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Design Awareness: Developing Design Capacity in Chinese Manufacturing Industry

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Abstract: This study is an extension of John's research of managing design in Chinese manufacturing industry and focuses on their design awareness. Two sets of factors about design awareness and support for design are utilized for questionnaire survey. The result introduces the levels of design awareness in the firms and its influence in design implementation and management.

Keywords: Design awareness; design capability, design policy; manufacturing industry

1. Introduction

Raising design awareness is the first step of introducing design to a firm (Brazier, 2004). For many years, different ways of nurturing design awareness have been developed at national level and firm's level. At national level, an design agency of government maybe established to promote design in industries (Malvido, 2008; Stashenko, 2009). The earliest one could be Design Council in UK. At firm's level, there are two ways, workshops and assessment of design capability. A company first experience design through a successful project or a workshop (Lee, 2008; Manzini and Rizzo, 2011). With an effective result, they maybe plan to invest in design and develop long-term projects (Jevnaker, 2000; Brazier, 2004). A project or a workshop just creates the context for communicating design through showing, telling, arguing and revision. Nurturing design awareness is a part of constructive action (Jevnaker, 2000).

Design awareness can be raised through assessing design capability (Moultrie, 2007) and will influence business implementation and growth (Bruce, et al., 1999). Good design awareness can contribute to design knowledge and good design performance with support from CEOs. Their awareness of and knowledge about design is main factor of innovation skill (Dickson, 1995; Song, et al., 2010).

In recent years, with the hype of design thinking, the design awareness is raised significantly (Rylander, 2009). However, it is reported that SMEs are still unaware of design as a strategic resources (Acklin, 2013). The situation is even worse in Chinese manufacturing industry.

Despite the rapid progress of manufacturing in terms of quantity, Chinese manufacturers have been unable to break the bottleneck of quality, because of the lack of key basic materials, reliance on exported core components, limited key technologies, lack of research on advanced basic processes, limitations in application, and an underdeveloped service system.[1] In view of the weak basis for manufacturing, China's manufacturers are limited in competing on both cost and speed of production, and they cannot extend their business through improving the quality of products, building brands or enhancing capability for independent innovation. The urgent demands for solving the problem were stated by National Chairman Jinping Xi as Three Transitions, "from China's speed to China's quality, China's products to China's brands, and Made in China to Created by China." [2] Bruce Nussbaumin (2005) his article, "How to Build Innovative Companies," indicated that design strategy begins to replace the Six Sigma as a key organizing principle and has played the most important role in product differentiation, the decision-making process, and in understanding the consumer experience.

The juxtaposition of challenges and opportunities requires new thinking on the subject of design to lead product development. The application, role and awareness of design in China is closely connected to, and influenced by, its economic development (Cai, 2008). Since the open door policy, China has maintained its pursuit of developing technology via absorptive and re-innovation means (Wang, 2006). This has resulted in China becoming the world's second largest economy. However, having entered the new economy, and facing new market needs, it has become apparent that the traditional path of innovation is no longer sustainable. Although China was active in both industrial transformation and upgrading in 1992, with the emphasis on higher added value, lower energy consumption and pollution, and upgrading from extensive to intensive development, absorptive and re-innovation is still the dominant approach. This should be replaced by a new innovation strategy which emphasizes independent innovation through design. Raising design awareness is a critical step to fulfill the target.

In this instance, John Heskett initiated a study of design development in manufacturing industry in 2007. The initial idea is to explore unique characteristics of developing design in Chinese manufacturing industry based on existing frame, which is built from Western experience. As a result of his research, characteristics of managing design are reported and six models of developing design capacity is explored. This is published in DMI conference (2012). Later, the criteria of the models is combined with Design Ladder by Storvang (2014)

[1] The problems were first mentioned in the work meeting and were defined as three basics (basic part, basic manufacturing process and basic material). The meeting was organized by the China Machinery Industry Federation, CMIF) on 19 Jun, 2011. They were redefined in 2015 into four basics, including key basic material, core basic parts (components), advanced basic process and basis for industrial technologies (abbreviation: Four Bases).

