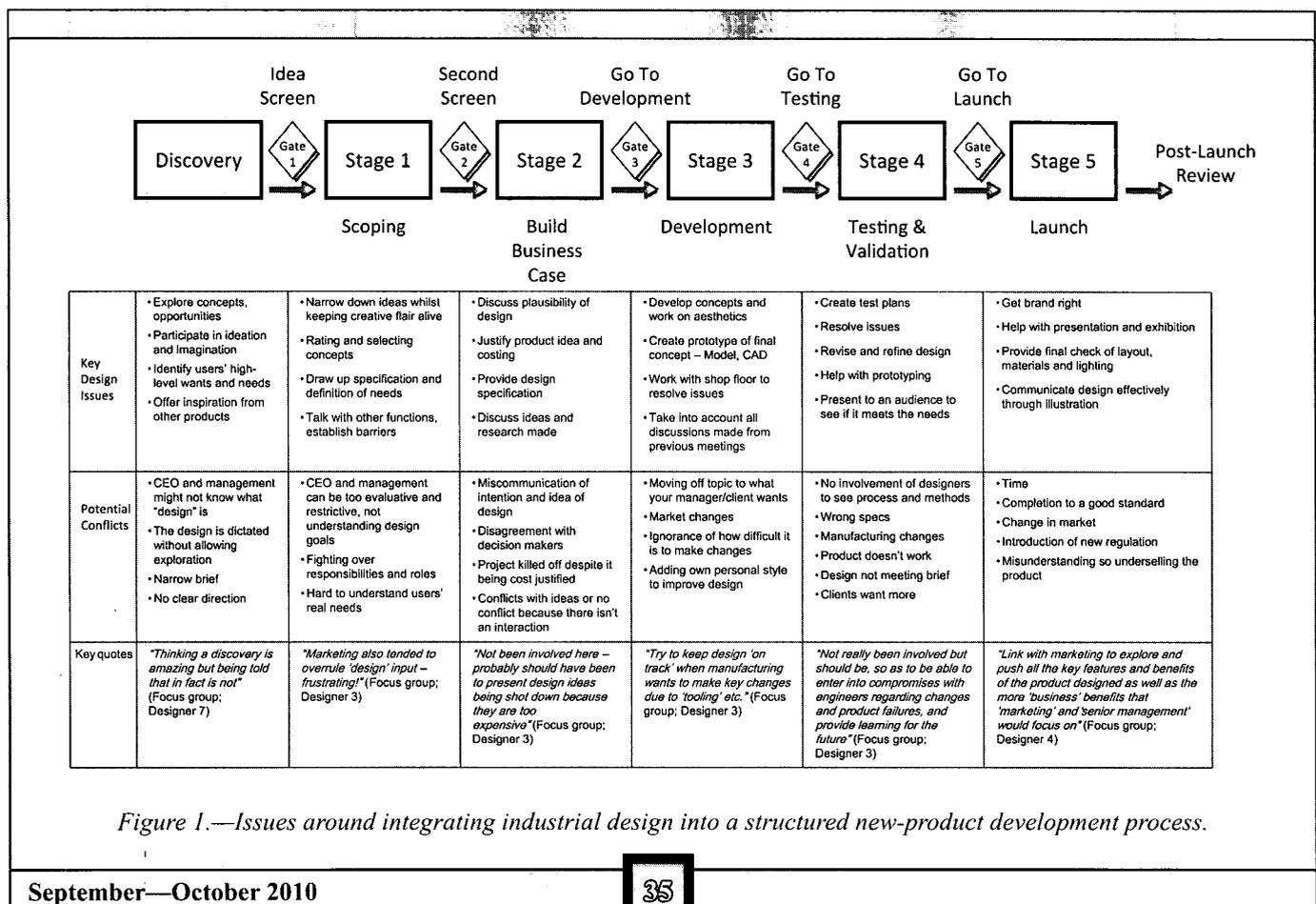


Figure 1.—Issues around integrating industrial design into a structured new-product development process.

