# Breakthrough Innovation through Design Education: Perspectives of Design-Led Innovators

Cees de Bont, Sylvia Xihui Liu



**Introduction**

In recent decades, the discipline of design has attained its position in the innovation arena. Evidence of this presence can be found in many articles on the topic, both in design journals and in business-related journals. For example, Leonard and Rayport published on the virtues of empathy and design research for innovation.[1] The many contributions of design to the breakthrough innovations that have come from Apple and Google and their subsequent business success have been a positive force to encourage the adoption of strategic design by many other companies.[2]

In the study under discussion, the authors address the question of how breakthrough innovation can be stimulated in China through design education. China has the largest industrial manufacturing base; it has more design students than any other country in the world;[3] and in terms of consumer spending, China is second only to the United States.[4] In China, most design schools follow either the fine arts tradition or that of industrial design. They initially borrowed from Germany and Japan to build design education geared at supporting large-scale manufacturing. This approach resulted in the production of huge quantities of pre-specified, and often also pre-designed, products and to some incremental product innovations. The next step in design education—in which design strategy and breakthrough innovation affected design education and design practice—was implemented in many countries, including the United States, Korea, and Finland, but China seemingly has not taken this step. In adopting changes in design that have been developed in other places, Chinese educators need to be conscious of the local context and content.[5] A number of scholars have identified challenges related to the transfer of design education into China.[6] A holistic understanding of the factors that have hampered the innovativeness of corporations in China is needed to reveal what type of design education is most suitable in generating breakthrough innovations, and how it can best be delivered.

1 Dorothy Leonard and Jeffrey F. Rayport, "Spark Innovation Through Empathic Design," *Harvard Business Review* 75 (1997): 102–15.

2 Some cases are discussed by Christopher Lorenz in "Harnessing Design as a Strategic Resource," *Long Range Planning* 27 (1994): 80. Additional cases are shown in the article by Davide Ravasi and Gabriella Lojacono, "Managing Design and Designers for Strategic Renewal," *Long Range Planning* 38 (2005): 53.

3 In the statistics reported on design education in China, the number of undergraduate design students in China was around 2.3 million in 2012. The data is obtained by requested from an unreleased research report of China Design Education Survey conducted the Central Academy of Fine Arts, funded by Ministry of Education.

4 Consumer spending in China increased to CNY264,757.60 HML (High Minus Low) in 2015, while in the United States it increased to $11,482.80 billion in 2015, as reported by Trading Economics, http://www.tradingeconomics.com (accessed on Oct 1, 2016).

5 Xihui Liu and Jun Cai, "Design para o desenvolvimento: uma perspectiva da China," [Design for Development: A Chinese Perspective], in *Design & Desenvolvimento: 40 Anos Depois* [Design and Development: After 40 Years], eds. Gabriel Patrocinio and Jose Mauro Nunes (Brazil: Blücher, 2015): 167–88.

6 Shulin Sang and Wenzhe Li, "中国工业设计学科的现状及发展道路" [The Current Situation and Development Path of Industrial Design in China], *中国机械工程* [China Mechanical Engineering] 7, no.4 (1996): 10–11.



 doi: 10.1162/DESI_a_00437

The main research question was formulated as follows: What can be done in Chinese design education to facilitate breakthrough innovation? Related questions derived from the main question include the following:

- What are the major barriers in implementing strategic design to support breakthrough innovation in China?
- What are the current solutions identified by industries to address the barriers?
- What kind of design talents are needed by industries to stimulate breakthrough innovation?
- What are the implications for design education?

**Literature Review**

We conducted a literature review to provide clarity on key concepts, to address some of the research questions of this paper and to focus the further research.

*From Incremental Innovation to Breakthrough Innovation*

A user orientation that is central to the discipline of design has proven to be useful for developing new and better products and services.[7] User-centered design takes many different forms, such as participatory design and experience design.[8] Norman and Verganti acknowledged the contribution of user-centered design to generating incremental innovations.[9] However, they did not think that user-centered design would lead to breakthrough innovations. Leading design firms from the Western world (e.g., IDEO, frog, and Doblin) developed and deployed strategic design tools and methods to generate innovative outcomes. A few years ago, the CEOs and founders of these design consultancy firms began to disclose their approaches in books and journal papers—for example, *A Fine Line: How Design Strategies Are Shaping the Future of Business*, by Hartmut Esslinger, and *Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation*, by Tim Brown.[10]

In the same spirit, Kiffin and Gardien illustrated their design-based innovation approach and showed examples from Philips.[11] They coined the term "design-led innovation." The underlying message from these two authors was that innovative and meaningful user experiences resulting from well-equipped design teams appeared to excite end-users and to demonstrate their key role in the development of innovative products and services. In design management, several books on branding and innovation have been published as teaching materials for students and practitioners.[12] In the academic field, Dorst and Verganti analyzed the

7 Donald A. Norman and Stephen W. Draper, *User Centered System Design: New Perspectives on Human–Computer Interaction* (Hillsdale, NJ: Lawrence Erlbaum, 1986).