[2] This was stated by National Chairman Jinping Xi in May, 2014, when he was in Henan Province.

and developed into a new set of factors. Besides academic field, the results is also introduced to industries through speech and training programme in China. Good feedback had been received for its function of efficient diagnose and guideline of design development. There are some successful cases, which followed the models to improve their design capability. Furthermore, the model caught the attentions from government, when they planed to study new design policy of China around 2012. Later. It contributed to the definition of innovation design, which is the domained concept of innovation in *Made in China 2025*, which is released in May 2015 as national strategy of upgrading manufacturing (Liu, 2016).

This research reports certain findings from an extended research of John's. In John's research, he had never closed the door of models to fix it into six categories. His criteria and models were explored through case studies, which were selected purpose samples through questionnaires. In our research, questionnaire is utilized to describe the understanding of design in Chinese manufacturing industry. Our research question is: what is the design awareness in Chinese manufacturing industry? The purpose of this paper is twofold. First, understanding the design awareness and support for design. Second, explore models and factors to describe it.

2. Literature Reviews

2.1 Criteria of managing design in Chinese manufacturing industry

As an extension of John's research, the questionnaire keep main questions designed by John in his research of managing design in Chinese manufacturing industry (Heskett, *et al.*, 2012). Through reviewing literatures related to design management, main topics of managing design is proposed as a frame of design management content, which is divided into three levels (Borja de Mozota, 2003). Questions are developed from the interface between strategic and functional levels. The topics include strategy of business (business type and brand), company competitiveness, investment in design, design resources (outsourcing design, internal design and mixed), as well as new product development. This frame is utilized in our research to support designing questions.

2.2 Design awareness

Design awareness has been defined as a critical factor for design capability of a business organization (Dickson, 1995; Jevnaker, 2000; Best, *et al.*,2010; Heskett and Liu, 2012; Storvang, *et al.* ,2014). To better understanding product design skills in small, high-growth firms, Peter Dickson (1995) conducted a survey of CEOs of Inc. 100 and Inc. 500. In the final reported 16 factors, design awareness is listed in the category of innovation skills. Jevnaker (2000) indicated that with good design awareness, design championing will foster corporate design capability. Heskett and Liu (2010) stated six factors to assess design capability through a mix of quantitative and qualitative research. In it, design awareness is defined as

one critical factors. Two years later, Storvang (2014) developed the factors further, combining it with Design Ladder (DDC, 2003).

At one hand, design awareness is a critical factors for design capability of a firm, on the other hand, it can be raised through assessing design capability. With developed design audit tools and validity through cases, Moultrie (2007) shown design awareness can be raised through assessing design capability. Once design awareness is raised in a firm, it will influence implementation and growth (Bruce, *et al.*, 1999). And the design awareness could be consistently grown via successful projects (Jevnaker, 2000; Manzini, *et al.*, 2011) and design knowledge will be built also based on it (Jevnaker, 2000).

Among all the research, it is Design Management Europe (DME) survey (Best, 2009) introduced five factors for evaluating design awareness into four levels. In our study, the five factors is employed as a frame to understand design awareness (DA). They are: 1) awareness of benefit; 2) planning for design; 3) resources for design; 4) Design management expertise; 5) design management process.

2.3 Support for design

In previous research related to design awareness, the most important role studied is the CEOs (Dickson, 1995; Song, *et al*., 2008; 2010) and their role in design activities, especially in design project and decision making (Beverland, 2005; Zhang and William, 2008; Buganza and Vergant, 2009; Acklin, 2013; Chang, 2015). Their design awareness will directly decide their strategy of design and implementation (Mozota, 2008; Song, *et al.*, 2008; 2010). Song (2010) proposed four influential factors: design awareness, good sense of design, support for design, and involvement in design. Our study utilizes the five categories of support for design (SD): 1) choosing design talents; 2) financial support for design ; (3) allocation design resources; (4) building a design-supportive climate and structure; (5) improving designer conditions.

