MANAGING DESIGN IN CHINESE MANUFACTURING INDUSTRY

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2011

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A thesis submitted in partial fulfilment

of the requirements for the

Degree of Doctor of Philosophy

May 2010

Certificate of Originality

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________________________________ (Signed)

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Abstract

Since the term of design management emerged in the 1960s in Britain and Japan, the basic knowledge body of it has been established based on numerous studies. However, with its broad and vague scope, there is not a confirmed definition of it. At present, the three-levels theory of design management content, which was defined by Borja de Mozota in 1998, usually is utilized as research frame in this new discipline.

The approach to design management also varies in different countries, because of their different history of design, utilization of design in industries, development of design consultancies, evolution of design education, and content of design management. In the UK, with the longest history of modern design, design management tends to be an independent function related to management. It lacks linkage with the practice of industries, however, and is limited to academic studies. In the U.S.A., design has been integrated into industries from its beginning. Based on it, design management emerges as a part of management profession. In Japan, supported by the government, design was utilized in its rapid-growth economy after WWII. It is viewed as an important element of Japanese innovation management, which contributes to the 'Japanese Miracle.' These various approaches also lead to diverse definitions and understanding of design management.

In China, design management emerged based on its own background. The concepts of modern design were not really introduced into China until the Open Policy in 1978. After that, it has developed rapidly accompanying with the rapid-growth economy in the last thirty years. However, a gap between design theories and practice in industries has become evident. On one hand, its design theory is mainly borrowed from foreign countries without relating to local

conditions. On the other hand, it seems that Chinese companies have developed their own ways of managing design in their practice. In addition, though theories of design management were introduced into China in 2000, it still has the same problem as design: a gap between Chinese local practice and conditions.

In this instance, it is necessary to understand design management practice in Chinese companies and find solutions for bridging this gap through researching practice of managing design in Chinese companies. These reflect the two objectives of this study: to describe the basic situation of design management in Chinese manufacturing industry; and to explore the ways of managing design in Chinese manufacture-based companies.

This study conducted a combined research approach, in which qualitative research took dominate place. In the first stage, to understand design development in companies, hard and reliable data had been collected and analyzed through a quantitative approach: a survey. As a result, 117 valid questionnaires were received from companies in the Pearl River Delta (PRD) and Yangzte River Delta (YRD). At a second stage, to explore characteristics of design management in Chinese companies, rich and deep data was achieved through a qualitative approach. Twelve companies were selected based on the results of analyzing questionnaires. The characteristics of design management in China were obtained through comparing the cases with the criteria. This finally led to six models and the recognition of Chinese approach to design management.

As a research initiative, this study contributes to the knowledge of design management in China in multiple aspects. An overview of managing design in Chinese companies is obtained, based on solid data from the survey of Chinese companies in the PRD and the YRD. The in-depth description of each interviewed company is organized into cases studies, which are the materials both for education and for establishing a framework of Chinese design management. With

12 cases and six models, practitioners of design management can learn practical experience and ways of managing design. In this instance, this study contributes to the practice, academic basis and education of design management in China by offering first-hand information and systemic understanding for Chinese and overseas researchers, as well as practitioners and educators of design management.

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Acknowledgements

I would like to thank my respected supervisor-in-chief, Prof. John Heskett from the School of Design, the Hong Kong Polytechnic University. He opened a door to the research through a lot of long and inspiring discussions throughout the process. Another contributor to the process has been my co-supervisor Professor Lorraine Justice who is the Head of the School of Design, the Hong Kong Polytechnic University.

The research would not have been possible without the support of the research studentship-funding scheme and help from staff members of the School of Design, the Hong Kong Polytechnic University. I want to especially express thanks to Ms. Gail Taylor.

In terms of research projects in the YRD and PRD, there are many collaborators I would like to thank: Prof. Huiming Tong (Head of Design School, Guangzhou Academy of Fine Arts) and the research team members; Prof Yajun Li (Head of Meachical Engineering Institute, Nanjing University of Science & Technology) and the staff members. I owe several people grateful thanks for conversations about design management at conferences.

I want to extend my thanks to the 'samples' I have interviewed, especially managers of the twelve companies in my case studies. They are: Mr. Qunqi Ma, General Manager of BREO; Mr. Yongjun Xie, Vice General Manager of Canbo Group; Ms. Jie He and Mr. Liang Hu, Design Leaders of Media Microwave; Mr. Xin Pan, Planning Manager of Vatti; Mr. Yuan Yao, Design Director of TCL Multimedia; Mr. Pan Ni, Design Director of Hisense Kelon; Mr. Rong Wang, General Manager of Hiaward; Mr. Yipeng Pan, Vice General Manager of Ruyi; Mr. Liren Wang and Mr. Liping Hu, Vice General Manager and Design Director of

Heng Feng Group; Mr. Dehong Zheng, Design Manager of Genvana Group; Mr. Jiaxiong Gong, General Manager of Ted Golf; Mr. Xuqing Sun, General Manager of Muyang Group.

Last but not least, I would like to thank my family members, Xuegang Pei and Owen, for their uninterrupted and selfless support.

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Part I

Overview

Chapter 1.

Introduction

Chinese enterprises should recruit more talents and hone their research and development capabilities in order to facilitate the transition from "made in China" to "created in China,"

Hu Jingtao, Chinese President, 2009

1.1 Research Problem Identification

1.1.1 Motivation for research

Like many other forms of practice, design originated in the crafts that evolved over the ten thousand years since human life became based on settlement and agriculture, rather than nomadism and hunting. The pattern in most parts of the world was for crafts to be learned by experience, by doing in imitation of what a master practiced. The forms that resulted were collectively representative of the traditions and culture of a social group.

At a relatively early stage in human evolution as a settled being, two characteristics emerged as a response to the need for greater quantities of material goods: ripple machinery began to evolve, such as the potteries wheel, and standardized products were repetitively produced by hand methods. In early China, in the Shang Dynasty, in American culture in Mesopotamia and in early dynastic Egypt, the growth in quantity by multiplying existing hand methods was widely practiced – all of this occurring around 2,500 years ago or more.

Craft work remained relatively unchanged, both on the level of personal work and manufacturing until the 1500s in Europe. Some of the more complex areas of craftwork, such as building of major structures and also ship-construction, began to evolve as independent areas of practice as architecture and naval-architecture. The scale and complexity of work required a basic body of codified and structured knowledge, rather than subjective, tacit experience. By the mid-1700s in major Europe countries, these two areas of practice had evolved new methods and techniques of designing major buildings and naval vessels that established them as professions, rather than inheritors of craft "mysteries" who learned by trial and error.

Design as a whole, however, did not go through the process of professionalisation

– instead, it remained enclosed in craft traditions. Even when the Industrial Revolution began, there were many areas of design embedded in industry that found great difficulties in specifying design for manufacture, a task that eventually was taken over by a group known as draughtsmen workers specializing in translating aesthetic concepts into manufacturable reality.

By the late nineteenth-century in Europe and the U.S.A., there emerged two problems that had not been satisfactorily solved in manufacturing: one was a shortage of designers' capable of working in manufacturing industry; the other was a lack of managers' capable of integrating design into manufacturing processes. An early indication of how these two needs could be met was the design work of Christopher Dresser in the UK, and the management of design in a major German company by Peter Behrens. Christopher Dresser not only is the first independent industrial designer in Britain, who started his design work in 1860s covering a wide scope of products, but also is a contributor to the Anglo-Japanese. Peter Behrens was the member of Deutscher Werkbund (German Work Federation) and an architect and designer of wide experience in industry. As artistic consultant in AEG since 1907, he designed the whole corporate identity system for the company.

On a broader scale, with the emergence of modernism in the early decades of the twentieth century, the power of human beings to create, improve, and reshape their environment was enhanced, with the aid of scientific knowledge, technology and practical experimentation. Based on the requirements of industrialization and consumer industries, these activities pushed the development of design in practice.

With the popularization of design practice, government began to introduce concepts of good design to improve the standard of production. The British played a leading role in this period, with the establishment of the Society of Industrial Arts (SIA) in 1930, the National Register of Industrial Designers, and the

Government Council for Art and Industry in 1934. In America, during the Great Depression from 1929 to 1933, the National Recovery Administration set minimum prices, wages and competitive conditions in all industries. This created the opportunity of introducing industrial design as a powerful weapon for competition. Professional industrial designers emerged in the U.S. during this period.

Based on increased professional design practice, design policies developed to a strong position after Second World War. The main event was the establishment of the Council of Industrial Design (CoID) in United Kingdom in 1944, which was founded by Hugh Dalton, President of the Board of Trade in the Wartime Government. The Design Council became the spokesman and practicer on design policies and influenced the institutions related to design in other countries, especially in the west.

The trend to integrate design with management emerged with the development of design policies and design practices. In 1951, the First Aspen Design Conference brought together business and design in America. In 1956, Eliot Noyes was appointed as design director for IBM. Increasing practice of design in business produced new questions. How to integrate design into process management? How designers can be involved into management, since a good designer may not be a good manager. These practices and questions led to the term of design management, which emerged in the mid-1960s. The Royal Society of Arts (RSA) introduced the term 'design management' for first time in the UK in 1965. The first R.S.A. Presidential Awards for Design Management was established in the next year. In the same year, Michael Farr published the book *Design Management*. From then on, the practice of design developed into a broader field, covering design implementation, design management and design policy.

Western and Eastern countries demonstrated different approaches to design management. The UK and America represent the Western approach, which also includes Europe and other English-speaking countries, such as Canada, Australia and New Zealand. With the establishment of the Design Management Institute (DMI) in the U.S.A. in 1975, Annual design management conferences were held in Western countries since 1976. They brought design management to an academic path, especially in English-speaking countries. Scholars, including Peter Gorb, Mark Oakley, Brigitte Borja de Mozota, Mike Press, Rachel Cooper, Kathryn Best and Margaret Bruce, published major books of design management in the 1990s. This pushed the theoretical development of design management and became the basis for the Western approach to design management.

In Eastern countries, Japan developed design management into a more practical approach than in the west. After Second World War, the Japanese adopted modern management and technology from America and Europe in the 1950s. Design was gradually involved into Japanese management, which is famous for KAIZEN: incremental innovation. Based on it, the Japan Management Association (JMA) published the book *Design Management* in 1965. The book first announced the term "設計管理 (Design Management)" in Japan, in the same year that British created this term in English. In 1969, Japan Industrial Design Promotion Organization (JIDPO) was founded. It not only was responsible for international exchange through the medium of design and the practical implementation of policies, also involved into design practice of companies and society. Its main activities include two occasions of a "Design Year" campaign, sponsorship for the "Good Design Awards" (the so-called "G-Mark"), publication of the quarterly magazine *Design News*, and training designers for companies. In this instance, design policies, design organizations and design implementation are integrated into one entity. All these activities serve the practice of management. This influenced the opinions of top managers in Japanese private companies. They initially utilized design as a way to control quality and cost in process management and formulated the Japanese approach to design management, in which "design management seeks to include design as a general part of process management in Japan" (John Heskett, Interview, September 5, 2008).

The Japanese approach influenced the development of design management in Korea and Taiwan. They copied it by developing design management inside process management, and establishing government agencies to promote the development of design practice. Established in 1970, the Korean Institute of Design Promotion (KIDP) was responsible for the Good Design 'GD' awards from 1985. Three Five-Year plans for constructing design capability from 1997 and the year of the Asian Financial Crisis were other major initiatives. Its vision is now focused on the improvement of design industry. In Taiwan, the China Productivity Centre (CPC) was established in 1955. They invited designers and professionals from America and Japan to lecture on design in Taiwan during the 1960s, and directly guided product design in companies. To promote design practice in companies and industries, Taiwan also established the GD-Mark Award and sent their awarded designs to compete in Japan's G-Mark.

Though China is an Asian country, its approach to design management is different from the above two approaches because of its unique development path in economy and culture. Since the mid-nineteenth century, China had suffered invasive wars. Before that, it was still an agricultural nation. Up until 1949, with the establishment of People's Republic of China (PRC), there were limited industries in the country. Though the new government managed to develop modern industries in the next sixteen years, the development was totally disrupted by the Great Proletarian Cultural Revolution since 1965. The real period of progress only began from Deng Xiaoping's *Reform and Opening-up* policy in 1978. After that, industrial design was introduced into China during the early stage of the 1980s by teachers who studied in Japan and Germany. But the development was limited to design education and the academic field during the next decade. It was not until the end of the 1990s that Chinese companies gradually recognized the function of design and attempted to apply it for good styling.

Design was not considered as a powerful competitive weapon until China joined the WTO at the end of 2002. Design management became gradually known by Chinese scholars after 2005, based on published translations from Japan and other Western countries. Now, as one of the fastest developing countries, China still does not have its own design policy, design standards, and design-related government department. Faced with fierce competition in local and global markets, more and more Chinese companies have performed excellently in competing through design. People all over the world have been shocked by the Chinese power of creativity, organization and implementation for the 2008 Beijing Olympic Games, especially the opening and closing ceremonies. Do these achievements imply that design management had been utilized in China? If the answer is yes, what is its content since the Chinese approach to design management will definitely differ from Japan and the Western countries? These are the initial questions, which led to this study.

Furthermore, a particular feature of Chinese development is the manner in which industrial design has been the foundation of design management. However, at the same time, Chinese design management also inherits problems from industrial design, most evident in the gap between theories and practice of design management. The reason for that is the juxtaposition of design management theories originating from the Western world, while practice is all derived from Chinese local experience. In this instance, to bridge the gap, there is an urgent demand for research and study of design management practice in China in order to evolve a body of data and knowledge that reflects Chinese experience and needs. This research aims to explore the practice of design management in Chinese companies, based on first-hand information collected by survey and interviews. As a result, an overview of managing design in Chinese companies is illustrated, related to its macro background.

1.1.2 Research questions

Concerning the issues of design management, the major question is:

- *What is the situation of design management in Chinese companies?*

This question emerged from the gap discovered from examining related literature. Though design management as a discipline has developed for over more than forty years, it is still viewed as an under-developed and under-researched discipline (Freeze, 1992; Potter, 1992). There is no existing body of literature or theoretical framework of design management in the world. Its situation in China is also laggard. There is still a gap about research into design management in China, although it is the fastest developing country, both in design and economy in the worldwide.

Based on the initial question, the first research question addressed by this study is:

- *How is design managed in the practice of Chinese manufacturing industry?*

This is the main content of this study, which can be viewed at three levels: strategy, function and operation. At the strategic level, recognition of design and the role of design in a company are involved. The functional level refers to how the design function in a company should be organized. At the operational level, utilization of design in a project is its main content. With findings in the three levels, an overall understanding of design management in Chinese companies can be obtained. Furthermore, its characteristics and models can be demonstrated based on analysis of data, which leads to another research question of this thesis:

- *Concerning the practice of design management in Chinese manufacturing companies, how does the Chinese approach compare to other countries? What are the similarities and differences?*

The approach to design management implies the evolution paths of its recognition and development. It also influences the content of design management. With an understanding of the Chinese approach and the comparison with others, the theory and practice of design management in China can be developed in an appropriate way referencing practical conditions. Chinese manufacturers can also define their positions efficiently.

1.2 Purpose of the Study

The purpose of this research is twofold: description and exploration, which can contribute to the practice and theoretical framework of design management in China.

It is through description that the 'fact' of a particular situation and event are established. A combined approach was employed in this study, primarily aiming at description to solve *what*, then going on to examine *why* the observed patterns exist and what they imply (Babbie, 2002). According to this approach, the situation of design management in Chinese companies was first described to fill gaps in design management research and its practice development in China, as well as to constitute the 'fact' of this topic. The results were sorted as case studies to explicitly describe the situation of design management in Chinese manufacturers. Furthermore, the knowledge structure of design management in China was constructed, based upon it.

Since this is the first study of design management in Chinese manufacturing industry, there are many uncertainties in its scope and the results cannot be well-estimated. This leads to the second purpose, exploration, which is special suitable for examining a new interest or when the subject of study itself is relatively new (Babbie, 2002). Based on comparison of the key issues in cases, the common ground and differences of companies were explored, which were analyzed and reported as characteristics and models of managing design in Chinese manufacturing industry. Compared to the different approaches in Britain, America, Japan and China, a preliminary approach to design management in China was obtained.

1.3 Significance

As an initial research, this study contributes to an understanding and knowledge of design management in China in multiple aspects, based on a large scale survey and case studies. An overview of design management in Chinese companies has been obtained with the solid data from the survey of Chinese companies in Pearl River Delta (PRD) and Yangtze River Delta (YRD). The in-depth description of each interviewed company has been organized in cases studies, which are the materials both for education and for establishing the knowledge framework of design management in China.

This study contributes to the understanding of design management in four aspects: practice, academy, education and policy. For practice, manufacturers can understand the whole situation of design management based on the characteristics and approach to design management in China. With it, they can locate themselves and plan strategies more efficiently. In addition, top management can plan their ways of managing design according to the models reported in this study. With various cases, they can also learn experience from other companies in developing design capacity. Design managers can directly manage, organize and develop internal design, based on the models. Designers can realize their roles and responsibility in a company. With these, they can precisely define their career objectives.

For academy, this study collected first-hand information from 117 companies and an in-depth illustration of twelve cases. These form a database of managing design in Chinese manufacturers. It fills the gap in research on this subject. Based on the quantity and quality data, the study also provides various opportunities for further study. The results constitute a basis for developing the knowledge body of design management in China and bridging the gap between its theories and practice.

For education, this study submits real cases for design management education, which are considered as the most useful materials with an insider's perspective of the practical operation and typical situation of design management in Chinese companies. It not only can be utilized as teaching material by teachers, but also is a practical guideline for design students and graduated designers to plan their professional directions.