8 For participatory design, see e.g., Elizabeth B.-N. Sanders and Pieter Jan Stappers, "Co-Creation and the New Landscapes of Design," *CoDesign* 4, no. 1 (2008): 6. For experience design, see e.g., Marc Hassenzahl, Sarah Diefenbach, and Anja Göritz, "Needs, Affect, and Interactive Products–Facets of User Experience," *Interacting with Computers* 22, no.5 (2010): 353–62.

9 Donald A. Norman and Roberto Verganti, "Incremental and Radical Innovation: Design Research vs. Technology and Meaning Change," *Design Issues* 30, no. 1 (Winter 2014): 78–96.

10 Hartmut Esslinger, *A Fine Line: How Design Strategies Are Shaping the Future of Business* (San Francisco: John Wiley & Sons, 2009); and Tim Brown, *Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation* (New York: Harper Business, 2009).

11 Steven Kyffin and Paul Gardien, "Navigating the Innovation Matrix: An Approach to Design-Led Innovation," *International Journal of Design* 3, no. 1 (2009): 57–69.

12 The two books typically assigned are Brigitte Borja De Mozota, *Design Management: Using Design to Build Brand Value and Corporate Innovation* (New York: Skyhorse Publishing, 2003); and Bettina Von Stamm, *Managing Innovation, Design and Creativity* (Chichester, UK: John Wiley & Sons, 2008).

success of expert designers and that of successful design companies, and they respectively proposed "frame creation" and "design-driven innovation" as ways to generate breakthrough innovations.[13] Verganti pointed out that technological breakthroughs would result in successful innovations only in cases where they led to meaningful benefits for end users.[14] Compared to user-centered innovation (market pull), design-driven innovation is closer to technology push.[15]

*Barriers to Adopting Strategic Design for Innovation*

Although many successful examples of design-led breakthrough innovations and many theoretical and methodological notions can be identified, a number of barriers to breakthrough innovation still exists. Several studies have focused on and named these barriers to innovation. Barriers that are reported in the literature, as shown in Table 1,[16] include the following: (1) Senior management does not understand strategic design or lacks vision; (2) corporations are cost-driven, lack an open mindset and are not organizing innovation so that design can take the leadership; and (3) shortcomings exist in the ecosystems of innovation, such as a lack of external resources.[17]

The predominantly Western studies shown in Table 1, while relevant and informative, likely have a cultural bias. Unlike cultures found in Western countries, which are often described as individualistic, Eastern societies tend to be more communal and collectivistic.[18] In addition, Asian societies are more prone to authoritarian leadership than others, which might not be the most effective leadership style for goals of exploring and defining new inroads for innovation. Innovation requires an environment in which ideas can flourish, in which mistakes are allowed, and in which individuals are given the freedom to experiment.[19]

*Design Education in China*

Chinese designers' knowledge of Western design traditions is not comprehensive. It is fragmented and full of misunderstandings and exaggerations.[20] Industrial design was introduced into China by the university professors who brought the systems of design education in Japan and Germany to China after overseas studies in the early 1980s. Through their enthusiasm in their teaching, the newly acquired design knowledge and design methods spread rapidly, and design education was re-established on a new basis, both in art schools and in the science and technology schools.[21]

The newly borrowed design theories and concepts (e.g., user-centered design) stimulated innovation in the leading design countries; meanwhile, Chinese manufacturers competed primarily on speed-to-market and on low production costs. This focus appeared to be a major barrier to user-centered innovation. As a

13 See Kees Dorst, *Frame Innovation: Create New Thinking by Design* (Cambridge, MA: MIT Press, 2015); and Roberto Verganti, *Design-Driven Innovation: Changing the Rules of Competition by Radically Innovating What Things Mean* (Boston: Harvard Business School Press, 2009).

14 Verganti, "Design-Driven Innovation," 20.

15 Ibid., 60–61; and Roberto Verganti, "Radical Design and Technology Epiphanies: A New Focus for Research on Design Management," *Journal of Product Innovation Management* 28, no. 3 (2011): 384–88.