Table 1. Frame of design awareness and support for design

Design Awareness *(DME, 2009)*		
DA1	Awareness of benefit	To what extent are people in the company aware of the benefits of managing design effectively
DA2	Planning for design	Is design part of business or marketing plans and objectives?
DA3	Resources for design	What level of resources (staff, budgets and means of production or implementation) are allocated to design activity and how?
DA4	Design management expertise	How do evaluation and selection of the best design solution-to satisfy business, market and consumer needs-take place?
DA5	Design management process	What place does design have in the process when something new is developed; when are designers typically involved?
Support for Design *(Song et al., 2010)*		
SD1	Hiring design talents	choosing design advisors, external consultants, and design directors
SD2	Financial support	approving financial systems and cost controls related to design;

SD3	Allocating design resources	allocating appropriate resources (e.g., working spaces and design equipment) to design;
SD4	Building design environment	building a design-supportive climate and structure
SD5	Improving designer conditions	Improving designer conditions.

3. Research Methodology

3.1 Samples

Manufacturers in the Yangtze River Delta and Pearl River Delta are drawn from the membership list of local industrial design associations. These manufacturing enterprises cover a broad range of size and product categories, mainly from four industries, home appliance, consumer product,digital product, instruments and transportation (Table 2). This is because these industries are the domain ones in the two deltas and with long history, which is titled as 'traditional industry.'

250 questionnaires were distributed to manufacturing businesses in the two deltas regions. 173 questionnaires were collected and judged as valid. All the samples matched the following four requirements simultaneously: 1)manufacturing-oriented; 2) employ design for product development; 3) Hire internal designers, or someone in the role as designer, or responsible for managing external design resource; 4) locate in the PRD or in the YRD.

Samples are selected to represent diverse firms, in term of size, history and business type (Table 2). Half of the samples are small-size business, while middle and big size is with similar number. Ceoncing business type, OEM and ODM firms is same, occupying 15 percent, while around 70 percent firms claim as original brand management (OBM). Among them, 8 percent firms mixed their business types. They may operate with OBM, meanwhile has ODM or OEM business. This is because they start up with OEM and develop to OBM later. Since their manufacturing capacity can maintain a steady cash flow for the business, they prefer to keep it to decrease the risk of launching own brand and offer sufficient financial support.

The history of the firms shows typical economic booms in China economy. More than 70 percent of firms are established after 1994, which is the starting point of second stage Open Policy, marked by Deng Xiaoping's Southern Tour Speech. Other 20 percent firms are set up in the first stage of Open Policy, in 1980s.

Table 2. Descriptive information of sampled firms

	No. of firms	% of sample
History of the firm		
Before 1979	17	10.2%
1980-1994	34	19.6%

1995-2004	101	58.2%
2005-Present	21	12.1%
Industrial sector		
consumer product	57	32.9%
home appliance	17	9.8%
digital product	14	8.1%
instruments	68	39.3%
transportation	17	9.8%
Firm size (No. of staff)		
Small (<300)	87	50.3%
Medium (300~1000)	41	23.7%
Large (>1000)	55	26%
Business type		
OEM	25	14.5%
ODM	25	14.5%
OBM	109	63%
OBM+others	14	8.1%

3.2 questionnaire

In this study, the questions are based on John's research (2010) with an emphasize on attitude toward design, which includes design awareness and support for design. The questionnaire consists of four parts, background of the firms, business performance, design awareness and support for design. Concerning the background, size, business type, history and industrial sector is designed for a brief description of the samples. In the performance part, factors about markets, ownership of brand, annual production and annual sales revenue are listed in questionnaire. Factors about design awareness are adopted from Design Management Europe's study of Design Management Staircase (DME,2009). Factors about support for design are borrowed from Song's study about CEO's influence on corporate design management activities (Song, *et al.*, 2010).

However, in DME's research, the five factors are assessed according to interviewees subjective answers. We prefer to transform it into objective questions and test the ideas with pilot study. Meanwhile, Song (2010) introduced five factors of support for design, but had not developed explicit questions about it. To solve the problem, we reviewed literatures of related topics and developed questions for pilot study. In the pilot study, interviewees showed their interested in objective questions, instead of subjective ones. They think these are easier to answer and contribute to reliable result, which they are interested in. The final questions are redesigned combining all these consideration (Table 3).