For government, the findings can help them understand the models of Chinese manufacturers in upgrading their business through design and innovation. Based on it, agencies of government can organize design activities and support the development efficiently, instead of superficial work, which brings complaints from practitioners.

1.4 **Thesis Structure**

This thesis is divided into four parts. Its structure is shown in figure 1.1. The first part consists of Chapter One, which gives an overview of the thesis. Research questions are identified based on description of motivation for research. The purpose and significance of the study are introduced to demonstrate contributions to the research field of design management.

The second part discusses related literature and research methods of design management. This part consists of four chapters. Chapter Two reviews the main concepts related to design management. It starts from a discussion of definitions of design management. Since there is not a confirmed definition, the three-level theory of design management content was utilized as main framework of this study.

Approaches to design in the UK, America and Japan are set out in Chapter Three. As leading countries of design development, the three countries demonstrate different approaches to design management, based on their evolutionary paths of industrial design, policies of governments, management profession, design education, internal design, design consultancies, emergence of design management and its content.

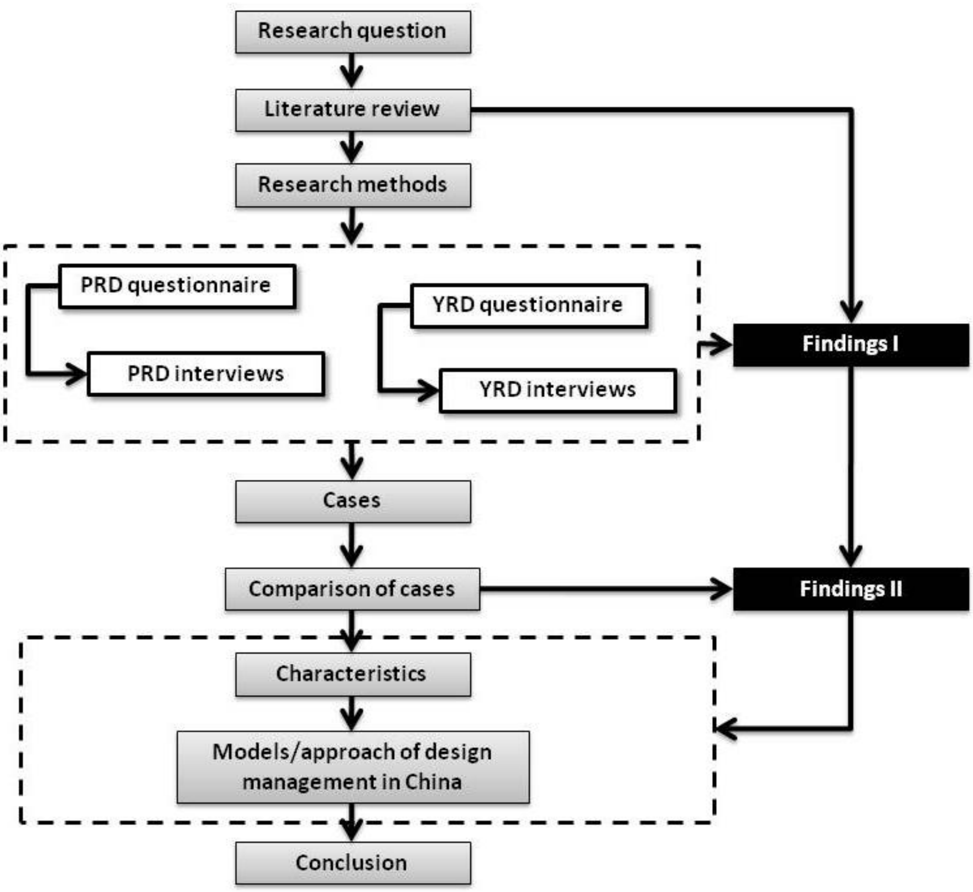

Figure 1.1: Structure of the thesis

In Chapter Four, design development and design management in China are discussed. They are mainly contributed by the academic field and are not widely connected to practical conditions. The emergence of design management in China is also reviewed based on design development. It is considered in terms of combining design theories with Chinese practice. In addition, problems of design development in China are revealed.

Chapter Five explains the process and reasons for selecting a combined research approach in this thesis, based on reviewing previous studies of design management. In it, qualitative research takes the dominate place. Quantitative data is first collected and analyzed as a basis for qualitative study. To collect information from multiple resources, triangulation is utilized as a research strategy. The case study is the main research method used to illustrate and analyze qualitative data. In addition, settings and samples of the study are introduced. And the process of data collection is also identified.

The third part reports the findings and discussions of the thesis, which is structured into three chapters. The sixth chapter states the first part of findings in this thesis, which is the result of data analysis of questionnaires. Following the introduction, its second section offers description of basic situation of design in practice of Chinese manufacturers, based on frequency analysis of questionnaire answers. The third section shows the characteristics of design development in practice, according to the cross-tabulation of questions analyzed through SPSS, a computer program for statistic analysis.

Chapter Seven consists of twelve cases. It first introduces the selection of the cases, which is based on the results of the last chapter. Then a brief description of each case is offered in the second part. The main body of the chapter is the description of the twelve cases according to the three-level design management content.

Findings II is reported in Chapter Eight, which involves the characteristics of managing design based on comparative case study, an overview of managing design, models and approach to design management in China. After a brief introduction, the findings from comparing cases are proposed as 26 characteristics in the second section, according to the criteria of evaluating design management. Based on it, an overview of managing design in Chinese manufacturing industry has been proposed in the third section. In the fourth section, the ways of managing and developing design in the twelve cases are sorted into six models, which not only represent a different recognition of design, but also show two ways of developing design capacity according to the practical conditions of the companies. Finally, the approach to design management in China is proposed based on previous findings and literature reviews in this thesis. Compared to approaches of other three countries, the distinct features of the approach are also stated.

The fourth part is also the final chapter of the thesis, which concludes the study by summarizing the main findings and results. It states the contributions of this research and recommends the possibility of further research in the area of design management.

Appendix A. Design Management Education in the Western Countries lists degrees of certificate, BA, MA and MBA relating to design management offered by main Western countries, such as UK, U.S.A., France, Spain, Netherlands, Germany, New Zealand, Switzerland and Canada.

Appendix B. Previous Studies of Design Management shows research methods and research approaches utilized in previous 40 studies about design management. All these studies are main publications of design management. Their authors have clearly defined their research methods.

Appendix C. Companies in the Survey lists all the 117 companies as survey samples in the YRD and PRD. Among them, 43 companies are from the PRD, while 74 samples are in the YRD.

Appendix D. Questionnaire shows the questions asked in the survey.

Appendix E. Interview Questions lists questions asked to the companies during interviews.

Appendix F. Crosstabulation of Questions shows process of calculating relations among questions of questionnaires.

Appendix G. Criteria for Evaluating Design Management defines the criteria covered by questionnaires and interviews in knowledge tree of design management.

Appendix H. Comparison of Cases demonstrates the detail informations of comparing performance of the 12 cases based on criteria of companies' facts and three levels of design management.

Part II

Literature Review
and
Research Methods

Chapter 2.

Concepts of Design Management

2.1 Introduction

Terms related to design management in this study are reviewed in this chapter, which consists of two parts: definitions of design management and three-level theory of design management content. Other terms used in comparing cases as criteria are reviewed in Appendix G.

As a new discipline, there is as yet no confirmed, generally accepted, definition of design management. To understand some basic concepts, definitions of design management in different development stages are reviewed in the first part. In the second part, the three-level theory of design management content is introduced, which has been accepted by most scholars as a way to study design management. It also defines the scope and basis for this study. Based on it, some key criteria have been selected to conduct survey and compare cases.

2.2 Definitions of Design Management

Design management is a subject combining design with management to study how design can be managed and utilized in projects, in an organization or in a nation. This issue is independent from other management content because of the nature and characters of design. The different cognitive structure between design and management is another reason for the emergence of design management: to study the controversy and to bridge the gap (Borja de Mozota, 1998).

Concerning the origin of design management, there are two main opinions: one emphasizes that it first emerged in Great Britain in the 1960s; the second thinks that design management initially emerged in Japan in the 1950s. The former is accepted by most scholars of design management, especially in English-speaking countries. In Japan, the term ‘design management’ was defined in 1957, based on a research project conducted by the Japan Management Association (JMA). It was widely recognized by Japanese companies as they set up design sections in the late 1950s onward.

Whatever the opinion about its origins, design management has experienced some fifty-years of development, and its content has kept changing during the process, especially in recent years. There has been accelerated progress in the last twenty years as a response to intensive business competitiveness. In the process, the content of design management has changed and evolved. A problem, however, is that researchers, both from design and business backgrounds, cannot agree on a definition of this young discipline. This will therefore require an initial consideration of the concepts of design management through introducing various definitions of it, in order to understand its evolutionary path.

The meaning of design management has continually shifted since it was first introduced in Britain in the 1960s. At that time, it referred to managing relations between a design agency and its clients (Farr, 1966). Later, it was expanded to the design policy of a company (Smith, 1977). In the 1980s, the content of design management came to focus on management issues related to design in a company. Topalian (1980) emphasized organizational management and project management. Willcock (1981) pinpointed the combination of design and marketing. In the U.S.A., Lawrence (1981) positioned the context of design management in the interaction and understanding between design and non-design function aspects of a company.

Since the 1980s, an increasing number of researchers with design or business backgrounds have been engaged in developing theories and the practice of design management. This resulted in the content of the term changing dramatically. The definition of design management was developed to a broader scope in the 1990s when Gorb (1990) extended its definition from design operations to organizational management and finally to the design policy. Similar opinion was expressed by Blaich (1993) in terms of combining design activities with the long-term objectives of a company. Hollins (2002) considered design management in design processes. Ahopelto (2002) described three aspects: the management of designing and planning; standardizing the language of management and design; and using the management of design in order to apply innovation and creativity in products. Borja de Mozota (2003) wrote of combining design with management relationship and the problem of integrating design into the corporate environment. Concerning the diverse outcomes of design, Best (2006) indicated that management of design projects was only one part of design management.

In Japan, the definition of design management was slightly varied according to the different stage of design development. In the first book on design management in Japan, Kawahara and Tadayuki (1965) defined it as the planning, organization and implementation of strategy for business operations in design departments. It disclosed that from the very beginning, design management in Japan focused on the management issues in design departments. On the early 1980s, Yasuo Kuroki, former head of Sony Design Centre, confirmed the concept of design management as dynamism integrating all effective factors of design in design sections (Bayley, 1982).

By the 1990s, with many restructured design departments in companies, design management was considered as efficient methods to control the whole system of design (Minohara, 1990; Harada, 1993). Design was viewed as a service to management (Evans, 1990). Designers in industry were expected to have management and planning ability as specialists of product planning rather than the specialists of forms (Tada, 1991). Furthermore, design education was required to train students for management functions, such as product strategy, product planning, merchandising planning and building up of corporation identity (CI), visual identity (VI) and product identity (PI). The methodology of design management was also considered necessary for the curriculum (Hayashi, 1991). However, the concept of design management has not changed from the original one. Kiro (1994) expressed design management as a method of upgrading the efficiency of design department.

Entering the 2000s, design management in Japan is considered to be responsible for an expanded and broader role than previously. Hirano (2006) states that design management plays its role as an "across the board" solution. It can not only help the Japanese government to visualize, establish, and realize its goals, but also supports a myriad of small business and craftsman. The main definitions of design management emerging both in the West and Japan are listed in Table 2.1.

Table 2.1: The definitions of design management

Note: the grey parts represent definitions from Japan

Author	Content of Design Management
Kawahara and Tadayuki (1965)	Design management is the planning, organization and implementation of strategy for the business operations of design departments.
Farr (1966)	Design management is the function of defining a design problem, finding the most suitable designer, and making it possible for him to solve it on time and within an agreed budget.
Smith (1978)	Emphasizes the need for concern by companies about moral, social, and ethical issues.
Topalian (1980)	Top management to formulate policy, take decisions about setting of design standards, and organize design activities. Second, the management of individual projects as well as routine administration and control.
Willcock (1981)	The matching of design talent with marketing opportunities.
Lawrence (1981)	Our definition of design management is now two-fold. First it relates to the management, organisation, structure and funding of a design group whether it is a design consultancy or a section within a company. It covers the nuts and bolts of how it is managed, what people are paid, who does what work, where people fit within the company and how the work is funded. The second and equally important part of the definition relates to non-design executives and their understanding of design, the communication between the design function and the rest of the company.
Kuroki (1982)	Designers should not be artists. Industrial designers, in particular, should be the creators who understand fully all the facilities available for them within the company. They should be market creators who can make new products by combining social trends and the inner factors of their own corporation. The dynamism which organizes all these factors effectively is what I call 'design management'."
CNAA (1984)	Refers to the international management of design organizations, nor simply to

	the management of design projects in manufacturing organizations.
Ughanwa and Baker (1989)	The effective control, review and monitoring of new products by managers, as well as the efficient and timely application of techniques by which a product/process can be improved upon in order to achieve international competitiveness.
Gorb (1990a)	Design management is not the process of managing a design consultancy or practice… Design management is the effective deployment by line managers of design resources available to an organization in the pursuance of its corporate objectives.
Blaich (1993)	The implementation of design as a formal program of activity within a corporation by communicating the relevance of design to long-term corporate goals and coordinating design resources as all levels of corporate activity to achieve the objectives of the corporation
Kiro (1994)	Design management achieves the efficiency of design department through systematic arrangement of business in design section, and management with systematization and institutionalization.
Hollins (2002)	The organization of the process for developing new products and services.
Ahopelto (2002)	Design management can be seen as management of designing and planning, and also as standardizing the language of management and design. Design management can also be described as being management of design in order to apply innovations and creativity into products.
Borja de Mozota (2003)	To train partners/managers and designers. This entails familiarizing managers with design and designers with management. To develop methods of integrated design into the corporate environment.
Best (2006)	The outcome of a design can be seen in the products, services, interiors, buildings and software process that we come into contact with daily. The management of these design projects is only one aspect of design management.
Hirano (2006)	Design management: an ‘across the board’ solution through the creation of a network between traditional craftsmanship, new technology, and top design.

It was noted earlier that inadequacies in developing design management were caused by its complexity and wide scope. As a result, scholars tended to define design management through describing its content, instead of a confirmed definition. In the next section, the content of design management is introduced, based on the three-level theory of Brigitte Borja de Mozota.

2.3 Three Levels of Design Management

It was not until the end of the 1980s that a description of design management with three-level was gradually established (Heskett, 1989; Walsh, Roy, Bruce and Potter, 1992; Cooper and Press, 1995; Borja de Mozota, 1998). The three levels are: operational design management – managing a design project; functional design management – managing the design function; strategic design management – managing the design vision.

It was John Heskett (1989) who primarily discussed the role of design in a company influenced by three levels of management: senior general management, overall management of the design function and project management. Three years later, Walsh, Roy, Bruce and Potter (1992) directly used the three levels to track design management. Furthermore, the title of the three levels was changed to strategy, organization and project design management. However, this recognition had not been developed further until Brigitte Borja de Mozota disclosed the changing nature of design management with the same three levels in 1998. According to it, there were different roles of design at each level. At the operational level, design was usually managed by other activities and was utilized to build a competitive advantage by improving a function, such as engineering, marketing and communications. At the functional level, design was considered as an independent function and coordinating technique to build a competitive advantage by focusing on relations in the value chain. At a strategic level, design is viewed as a board level activity for building competitive advantage by changing the company's vision (Borja de Mozota, 1998).

In 2003, Borja de Mozota formally introduced a three-part design management model in her book, *Design Management: Using Design to Build Brand Value and Corporate Innovation*. The model is based on the study of Patrick Hetzel in the fashion industry in 1993 and validated in her European study of the "33," which, it was proposed, can be applied to any type of business. Borja de Mozota systemically indicated that the three levels of design management not only corresponded to the three decision-making levels of design managers, but also coincided with the three levels of value creation through design.

Table 2.2: The three levels of design management

Design ACTION	Design FUNCTION	Design VISION
The differentiating value of design	The coordinating value of design	The transforming value of design
Design is an economic competency that changes the primary activities in the value chain.	Design is a management competency that changes the support activities in the value chain.	Design is core competency that changes the value chain of the sector and the vision of the industry.
"3" brand marketing Production Communication	"3" Structure Technology management Innovation management	"3" Strategy Knowledge management Networking management
Operational design management	**Functional design management**	**Strategic design management**

Source: Borja de Mozota, B. *Design management: using design to build brand value and corporate innovation*. New York: Allworth Press, 2003, pp. 258-9.

Using the three levels, all the topics in the literature related to design management can be listed and organized. Figure 2.1 illustrates the key topics of design management, which have been mentioned in major works of design management. Based on relations among these topics and three levels of design management content, a knowledge tree is formed.

Although there is not a confirmed definition of design management, because of its wide and vague scope, the theory of the three-levels has been admitted as the most appropriate way to understand design management, and the content of the three levels is therefore utilized as the basis for this study. Based on it, criteria for comparing cases are selected according to the scope and content of each level.