## **Lucci Orlandini Design—Designing for the Disabled**

Lucci Orlandini Design is an Italian company founded in 1968 by Roberto Lucci and Paolo Orlandini and based north of Milan. The company has designed over 500 products, including household appliances, furniture, and lighting for many well-known brands and has won several design awards. Their credo is to create designs that are “simple to manufacture and simple to use.”

In December 2002, one of Europe’s largest kitchen manufacturers, Snaidero, asked Lucci and Orlandini to design a kitchen suitable for disabled citizens, of which there are almost 40 million in Europe. “We were experienced at designing kitchens but with this project, we were entering new territory,” Lucci recalls. The firm quickly realized that it would be impossible to design a kitchen that covered all disabilities; so, with Snaidero, they decided to focus on several conditions including paraplegia, amputations, vision impairment, and Alzheimer’s disease. “People with these disabilities share similar needs and are looking for greater independence and safety in the kitchen and being able to move around in a wheelchair. We really wanted to design something great for them! But the kitchen needed to be versatile, so that it could also be used by friends and relatives who are not disabled,” Lucci explains.

A full prototype with real appliances was made at the Snaidero plant, and the team had it tested at the Gervusutta Hospital in Udine. The prototype went through several iterations before the final product was introduced in 2004. The product has been very successful and has won several design prizes, including the “Good Design Award”, by the Design Athenaeum of Chicago, which typically goes to designers and manufacturers for the creation of innovative and original concepts, the Well-Tech Award and the Dedalo Minosse International Award.

The process that was followed for the creation of the Skyline kitchen is a good example of design-driven innovation, as design played a driving role at all development stages. Lucci Orlandini Design covered the whole span of the design process, including prototyping and working with suppliers, and were also involved in examining manufacturing solutions. For example, although curved units offered several advantages for accessibility and mobility, the designers knew that curved units would be more expensive to produce; during their interviews, they had learned that many disabled people live on low incomes and kitchens had to be affordable. Therefore, they worked to identify less expensive materials and worked with Snaidero to reduce cost throughout the NPD process by bringing different functions to work more closely together. The resulting concept is indeed based on the principle of reducing the superfluous and enhancing functionality.

However, the development of Skyline would not have been possible if Lucci and Orlandini had worked with most other kitchen manufacturers. As Lucci stated, Snaidero relies “a lot on product design. Snaidero invests 50 percent in aesthetics and the other 50 percent can be the reliability of the product, ergonomics, quality of materials, price.”

(Adapted from Goffin, Lemke, and Koners 2010)

just one of several inputs into the NPD process, and sometimes as just concerned with styling. These differences in understanding and perceptions often result in significant tensions between designers and other NPD professionals and limit the impact that design can have on business performance.

Tackling both cultural and process barriers is of primary importance for companies that want to make design work more effectively with other NPD functions, as much as for those aspiring to move toward a design-driven approach to innovation. Lucci Orlandini Design, a company we have worked closely with in past studies, is a good example of how designers can make their own interpretation of user and market signals to develop radically innovative solutions. In the case of the “Skyline” kitchen designed for Snaidero (one of Italy’s main kitchen manufacturers), industrial design played a driving role at all development stages. This was possible because Snaidero regards design as a key means for ensuring competitive advantage, and

Lucci Orlandini Design had already collaborated with Snaidero in the successful development of other new products.

### **Conclusion**

Industrial design can make a major contribution to the success of products and the building of brands. To capitalize on the competitive advantages design can offer, we recommend that managers and designers actively work to resolve unproductive tensions. Indeed, NPD is by its very nature cross-functional, and the rich ideas that result from the clash of different views are absolutely essential. The most innovative organizations are not the companies with the best marketing department, the best R&D group, or the best design team. Rather, they are the ones that can capitalize on cross-functional tensions by using them as a catalyst for creativity.

Managers and other members of the NPD team need to understand the different culture, language, and approach

of designers, as they can potentially bring novel and enriching perspectives. The expertise of industrial designers can provide important support for the NPD team at most stages of development, provided that the design function is integrated in the NPD process.

In openly identifying and addressing the cultural and process barriers excluding design from NPD processes, managers can use industrial design to develop products that are different from the competition because, as one designer asserted, "we need to differentiate, we need to stand out" (Designer 2, FloorCo.).