Table 3. Redesigned questions in questionnaire

Area	Questions in questionnaire	No. Of item	Origins
Background (4)	Date of establishment.	-	
	Number of employees.	3	
	Division & plant	3	
	Product category	5	
Business performance (6)	Business type	4	
	Core competence	5	
	Net annual production (quantity) of products.	5	
	Net annual sales revenue.	5	
	Ownership of brand	2	
	Market	3	
Design awareness (5)	Design awareness	2	DA1. Awareness of benefit
	Design plan	2	DA2 Planning for design
	Developed annually product by design.	5	DA3 Resources for design
	Design expertise needed	3	DA4. Design management expertise
	When design in a process	3	DA5. Design management process
Support for design (6)	External design	2	SD1 hiring design talents
	Annual expenditure in design	5	SD2 financial support
	Design dept	2	SD3 allocating design resources
	D Investment in a process.	6	
	Decision maker	-	SD4 building design environment
	goals for the internal design facilities?	2	SD5 improving design conditions

3.3 Settings

According to the report of the World Bank, the leading role of the PRD in Chinese economy and business can be demonstrated by the following fact: the PRD economic region accounts for 34% of China"s exports and 24% of China"s foreign direct investment (FDI), mostly contributed by SMEs (including those invested from Hong Kong). The region is a vital part of global production networks across the Pacific. The PRD also takes a leading role in developing design. The first design firm in China is established there. The provincial of Guangdong government has realized the importance of design and manages to develop it in various ways. They have established Shunde Industrial Design Distinct and a China original product design award: Cottontree prize. Furthermore, Shenzhen has even been awarded the

title of City of Design by the United National Educational, Scientific and Cultural Organization (UNESCO) in 2008.

Although the YRD only covers an area of 109,961 sq.km which is about 1% of China's total land area, its GDP reached RMB 7,179 billion in 2009, which was 21.4% of the whole China economy. The YRD is an important economic powerhouse of the Chinese mainland, with Shanghai as China's financial and logistics centre, and Zhejiang and Jiangsu as increasingly important manufacturing regions. The YRD's total population stood at 92.2 million at the end of 2006, accounting for 7% of China's total. At present, there are more than 100 design firms in the YRD. Since 2007, the World Industrial Design Fair (WIDF) was held in Ningbo every year. And the Wuxi (National) Industrial Design Park is established. As the leading city in the YRD, the Shanghai Creative Industry Centre (SCIC) had been set up in 2004 to promote the development of creative industry. It is responsible for organizing Shanghai International Creative Industry Week every year. With its endeavour, numbers of creative industry clustering parks have been formed.

3.4 Data collection

The process of collecting data is divided into two stages: survey and interview. Local design associations prepare a list of membership and potential samples. After discussion, the final list of 250 firms are selected. Questionnaire are distributed to the PRD and the YRD by them via email. Questionnaires were sent out via email. Telephone interview was utilized to clarify certain answers and further understanding of certain confused results.

4. Results

4.1 Business performance

The firms have developed solid manufacturing basis, producing a large number of products every year and achieving sales revenue around 100 RMB per unit (Table 4). Around half firms produce product more than 1 million units annually and annual sales revenue is over 100 million RMB.

Majority firms claim that they have established their own brands. However, there is a 5 percent gap between firms with own brand and firm with OBM business. These firms state established own brands, while they do not operate OBM business. We try to explore the reasons for this via telephone interview. They consider registered trademark or even logo of firm as brand. This is a misunderstanding of brand concepts.

Concerning markets performance, around 70 percent firms have developed oversea markets and more than 20 percent only focus on exported markets. This is the evidence of Made in China known as manufacturing base of the world and producing about 80% of the world’s air-conditioners, 70% of its mobile phones and 60% of its shoes (The Economist, 2015).