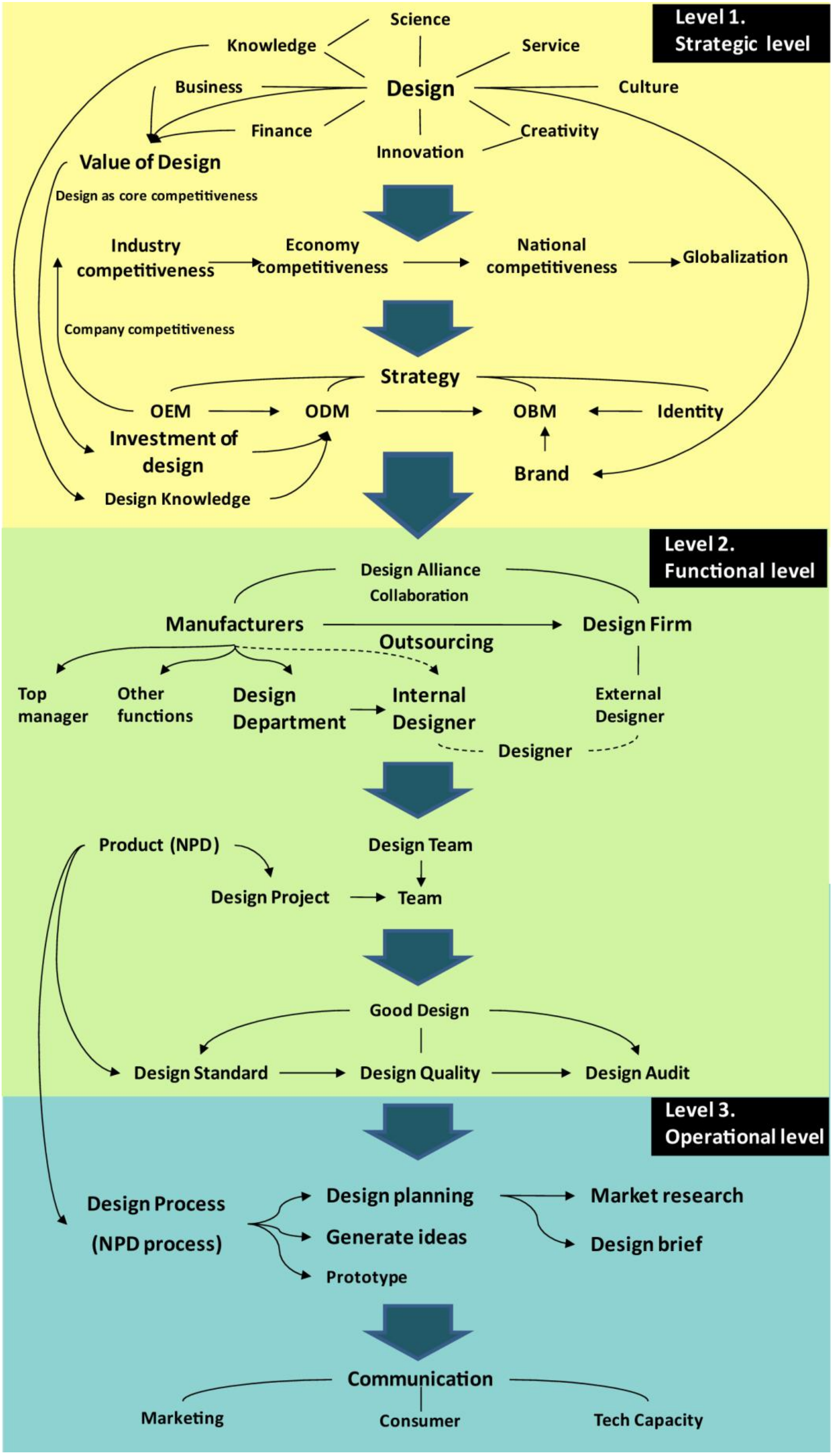

Figure 2.1: Knowledge tree of design management (Designed by Xihui Liu)

2.4 Summary

After its first emergence in the UK and Japan around 1960, design management has developed over the last 50 years with different stages of development, and its meaning also changed in this process. With changed content, meaning and scope, there is still no confirmed definition of design management. As a result, the three-level theory of design management content is utilized as basis for this study, because it is accepted by most scholars and influentially utilized in previous studies relating to design management.

Chapter 3.

Approaches to Design Management

3.1 Introduction

The concept of the three levels of design management does not refer to management in design firms or consultancies, but rather to managing design in a manufacturing context and issues relating to design in a manufacturing company. In short, according to this concept, manufacturing industry is the place where design management happens and exists. This implies that manufacturers, related design issues and their relations or interaction are the key elements of design management research. In practice, these elements can be studied through two aspects: design development and design awareness in a company because these two aspects directly influence design management practice at a company level. In addition, it is also influenced by the macro background, which consists of economic, political and cultural factors. Since the evolution of these background factors varies in different countries, this has resulted in different practices of design management and patterns of recognition of design in companies. In the academic field, this has been evidenced by there being no confirmed definition of design management. The relation between design management practice in companies and its macro background is shown in Figure 3.1.

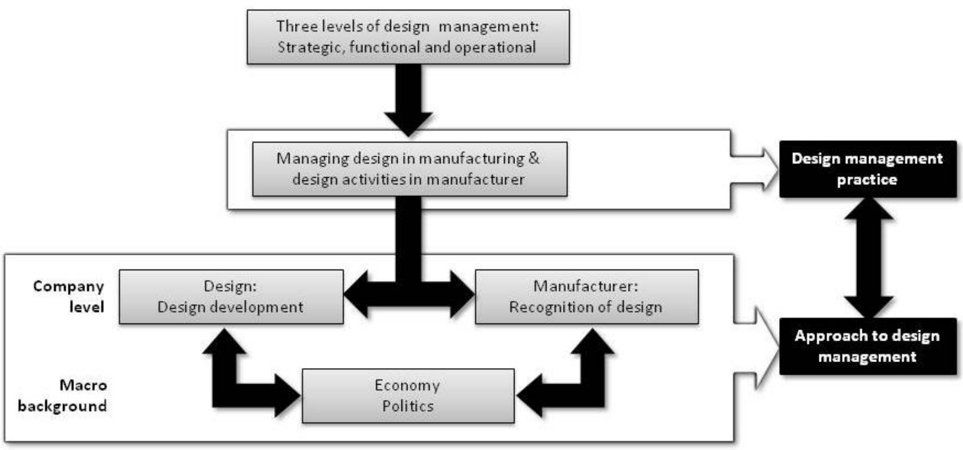

Figure 3.1: Factors of studying design management approach (Designed by Xihui Liu)

In this instance, the factors both at a company level and at macro level should be studied to understand design management practice in different countries, which represent different approaches. In this research, factors of design management in the UK, U.S.A., Japan and China were studied. The other three countries were selected as subjects for literature review because of their leading place in design, design management, technology and economy. The UK and U.S.A. have played a major role in representing a particular approach to economic development, based upon neo-classical economic doctrines, most recently evident in the ideology of the "free market." This advocates the free play of market forces unhindered by any government control or interference.

On contrast, the economic recovery of Japan after The Second World War was actually based upon government intervention, with the Ministry of International Trade and Industry (MITI) playing a leading formative role. This also profoundly influenced the subsequent development of Taiwan and South Korea as economic powerhouses. An overlooked component in the Japanese "economic miracle" was the development of design and, in particular, of design management as integral component of industrial development.

To understand design management in China, the particular factors of the Chinese context have to be studied: it is in comparison with the examples of other countries that the characteristics of Chinese design management will be discerned.

In this chapter, design development and evolution of design management in the three countries are reviewed according to factors at the company level and the macro background. Finally, different approaches to design management are proposed.

3.2 Design Management Development in UK

Although European and American designers are varied in their economic, management, and political backgrounds, they had much to learn from one another. Europeans generally manufactured products in smaller quantities to serve a more homogenous national market. Their products were developed with less dependence upon marketing and consumer studies, with smaller production volumes that could be achieved with simpler tooling and higher labour costs. American products, on the other hand, had to appeal to a diverse consumer base. Therefore, they were more dependent upon marketing analysis and promotional planning and on high-volume production, which demanded more complex tooling and lower labour cost (Pulos, 1988). This led to their different performance of design development.

Among all the European countries, Britain first used the term ‘design management’. Until now, its research into design management is still considered as a major influence in the world, with strong support from government and education. In this section, the evolution of design management in Britain is described, based on a historic review of its national design policy and development of design in consultancy, education and academic research.

3.2.1 Industrialization

As the cradle of Industrial Revolution, Britain had many achievements and kept its technological leadership in the world until the middle of the nineteenth century. By the 1830s, however, it became obvious that design leadership was not necessarily generated by technological advances. This was clearly evident in the proceedings of the British Parliamentary Commission on Art and Industry (Quentin Bell) that issued a report in 1836. In it, industrial design was mentioned as an independent activity for the first time. One of the major findings of the Commission was that despite its technological lead, Britain was unable to compete with the higher design standards of products from foreign countries – the French, in particular, being acknowledged as leaders of taste. In the 1840s, as a result of the commission’s recommendations, design schools were set up, represented by the establishment of the Normal School of Design in 1837 (later renamed the Royal College of Art, RCA in 1896).

It was Henry Cole who was the key figure of advocating the application of art to industry. As he stated, an alliance between fine art and manufacture would promote public taste (Woodham, 1996). His thinking even influenced the British products in 1851 London Exhibition. In it, on one hand, the Crystal Palace indicated that a winning industrial strategy would be to harness what was described as "artistic craftsmanship" for the design of manufactured products. The exhibition was praised for 'the great principle of division of labour' and 'the stimulus of competition and capital' by Prince Albert (Sparke, 1978). On the other hand, British products were not based on mass-production by mechanical techniques, because its method of production was a craft-based one with moulds made and products finished by hand (Conway, 1977). Owen Jones critized the Exhibition, which proved that Britain was far behind its European neighbours, was plunged in 'chaos and disorder in art', and British manufactures were incredibly stupid because they had not realized the value of design offered by artists (Woodham, 1996).

The London Exhibition is considered as a turning point, from which Britain began to lose its technological leadership, to be eventually surpassed by the United States with its American System and by Germany. As Hazel Conway (1977, p36) stated:

> Mass-production by mechanical techniques means that the operator is not required to exercise judgment in the use of his machine, nor is he required to be skilled in the use of tools, and the items produced, whether of metal or of wood or whatever, have standardized dimensions and are interchangeable with any other part produced by the identical production process. The Americans' lead in this area became apparent in Britain for the

first time at the Great Exhibition of 1851.

Another dominant opinion was represented by William Morris, who, as a leader of the 19th-century English Arts and Crafts Movement, advocated the combination of art and craft with an anti-industry attitude. He proposed that industrial crafts could be revived as a collaborative enterprise of designers and craftsmen. Later, he extended his opinion to found a crafts-based school of design and "production" that was anti-industry. In fact, Morris's opinion resulted in not only a separation from industry, but also a separation between design and art, which was shown in education. As a design school, RCA maintained its name as an 'art' school, instead of 'design' school from 1896 to now.

After the severe Great Depression of 1873-1896, which had followed fifteen years of great economic instability, British technological leadership since the Industrial Revolution was gradually lost. Meanwhile, other industrializing nations, such as the United States and Germany, were more receptive to the desires of prospective overseas investment and began industrializing at a rapid rate, especially after the Queen Victoria's death in 1901. The losses and destruction of World War I, the depression in the 1930s, and decades of relatively slow growth eroded the United Kingdom's pre-eminent international position of the previous century.

Although the British economy was not growing as fast as other major European powers and gradually lost its colonial markets, professional design emerged slowly but continuously, especial the consultant design profession (Sparke, 1990).

The professionalisation of industrial design began in Britain, with the establishment of the register system of industrial designer in 1937 (He, 1991). However, its design lagged during the 1920s to the 1930s, because Britain focused on definition and theories of design, instead of practice (Wang, 1995). The period from the 1950s to the 1970s saw the emerging practice of the design profession, which began to develop its structure and working methods and gradually became an influential force (Jackson, 2009). There are two resources for the progress. One is the endeavour to promote design by the British government through national polices and promotion organizations; another is the practice of design consultancy.

3.2.2 The role of British government: managing design in national level

The British Government played an active role in providing support for design and innovation policies (Walsh, *et al*, 1992). They usually promoted design in industries and the public arena by national design policy and design (management) research projects, through its various agencies. Among them, the Design Council (former the Council of Industrial Design, CoID) played an essential role in connecting design practice with national policy.

The Design Council was established in 1944 by Hugh Dalton, President of the Board of Trade in the wartime Government. Its objective was "to promote by all practicable means the improvement of design in the products of British industry (Russell, 1968, p230)". In its formative years the Design Council was seen as an important propagandist in Britain's post-Second World War efforts to penetrate overseas markets with well-designed goods. To promote good design among manufacturers and consumers, it organized a series of exhibitions, lectures and conferences, including the *Britain Can Make It* (BCMI) exhibition of 1946, 'Design Weeks' around Britain, *Design* magazine launched in 1949, the Festival of Britain in 1951, the establishment of the Design Centre in 1956, and the Design Centre Award Scheme in 1957 (Black, 1974).

In terms of practical implementation, the Second World War, which broke out in September 1939, provided the conditions for a major design initiative known as the Utility Programme. Heavy air-raids by German bombs on British cities destroyed many homes with their contents, and timber stocks were also badly reduced due to incendiary bomb attacks. A shortage of furniture led to profiteering and the government determined to prevent exploitation of this kind which created poor morale among the population.

The outcomes were complete government control of furniture materials, production, distribution and sales. Under the direction of Gordon Russell, a prominent furniture designer, a complete range of standardized furniture was designed and produced to be available to those in need. It was only in time of war that this sweeping control was possible, but it did demonstrate that design could satisfy the needs of people in an appropriate way in time of crisis in a cost-effective and efficient manner.

The Design Council was in its structure a typical British solution, in that it was financed by government but not controlled in detail by it. The role of the Council was intended to be a bridge between government and practice, but in fact, it remained an outside force to both. The Design Council kept an embarrassing position, since it could never be involved in practice, no matter whether of defining policy, design education, or design management. This finally led to negative comments on its achievements. As G. H. McEwan, a member of the furniture trade, reported:

> Manufacturers were suspicious of the Council of Industrial Design, whom they considered well-intentioned people devoid of reality….
>
> The Council was out of touch with popular taste and did not realize that the modernistic exhibits of 'British Can Make It' could not sell (Woodham, 1986, p58).

3.2.3 Design consultancy

As another resource of professional design development, design consultancy was in fact the main context of design activities and design management practice. It was in the 1930s that British efforts to develop design consultancy along American lines emerged (Sparke, 1986). During that time, there were numbers of books to introduce American design consciousness, including John Gloag's *The Missing Technician in Industrial Production* in 1944 and *Industrial Art Explained* in 1946; Harold van Doren *Art and Industry* in 1944; and F. A. Mercer's paper to the RSA, *The Industrial Design Consultant*, in 1947. In the 1940s, the early British consultant designers emerged to provide a necessary alternative to the traditional system of in-house designers. Later, a mature generation of design companies appeared from two directions in the 1950s. One was from the RCA, influenced by Scandinavia, which transformed the concept of designer-craftsman to an emphasis on modern design companies. Another was new American-inspired design offices focusing on international service. From the 1970s, new design companies came out with greater specialization, which usually broke down into groups within large organizations (Spark, 1986).

In these design consultancies, management issues were gradually involved in their business development. The relationship between design and management in practice became divided into two stages: first, the management of different functions, project management and financial management; second, management of expanded business. In the early stages, design consultancies were usually founded by designers or partners, who were professionals in design or related principles. They lacked the experience and knowledge to run a business. To solve the business and management problems during their development, many design consultancies employed management consultants or marketing professionals. This led to the original combination of design and management in practice.

The second stage was from the 1980s, influenced by a transformation of business type and globalization. Going public led to a series of mergers and transformations in the practice of design consultancies. There are many challenges faced by an expanding design consultancy, such as how design should be managed as a resource both in design business and outside, and how to transform design from one-off jobbing activities to become part of a corporate system (Sparke, 1986). These problems finally led to the boom of design management research. Faced with these challenges, the design consultancies modified their structure and management through employing professionals (Linton, 1988).

It is the practice and study of managing design consultancies that directly contributed to the emergence of design management in Britain. In 1960, Dorothy Goslett published the first version of her influential book *Professional Practice for Designers,* which explicitly introduced professional practice and design administration to professional designers both in consultancy and as freelancers. In the academic field, it is the book *Design Management,* written by Michael Farr in 1966, that represents the emergence of the term ‘design management’ formally. In fact, its context is based on Farr’s personal consultant experience and focuses on summarizing communication between design consultancy and its clients. Furthermore, due to his work in Pentagram, Peter Gorb published *Living by Design* in 1978 and established the first design management class for MBA students at the London Business School (LBS) in the UK.

3.2.4 Design in industries

Concerning design practice in industry, the earliest person who contributed to industrial design and design-management in UK was Frank Pick. Based on his long-term promotion of industrial design, he became the president of the Design and Industries Association (DIA) in 1928, and Chairman of the Council for Art and Industry in 1934 – a forerunner of the Design Council. Nevertheless, his major contribution was the redesign of the London transportation system, which in the 1930s reached a height of excellence in a strongly unified system. This work was outstanding, but it should be noted that it was a transport system, a public service, that he managed, not a manufacturing company.

After the Second World War, with enlarged marketing, sales and distribution systems emerging, European and American companies began to expand into large international organizations. Resources for industrial production became highly uncertain (Hawk, 1990). Since 1950, the UK has consistently lost market shares both within the UK itself, where imports have been taking an increasing share of the home market, and in world markets. Corfield (1979) indicated that it was because the British were not doing well enough in what they attempted, and this was a problem of design and technology. In another words, a lack of emphasis on design led to lower product quality, which directly resulted in decreased quantity of export products.

However, beyond Pick's contribution at London Transport, it was not until the mid 1950s, that a few of the larger companies began to employ 'stylists' or designers in Britain (Olins, 1986). Although design as a profession had developed into an independent industry to a certain extent at that time, designers were still at low status. The companies preferred to rely on large advertising agencies for all kinds of creative and marketing service. Until the early 1960s, there were a few Britain enterprises employing designers on a massive scale.