16 Dougherty, Deborah, "Interpretive Barriers to Successful Product Innovation in Large Firms," *Management Science* 3, no. 2 (1992): 179–202; Anna Filson and Alan Lewis, "Barriers Between Design and Business Strategy," *Design Management Journal* (Former Series) 11, no. 1 (2000): 48–52; Birgit H. Jevnaker, "Championing Design: Perspectives on Design Capabilities," *Academic Review* 1, no. 1 (2000): 25–39, and Birgit Helene Jevnaker, "How Design Becomes Strategic," *Design Management Journal* (Former Series) 11, no. 1 (2000): 41–47; Sally Brazier, "Walking Backward into Design: Support for the SME," *Design Management Review* 15, no. 4 (2004): 61–70; Millward, Huw and Lewis, Alan, "Barriers to Successful New Product Development within Small Manufacturing Companies," *Journal of Small Business and Enterprise Development* 12, no. 3 (2005): 379–94; Maaike Kleinsmann and Rianne Valkenburg, "Barriers and Enablers for Creating Shared Understanding in Co-Design Projects," *Design Studies* 29, no. 4 (2008): 380–82; Keith Goffin and Pietro Micheli, "Maximizing the Value of Industrial Design in New Product Development," *Research-Technology Management* 53, no. 5 (2010): 29-37; Lee, Younjoon and Martyn Evans, "What Drives Organizations to Employ Design-driven Appraoches? A Study of Fast-Moving Consumer Goods Brand Development," *Design Management Journal* 7, no. 1 (2012): 74–88; and Ahmed Hassanien and Crispin Dale, "Drivers and Barriers of New Product Development and Innovation in Event Venues," *Journal of Facilities Management* 10, no. 1 (2012): 75–92.

**Table 1** *Related Studies on Barriers to Innovation*

| Author | Topic | Core Findings | Field | Methods |
|---|---|---|---|---|
| Dougherty (1992) | Barriers to successful product innovation in large firms. | Departments are like different "thought worlds," organizational routines separate rather than coordinate the thought worlds, further constraining joint learning. The barriers require cultural solutions, not only structural ones. | Product management | Interview |
| Filson and Lewis (2000) | Issues that hinder the integration of design and business strategy in small and medium-sized enterprises (SMEs). | Barriers from strategic, operations, and culture issue. | Design management | Survey, case studies |
| Jevnaker (2000) | The role of design leadership in developing design capabilities. | Barriers to building dynamic design capability, including neglect of design and interpretive and organizational barriers. | Design management | Case study |
| Brazier (2004 | Companies often perceive design as a low priority and as an expensive luxury. | Barriers to awareness, understanding, practice, and performance. | Design management | Case study |
| Millward and Lewis (2005) | The main barriers to new product development in SMEs. | Three generic managerial issues: the influence of a dominant owner/manager; a focus on time and cost ahead of other key factors; and a failure to understand the importance of product design. | Product management | Case study |
| Kleinsmann and Valkenburg (2008) | Barriers and enablers for creating shared understanding during a co-design process. | 44 barriers at the actor level, 32 on the project level, and 20 at the company level. | Product design | Case study |
| Goffin and Micheli (2010 | Recognizing and resolving the cultural and process barriers between design and other functional areas. | Cultural barriers (design & other functions) to design thinking. Barrier to the successful adoption of design thinking is a process barrier. | Research management | Case study |
| Lee and Evans (2012) | Barriers from fast moving consumer goods (FMCG) context affecting brand development. | Barriers from FMCG industry; organizational barriers. The difference between barriers in global market corporations, local market-based corporations, and private equity corporations. | Design management | Survey, case study |
| Hassanien and Dale (2012) | Drivers and barriers of new product development (NPD) and innovation in event venues. | 19 barriers to NPD. | Product management | Interview, case study |

result, the endeavors by educators and scholars to promote user-centered design in China became a Utopian prospect.[22]

Industrial design education in China started to bloom in the 1990s, and the number of students grew exponentially. Design programs were established within two streams: arts and engineering. The first stream offered design education in the arts and crafts tradition, while the latter focused on the contexts of engineering and architecture. Not until quite recently did the two types of design education start to collaborate.

17 Lee and Evans, "What Drives Organizations to Employ Design-Driven Approaches?" 79–82.

18 Geert Hofstede, "The GLOBE Debate: Back to Relevance," *Journal of International Business Studies* 41, no. 8 (2010): 1339–46.

19 See e.g., Markus Hauser, "Organizational Culture and Innovativeness of Firms: An Integrative View," *International Journal of Technology Management* 16, no. 1–3 (1998): 239–55.