Table 4. Business performance of sampled firms

	No. of firms	% of sample
Annual production		
missed	9	5.2%
<100,000	37	21.4%
100,000-300,000	19	11.0%
300,000-600,000	12	6.9%
600,000-1,000,000	14	8.1%
>1,000,000	82	47.4%
Annual sales revenue (Million RMB)		
<10	24	13.9%
10-30	23	13.3%
30-60	23	13.3%
60-100	25	14.5%
>100	78	45.1%
Brand		
Established own brand	132	76.3%
No brand	41	23.7%
Markets		
Domestic: China	55	31.8%
Global: China &oversea	79	45.7%
Oversea	39	22.5%

4.2 Design awareness

Five questions of assessing design awareness in DMS is employed in our questionnaire. In it, there is an independent question about whether they have the awareness of benefit contributed by design (DA1). However, all the firms gave confirmed answer and stated they had clear awareness about design. Although their design performance varies, they seems eager to show their confidence about design and motivation for developing design from their answer. Another possible explanation is the interviewees of the firms are shame of showing no or little awareness of design, especially most of them are CEO. This is quite same in plan for expanding design capacity (DA2). Nearly 80% of firm gave positive answer (Table 5).

According to feedback from pilot study, the factor of annual products developed by design replaces the question about resource for design (DA3). This is because the new question is easy to answer with explicit number and is a critical factor to demonstrate the resource allocation for design. Developing new products is the main function of design in a firm. There are two opposite directions of design used in all enterprises, extremely limited utilization

and sufficient utilization. In the first direction, design is only employed in 10–20 percent of annul products, while it is used in more than 60 percent of products in the second direction. The two directions define design status and its role in a business. In the first direction, design plays a supplementary role in product development. It is seldom applied to products annually and usually with a limited investment in the whole product development process. In the second opposite direction, design is used frequently with high investment. In this regard, design usually has high status and takes a leading role.

Based on feedback from pilot study, design expertise needed in the coming three years is utilized to show the design management expertise (DA4). More than 60 percent of firms have planned to expand the scale of the current design team; 50 percent prefer to hire 1–5 designers in the near future. Compared with 70 percent of firms which have plans for internal design facilities, this shows that not all firms will improving design capability via expanding scale.

When design is involved in a typical new product development process is utilized to understand design management process (DA5). In around 40 percent firms, design is involved upstream of a product development process. This demonstrates a high status of design. In nearly 50 percent firms, design is involved midstream. This implies its contribution for product development as styling offering, instead of planning strategy.

Reviewing the results of five questions for design awareness, a distinguished answer between subjective and objective questions is shown. For subjective questions, such as design awareness (DA1) and design plan (DA2), no evidence needed to support the answer, the interviewees managed to demonstrate high design awareness through the answers. For the objective questions, such as annual product developed by design (DA3), designer needed (DA4) and when design in a process (DA5), concrete evidence is required. And the results show backward design awareness.

Table 5. Design awareness

	No. of firms	% of sample
DA2. Plan for design		
With plan	134	77.5%
No plan	39	22.5%
DA3. Annual products developed by design		
No answer	6	3.5%
5~10%: ;	54	31.2%
10~20%	32	18.5%
20~40%	39	22.5%
40~60%	17	9.8%
>60%	25	14.5%
DA4. Design expertise needed		

No need	65	37.6%
1~5	85	49.1%
5~10	14	8.1%
>10	9	5.2%
DA5. When design involved in process		
No answer	4	2.3%
up-stream	69	39.9%
mid-stream	85	49.1%
down-stream	10	8.7%.

4.3 Support for design

Questions for understanding the top managers' attitude and actions of supporting design are developed based on Song's research (2010). It have been adjusted according to comments from pilot study too.

External design service (SD1) is popularly utilized in 70 percent firms. Most of them hire external designers not only for fresh ideas, but also to accumulate good design knowledge and experience of design management. These small businesses usually lack investment and experience. They prefer to rely completely on external design resource to fulfill all the design work. Annual expenditure on design is limited (SD2) . More than 40 percent firms spend less than 500,000RMB annually, while nearly 80 percent allocate less than 2,000,000 RMB per year (Table 6).

Nearly 90 percent firms have established their internal design department (SD3). However, its location in a organization structure varies from independent functional department to a sub-function in R&D, Marketing or Engineering department.

CEO is reported as the final decision maker of design in 65 percent firms, while only 10 percent firms leave design to make decision (SD4). This implies the status and influence of design in the firms is still weak.