Concerning this situation, scholars suggested that the move to better design must be export-led, and a general improvement in communication between the design profession and industry was needed. The establishment of the Design Management Unit at LBS was considered as the kind of positive initiative required.

Meanwhile, government played an active role in promoting the utilization of design in manufacturers. In 1982, a Funded Consultancy Scheme was founded by the Design Council. It offered companies having 30-1000 workers the use of a design consultant free for two-weeks and a further similar period at half-price. This was closely attuned to the thinking of Margaret Thatcher's Conservative government, and soon became the order of the day.

However, from its beginning, based on various studies, British manufacturers were analyzed and criticized as lacking awareness of design value, which resulted in the poor performance of industries and the economy in international markets. The Fielden Committee (1963) stated that in British manufacturers, design was separated from management. In 1977, the Carter Report indicated that many UK industries lacked awareness of the benefits designers can bring. In addition, British managers were critized as lacking recognition of the design potential, which led to poor industrial and economic performance (CNAA, 1984; Oakley, 1984; Ughanwa *et. al.*, 1989). And in many enterprises, design was only viewed as a ‘facelift’ or styling a product (Lorenz, 1984). According to Olin’s study (1986), in most cases, a lack of managing design resulted in product failure. Furthermore, though design had been employed in some British industries, it had not high status (The Fielden Committee, 1963; SERC Report, 1983), and the relationship of managers and designers was distanced (CNAA, 1984). With practical experience of design and education background combine business and design, Alan Topalian clearly stated the situation: “the UK’s dramatic slide down the league of industrial nations is a clear indication that the neglect of design is detrimental to profitability (Topalian, 1985, p81).”

3.2.5 Design management

The emergence of design management

The emergence and development of design management in UK has been shaped by two impetuses. One is from design consultancies as a profession in the practical field. Another is the education and research of design management in academic contexts, which, in most cases, are supported by the British government.

In the UK, the term “Design Management” officially entered the vocabulary in 1965, with the first Presidential Awards for Design Management, which was bestowed by Britain's Royal Society of Arts in conjunction with the Design Council. The awards defined design management as a cohesive approach to corporate design activities, one that contributes to the total quality of a company as perceived by its customers, employees, and others (Chung, 1998). One year later, in 1966, Michael Farr published the first book, *Design Management*. As a design consultant, he focused on good communication between the design agency and its clients (Borja de Mozota, 2003).

In Britain, both design profession and design management are based on the practice of design consultancies, which started in the 1930s. Comparing with the practice in America, it had slight effect and there was little change of the designers' status at that time (Sparke, 1983). Its real development was in the post-war period. During that time, management issues were gradually involved in business development of design consultancies with their increasing number and size. Management problems were changed from the management of different functions, project management and financial management in the 1970s to the transformation of business type and globalization in the 1980s. With these changes, design management was gradually recognized as an efficient way to bridge the growing gap between design and management in these consultancies.

Design management research: design in industries

Concerning the research direction and its achievements, the majority of studies are focused on design at the macro level, such as national competitiveness and economy, which are funded by governments (Appendix B). Because a lack of attention to design caused the British products' failure in the world markets, the British government paid more attention to design management (Lorenz, 1990). In most cases, these studies were funded by government directly or through its agencies, such as the British Standards Institution, the Engineering Council, the Design Council and the Department of Trade and Industry. Instead of participating in practice, these studies emphasize the importance of design and its management in various entities. Research at the macro level tries to convince government and public to be concerned with design functions, based on analysis of previous performance and comparison with other countries. At the micro level, it emphasizes design as a profitable investment, without an explicit guide of how to apply it.

However, there was criticism that while the influence of design management seemed to be enlarged, it tended to develop into an independent function or a new discipline. Many studies seemed to be theory-oriented, instead of practice-oriented. Bruce indicated that:

> Various studies tend to build a consensus on the importance of design in the innovation process. They consequently isolate design among the other actors of innovation and separate design from management theories, when obviously design is not the only actor that deserves to be credited with the success of an innovation (cited by Borja de Mozota, 2002, p88).

Design management education

There are two types of design management education: in business schools and in polytechnic universities. It was Peter Gorb who first taught design management for MBA students in London Business School (LBS) since 1976. He believed that the work of bridge-building between design and management had to start on the management side (Gorb, 1976; 1992). His work in LBS was so significant that it led to the establishment of Design Management Unit, which became the model for other business schools in the UK. At the RCA, Bruce Archer (1976) emphasized the need for an academic role in design management in order to encourage innovation. Brain Smith (1977) contributed thoughts on establishing a philosophy of design management. Later, the RCA began to emphasize the specific aspects of design project management (Cooper, 1993).

In another approach of design management education in the UK, the teaching of the "management of design" was introduced into post-graduate management courses in a number of public-sector polytechnics (Praag, 1992). On contrast with the education in business schools, academics from engineering, design, and management departments can collaborate on the course development and implementation in these polytechnics (Cooper, 1993). The "Managing Design" was chosen as the course title rather than "Design Management" because managing design was considered as a number of interlinked business functions, instead of a discrete discipline. Their education concentrated on developing broad design awareness among post-graduate management students to nurture a cadre of industrial managers empathic with the role of design, and proud of their ability to use it. The curricula found its way into courses at twenty-nine institutions. Some were encouraged by government, but viewed with hesitancy and anxiety in their institution, diffused the teaching into undergraduate courses of business studies, where they could not be certain of its value (Praag, 1992).

Today, there is a broad curriculum for both post-graduate diplomas and undergraduate degrees in Design Management. Their modular programs are aimed at both designers and managers wanting to develop design-management knowledge and skills (Cooper, 1993). However, there is a declining trend of design management education in business schools. In most cases, master degrees in design management are offered as MA's (Appendix A).

3.2.6 Summary: design management in academy

In Britain, design management originates from the early designers, who worked in design practice as professionals through introducing the concept of good design to government, manufacturers and the public. Their efforts first influenced the recognition of design by government after the Second World War. The establishment of the CoID, exhibitions and design policies released by British government had promoted design. At the same time, professional designers obtained more development opportunities, especial in the form of consultant designer. In Britain, it is the practice of design consultancies that is the primary source for the birth of design management.

Though the term 'design management' first emerged in Britain, its development is limited to academic field with a separation from practice in industries. Since the first Industrial Revolution, Britain maintained a weak industrial structure and relied on its imperial-trade market. During the twentieth century, especially after the Second World War, its manufacturing has been surpassed by Germany, America and other countries. Based on studies supported by the UK government, it was reported that the poor performance of British industry and economy was in part the result of a low status of design in industries and a lack of design awareness among managers of industries. In this instance, after the Second World War, the British government's emphasis on design through the CoID, as well as its design exhibitions and policies were not really successful. However, with declining manufacture, the gap between design and manufacture still existed in practice and even became bigger, compared to the progress of design management as an independent profession.

As a result, the content of design management in Britain mainly consists of two separate parts: practice and theory. The practice part originates from the management of design in design consultancies. The theories are contributed by the academic research, in which researchers endeavour to establish the knowledge body of design management. Since British government plays an active role in design promotion and try to connect practice with research, design management not only concerns the management issues of design project, organization and strategy, but also involves the design policy, and national competitiveness. As John Heskett (Interview, September 5, 2008) states, in the UK, design management seeks to develop a separate category of management related to design. It endeavours to be independent from design and become a sub-category of management.

3.3 Design Management Development in U.S.A.

3.3.1 Protectionism and the American System

Given the current emphasis on “the Free Market” in the U.S., it can appear surprising that protectionism is the macroeconomic background of early industrial development in America. Previously, British trade policy toward the American colonies was mercantilist, positioning the colonial economy as part of a closed and tightly-controlled system. Having achieved independence, however, many Americans advocated protectionist policies similar to those they had earlier condemned (Eckes, 1995). In his "Report on Manufactures" in 1791, Alexander Hamilton, the first U.S. Secretary of the Treasury and the principal advocate of import restrictions, emphasized his proposals on the alleged needs of infant industries (Hamilton, 1957). It claimed that imposing tariffs to help protect newly founded infant industries allowed those domestic industries to grow and to later become self-sufficient within the international economy once they reach a reasonable size. As a basic national policy, it offered a protected market for American manufacturers.

The United States was influenced by the Industrial Revolution in Britain around 1770, which led to the development of industrialization and mechanization (Heskett, 1980). It established a basis for modern manufacturing, and transformed a scattered and erratic system of home manufactories into industries. Meanwhile, there was also a sense of urgency in demands to establish an independent nation. The Americans were eager to confirm their identity. With independence, products were designed with historic features as a model for countless reproductions in the future (Pulos, 1993). The earliest design practice can be traced to this time.

As Heskett (1980) pinpointed, a characteristic approach was taken up in the United States around 1800, and developed on a scale that thoroughly justifies its being called the ‘American system.’ Throughout the 19th century, leading American statesmen, including Senator Henry Clay, continued Hamilton's themes within the Whig Party under the name the "American System", which first began to be recognized by the world as a result of the 1851 London Exhibition.

Although the American products in this exhibition were criticized at first as being severe and even tasteless with little or no ornamental value, the latest improvements in the American system of manufacturing demonstrated that a product designed for machine production could be made substantially less expensively than the best handmade product. This was finally recognized by visitors (Pulos, 1993). Foreign observers were obliged to acknowledge that America’s progress in manufacturing technology would force them to change their own methods. In fact, the design of products for mass-production affected the whole working system, including organization, co-ordination of production, nature of the work-process, marketing methods, and type and form of the goods produced (Heskett, 1980; Pulos, 1993).

In the second half of the nineteenth century, there were series of tremendous changes in manufacturing, society and arts, including Frederick W. Taylor’s studies of Scientific Management, which transformed the life of Americans with mass-produced products, continued its influence into the twentieth century and totally changed the management of manufacturing.

3.3.2 Mass-production

Since the beginning of the twentieth century, the concept of modern mass-production had been emphasized more and more. Because increased competition had compressed their margin of profit, manufacturers were obliged to expand the volume of production to a broader buying public. In this instance, price and improved beauty became two key factors in marketing competition, which evolved together with modern mass-production and industrial design (Pulos, 1993).

Inflexibility of mass-production

The culmination of early mass-production began to appear before World War One in the automobile industry. In 1907, Henry Ford began manufacturing the Model T on the premise that the automobile of the future should be affordable to the masses. The principle of modern mass-production system is: quantity production of a standard design with interchangeable parts, on a moving assembly line, to the pace and nature of which the workers were compelled to adapt (Heskett, 1980). When Henry Ford's production lines became the prototype for other factories producing war materials in the First World War (1914-18), the world began to realize fully the capabilities of mass-production methods (Pulos, 1993).

In America, mass-production became dominant in the 1920s. It contributed to the development of American system in various aspects, including standardization and rationalization, the development of scientific management, and changed the expectations of the American people.

With technological innovation and mass-production which brought former luxury items to people at lower income levels, American people preferred 'buying a living' in the 1920s (Meikle, 2001). To meet market demand, the productive capacity developed in wartime was transformed into consumer production. To align market demand with their production capacity, manufacturers began to focus on variations in product form and packaging (Heskett, 2003). Businessmen were advised to revise their products 'to fit new needs or ideas.' However, it seemed that there was a conflict between the demand and the system of mass manufacturing (Pulos, 1993; Meikle, 2001).

As Heskett has indicated (2002; 2003) the nature of mass-production is inflexible. The system of mass manufacturing is based on a fixed production line and standardized components, which require a large amount of investment. To achieve high market returns based on this inflexible system, products had to be manufactured in large volume with constant flows. Any changes of the line and tooling would increase the cost of the product significantly. There had to be a large market for a large quantity of products and its demand had to be managed efficiently. This logic is indicated by Heskett (2002, p68) '…mass-production required mass consumption and public taste had to be shaped accordingly. The concept of a "consumer society" began to emerge.' It was considered that design was the economic and efficient method to balance the requirement of mass manufacturing system and demand of mass consumption. It was General Motors (GM) which first utilized this logic to guide their planning and management. This can be viewed as the earliest practice of design management in automobile industry with a combination of the practice known as styling and industrial management.

GM: managing design under conditions of mass-production

Facing changes triggered by mass-production, GM developed a new product-policy programme by emphasizing 'the very great importance of styling in selling' in 1921 (Sloan, 1990). Based on it, the management policy of GM was adapted in several aspects, including strategy, organization and operation, according to the three levels of design management content.

In the three levels, design played an important role in enhancing the competitiveness of GM. At strategic level, GM set an explicit aim in the product-policy programme, which stated that 'the future of the corporation and its earning power, depended upon its ability to design and produce cars of maximum utility value in quantity at minimize cost (Sloan, 1990, p64).' Based on this, the annual model change plan was launched. According to it, the company designed changes for new models with novel and attractive styling to create new demand for the new value in the market. However, design was limited by the requirement to keep tooling costs reduced. In this instance, GM clearly stated their strategy as 'styling adapted to mass-production, while engineering and production adapted to styling.' At organizational level, the Art and Colour Section was established by General Motors' president, Alfred P. Sloan, Jr., which had fifty employees with ten designers and was led by Harley T. Earl (Meikle, 2001; Heskett, 2003). From then on, styling rapidly developed in GM. This department was expanded to the Styling Section in 1938 (Heskett, 1980; Vogel, 1996). In 1940, Earl was assigned as vice president of GM. It was the highest managerial position assigned to a designer at that time. At operational level, the management of design also kept developing. In 1935, a product-approval procedure was formed as a system and method, which was revised in 1946. According to it, the entire new-model program included three parts: styling, engineering design, as well as equipment and tooling. And styling was the most important content in the program (Sloan, 1990)

With a similar logic of the annual model change in the product-policy program, a concept of 'planned obsolescence' was proposed by the American consultant designer, Brooks Stevens, in the 1950s. The term was defined by him as inciting the consumer's 'desire to own something a little new, a little better, a little sooner than is necessary (Heskett, 2003, p4).' It was a concept first explored by Christine Frederick and was based on the scientific management techniques of Frederick W. Taylor. Despite the fierce criticism it received, especially from Vance Packard, 'planned obsolescence' became the theme of design in the 1950s (Heskett, 2003). In fact, both GM's product-policy program and Steven's planned obsolescence can be viewed as the earliest practice and concepts of design management under conditions of mass-production.

Professional design in mass-production

It was the First World War that marked a turning point to American design. The American industrial arts, despite the general feeling that they were generations behind those of Europe, began to catch up. The war stimulated an enormous expansion of American productive capacity, which was converted after 1918 into a consumer boom. With the growth of mass-production based on massive capital investment, there was a constant search for means of reducing costs and increasing sales. Standardization and rationalization appeared as an answer. Improved visual form of products became an important instrument to boost sales. However, the Wall Street Crash of 1929 and the Depression created intense competitive pressures among those firms that survived. As a result, there was a further combination of industrial design and manufacture.

From its beginning, industrial design was embedded in American industries. However, its value had not been widely recognized until the Depression. Industrial design was more concerned with making common necessities attractive to the general public during this decade. At that time, encouraged by the successful example of GM, numbers of design departments were established under various titles by other large automobile manufacturers and also other product manufacturers (Heskett, 1980). Meanwhile, professional design consultancies were also employed by diverse companies (Meikle, 2001). Thus American designers began to demonstrate their ability more, from the short-term commitments of manufacturers to design leadership in transforming science and technology for human service (Pulos, 1993). Streamlining emerged at that time as a recovery slogan (Heskett, 1980; Meikle, 2001). In addition, an Index of American Design in the Federal Art Project was established by the American government (from 1935 to 1943) to stimulate the public’s interest in design (Pulos, 1993). Two major design organizations, the American Designers Institute (ADI) and the Society of Industrial Designers (SID), were also founded in the United States in 1938 and 1944.

3.3.3 Internal design: management in organization

After the Depression, both the relation of design and business, and its position in an organizational structure were constantly developed, especially in the content of organizational management. Integration of the design-function into the structure of companies means, however, that designers' achievements cannot be considered in isolation, but have to be understood and evaluated within the framework of the corporate purposes they serve, and the corporate values they express. In many companies, such as IBM, design is linked closely to a large 'Research and Development' department, its role being to give the latter's work a form accessible and acceptable to the public (Heskett, 1980). The recognition of the relation between design and business is expressed by the famous sentence: "Good design is good business" by IBM's president. Thomas J. Watson, Jr. (Watson, 1975; Murrin, 1990).

As a result, according to different scales of business, companies began to use diverse strategies of developing in-house design. Some middle-size companies depended upon outside consultants. Major manufacturers were the most likely to have fully staffed corporate design departments, the heads of which reported to top management and were at the same level as the heads of engineering and marketing. In some companies, the industrial design group operated, in effect, as a company within the company (Pulos, 1988).

3.3.4 Design consultancy: managing design for business

In America, the first generation of professional industrial designers was represented by the 'big four,' Walter Dorwin Teague, Norman Bel Geddes, Henry Dreyfuss and Raymond Loewy in the 1920s. They contributed to the American design consultancy by establishing the first full-fledged industrial design offices with similar methods of operation. Their lives and work provide an index of the origins, purposes, and early accomplishments of industrial design (Heskett, 2003; Meikle, 2001). Their work also contributed to the management of design consultancies including the formation of a basic working procedure of design service and administrative management. For example, in the 1940s, Bel Geddes distinguished his operation of design consultant with office manuals, which combined Taylor's theory of the factory management for efficiency (Meikle, 2001).

3.3.5 Design management as a profession

In the academic field, based on design practice in industries, the Aspen conference in 1950s and the establishment of the DMI in 1975 represented the emergence of design management as a profession.