In light of the rapidly changing industrial and economic global context, the current design education system of China cannot adequately satisfy the new demands. Many design schools still teach the theories and body of knowledge borrowed from overseas at the beginning of the 1980s. More recent types of strategic design education, such as those on design-led innovation and design-driven innovation and aiming at breakthrough innovations, have only scarcely been adopted by the Chinese design schools that have ongoing international connections: Tsinghua University, Tongji University, The Hong Kong Polytechnic University, and Jiangnan University. The implementation of such new practices not only means a significant change to the curriculum, but also poses new requirements for the teaching staff.[23] Building this new curriculum starts from an understanding of the needs expressed by the key stakeholders: the Chinese design-led innovators.

**Research Methodology**

To identify barriers to the adoption of breakthrough innovation and the demands for design talent in China, a series of in-depth expert interviews was conducted. Expert interviews are an efficient method to gain insights into experts' knowledge.[24] We first identified different types of experts with experience pioneering in design-led innovation in China, making a distinction between experts from design consultancies and representatives from design departments of larger corporations. The perspectives of both types of experts were considered to be relevant to this study. We focused on the leading design consultancies in China because they are more likely to work on strategic projects and innovation-related projects than others. In addition to the design consultancies, we included experts from innovation consultancies, who were expected to have a broad view of the organizational and infrastructural aspects of innovation.

*Research Method*

We used semi-structured interviews to collect rich insights. We prepared an interview guide to structure the flow of the interviews after which we then interviewed CEOs and design directors of the selected firms. The interviews were initiated by asking several background questions about the type of organization (ownership, business nature, business focus, product-lines, number of employees), the role of the interviewee in the organization, and the team(s) he/she was working with. After that, we discussed the major changes and collaborations in the recent years in the company. At intervals in the course of each interview, we queried the role of design in the operational and strategic activities so that the interviewee could speak about design—and specifically, about the desired profile of the designer—in relation to innovation

20 Shouzhi Wang, *Modern Design History of the World: 1864–1996* (Guangzhou: New Century, 1995).

21 Hong Kong Trade Development Council (HKTDC), *Bright Prospects for Foreign Design Companies in Yangtze River Delta (YRD)* (Hong Kong: HKTDC, 2004); Ruifen Liu, *Design Process and Design Management* (Beijing: Tsinghua University, 2006).

22 Hui-Ming Tong, "理想与现实的冲突: 中国工业设计20年反思" [The Conflict of Ideal and Reality: Rethinking of Chinese Industrial Design in Twenty Years], 艺术与设计 [Art & Design] 1 (1999): 4–9; John Heskett and Sylvia Xihui Liu, "The Approach of Design Management in China," *IASDR 2009: Design/Rigor & Relevance* (Seoul: COEX, 2009).

23 Liu and Cai, "Design para o desenvolvimento" [Design for Development], 180.

24 Michael Meuser and Ulrike Nagel, "The Expert Interview and Changes in Knowledge Production," in *Interviewing Experts*, eds. Alexander Bogner, Beate Littig, and Wolfgang Menz (UK: Palgrave Macmillan, 2009), 17–42.

**Table 2** *Corporations Interviewed*

| Firm | Location | Ownership | Business Type | Interviewee | Design Team Size |
|---|---|---|---|---|---|
| *Automobile* | | | | | |
| 1. BAIC | Beijing | State owned, joint-venture | OEM, ODM, OBM | Design Director | 126+ |
| 2. GAC | Guangzhou | State owned, joint-venture | OEM, ODM, OBM | Design Director | 160+ |
| 3. SAIC | Shanghai | State owned, joint-venture | OEM, ODM, OBM | Design Director | 160+ |
| *Consumer electronics* | | | | | |
| 4. Echom | Guangzhou | Private, joint-venture | ODM | Design Director | 20+ |
| 5. Lenovo | Beijing | State owned, joint-venture | OBM | Design Director | 200+ |
| 6. Ezon | Shenzhen | Private | ODM, OBM | CEO | 20+ |
| 7. Geak | Shanghai | Private, joint-venture | OBM | CEO | 70+ |
| 8. Xiaomi | Beijing | Private, joint-venture | OBM | CEO | 10+ |
| *Lifestyle products* | | | | | |
| 9. emoi | Shenzhen | Private | OBM | CEO | 10+ |
| *Internet service* | | | | | |
| 10. Baidu | Beijing | Private, joint-venture | OBM | Design Director | 30+ |

projects and to changes in the organization and the wider environment. This path of inquiry included asking about the barriers to the use of strategic design.

We conducted all interviews face-to-face, and supplemented with site visits. Besides these interviews, documents, such as firm catalogs, financial reports and development plans were collected for objective data support.