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## References

- Beverland, M. B. 2005. Managing the design innovation-brand marketing interface: Resolving the tension between artistic creation and commercial imperatives. *Journal of Product Innovation Management* 22(2): 193–207.
- Brown, T. 2008. Design thinking. *Harvard Business Review* 86(6): 84–92.
- Chhatpar, R. 2007. Analytic enhancements to strategic decision-making: From the designer's toolbox. *Design Management Review* 18(1): 28–35.
- Cooper, R. G. 2001. *Winning at New Products*. Cambridge, MA: Perseus Publishing.
- Cooper, R. G. 2005. *Product Leadership: Pathways to Profitable Innovation*. New York: Basic Books.
- Cooper, R. G., and Kleinschmidt, E. J. 1994. Determinants of timeliness in product development. *Journal of Product Innovation Management* 11(5): 381–396.
- Cox, G. 2005. *Cox Review of Creativity in Business: Building on the UK's Strengths*. London: HM Treasury.
- Curtis, C. C., and Ellis, L. W. 1998. Satisfy customers while speeding R&D and staying profitable. *Research-Technology Management* 41(5): 23–27.
- Eckert, C., and Stacy, M. 2000. Sources of inspiration: A language of design. *Design Studies* 21(5): 523–538.
- Gemser, G., and Leenders, M. A. A. M. 2001. How integrating industrial design in the product development process impacts on company performance. *Journal of Product Innovation Management* 18(1): 28–38.
- Goffin, K. 2002. Repertory grid technique. In *Essential Skills for Management Research*, ed. D. Partington, 199–225. London: Sage Publications.
- Goffin, K., Lemke, F., and Koners, U. 2010. *Identifying Hidden Needs: Creating Breakthrough Products*. New York: Palgrave MacMillan.
- Hertenstein, J. H., Platt, M. B., and Veryzer, R. W. 2005. The impact of industrial design effectiveness on corporate financial performance. *Journal of Product Innovation Management* 22(1): 3–21.
- Heskett, J. 2002. *Toothpicks and Logos: Design in Everyday Life*. Oxford: Oxford University Press.
- Jang, S., Yoon, Y., Lee, I., and Kim, J. 2009. Design-oriented new product development. *Research-Technology Management* 52(2): 36–46.
- Keinonen, T. 2008. Design in business: Views from nucleus and the periphery. *Design Management Review* 13(3): 30–36.
- Lawson, B. 2006. *How Designers Think: The Design Process Demystified*. Amsterdam: Elsevier.
- Lockwood, T. 2007. Design value: A framework for measurement. *Design Management Review* 18(4): 90–97.
- Perks, H., Cooper, R., and Jones, C. 2005. Characterizing the role of design in new product development: An empirically derived taxonomy. *Journal of Product Innovation Management* 22(2): 111–127.
- Petrie, A. 2008. Developing products with a holistic process. *Design Management Review* 19(3): 68–73.
- Rodriguez, N. G., Perez, M. J. S., and Gutierrez, J. A. T. 2008. Can good organisational climate compensate for a lack of top management commitment to new product development? *Journal of Business Research* 61(2): 118–131.
- Verganti, R. 2008. Design, meanings, and radical innovation: A meta-model and a research agenda. *Journal of Product Innovation Management* 25(5): 436–456.
- Verganti, R. 2009. *Design-Driven Innovation – Changing the Rules of Competition by Radically Innovating What Things Mean*. Boston, MA: Harvard Business Press.
- Veryzer, R. W. 2005. The roles of marketing and industrial design in discontinuous product development. *Journal of Product Innovation Management* 22(1): 22–41.
- von Stamm, B. 2004. Innovation – What's design got to do with it? *Design Management Review* 15(1): 10–19.
- Walker, D. 1990. Design maturity: The ladder and the wall. In *Design Management: A Handbook of Issues and Methods*, ed. M. Oakley, 43–46. Oxford: Blackwell Publications.

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Strategic Partnering for Developing New  
Products  
... AND MORE

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