In practice, some designers, either in corporate and consultant context, began to enter the management level. They were gradually moving up the management ladder to positions where the appearance, the performance, and the dependability of the product were only part of a broad spectrum of concerns that included price planning, programming, line control, and market analysis (Pulos, 1988).

The Aspen conference began to systemically think about design in the content of management in a series of conferences, which included 'Design as a Function of Management' in 1952 and 1953 (Pulos, 1988).

With the establishment of the Design Management Institution in 1975 at the Massachusetts College of Art in Boston in the United States, design management tended to refer to the movement in Europe and the America in the late 1970s (Cooper, 2006). The contribution of DMI includes organizing conferences, seminars, publications and case studies (DMI, 2007; 2009; Walton, 2007).

Design management education

In America, design management education is in accordance with the educational system it belonged to. In business schools, it is initially only part of classes in business schools and focused on marketing courses (McAusland, 1993); Engineering schools emphasize engineering science; Industrial design schools have a strong product focus (Ulrich and Eppinger, 1992; Kefallonitis, 2007).

In addition, there are two types of degree programme in design management, Master of Arts (MA) and Master of Business Administration (MBA) (see Appendix A). In the America, design management education is characterized as a part of MBA class, which demonstrates a tight relation with industries. It was not until the 1970s that design was formally involved in business schools, when it was gradually recognized that today's business students will be tomorrow's business leaders and play a very important role in the design process (Hanks, 1975). Its development is mainly contributed by a series of lectures by Walter Hoving in 1977 (Formosa and Kroeter, 2002); design as curricula in major business schools, such as the Harvard and Kellogg, and design schools, such as Art Centre College of Design, the Institute of Design at IIT, Ohio State and Carnegie Mellon (McAusland, 1993); DMI cases used by MIT and Boston University; as well as industrial design as a part of 'Developing and Managing Technology' program at HBS (Hauptman, 1992).

Furthermore, concerning its framework in education, design management can be divided into two lines in America. The first positions design as a part of the chain of management disciplines required in successful business initiatives. It mainly refers to the MBA programs at Harvard, Stanford, University of Pennsylvania, and University of Texas at Austin. In the second, there is not a framework for understanding or determining the dynamics of successful design, such as in MIT, Carnegie Mellon, and Columbia University (Formosa and Kroeter, 2002).

3.3.6 Summary: design management in industries

Design management in the content of industry is the key characteristic of the American approach to design management (Murrin, 1990). After the War of Independence, protectionism was initially the basis for national policy, which offered solid support and protection for manufacturers. The 'American System' was created based on it. The 1851 London Exhibition was a turning point with new approaches to manufacturing capacity shown to the world as a result of industrialization. In the 1920s, mass-production became dominant. Because its inflexible nature required managing consumer demand and creating mass markets, design was utilized as an efficient method to balance standard production with the requirement of new attractive products in market. Based on the product-policy program launched, an annual product plan was developed and the Styling Section was established in GM. From then on, design was tightly connected with sales and markets in the business of manufacturers. It was the 1930s Depression which directly led to the expansion of industrial design in America and the formal development of industrial design as a profession.

In the America, both in business practice and in academic research, design management is viewed in the context of business and as a part of management in practice. Design management refers to the management of design related issues, including strategy, organization and operation to adding value for business development. Even in education, in most cases, design management is a part of MBA program in business schools. And it is viewed in content of the management profession, instead of an independent discipline.

3.4 Design Management Development in Japan

The emergence of Japanese design management results from the evolution of design in Japan. The whole evolution process of Japanese design can be divided into two brief phases by the Second World War. Before it, Japanese design was influenced by Germany and focused on the options between crafts and new technologies. The second was the major period for the development of modern Japanese design, which not only formulated the basis for design, but also contributed to the emergence of the so-called "Miracle in Japan". Design management emerged at the end of the 1950s and its growth accompanied the expansion of Japanese economy.

3.4.1 Influenced by foreign countries

Design development in Japan was influenced by foreign countries in various ways, such as national policy, oversea study projects, design promotion organization, and foreign consultant.

American policy

After the Second World War, American policy had the greatest influence on economic and design development in Japan. From 1945 to 1951, in the post-war occupation, Japanese industries were limited by America. They were called "Copycat" because they imported American products and imitated them. The U.S. forces occupied Japanese cities and influenced the Japanese people with American life style (Tsuruta, 1990; Ekuan, 1991). As John Heskett (1998) stated, it 'was held in high esteem and was considered as being clean, efficient, and one that afforded comfort and was within the reach of anyone living within a democratic society.'

The Japanese economy did not develop until the America changed its limitation policy into support for growth in 1951. After the outbreak of war in Korea, a powerful Japanese economy became a vital element of American policy, needing to be revived rapidly. On the other hand, Japanese enterprises were enriched by large and valuable orders for military equipment and supplies (Heskett, 1984). It established a foundation for the development of the Japanese economy, which was recognized as a milestone in the development of design.

Oversea study projects

In Japanese modern history, overseas study projects were the main channel to study advanced foreign technology and knowledge, and the majority of them were organized by government. They contributed to the design development of Japan in two aspects: firstly, it introduced the foreign knowledge of design into Japan; secondly, the first generation of Japanese designers was cultivated in this way.

The Iwakura Mission was the first study abroad project, which was launched in 1871, and consisted of about one hundreds officials, translators, technical experts, and students, to set out to learn about European manufacturing techniques and collect examples of European goods (Tsunoda, R., cited from Hiesinger, 1994, p8; Breen, Cobbing, Ohta and Checkland, 1998).

There was also a special project for industrial design from 1955 to 1966, which was instituted by the MITI and administer by the Japan External Trade Organization (JETRO). They sent 82 students to learn four-year undergraduate courses of industrial design in one year from European and American schools. Nevertheless, they learned rapidly and on their returned to Japan they were sent by MITI to introduce design and their overseas experience to businessmen all over Japan (Ekuan, 1991; Heskett, 2004).

Influenced by the overseas study project by MITI, from 1950, there were increasing numbers of oversea design studies, organized either by professional design organizations or by private companies since 1950. For example, Institute of Cultural Affairs (ICA) Japan and the Japan Productivity Centre (JPC) invited Japanese designers to America in 1956 (Hiesinger, 1994).

Consultant

Foreign advisors and consultants are another main way of transferring knowledge in the development of modern Japanese design. According to their contribution, these advisors can be divided into three levels: national, design professional and management.

At the national level, German scholars, such as Dr. Gottfried Wagener and Bruno Taut were invited by Japanese government in the nineteenth century and after World War I. They introduced the ideas of designing and producing consumer goods, referencing practices in the Deutscher Werkbund (Fischer, 1994). With a similar role, American scholars, George Nelson and Freda Diamond were invited in 1957 to review Japanese goods for their suitability as exports (Hiesinger, 1994).

At professional level, Raymond Loewy, Niels Diffrient and Jan Doblin were invited by MITI in the 1950s. The effect of this was so significant that it influenced the development of the consultant-design profession in Japan. In addition, an advisory group was invited from Art Centre School of Los Angeles in 1956. They recommended improving design standards in Japanese products and packaging, encouraged the development of design education, and urged a long-term view in developing markets for new products.

At the level of management, W. Edwards Deming and J. M. Juran were also invited to advise Japanese enterprises. With their theories and practice in Japan through books, *Quality-control Handbook* (1951) and *Sample Design in Business Research* (1960), they contributed to the modern practice of management in the Japanese enterprises which boosted the basis of the 'the art of Japanese management'.

Design education

Modern education in Japan began in 1873. Its system was based on Western models and its aim was to promote the modernization of Japan (Matsumoto, 1991). The evolution of modern design education in Japan was initially modelled on the Bauhaus (Fischer, 1994). Later, together with the influence of the United States, design education was characterized by a blending of traditional art and craft education (Kato, 1991).

3.4.2 Government promotion-national policy

Among the Japanese government's role of contributing design and design management, the government-business linkage is a distinctive and significant one (Heskett, 1984; Evans, 1990). There is a close co-operation of the Zaibatsus with the state (Sparke, 1987). When worked as design consultant in Japan, John Heskett once had been invited to the meeting between government officers and top managers of Japanese enterprises. As he recalled, the meeting was held in an exclusive club with high-standard service. In it, government officers seek advices from top managers of industries about policies (Interview, 16 March, 2010). The links are fundamental elements of the design management success in Japan, because it enabled rapid progress in highly capital-intensive research (Evans, 1990).

Japanese government not only supported economic growth (Herbig, 1995; Kodansha American Inc., 1999), but also contributed to design development in various ways. Aldersey-Williams (1992) pointed out that it is the technology and quality control introduced by the government that made it possible for one industry after another to overtake longer-established competitors aboard and build Japan's export markets. It also sowed the seeds for design to join the armoury of Japanese companies. Powell (1993) contended that the national policy set by MITI, as the essential design policy for Japan, had a profound influence on Japan's society, and their investment in design was impressive, enormous and timely. Hiesinger (1994) gave examples of design laws and policies set by Japanese government, such as the design law in 1921 to require a statement of "originality" in copyright application, the Export Commodities Design Law in 1959 to regulate official registration of design, and the design policy for 1990s. Raizman (2004) also emphasized the contributions of Japanese government through its agencies, such as the MITI, JETRO, JIDPO, and the awarding of prizes, especially the G-Mark.

3.4.3 Design consultancy

The consultant-design profession in Japan was modelled on the practice of American industrial designers (Hiesinger, 1994). According to Sparke's opinion, a profession of industrial design consultants began to form based on the influence of

Loewy's design of Peace cigarette, texts by Henry Dreyfuss and Harold Van Doren translated into Japanese, and support from JIDA (Spark, 1983). However, these outside commentators fail to note the factors influencing the foundation of Japanese consultancies in the 1960s, such as GK Associates and Hirano Associates, based on internal needs rather than outside example.

At the current stage, with the changed business, industrial and market environment of design, Japanese design consultants have developed into three new types: the network system, design-market critics and technology direction (Masuda, 1996). They also formulated their own characteristics, which can be sorted into four points:

(1). A small proportion of design consultancies in Japanese design;

As Aldersey-Williams (1992) stated, five of six Japanese designers worked in-house. Independent practitioners remain a tiny minority.

(2). Integration of external design and internal design;

This is a new trend in the design practice in Japan, since 1990s. Yamada (2003) indicates that since recent young and thirty age freelance designers have strong opinions and developed their own temperament, it is helpful in enhancing creativity and innovation in the companies, if internal designers can collaborate with them.

(3). A long-term relationship with manufacturers in the major key industries;

Heskett (1984) pointed out that Japanese design companies tended to be closely identified with major manufacturers, such as the long-term relationship between GK and Yamaha, and Hirano Design Associates with CKD Corporation. A report from the Japan Industrial Designers' Association (JIDA) (1992) gave a detail description of this relationship. It stated that designers preferred to regularly visit clients once a month.

(4). A limited role;

Sparke (1987) stated that the role of the consultant designers was very restricted in Japan, except for some large-size businesses, such as Kenji

Ekuan in GK. JIDA (1992) introduced the situation clearly that Japanese design consultancies were quite similar to a design section of a company.

3.4.4 Internal design

After the Second World War, the modified industrial structure and national policies improved the recognition of design in Japanese manufacturers. When home appliances were assigned to large-size companies to produce, new foreign technologies were employed to increase the competitive capacity of product. This led the manufacturers gradually recognizing the role of design (Lu and Luo, 1997). On the other hand, the channel between bureaucrats and businessmen to exchanged ideas in Japan cannot be underestimated. It indirectly promoted manufacturers to employ designers at that time (Heskett, 1998).

From the early 1950s, in-house design departments were established in large companies (Sparke, 1987; Lu *et al.*, 1997; Heskett, 1998). However, during this period, most design was still carried by engineers or imitated European design, such as Canon copying German Leica camera and the imitation of the British Mini by Honda (Hiesinger, 1994). Japanese products were marked as ‘cheap, imitative and shoddy’, because Japanese companies were unwilling to employ designers and preferred to emphasize low price (Spark, 1987; Hirano, 1995).

This situation was not changed until the 1960s. At that time, design began to demonstrate its important role of promoting exports (Tsuruta, 1990) and most large firms had established their in-house design division (Lu *et al.*, 1997). Designers started to be involved in the process of market research, consumer research and product planning. As a result, the standard of products and production was improved, and a rational mass-production system was established. Later, in-house design departments expanded in both scale and quantity in the 1970s and the 1980s.

In-house design demonstrated some new directions in its development, including the restructuring, the broadened role and collaboration with outside design. The majority of design departments of Japanese manufacturers were restructured in the late 1990s, because their work was considered too focused on mass-production which led to uniformity and a lack of ground-breaking design. As a result, the restructured design departments introduced a process of open-ended design, which had broadened connection with the consumer. This reorganization of industry's design sectors and the creation of subsidiaries within existing companies are considered remarkable (Davey, 2003).

Managing design

In Japan, the concept of design management is overwhelmingly derived from managing design sections in enterprises. With the new technology learned from America and Europe, these enterprises realized the difficulties of transferring these technologies into products to meet the Japanese consumers' requirement for modern life. Meanwhile, there was a gap between the increasing demand of design and limited number of professional designers.

John Heskett (2004) stated the characteristics of Japanese business using design into six points:

(1). Strong top management support for the design function in major companies;
(2). The integration of designers with engineers and marketers in major companies;
(3). Using off-the-shelf components rather than designing everything new;
(4). A continuous flow of information between manufacturers and suppliers;
(5). Long-term investment in new technology and manufacturing, and the their continuous design development;
(6). Continual investment in design education.

In addition, Heskett (1984) indicated the three characters of Japanese in-house design: the maintenance of the vitality of staff through on-the-job training, workshops, discussions further study and job-rotating; the diverse product design range; an emphasis on research and development, special market research. Sparke (1987) stated that the Japanese in-house designers received no personal credit or international recognition, because the company name was considered much more important than the name of individual designers. Davey (2003) emphasized the strong organizational systems of design department, which gave power to their companies against global competitors. As Nick Butler commented, from the very beginning, design was involved as an integral part of the process of manufacturing. 'In Japan, as in the States, West Germany and Belgium, companies bring in a designer at a very early stage in their thinking. You are involved from the moment they identify a potential point in the market. They won't know yet how to attack it, but they will spend time with you formulating the brief (Butler, 1981. cited in Sparke, 1983, p49).'

3.4.5 Development of design management

In Japan, design management was considered as a key factor of contributing to the Japan success in economy (Hawk, 1990). The content of design management synchronously developed in Japanese companies. It was considered as an advantage for Japanese products, which contributed to their international competitiveness (Kiro, 1994; Liu, Li and Zhou, 2006). The term "design management" was emerging in 1957, when Japan entered the period of rapid economic growth. Differing from other terms in management which have been directly translated into Japanese from English, design management is expressed in Japanese as デザインマネジメント(Design Management) (Kiro, 1994).

In the 1950s, Japan began to acquire technologies from Europe and America, and firms utilized industrial design to produce products matching the requirement of local consumers. This led to a dramatically increasing demands for designers which exceeded the supply even with the large numbers of overseas studies. In this instance, 'design efficiency' was the focus of business management. This contributed to the emergence of design management, which aimed to explore the methods of enhancing the productivity of design departments. To define the content of design management, the JMA launched a research project, consisting of twenty design managers from different companies. From 1958 to 1960, they utilized design management conferences as a platform to discuss (JMA, 2008). As a result, they establish a design library and published the first book of design management in Japan (Kiro, 1994).

The whole evolution of design management in Japan can be divided into four stages.

(1.) Stage one (1957-1966): the emergence of design management

As the first stage of design management, its work focused on two aspects: definition of design management and standardizations of design business. Since the concepts of design management were proposed in 1957, business consultants took it seriously. It was JMA who organized a series of conferences to create the term "design management", in reference to the management of design departments. According to them, design management refers to planning strategy, systematization and controlling the implementation of business in design department.

(2) Stage two (1967-1976): the enrichment of design management

There are two aspects of the development of Japanese design during this period. One was the growth of industrial design both in domestic and international platforms. Another was its increasing contribution to the growth of the economy. The International Council of Societies of Industrial Design (ICSID) International Conference held in Kyoto in 1973 was a milestone of design in Japan. It indicated that Japanese design was accepted and recognized by the international professional field (Harada, 1993; Yoshioka, 1993).

Meanwhile, in Japanese companies, the importance of innovative product and design development was gradually realized. Design and technology management came into the content of culture, economy, and strategy. This was a hitherto unique phenomenon in Japan's design and economic history (Bangert, 2007). As a result, the effect of design in promoting exports was admitted; designers started to be involved in the process of marketing research, consumer research and further to product planning; in-house industrial design sectors were rapidly reinforced (Tsuruta, 1990). All these broadened the practice and content of design management.

With diversified demands at that time, a theme of design management in this period was the research about design methods for efficient design and management. The major methods were group technology (GT) and computer aided design (CAD), which were employed to solve the contradiction between diversity and standardization of products. They offered the basis for high-speed economic development with limited human resource and efficient documentation.

(3.) Stage three (1977-1986): the deployment of design management

Japanese industrial design entered its mature phase in the early 1980s. To cope with market segmentation and the diversification of consumer needs, market strategy began to focus on design. Industrial designers and marketing personals had intensively collaborated on development process from conceptualization to advertisement of a product (Tsuruta, 1990). The issue of design in this period had transformed into added value by design. Meanwhile, there was a global energy crisis at that time. To survive, Japanese enterprises emphasized enhancing product quality, decreasing production-cost and low-cost sales. 'Design efficiency' became an influential topic.