*Selection of Research Subjects*

The sampling frame for this study consisted of three types of entities: corporations, design consultancies, and innovation consultancies. They represented design clients, suppliers of design services, and suppliers of innovation services, respectively. In particular, large firms representing design clients were selected for interviews because they were considered to be more likely than smaller corporations to use strategic design consultants.[25] This expectation is explained by the relatively high fees and the higher educational background needed for strategic design. In most cases, large firms are better equipped for such design perspectives than small firms. The corporations interviewed in this study were in the forefront of innovation in the following sectors: the automotive sector (3 companies), consumer electronics (5 companies), lifestyle products (1 company), and internet services

25 John Heskett and Xihui Liu, "Models of Developing Design Capacity: Perspective from China," *Leading Through Design: Proceedings of the DMI 2012 International Research Conference* (Boston: Design Management Institute, 2012), 225.

**Table 3** *Design and Innovation Consultancies Interviewed*

| Firm | Location | Ownership | Business Type | Interviewee | Design Team Size |
|---|---|---|---|---|---|
| *Design Consultancy* | | | | | |
| 1. Design affairs | Shanghai | Private, joint-venture | Service | CEO | 30+ |
| 2. CIGA | Shenzhen | Private, joint-venture | Service, OBM | CEO | 30+ |
| 3. Daye | Guangzhou | Private | Service, OBM | CEO | 150+ |
| 4. LKK | Beijing | Private | Service, OBM | Director of Design | 500+ |
| 5. Newplan | Shenzhen | Private | Service, OBM | CEO | 400+ |
| 6. R&D | Hangzhou | Private | Service | CEO | 40+ |
| 7. Utop | Guangzhou | Private | Service, OBM | CEO | 10+ |
| *Innovation consultancy* | | | | | |
| 8. SIID | Shenzhen | State-owned, joint-venture | Service | CEO | 10+ |
| 9. Shengjing360 | Beijing | Private, joint-venture | Service | CEO | 1 |
| 10.CIDI | Shanghai | State-owned, joint-venture | Service | CEO | 10+ |

(1 company), all of which are key sectors in the Chinese economy. Well-known firms among these corporations include Xiaomi, Baidu, and Lenovo (see Table 2).

We also interviewed representatives of seven leading design strategy consultancies that currently are active in China to represent the design supply side. They each introduced design research, design strategy, and design thinking into corporations and offered top-down solutions for adopting strategic design. Their clients include Chinese corporations, as well as Western companies. Some of the design consultancies have developed their own products to be sold in China or overseas markets.

The three innovation consultancies selected for this study were mostly initiated by local governments as mediators between government and industries. They serve to educate firms about innovation policies and strive to improve innovation capabilities of corporations by introducing external resources. Sometimes, the innovation consultancies conduct innovation projects as well (see Table 3).

*Data Analysis*

After completing the 20 interviews, the research team transcribed and translated the voice recordings. We constructed the major findings based on a coding process that followed predefined categories. The findings described barriers to the adoption of strategic design, based on a summary of the barriers the interviewees mentioned. On the basis of previous studies in Table 1, we divided the

**Table 4** *Barriers Reported from the Interviews*

| Catagory | Barrier | Frequency |
|---|---|---|
| *Actor Level* | | |
| Unqualified Designer | 1. Lacking specialized designers* | 14 |
| | 2. Lacking multidisciplinary designers* | 10 |
| | 3. Lacking strategic designers/critical thinking* | 9 |
| Immature Consumer | 4. Price-driven* | 8 |
| | 5. Low brand loyalty* | 7 |
| CEO with Low Design Awareness | 6. Do not understand strategic design | 9 |
| | 7. Lack vision | 7 |
| *Corporation Level* | | |
| Strategy | 8. Cost-driven product focus | 11 |
| | 9. Traditional mindset | 9 |
| Organization | 10. Inefficient communication | 5 |
| Innovation Capacity | 11. Lack of market skills to understand users | 5 |
| *Ecosystem Level* | | |
| Industry Chain | 12. Short-term design collaboration/lack of external resources | 6 |
| Policies | 13. Inertia in absorbing innovation policies* | 5 |

Note: * This is a new barrier explored in the context of China.

barriers into three levels and eight categories. See the discussion section for the underlying patterns in the data, seen in light of the key research questions of this study.