Nearly 70 percent firms state they will keep developing internal design facilities (SD5). However, comparing with 80 percent firms planing to expand their design capacity, a 10 percent gap is shown. It is highlighted later in the interviews. In practice, the means of expanding design capacity can vary from internal design facilities to equipment investment. Some enterprises emphasize investment in physical products or facilities, while others prefer intangible knowledge and experience, which leads to difficult definition of an explicit goal.

Overall, a positive attitude toward design is shown from the results of questionnaire. Majority of the firms have established their internal design team, had ever hiring external design for learning-by-collaborating and set up goals for the internal design facilities. However, their investment in design shows conservative attitude. Annual investment in

design is lower than 2 million RMB in around 80 percent firms, while design expense is lower than 20 percent of a project cost in 70 percent firms. This implies that the function of design is understood by the firms and they would like to develop related resources. However, the profit contributed by design is unknown. As a result, the firms are cautious of cost input of design.

Table 6. Support for design

	No. of firms	% of sample
SD1. Hiring external design		
Yes	121	69.9%
No	52	30.1%
SD2. Annual expenditure in design (Million RMB)		
No answer	3	1.7%
<0.5	74	42.8%
0.5~2	62	35.8%
2~5	22	12.7%
5~10	6	3.5%
>10	6	3.5%
SD3a. Establishment of design department		
Yes	149	86.1%
No	24	13.9%
SD3b. Investment of design in a NPD process		
No answer	5	2.9%
<5%	34	19.7%
5~10%	52	30.1%
10~20%	37	21.4%
20~40%	28	16.2%
40~60%	12	6.9%
>60%	5	2.9%
SD4. Decision maker		
CEO	113	65.3%
Design director or design team	16	9.2%
Other managers	44	25.5%
SD5. Goals for the internal design facilities?		
Yes	119	68.8%
No	54	31.2%

5. Discussion

5.1 Design awareness

In John's research, design awareness is reported as an independent factor, which consists of two dimensions, top manager and whole firm (2012). This is summarized from the interviews of CEOs. Top manager means only top managers understand the importance of design, while middle-level managers and staffs may do not understand. This is explained further in our research. All the top managers are eager to show their good design awareness, while their implementation is backward. This implies that their design awareness maybe not good as their statement and the real awareness may be shown by their implementation.

5.2 Support for design

This is only one factor in John's research related to support for design, which is the establishment of internal design department (2012). This has been involved in our study. With additional questions, support for design in the firms is explored further. The firms emphasize it on resource allocation and development, such as expertise, facilities and organizations. This show an positive attitude toward design development. However, coming to the financial support, the firms are conservative. This may be because of their understanding of design. From the interview, we know the firms think design is important, because it had begun a common sense in the industries. They learned it from fierce market competition. However, in most of the firms, design is still viewed as part of cost input, instead of value added or creation. This can explain two models in John's research, design follower and styling-focused. Both view design as a component of product.

5.3 Research possibilities

Transform the research language into new context is the difficulty we meet in this study. Chinese manufacturers lack knowledge of design and can not understand the questions very well. This is our finding in pilot study. They prefer questions with scale or order, with which they can answer easily. So HOW TO adopt existing frame into new context could be a research opportunity. It could be related to linguistics, history, cross culture and education.

In the previous studies, a positive loop among design awareness, design capability and support for design is proposed. This study just focuses on the design awareness and support for design and emphasizes on describing the performance, instead of explore cause-linkage. A study of WHAT IS their linkage and relationship among them could contribute to built a model of it and will be an efficient guideline for developing design capability.

6. Conclusion

Based on John's research of managing design in Chinese manufacturing industry, we studied design awareness and support for design for further understanding design in the context and explain John's models. Basic understanding of design and its importance has been

established in the manufacturers. However, they still lack understanding value of design and design is viewed as a cost, instead of increased profit in most cases. Overall, they have the basic understanding of design, while lack good design awareness. Their support for design also illustrates similar results. Firms endeavor to develop or allocate design resources for efficient work, but limited in investment in design. This can be explained by their cost-view of design. In the future, study the relationship between design awareness, support for design and design capability is urgent and important. With it, CEOs could transform their awareness of design as value creation from brief understanding as styling.

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