The key issues of design management at that period were: how to operate a company in the low-growth economy, and how to cope with the relationship between different functions. With the second generation of variety reduction program (VRP) and CAD, the standards of design management and the predictability of professionals were established in this period (Kiro, 1994; Liu, 2003). Later, with the enhancement of human resources and the consciousness of productivity in design departments, the R&D departments in companies began to study design management (Kiro, 1994).

(4.) Stage four (1987-present): the development of design management

Design in this period achieved distinct effects in two areas: design and national life. In the area of design, 1989 was the Japan Design Year. The ICSID’89 Nagoya conference and the plan for new targets of design for the 1990s were completed in the year (JIDA, 1990; Yoshioka, 1993). In the area of national life, the "Bubble Economy" in 1992 sent deep shocks throughout Japanese society. The annual expansion rate in design services of nearly 9% prior to 1992 collapsed, with serious cut-backs and some design consultancies going bankrupt (Heskett, 2004).

However, with the new trends of the global economy, information design, and the high added-value of products, the content of design management was extended to a broader scope in this period (Liu, 2003). Its content consisted of product development, organization management and globalization (Kiro, 1994).

3.4.6 Summary: design management as part of process management

Concerning the evolution of design management in Japan, the Japanese government was the original motivator. It promoted design through its agencies in different historic stages, such as IAI, MITI and JETRO, as well as design policies, including overseas study projects and invitation of foreign designers or experts. It contributed the emergence of professional design both in manufacturers and design offices. To guide the direction, the Good Design Award was established. Together with the development of design education and the utilization of design research, especially market research, design management in Japan first emerged in manufacturing. This also determined the content of design management in Japan, which is different from other countries. As Heskett (Interview, September 5, 2008) stated, design management in Japan has been from its beginning, and still is, a part of the process of management.

3.5 Approaches to Design Management

The main information of design management in the UK, U.S.A. and Japan is listed in Table 3.1 and Figure 3.2. Table 3.1 demonstrates the practice of design management through criteria in company level and the macro-background. At the company level, to describe design development and manufacturer's recognition of design, criteria of design origin, early design practice, design organization, internal and external design were involved. For the macro background, criteria of design education and industry were listed. Figure 3.2 shows the main events in the economy, technology, design and politics based on a timeline. According to these, different approaches to design management in the three countries are revealed.

Table 3.1: Design management practice in countries

	UK	U.S.A.	Japan
Origin of design	1836 British Parliamentary Paper (Art and Industry)	Inflexible mass-production	German consultants in the 19th century, referencing practice of Deutscher Werkbund; Raymond Loewy.
Early practice of design	DIA in 1914 Design consultancy and freelancer	GM product-policy program; Raymond Loewy.	Mainly by internal design
Design organization	Design Council(1944) DIA (1938) SIAD (1944)	ADI SID DMI	JETRO JIDPO
The role of government	Influenced by design promoters Endeavour in introducing 'good design' to public; Promote utilization of design in industry;	Index of American Design in Federal Art Project	National policy; Initiatively introduced design to practice of enterprises; Oversea study project; Employ foreign consultant.
Internal design	Company lacks design awareness Design without high status.	Product-policy program in 1921; design departments established in the Depress; Design function integrated in organization structure.	Design management refers to managing design section; internal design department established after WWII.

Design consultancy	A large number of design consultancy; Studies of managing design consultancy led to the emergence of design management.	Represented by the 'big four,' the 1st generation design consultancy emerged in the 1920s.	Modelled on U.S.A.; Small number; Integrate with internal design with long-term relation.
Industry	Poor performance of export industry; Manufacturing was surpassed by U.S.A. and Germany after WWII.	Protectionism since 1791; From its beginning, industrial design is in the context of industry.	Obtain export market through technology and quality control.
Design education	Start from the 1840s; Design management in MBA and MA.	Design management in MBA and MA.	Start from 1873; Modelled western style.
Design management	Emerge in the 1990s in design consultancy; Limited in academic field; Design management as an independent discipline and a separate category of management relating to design.	Emerge in Aspens Conferences in the 1950s; Design management in context of business and in management profession.	Emerge in 1957; Design is an essential element of contributing innovation management.

In the UK, modern design practice initially emerged in design consultancies, a professional field. The British government also supported design through supporting research projects, forming a platform to combine design and business, promoting 'good design' in industry and formulating design policies. However, British manufacturers still lacked recognition of design and design was not really integrated into industry. This resulted in poor performance of its export industry. Since manufacturing is the basis for design management practice, with the erosion of its manufacturing base, British design management is generally limited to the academic field and tends to develop into an independent discipline. As a result, the British approach to design management could be viewed as a separate category of management relating to design.

From its beginning, design was connected tightly to manufacturing and business in America. It was the inflexible character of mass-production that directly led to the emergence of industrial design in the form of "styling" in American manufacturers. The first generation of industrial designers emerged in the 1920s. After that, the importance of design was recognized by the majority of American companies during the Depression in the 1930s. A large number of internal design departments were established as a result. On the other hand, based on the

American system and Taylor's scientific management theory, management had become a profession and took an importance role in the practices of American companies. Since design was developed in the content of industry from its beginning, design management was viewed as a part of the management profession and business content in America.

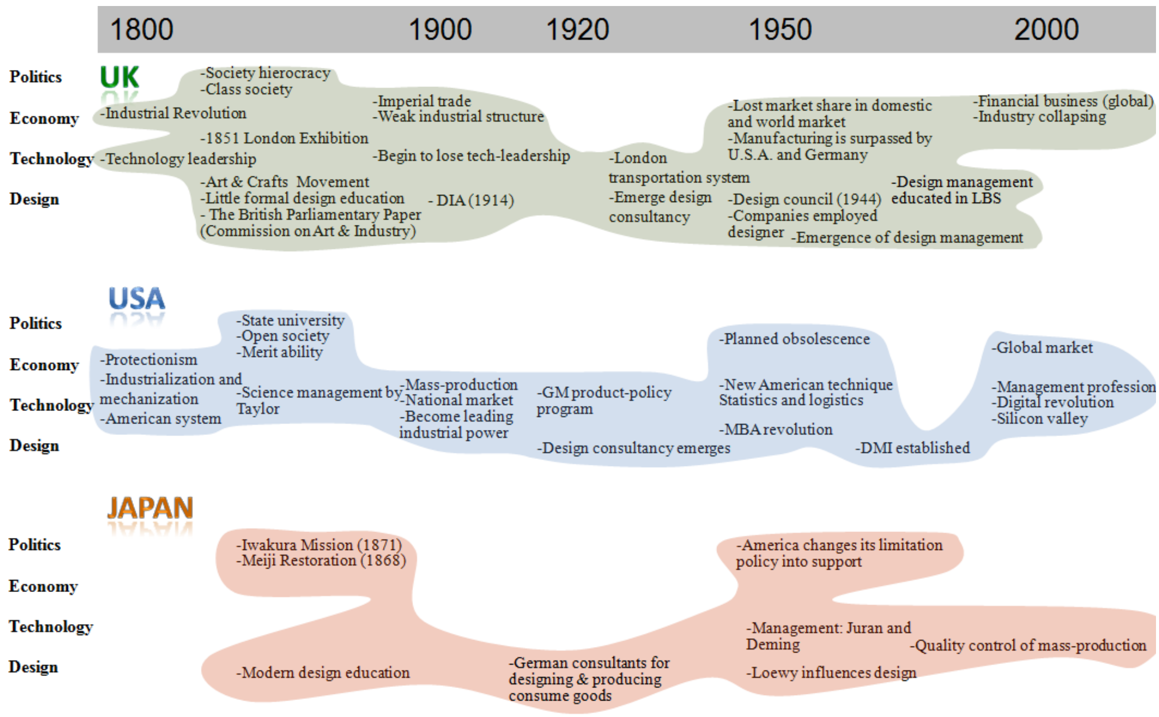

Figure 3.2: Timeline of design management development in the countries

(Designed by Xihui Sylvia Liu)

Japanese manufacturing industry developed significantly after American changed its post-war economic limitation policy into a policy of expansion during the Korean War in 1951. Overseas study projects and the use of foreign consultants established a solid basis for developing manufacturing, design and management. Based on it, a large number of design schools and internal design departments were established. In addition, the modern management theory of Juran and Deming was adapted to Japanese conditions. Together with incremental innovation and quality control, it formed Japanese innovation management, which finally led to the 'Japanese miracle' and a large market share in export markets.

During this process, design played as an essential role in contributing to Japanese innovation management.

3.6 Summary

It can be seen that the concepts of design management not only vary in development stages, but also vary in countries. Different economic backgrounds could result in different understanding and practice in design management. In this chapter, the macro background of design management in each country has been studied. It involves design development, design in industries, design consultancies, design education, the role of government in promoting design and the development of design management. Based on studying evolutionary processes of these aspects, different approaches to design management in the UK, U.S.A. and Japan have been explored.

Though the Industrial Revolution first took place in the UK, the country had lost its technological-leadership and market share in the world. With a weak industrial structure, design is still not widely used in industries. Tough its government and academic field endeavour to promote design management, their efforts are critized as limited to theory and a lack of relations with practice. As a result, British approach to design management is academic-oriented, which prefers to define design management as a separate category of management relating to design. In the U.S.A, design was part of the content of industries from the beginning. Its content of design management is viewed as a part of management profession. After WWII, Japan became famous for its 'Japanese economic miracle', to which Japanese innovation management has substantially contributed. Design management initially emerged to find solution to upgrade design efficiency. So design management must be viewed there in the context of process management.

To understand design management in China, the same information on its macro background should be collected and reviewed. Based on it, the content of design management can be clarified and characteristics can be defined through comparing other countries and related theories. The evolutionary processes of design and design management in China is therefore reviewed in the next chapter.

Chapter 4.

Design and Design Management in China

4.1 Introduction

In this chapter, the evolution of design and design management in China are introduced. It consists of three parts: the evolution of design; the emergence of design management; and problems of contemporary design development in China.

Concepts of industrial design were not really brought into China until the Open Policy in 1978. After that, although industrial design was taught as an independent program in schools and institutes, it was critized as being isolated from practice. To bridge the gap between design education and practice, design management was introduced by scholars after 2000. However, with the same background and basis as industrial design, design management has also been limited to the academic field. These problems are discussed in section 4.4. It also shows the aim of this study as bridging the gap through establishing a basic understanding of design management practice in China.

4.2 Design Development

4.2.1 Design influenced by politic and economic background

The evolution process of industrial design

The development of design is tightly connected with the changing background of the economy in China (Hang, 2009). There are two viewpoints of the origins of industrial design in China. One considers that Chinese design started from the beginning of the twentieth century, at the end of Qing Dynasty. With a series of laws and regulations, the Qing government not only admitted the legal position of craftsmanship and encouraged invention, but also established modern schools for teaching fine arts and design (Wu, 2006; Li, 2007; Chen, 2009). Another opinion argues that it was after the establishment of the People's Republic of China in 1949 that industrial design was gradually introduced in China with the development of economy, especially after the 1980s with the open policy (Zhang and Xu, 1995; Wang, 1995a; Tong, 1999; BMSTC and BIDC, 2000; BIDPO, 2003;

Guo and Hu, 2003; Liu, 2006; Hang, 2009). However, both views agree that modern Chinese design lacks opportunities for development because of the continual wars, and it has been influenced by foreign design concepts to a great degree because of its disadvantaged local technology and manufacturing.

The consciousness of industrial design emerged in China from the beginning of 20th century. In 1898, the Qing government released the *Zheng Xing Gong Yi Gei Jiang Zhang Cheng* (Regulations of Awarding Revitalize Technology Award). It was the first regulation for encouraging technology and craft invention, and protecting intellectual property. In 1906, to meet the demand for specialists from new style manufacturers, the Commerce Department of the Qing Dynasty began to set up various schools, such as the special *Yi Tu Xue Tang* (school of technique and craft apprentice) (Li, 2007). Their graduated students were sent overseas to study, employed as teachers in other schools, or worked on industrial art in society (Chen, 2009). At the same time, modern design was first introduced during the economic boom to attract more domestic and foreign investment to the foreign-dominated treaty ports, especially in Shanghai. However, design achieved very limited development in the early stage, except for graphics.

There is different development of modern design in the West and China because of the wars Western countries suffered are different from those in China**.** Firstly, until the 1950s, China had no modern industry, which by that time had been developing for almost two centuries in the Western nations. Secondly, Western nations had a breathing space between the two wars that China lacked. It has been suggested that China did not have a really modern design movement until 1979 (Wang, 1995).

In the 1950s, Mao Ze-dong, the Chairman of the Communist Party of the People's Republic of China, determined the national policy as creating conditions for realizing industrialization through primitive accumulation in handicraft industry in the transition period. Under Mao's direction, the crafts and arts in China were confirmed as based on handicraft at that time (Hang, 2009). This was also reflected in the establishment of related government sections, such as the Central Administration of Handicraft in 1954, the Light Industry Department in 1958 and management agency of the handicraft industry in 1959.

There is therefore a strong argument for the viewpoint that China's modernity began from 1979. On the surface, the Four Modernizations of Prime Minister Deng Xiao-ping, including agriculture, industry, science and defence, have little to do with the development of Chinese design. In fact, as part of a wider pattern of economic activity, design had to be brought to the forefront of China's reform of its economy and the restructuring of its bureaucracy (Wang, 1995).

However, among all the forms of design, industrial design or product design is the most ignored. The reason for this neglect has been considered as due to the still-underdeveloped consumer-product manufacturing sector. It did not emerge until the open-policy, when supply gradually exceeded demand, and the shortage of many consumer products ended in the Chinese market. Later, with increasing income levels and more people having their basic needs satisfied, poorly-designed, old-fashioned products could not be sold anymore. Consumers began to seek better-quality and better-looking products (Wang, 1995). Industrial design was gradually introduced under these conditions.

The evolution of modern Chinese design is therefore tightly connected to the changed content of economy and politics. In terms of politics, it was influenced by wars and national policies. In terms of economy, it related to marketing, consumers and manufacturing.

In recent years, there is a new stage of developing industrial design, which is contributed by a series of endeavours from central government. February 12, 2007, the China Industrial Design Association (CIDA) submitted proposals of developing Chinese industrial design to the central government. One day later, Mr. Wen Jiabao, current Premier of the State Council of the People's Republic of China, approved the proposals with instruction: “Attach great importance to the industrial design.” March 13, 2008, industrial design is officially included in modern service industry according to *Suggestions on Implementing Policies of Accelerating the Development of Service Industries of State Council*. In the same year, Premier Wen emphasized the importance of developing industrial design when he inspected Wuxi Industrial Design Park. In 2009, Chinese President Hu Jintao had called on the country's enterprises to recruit more talents as well as strengthen research and innovation in order to facilitate the transition from "made in China" to "created in China." This implied that design had been involved in the national development strategy. In April, Premier Wen visited Echom, a design-oriented enterprise which is involved in this research, where he highly praised the function of design in forming innovation ability of Chinese enterprises. In the government work paper reported by Premier Wen in the 2010 Lianghui,[1] industrial design is officially defined as one of the seven service industries which should be developed rapidly. March 16, 2010, *Advice for Directions about Promoting Development of Industrial Design* is released by the Ministry of Industry and Information Technology of the People’s Republic of China (MIIT). In addition, one month later, *Notice of Cognizing National Innovative Products in 2010 (April 15, 2010)* is made by National Development and Reform Commission, Ministry of Science and Technology, and Ministry of Finance. All these actions and policies have significantly promoted the development of industrial design in China and will bring it to a new stage.

Borrowed design theories

Chinese designers’ knowledge of Western modern movements in design is not comprehensive; it is fragmented, full of misunderstandings and exaggerations

[1] Lianghui refers to the National People’s Congress (NPC) and the Chinese People’s Political Consultative Conference (CPPCC).

(Wang, 1995a). Previously, Chinese products either imitated foreign modern design or just maintained the production of daily necessities, generally with a mechanical and engineering appearance. With an increasing number of new products and fierce foreign competition, however, the demands for design became strong and urgent. Later, since the majority of Chinese modern enterprises were established without any basis in the early 1980s, most of them produced new products through copying or imitation. This way is called as *Duo kuai hao sheng* (more, faster and better with less investment) (Tong, 1999). To save time and investment, Chinese designers usually copied foreign models, instead of spending time in designing and planning. This was summarized by the slogan of the Shenzhen project as "Time is Money" (Wang, 1995).

In the first decade of the Open Policy, design education was gradually transformed from the old model to a new one. To study industrial design, university lecturers in Beijing, Shanghai, Wuxi and other cities were sent to Germany, Japan and other advanced countries. These educators brought back the latest industrial design theories and design education system, as well as shared their experience with domestic scholars. Through their enthusiasm in teaching and introducing these knowledge, system and experience, industrial design was widely spread and design education was established on a new basis (HKTDC, 2004). Later, industrial design programmes were expanded both in art schools and in the science and technology schools (Liu, 2006).

The development of industrial design in the 1980s demonstrated its idealization and theorization, because it all relied on design concepts of the West. The development of Western science and technology also provided the basis for Chinese modern civilization and determined the blueprint of Chinese design education. As a result, the endeavour of educators and scholars was more like a Utopian prospect (Tong, 1999).

4.2.2 Design consultancy

The earliest Chinese design firms emerged in the Pearl River Delta (PRD) in the 1980s. Initially, all professional designers worked in design departments of companies. Later, with accumulated experience in practice, an efficient design team was established to bridge the gap between the demand for professional design service and limited numbers of qualified designers. Their success encouraged the establishment of design firms in the PRD, which mainly offered design services for home appliances. Later, it influenced the establishment of other design firms in the Yangtze River Delta (YRD), which utilized the regional advantages and international influence of Shanghai to build their own design brands and accumulate local and international clients. At the same time, another type of design firm emerged in Beijing. With a large number of cross-national companies, Beijing became the centre of high-tech R&D, which, as a result, led to a rapid development of industrial design services. Design houses, a special type of design service, emerged as a response. These were modelled on Korean design services and focused on promoting original design manufacturing (ODM) (Zhang, 2005).