**Results: Barriers to Breakthrough Innovation**

The process of transcribing, translating, and coding resulted in the identification of 13 barriers to adopting strategic design as a driver for breakthrough innovation in Chinese corporations. These barriers can be divided into three levels: actor (particularly focusing on the designer and the CEO), corporation, and ecosystem (see Table 4). Each barrier was mentioned by at least 5 of the 20 interviewees. Of the 13 barriers, 7 barriers have been reported in the literature on related topics, while the other 6 barriers were newly identified in this study. Interestingly, all of the newly reported barriers were located at the actor and the ecosystem levels, instead of at the corporation level. This finding suggests two probabilities: 1) that previous studies have concentrated on the corporation or project level, and 2) that distinct barriers arise at the actor and the ecosystem levels, which might be unique to the Chinese context.

We found that three of the thirteen barriers directly relate to design education, describing the "unqualified designer" as one of the failing actors. The first education barrier surfaces in shortcomings of the junior designers. Junior designers often do not have specialized knowledge and skills which are needed to add strategic value to particular industry sectors, such as healthcare and automotive. Design schools do not seem to offer these

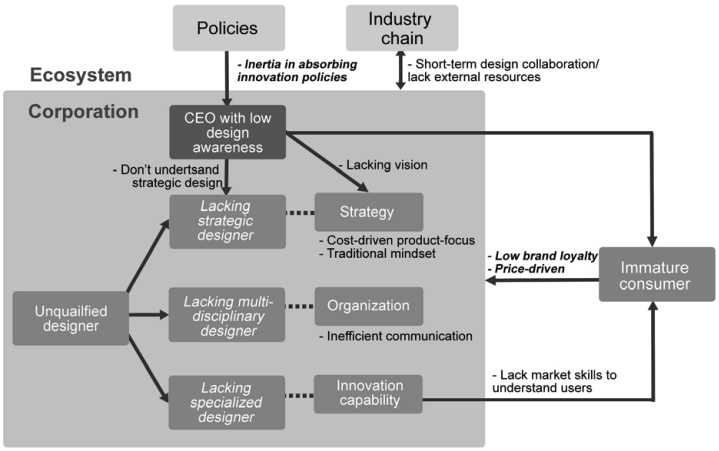



Figure 1
Connections between barriers at the different system levels. Note: The words in italics represent new barriers reported in a Chinese context.

specialized skills and knowledge. The second and third education-related barriers reflect more specifically a senior designer's lack of multi-disciplinary knowledge and strategic thinking.

The fourth and fifth barrier, stemming from "immature consumers," are another typical Chinese phenomenon, caused by the incredibly fast growth of consumerism in the past 15 years.

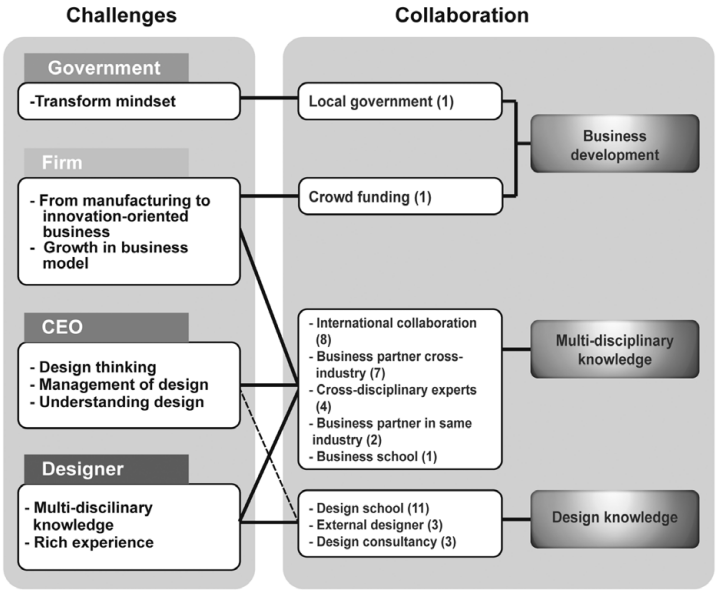
Similar to previous studies, our study reveals that CEOs who have no understanding of strategic design are seen to lack vision and are reported as a barrier (barriers 6 and 7 in our study). Their low design awareness leads directly to barriers at the corporate strategic level, such as a cost-driven, product-focused, traditional mindset. In the Western countries, problems were attributed to a technology focus in CEOs' mindset or to a lack of design knowledge.[26] The tendency to be unaware of strategic design is even more serious among the Chinese CEOs, some of whom finished their education at a primary level and thus have no idea about design. Our study shows, therefore, that all barriers that we find at the corporation level (barriers 8 through 11) were reported before, but that the underlying processes may be unique to China.