Though Chinese design firms have developed rapidly, their status is still troubling. Most of them are small scale with no more than ten staff, which has a narrow knowledge. They only work on part of a whole design project, co-operating with internal design (Liu, 2003). The majority of their clients are start-up enterprises and small and medium enterprises (SMEs). Their low level of independent research and development capacity, and the low-profit of these companies lead to a limited budget for design service. As a result, these small design firms can only focus on the quantity of design instead of quality. This blocks the development of these small design firms (Zhang, 2005).

At the same time, there are some larger-size design firms in Beijing, Shanghai and Guangdong with 20-50 staff. They can fulfil complex projects with multiple professional knowledge (Liu, 2003). Because they can offer higher quality design services, they attracted clients of medium and large size companies. However, a long time span of new product development and frequent adjustment of strategy obstruct the establishment of long-term collaborative relationship between large size design firms and their clients (Zhang, 2005).

Up to the present, various types of design firms and their common characteristics have been formed. There are six types of design firms in China: design firms developed from internal design; designer firm; cooperative design companies; independent design firm; government-supported design firm; and design studios in colleges (Liu, 2003). According to the report from the Japan Design Foundation (JDF), the features of Chinese design firm include their open attitude, a large number of graduated designers, good ability of computer operation, and traditional master-apprentice relation (Nikkei Net, 2004).

4.2.3 Internal design

It is from the 1950s that Chinese manufacturers began to establish design sections. But their work usually referred to decoration of products or engineering design, instead of real design (Liu, 2006). In most cases, engineers were responsible for everything, from mechanics to styling. Sometime artists were employed to decorate and beautify products. Concerning content of their work, these artists were known as *Mei Gong* or “art worker” (Wang, 1995).

The modern internal design departments formally emerged in the 1990s, especially in transportation companies. To achieve high quality design, these companies established their design sections as industrial design centres to attract talented designers and experts. Some even co-operated with foreign design consultancies to upgrade their own design capacity (BIDC, 2006). However, the original work of these design sections just focused on designing products for China’s market, typically with either cheaper versions of Western designs or slightly modified versions of local products (Whitney, 2006).

Attracted by growing markets in China, foreign companies began to expand their business by establishing local design offices to offer tailored products for Chinese consumer, such as Motorola Beijing-office in 1987, General Motors Chinese design team in Shanghai in 1997, LG electronics design shop in Beijing in 1998, and Samsung studio in Shanghai in 1999 (Balfour and Roberts, 2003; Rocks, 2005; Whitney, 2006).

With increasing pressure from these international brands and with the intention of expanding global markets, some Chinese companies changed their attitude toward design, especially some leading companies. They managed to enhance their design capacity in various ways, such as focusing on design research, collaborating with foreign design consultancies and establishing overseas design offices.

Concerning the difference of business types, design consciousness and development stage, the forms of internal design in a company are various, but can be generally divided into three types: without an independent design department; designers in engineering department; and with an independent industrial design department. Concerning companies with their own in-house team, there are a further three categories according to their business type (Zhang, 2005):

(1) *Companies focusing on ODM.* These enterprises employ designers to offer design proposals for their clients as a further service of manufacturing.
(2) *Companies specializing in certain professional fields.* In these companies, the main motivation of innovation is their leading core technology. Industrial design is utilized to upgrade their product quality and brand image.
(3) *Consumer product Companies.* With a widespread similarity of the core technology in these products, industrial design became an essential factor for marketing and product differentiation.

With the central government’s recent goal of transition from 'Made in China' to

'Designed in China,' Chinese companies are keen to reap the higher margins and market share that often reward flashy, well-designed products, just like the Japanese in the 1970s and the Koreans in the 1990s (Balfour and Roberts, 2003). To achieve this goal, there is an urgent need to study the current situation of design in Chinese companies, find these practical problems, explore successful experience and share them. These studies not only can offer systemic knowledge of managing design in Chinese companies, but also can supply the materials for academic research and design education. In this instance, the gap between design education and practice could be authentically filled. This is the aim of this study.

4.3 The Emergence of Design Management

Modern design management was introduced into China in the beginning of the 21st century, with several design management seminars held by scholars from Beijing, Shanghai and Hangzhou (Wang and Jin, 2008). From 2003, books titled as design management emerged in China. Table 4.1 demonstrates the major publications. Nevertheless, these books are too similar in their content. The authors are teachers of design in universities, schools or institutes. The majority of books were published as teaching materials for design management classes. With little content related to Chinese design, they consist of information from Western countries, obtained in turn from Taiwanese books or from overseas study in Britain. All the books are edited, instead of 'written.' In this instance, some of them were critized for their low quality.

Table 4.1: Books of design management in China

No.	Year	Title	Author	Occupation of author
1	2003	Design Management.	Liu, G. Y.	Teacher
2	2005	Design Planning and Management	Hu, J. H.	Teacher
3	2006	Design Management.	Liu, H. S., Li, P. H. and Zhou, Y. H.	Teachers
4	2006	Design Process and Design Management	Liu, R. F.	Student

5	2007	Design Management: Product Identity of Corporate	Hua, J. Y.	Teacher
6	2007	Design and Research of Design Management	Liu, G. Y. and Zhang, L. Q.	Teachers
7	2008	Design Management.	Wang, X. J and Jin, H.	Teachers
8	2009	Design Management	Xiong, Y	Teacher
9	2009	Design Management	Li, Y. and Qu, Z. B.	Teachers
10	2009	Design Management	Xu, R. P.	Teacher
11	2009	Design Management and Design Innovation: Theories and Cases	Li, Y.	Teacher

Concepts of design management in China

In China, the definition and content of design management were mainly cited from Europe and America. Since design management has not a confirmed definition in Western academic fields, it seems even vaguer in China. However, some Chinese scholars still endeavoured to define it according to their own understanding (Table 4.2). These definitions demonstrate that their understandings are still based on the western theories of design management.

Table 4.2: Definitions of design management content in China

Author	Content of design management
BMSTC and BIDC[2] (2000)	Design management is a process including utilizing design methods, implementing design oriented idea and behaviour, and the transformation of strategy and technology into product or services, in a series of product development management of project, interface and design system. In this instance, design activities are an essential part of enterprise's operation.
Xu (2002)	Design x Management=added value of design and maximize profit
Liu (2003)	Organization management and innovation management, design strategy (business strategy and design strategy, corporation image management), design project management (process, team, plan and audit), external design (operation: contract, quotation, outsourcing project), design communication.
Liu, Li and Zhou (2006)	Design strategy, design project management, design management of human resources, management of design laws and regulars.
Wang and Jin (2008)	Design management strategy, design project management, implementation of design management(design project, process, audit, IP)

These Chinese scholars modified the content of design management. Innovation

[2] BMSTC: the Beijing Municipal Science & Technology Commission; BIDC: the Beijing Industrial Design Centre.

management was added as an independent content or level. The figure 4.1 demonstrates its structure. Compared to the confirmed three levels of design management in Western theories, there are two levels of design management in China (Zhang, Zhang and Shi, 2007): operating and strategy. The operating level involves design project management and design organization management, which includes internal and external design organization. The strategic level refers to design strategy management, which includes corporate design management and innovation management, such as corporate image, design strategy, colour planning, and product image. In their statement, design strategy is involved in innovation management. Wang and Jin (2008) restructured the levels according to the administrative hierarchy, ranging from top level (design strategy management in top management), medium level (design strategy management of design director), bottom level (design administrative management by design manager), and management of design implementation (design project management by project leader).

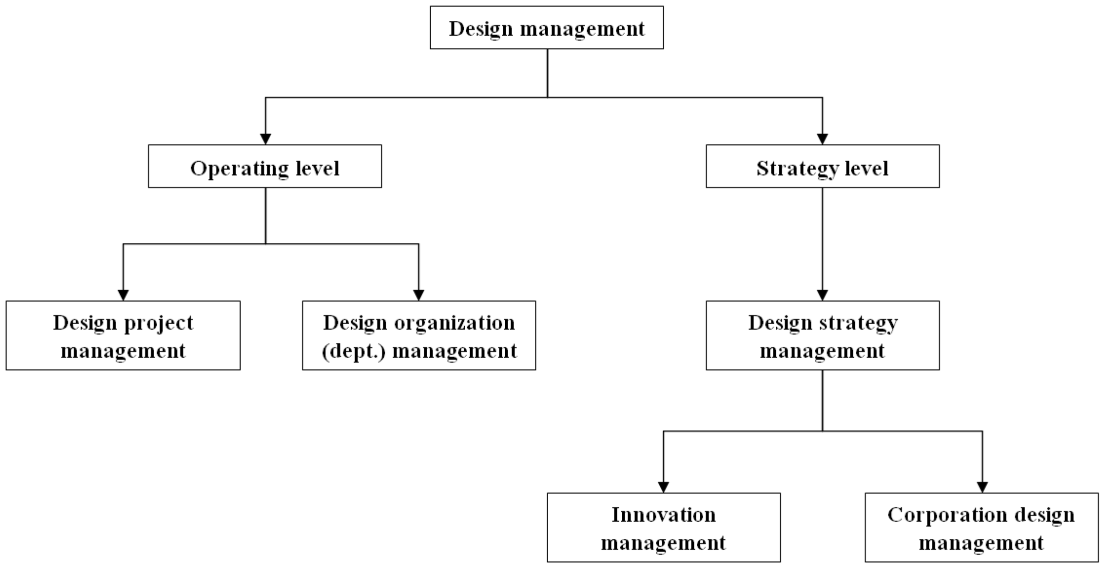

Figure 4.1: The structure of design management level.
Source: BMSTC and BIDC, 2000, p5.

4.4 Problems of Design Development

Industrial design faces a changing situation as it develops into the 21st century. For

China, its current problems of design relate to the global economy, international manufacturers and sustainable development (Wang and Jin, 2008). Meanwhile, the development of industrial design has led to an explicit recognition of its problems, which resulted in laggard industrial design in China.

These problems were indicated by BMSTC and BIDC (2000) as: insufficient recognition of the value of industrial design; a lack of support from government; weak design ability; a gap between design education and practice; and no industrial design management. Furthermore, BIDC (2006, July 4) explained that there were three reasons for the laggard industrial design in China. Firstly, the increasing business of OEM led to the ignoring of design capacity in manufacturers. Secondly, industrial design lacked investment and a supportive policy from government. Finally, the industrialization of industrial design was kept in a low level. With similar opinions, Liu Rui-feng (2006) proposed that the barriers of developing design in China consisted of a weak basis for design education, a lack of professional teachers in design education, emphasizing copying instead of design in companies, and a lack of design promotions from by professional organizations or government.

Concerning internal design, although some leading companies have emphasized industrial design, with substantial achievements from their endeavours, other companies are considered to be lacking consciousness of design innovation or a systemic view of design. Even when design sections are established and not used for copying or imitating others' design, their work may still focus on packaging and styling without an explicit direction of development. For the management of internal design, establishing their specifications for design implementation is still underdeveloped (Liu, 2006). All these problems are involved in the content of design management in China.

Concerning design education, although current industrial design education in

China tries to combine technology with arts, and theories with practice, scholars reveal that there are several problems blocking its development. These are: a vague aim of education; a gap between education and practice; a lack of systemic thinking of education, such as teaching methods and subject planning; teaching teams limited to design professional ability; low quality of teachers and students; design education as an attachment of the planned economy, and Chinese bureaucracy.

In addition, the function of design organizations is also considered to be limited. There are ten special societies which organized design activities for major design specialties. There are also numerous provincial and city branches of design associations. The foundation of the CIDA as the organizer of design activities in the country is a great step forward. However, China's complicated bureaucratic structure restricts overall design cooperation. Furthermore, the Council is a very loose organization and has limited power in policy making on design for the nation (Wang, 1995).

Concerning the development of design management in China (figure 4.2), three main features have been identified. Firstly, the development consists of practice in three aspects: Chinese education, business and design. Secondly, foreign theories and practice play an important role in influencing the understanding of design management in China. Thirdly, design management education is supposed to be a foundation for development in design consultancies and enterprises.

In China, industrial design was first introduced by the academic field. It was teachers in colleges and universities who introduced the modern concepts of industrial design after studying overseas in the early 1980s. Later, they managed to promote industrial design in China through their practice in design studios or design firms. In addition, some design organizations were also established, based on their efforts.

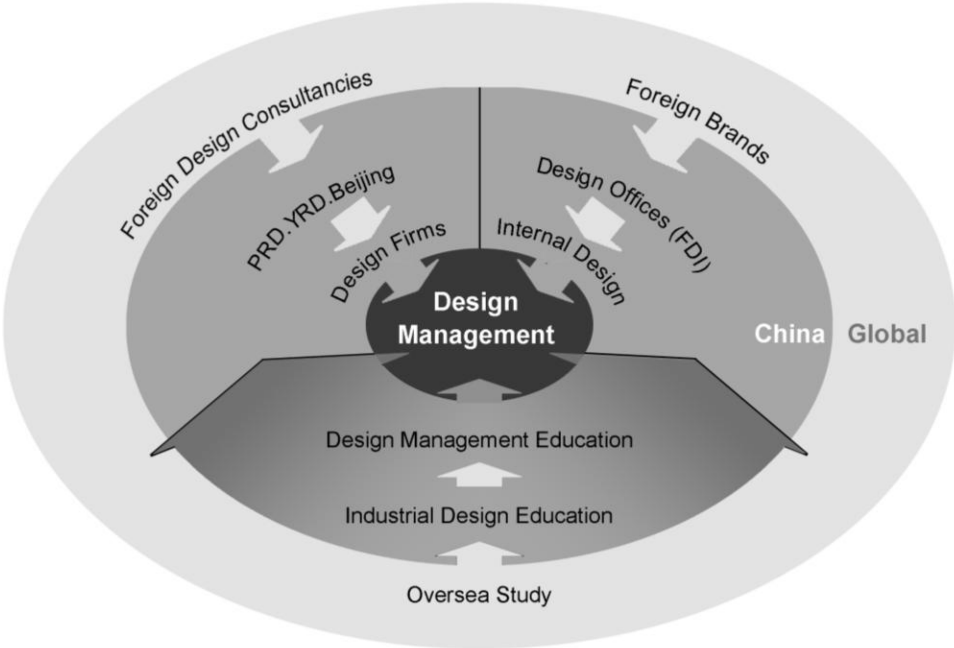

Figure 4.2.: The approach to design management in China

It is sometimes considered that the entry of foreign companies into Chinese marketing, especially foreign design studios, is the main motive power of using design in Chinese manufacturers. The quality of Chinese designers was certainly improved through the knowledge spill-over from those foreign design bodies. Chinese design firms also benefited from it. At the same time, confronting the intense competition in both local and global markets, Chinese companies began to know the value of design from their international competitors. Though leading Chinese companies have come to emphasize design, however, design and management still cannot be integrated into the systems of companies. The majority still prefer to develop new products relying on the traditional ways, such as marketing and technology (Liu, Li and Zhou, 2006). In this instance, the understanding of design management in Chinese companies is still an unknown topic. Is there already a systemic consciousness of design? What are the attitudes toward design? And how is design utilized in different companies? These are problems to be considered by this study.

On the other hand, with the rapid-growth economy, the central government has shown their awareness of industrial design and determination of developing it. This is demonstrated by a series measures and policies since 2007, including the first official policy for industrial design: *Advice for Directions about Promoting Development of Industrial Design* which was released by MIIT in March 2010. However, to rapidly develop industrial design and sufficiently utilize it to enhance competitiveness of companies, the critical issue is not the ability of design, but the way of using and managing it. Only with efficient design management, can design create value for business development. In this instance, finding a way of managing design in Chinese companies relating to their practical conditions is urgently needed. In this study, models of managing design in various types of companies are reported, which are developed based on practice of companies. These not only are basis for studying Chinese ways of managing design, but also can offer reference for development of other companies.

4.5 Summary

In China, industrial design was introduced by scholars and limited to the academic field. Since the Chinese education system was borrowed from Western systems and isolated from practice, there is a gulf between design education and the practical demands of Chinese manufacturers. To fill it, design management education was introduced into the current education system after 2000. However, similar to design education, it still was limited to the academic field without relating to practice. On the other hand, with the rapid-growth of economy, Chinese manufacturers progressed significantly. They began to establish their own brands and internal design departments to face competition and expand overseas markets. In this instance, a lack of practical experience and knowledge of managing design becomes a main obstacle of their development. There is an urgent need to understand the practical situation of design development in Chinese manufacturers, and formalize the Chinese experience of managing design. This is an objective of this study. Based on examining the characteristics and models of design management, this study can offer an overview of design management experience in China, which could fill the gulf between design research and practice.

Chapter 5.

Research Methodology

5.1 Introduction

In this chapter, the research methods of this study are introduced. Based on the analysis of pervious studies of design management in companies, three research approaches are discerned. These are not only frequently used in earlier studies, but also represent different aims and development stages of design management research. The combined approach was finally utilized in this study, which is the first known specific study of design management practice in China.

In addition, triangulation is employed as a research strategy to obtain information from various facets. Case studies are the main research method of this research. Concerning its generalizability, a survey was conducted to offer a basis for selecting cases. Furthermore, the settings, samples and the methods of data collection are also introduced in this chapter.