From the barriers related to the ecosystem, only the final one is a unique barrier in China. This one is about the influence of the national innovation policies. The strong, top-down national policies make China stand out from most other countries. Chinese companies intensively follow the policy regulations, but they find aligning to new policies difficult after having relied so heavily on the existing ones.

The barriers that experts reported most dominantly are the shortcomings of designers and CEOs. In addition, the ambiguous innovation strategies of corporations and the immaturity of Chinese consumers clearly hamper breakthrough innovation as well. These barriers are embedded in other barriers that exist in the wider ecosystem. To facilitate breakthrough innovation in China, the stakeholders need to address all these barriers. Before

26 The former problem has been frequently mentioned in most of the studies about the barriers, including Lorenz, "Harnessing Design as a Strategic Resource," 73–84; Filson and Lewis, "Barriers between Design and Business Strategy," 48–52; and Brazier, "Walking Backward into Design," 61–70. The latter barrier also was reported as a common one in the previous studies, including in Filson and Lewis, "Barriers Between Design and Business Strategy," 48–52; Brazier, "Walking Backward into Design," 61–70; and Millward and Lewis, " Barriers to Successful New Product Development," 379–94.

Figure 2
Challenges faced at different levels and corresponding types of collaboration. Numbers in parentheses indicate how many respondents referred to that category.




turning to these challenges for each of the various entities, the authors first draw the interconnections within and between the different levels in the system (see Figure 1).

**Result: From Barriers to Challenges**

To further understand the barriers, especially those that hamper the future growth of firms, the authors asked questions about current operational strategies. As a result, various collaborations were reported as the most often used means to achieve three objectives: business development, the acquisition of multi-disciplinary knowledge, and the acquisition of design knowledge (see Figure 2). For *business development,* the firms collaborated with local government to change the mindset of government workers and worked with crowd-funding platforms to innovate business models. *Multi-disciplinary knowledge* was shown to be a critical factor for designers, CEOs, and corporations seeking to generate breakthrough innovations. It comprises knowledge of specialized fields, including marketing, sales, engineering, production, and emerging technologies. Access to multi-disciplinary knowledge can provide designers with a broader understanding of the innovation aspects to be considered. It can facilitate the design thinking of CEOs, support the operating modes of corporations, and lead to the adoption of new business models. For all entities in the system, access to multi-disciplinary information comes through collaboration with third parties. For designers, such knowledge comes not only through collaboration with design schools, with freelance designers, and with design consultancies, but also through their exposure to other disciplines. A link exists between the challenges faced by the different entities in the system and the current collaboration in design and business.

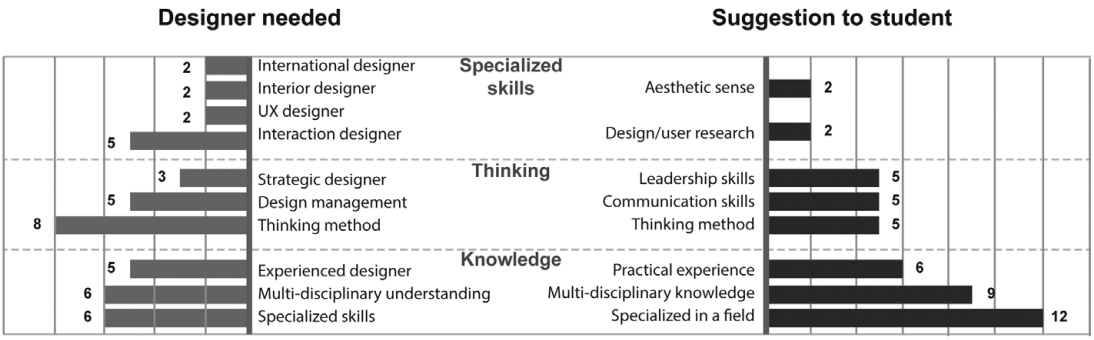



Figure 3
Links between "Designer needed" and "Suggestion to student."

**Discussion: Needs for Design Education**

The interviewees suggested that they would like to strengthen several aspects of the design schools in China so that they better prepare the design graduates for breakthrough innovation. Among these suggestions are giving students practical experience, multi-disciplinary knowledge, and specialized skills. Interviewees suggest that these aspects are the top three educational opportunities and needs to which design students should pay more attention (see Figure 3). Students are expected to accumulate a certain amount of practical experience. To boost breakthrough innovation, the interviewees want designers to develop a stronger multi-disciplinary understanding. Corporations are eager to employ designers who have special design skills, such as clay modeling, color, material, finish (CMF), and conceptual drawing in automotive design. They indicate that they need professional designers who specialize in a particular field, such as interaction designers, car designers, user-experience (UX) designers, and strategic designers.

In the suggestions to students, the strategic thinking methods (i.e., design thinking, critical thinking), communication skills, and leadership skills all were mentioned by five interviewees. This repetition implies that these interviewees think these aspects should be covered in the learning content of design schools. Although thinking methods rank at the top of the desired designer list, it falls only at the average level in the suggestions to design students. This result might imply that the interviewees find the thinking more important than the practical design skills; but they also might realize that the thinking skills, similar to the communication and the leadership skills but different from the hands-on design skills, might be taught outside the design school. Design and user research are the specialized skills for a design graduate, especially for user-experience designers and interaction designers. Aesthetic sense is supposed to be the strength of international designers and interior designers.

**Prescriptions for Design Education**

Design education needs to be strengthened in at least three ways. For undergraduate design education, the main recommendation from design-led corporation innovators to design educators is to

ensure a solid base of design skills, knowledge of a specialized industry or product domain, and practical experience from internships. Design education could be provided in design schools, on the job, or through collaborative projects and collaboration with third parties, such as design or innovation consultancies. Our findings also suggest an increasing demand for continuing design education to cultivate senior designers and design managers. For these professionals, developing the design thinking and communication and leadership skills is important. A multi-disciplinary orientation is not only critical for those who follow undergraduate studies but also for those who follow postgraduate studies in design. A possible way forward could consist of partially integrating education with design practice to develop leadership qualities and to explore effective methods for incremental and breakthrough innovation.[27] Strategic designers also need to be educated in areas such as organizational transformation in the Chinese context. This learning and skillset can increase their chances of being successful. The "Ignite Innovation Model," introduced by de Bont in 2015, is a design-led approach that addresses the issues of hierarchical layers in Chinese organizations and the fear of risk-taking by leaders and is thus a potential model to follow.[28]

**Conclusions and Implications**

In many Western countries and in Korea—as a leading design country in Asia—the discipline of industrial and product design continues to exist, but it has transformed itself into strategic design, thereby representing a driving force for breakthrough innovation. Design education in China was strongly influenced by other countries 30 years ago, but it did not adopt strategic design with the same enthusiasm; as a result design-led innovation and design-driven innovation are not well developed. When taking a system view of the barriers to innovation in China, we see many of the same barriers found in other parts of the world, including a poor understanding of the potential of design by CEOs and weaknesses at the level of the corporations. More than in other studies, the design-led innovators in this study point at specific weaknesses in the designer, at the immaturity of consumers, and at the difficulty in switching from one government policy to another. At all levels of the system, acquiring multi-disciplinary knowledge that is critical to breakthrough innovation is a challenge that can be addressed by various types of collaboration. The desired designer who can provide support in generating breakthrough innovation not only has advanced design skills and is specialized in a particular design field or product domain, but also has strategic and critical thinking capabilities that make it possible to collaborate with relevant third parties. Also critical are leadership and communication skills, which should be part of the education of a designer as well, whether in the design school or elsewhere.

27 Craig M. Vogel, "From Design Awareness to Design Integration: Influencing Corporate Strategy and Research in the United States," *Design Management Journal* 7, no.3 (1996): 32–36.

28 de Bont, "The Ignite Innovation Program," 54–67.

The implications of these necessary changes for design education in China include the following: In undergraduate design education, design students should be taught updated design knowledge and methods. They should be required to develop a specialization, most probably by gaining practical experience in internships. The innovation studios at the Guangzhou Academy of Fine Arts and Jiangnan University are putting this aspect of education into practice. Postgraduate design students need to be the leaders in strategic design. They should be trained in their critical thinking skills and be exposed to knowledge and expertise from other disciplines. Examples of such education can currently be found in the International Design & Business Management programs at The Hong Kong Polytechnic University and at Tongji University. The curriculum developed in the advanced design schools in China covers many of the necessary educational aspects to stimulate breakthrough innovation. These good practices should be codified so that teachers in other design schools can be trained to teach the new curriculum. Intensive collaboration with leading design schools in Europe, the United States, and Korea appears to be of vital importance.

This study takes the perspective of design-led innovators. Future research should address the perspectives of CEOs, design educators, and (government) policy makers to offer further insights into this subject.

**Cees de Bont** is dean and Swire Chair Professor of the School of Design at Hong Kong Polytechnic University.

**Sylvia Xihui Liu** is a research assistant professor in the School of Design at the Hong Kong Polytechnic University.

**Acknowledgments**

The work described in this paper was substantially supported by a grant from the Research Grants Council of the Hong Kong Special Administrative Region, China (Project No. 154014/14H).