5.2 Combined Approach

As Borja de Mozota (2003) stated, the knowledge body of design management consists of three levels: strategy, function and operation. Though terms used to describe each level may vary in sources and researchers, their content is essentially the same (Ahopelto, 2002; Borja de Mozota, 1998; 2003; Walsh *et al*, 1992).

The themes of previous design management studies can be divided into macro and micro level according to the scope of subjects. They range from the micro level covering topics, such as individual designers, design teams, product projects and companies, to the macro level focusing on clusters of firms and nations (Bruce and Jevnaker, 1998). According to these studies, the content of macro themes includes the discipline and vision of design management, as well as relationships between design and economy, such as how to improve international competitiveness through design policy and design. The micro level focuses on the practice of design and business, such as design implementation, design consciousness, design value and design investment in a team or an organization.

To find appropriate research methods for this study based on an overview, forty studies of design management and related topics had been collected (Appendix B). These studies have clearly defined their research as related to design management and introduced their research methods. They were published from 1974 to 2005, usually in forms of book, journal article and reports. To analyze their research methods, two groups of factors were employed:

- research approach: quantitative, qualitative, or the combined
- research method: survey, case study, or interview

In addition, time is also involved as an independent factor to study the relations between the above factors.

The result of the analysis is demonstrated in figure 5.1. According to it, there are three main features:

1) The three approaches all have been utilized in previous studies of design management.
2) The role of research methods is changed in different development stages of design management studies. Case study methods were utilized first in the studies of design management. About ten years later, survey emerged as another major research method. After the 1990s, the combination of survey and case study has appeared.
3) The combined approach involves two types: a combination of survey and case study, as well as a combination of interview and survey.

In this instance, quantitative and qualitative approaches could be employed as key clues to divide all the previous studies into three categories: quantitative, qualitative and their combination. The two approaches not only involved different strategies and data collection procedures, but they also represented different epistemological frameworks. Quantitative research is usually associated with a number of different ways of data collection, while the qualitative approach studies of the social world and seeks to describe and analyze the culture and behaviour of human beings. A similar logic can also be applied to the third combined approach (Bryman, 1988).

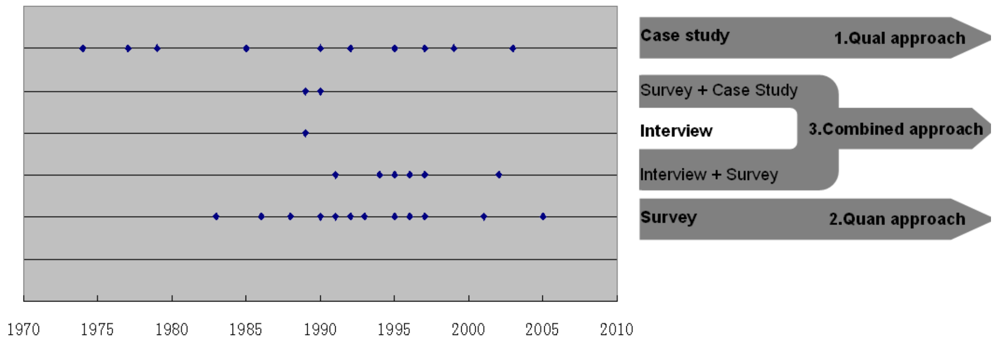

Figure 5.1. Development of research methods in design management

5.2.1 Qualitative research

Qualitative research of design management is usually conducted by case studies, which were initially utilized in the 1970s, focusing on the study of industrial innovation or technology innovation (Corfield, 1979; Robertson, 1977). At that time, the majority of studies were conducted by government as a basis for national politicise related to design. Today, although case studies are still considered to be a main research method of design management, their objective has been transferred to in-depth topics pf design management at company level as academic studies, instead of government research projects.

In academic and professional research, researchers prefer to conduct qualitative studies for in-depth theory building. To achieve this, they obtain thick descriptions and in-depth discovery of phenomena through case study. For example, Hart (1989) interviewed twenty firms to explore the solution to the successful development of well-designed products and establish a climate for design integration in a firm. To understanding the role of design in market strategy, Borja de Mozota (1990) studied eleven international projects with a qualitative approach. The DMI (1992) compared fifteen cases to discover critical successful factors for managing the product development process. These studies all focus on enhancing understanding of one explicit topic of design management through case studies.

5.2.2 Quantitative research

The majority of quantitative studies are supported by government bodies, such as the Department of Trade and Industry (DTI), and the Design Innovation Group (DIG) at the Open University and UMIST in Britain (Corfield, 1979; Cooper, 1993; Rothwell, Schutt and Gardiner, 1983; Ughanwa and Baker, 1989; Walsh *et al.*, 1992). These studies focus on industry and national competitiveness or design policies. Their findings are generally published as working papers or white papers. With government support, these studies normally have enough funds and multiple resources to conduct surveys or carry out substantial quantitative analysis of reported data. For example, Roy (1986) surveyed thirty-seven British firms and ten foreign sectors to explore principles and practices for successful design and production in Britain. This was supported by the DIG and published in Report DIG 02. Based on the co-operation between UMIST, DIG and the Design Council, Walsh, Roy, Bruce and Potter (1992) conducted two-stage study to describe British design performance in enhancing international competitiveness. Supported by DIG and UMIST, their first study involved questionnaires of forty-one British firms. In the second stage, 221 questionnaires were collected by the Design Council. The research aimed to generate a basic knowledge of design management in Britain.

5.2.3 The combination of quantitative and qualitative

Though both quantitative and qualitative approaches have been influentially employed in previous studies of design management, a combined approach has still emerged since the 1990s with the development of the knowledge body of design management. The advantage of such combination is to integrate different paradigms at various stages in the research process to better understand a concept being tested or explored (Creswell, 1994). Since design management remains an underdeveloped, under-researched field, researchers prefer to achieve a full picture of any design management subject. This requires both detailed qualitative information from in-depth interviews or case studies, and breadth provided by sample surveys (Freeze, 1992; Potter, 1992; Walton, 1992). However, it raises another question: how to organize the different paradigms in a single study.

As an answer, Creswell (1994) stated three models of the combination: two-phase design, dominant–less dominant design and mixed-methodology design.

> *Two-phase design*: in which, the researcher proposes to conduct a qualitative phase of the study and a separate, quantitative phase of study.
>
> *Dominant-less dominant design*: the researcher presents the study within a single, dominant paradigm with one small component of the overall study drawn from the alternative paradigms.
>
> *Mixed-methodology design*: this design represents the highest degree of mixing paradigms of the three designs. The researcher would mix aspects of the qualitative and quantitative paradigm at all or many methodological steps in the design (Creswell, 1994, pp. 177-178).

Concerning the three models, in design management research, the combination usually is conducted by dominant-less dominant design according to the previous studies.

The relationship between quantitative and qualitative research varies its form in the dominant-less dominant design. The relationship can be divided into two types, QUAL-quan illustration and QUAN-qual illustration (Creswell, 2003). The former employs a quantitative method to analyze data, based on qualitative research. The latter utilizes qualitative method to study, based on the preliminary quantitative results. These two types of research have developed their own context in design management studies.

In QUAL-quan illustration, a survey is usually conducted based on qualitative interviews. Hollins and Hollins (1991) stated that when interviews were utilized with a questionnaire, the purpose often was exploratory and diagnostic to provide information for a structured questionnaire. In implementation, a survey typically takes the form of face-to-face visits, telephone interviews, or postal questionnaires (Potter, 1992). Interviewing can be conducted under the headings of either qualitative or quantitative. Concerning four forms of interviewing - telephone, postal, computer based and personal interviewing - the former three are effective methods of collecting information for a questionnaire. Qualitative interviews usually refer to personal interviewing, either in small groups or in large groups, which are conducted as open-ended.

In most cases, QUAN-qual illustration refers to case studies based on the results of survey. Potter (1992) indicated that in this type of research, sample surveys complement case studies by providing statistically valid information and help to provide a contextual understanding of individual case studies. For example, to explore practice and attitudes towards the management of design in industry in Britain, Dumas and Whitfield (1990) employed four steps of research to combine the results of a questionnaire and case study materials. First, a pilot study to establish focus; secondly, the development and piloting of a questionnaire; thirdly, a company study to examine the design process in depth; finally, administering the questionnaire to companies. With the QUAN-qual illustration, researchers preferred to explore in-depth problems based on an objective overview of background. In this instance, a survey is conducted to offer focus or basic understanding of studied objects. With it, case studies can avoid the criticism of lacking generalizability and validity.

As a preliminary research of managing design in Chinese enterprise, the objectives of this research are to describe the practice of managing design in Chinese manufacturing industry and propose different models of managing design developed by various enterprises. For the former objective, hard and reliable data has been collected and analyzed by quantitative survey. For the latter, rich and deep data was achieved through qualitative interview. As a result, this research employs a combined research approach. In simple words, it employs QUAN-qual illustration. In it, qualitative research was conducted by interviews and the results were reported in form of case studies, which are based on questionnaires for the purpose of verification and generalization. In addition, triangulation is introduced as a research strategy, both in research methods and data collection.

5.3 Triangulation

According to Herman and Egri (2002), quantitative research can help to know what was happening, while the qualitative research can understand the reason for it. These are the two aims of this research. To achieve it, triangulation was utilized in this study.

Triangulation, as a research strategy, varies its context in different research processes and facets. Data, investigators, theories, and methods are four types of triangulation:

(1) *Data triangulation* has three subtypes: (a) time, (b) space, (c) person. Person analysis, in turn, has three levels: (a) aggregate, (b) interactive, and (c) collective.

(2) *Investigator triangulation* consists of using multiple rather than single observers of the same object.

(3) *Theory triangulation* consists of using multiple rather than simple perspectives in relation to the same set of objects.

(4) *Methodological triangulation* can entail within-method triangulation and between-method triangulation (Denzin, 1978, p294-307).

The concept of triangulation is based on the assumption that any bias inherent in particular data sources, investigator, and methods would be neutralized when used in conjunction with other data sources, investigators and methods (Jick, 1979). Fielding and Fielding (1986) suggested that the important feature of triangulation is not the simple combination of different kinds of data but the attempt to relate them so as to counteract the threats to validity identified in each. In this research, triangulation strategy is utilized both in data collection and for the validity of research.

5.3.1 Method triangulation

Method triangulation is employed to reduce the disadvantages of one method by using another one and has been developed in social science in the 1970s (Denzin, 1978). There are multiple types of methods triangulation, depending on different criteria. According to the logic between methods, there are two types of method triangulation, within-method triangulation and between-method triangulation. The former (within-method) involves the use of varieties of the same method to investigate a research issue, while between-method triangulation involved contrasting research methods (Denzin, 1978).

Considering the time scale between methods, method triangulation is divided into simultaneous triangulation and sequential triangulation. In the former, the researcher answers the qualitative and quantitative research questions at the same time in a study. In the latter one, the researcher conducts two phases of a project, with the results of the first phase essential for planning the next phase (Creswell, 1994).

According to the methods employed in previous studies, the between-method triangulation and sequential triangulation were employed in design management (Walsh, 1995; Teng, 1994; Press, 1995; Guimaraes, Penny and Moody, 1996; Teng, 1999; Borja de Mozota, 2002). As Walton (1992) stated, since design management research still is a young field, most of the work has focused on inductive techniques. In particular, survey and case studies have been the most commonly used methodologies. Concerning the qualitative research approach to design management, in most cases, a questionnaire survey is conducted followed by interviews. This is because that sample survey complements case studies by providing statistically valid information and helps to provide a contextual understanding of individual case studies (Potter, 1992).

In this research, "between-method triangulation" was utilized, which consists of questionnaire survey and interviews and were conducted to collect data in sequential order. As Diesing (1971) concluded, the variety of combinations is so great that survey research and fieldwork are better viewed as two ends of a continuum rather than as two distinct kinds of methods. In this research, methodological triangulation informed our decision to gather data through both questionnaire surveys and qualitative interviews, and then to analyze the data by content analysis and statistical procedures. A questionnaire survey was conducted to supply the data necessary to achieve basic knowledge about settings and to select the purposive sampling in interview at the first stage. Qualitative interviews played a dominant role in the research at the second stage. Case studies were finished based on the information collected from interviews. Through analyzing the ways of managing design in the cases according to the main criteria, the conclusion can be achieved.

5.3.2 Data triangulation

In this study, data for a case study were derived from multi-resource: questionnaire surveys, open-ended interviews, documents and direct observation. Yin (2003) suggested that the main idea of collecting case study data was to 'triangulate' or establish converging lines of evidence to make the findings as robust as possible. Data collection for a case study can benefit from six sources, which include documents, archival records, interviews, direct observation, participant-observation and physical artefacts. In this study, besides survey and case study, which is an influential method in current design management research (Walton, 1992), documents and direct observation are also employed to enhance the richness and depth of the data. These multiple sources of data all came from design practice and ensured a reliable and generalizable basis for the subsequent propositions.

5.4 Case Study Research

5.4.1 Definition of case study

It was not until the 1980s that case studies were broadly admitted as an efficient qualitative research method, in which researcher explored a single entity or phenomenon ('the case') bounded by time and activity (a program, event, process, institution, or social group) and collected details information by using a variety of data collection procedures during a sustained period of time (Merriam, 1988; Yin, 1989).

According to Yin, the technical definition of a case study begins with:

1. an empirical inquiry that
   - investigates a contemporary phenomenon within its real-life context, especially when
   - the boundaries between phenomenon and context are not clearly evident.
2. The case study inquiry
   - copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result

> - relies on multiple sources of evidence, with data needing to converge in a triangulating fashion, and as another result
> - benefits from the prior development of theoretica1 propositions to guide data collection and analysis. (Yin, 2003, p. 13)

In this way, 'case studies can be based on any mix of quantitative and qualitative evidence (Yin, 2003, p15). ' According to the definition, the object of a case study is real-life with unclear evident. It requires the triangulating concepts in data collection. This matches the qualitative-dominated research approach and triangulation as research strategy in this study.

Because design management is still an underdeveloped field, case study research is considered as a persuasive media with the power to bring design management concepts into the current knowledge body about management practice (Freeze, 1992; Potter, 1992). Since there is no existing body of literature or theoretical framework, the advantage of employing case study research is to help collect material for developing a framework. Once there is a sufficient number of case studies, researchers can begin to develop a framework for comparing key issues in the field (Freeze, 1992). According Kim and Chung's (2007) study of over 700 papers published in *Design Management Review* from 1989 to 2007, design management research was conducted largely by case studies, focusing on the practice in firms.

5.4.2 Generalizability of case studies

From its beginning, the generalizability of case studies was challenged by many researchers (Campbell and Stanley, 1966). When a case study was employed in design research, this disadvantage still existed.

> The disadvantages of the approach [case study] are first, that

> it tends to present a 'snapshot' of design (or innovation) over a relatively short period in the life of a firm or an industry, and thus does not capture the rather different circumstance, external influences, management 'style' and so on, that are relevant to other periods in the firm's or industry's evolution. ….Second, the approach is very rarely able to give a generalized picture of innovation or design, locked as it is into specific cases, and often gives a false impression of general validity, because the number of cases examined may be large, but not statistically representative (Walsh *et al.*, 1992. p90).

However, some solutions to solve the problem and challenge of generalization in case study method were explicitly suggested by Bryman (1988). In his book *Quantity and Quality in Social Research*, he advised three options: firstly, multiple case studies instead of a single case study; secondly, triangulating researchers both in case examination and in separate clusters of characteristics; thirdly, the combination of quantitative research and qualitative research.

Concerning the above arguments and options of generalizability, in this study, the three solutions are utilized. Firstly, multiple cases are employed instead of the single case. Secondly, multiple researchers worked in data collection. Finally, to confirm the statistically representative nature of the selected cases, all were chosen based on a quantitative questionnaire as purposive samples.

5.5 Setting and Samples

As the first stage of a long-term research project, which is led by Professor John Heskett and funded by the School of Design, the Hong Kong Polytechnic University, the data of this study was obtained through questionnaires and interviews of Chinese manufacturers in the PRD and the YRD.

5.5.1 Settings – the PRD and YRD

In this study, the PRD and YRD were determined as the geographical scope of investigation because of their representative position of economy in China. In addition, these two deltas also are the leading locations of design activities. This can be proven by large number of design schools, design organizations, design firms and design departments established in it.

Pearl River Delta (PRD)

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 Guangzhou Academy of Fine Arts (GAFA) is one of the best design schools in China, which also is one of the earliest schools offering design education. 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.

Located in the south of China, the PRD has the advantages of developing economy. Some manufacturers in the PRD are from Hong Kong, which changed its focus from manufacturing industry to service industry in the 1980s. Other manufacturers have developed based on the traditional industries in the PRD, such as ceramics, textiles, furniture and nonferrous metals processing. These form the solid basis for manufacturing industry in the area.

Meanwhile, with a convenient location and a blend of import and export activities, export industry comprises a large share of the economy in the PRD. The China Import and Export Fair (Canton Fair) has been held since the spring of April, 1957. With 188,170 oversea buyers in the 106th Session in 2009, it offers an international platform for Chinese products, especially for products from the PRD. Because of it, various updated information related to products can be easily achieved in the delta. Design has been recognized by manufacturers during the process of developing export industries, which creates large demands for design professionals. As a result, the quality and experience of designers in the PRD are better than other regions in China. This is the reason for the first design firm being established in the PRD.

At present, in the transformation of industries and the development of creative industry, design in the PRD plays a more important role than ever. Because of the above reasons, the PRD was selected as part of the geographical scope of this study.

The Pearl River Delta region includes the following twenty cities which were designated within the Economic Zones of by the State Council of China in 1985 (Figure 5.2):

1) Three special economic zones: Shenzhen, Zhuhai and Shantou
2) Six leading cities: Guangzhou, Dongguan Foshan, Huizhou, Jiangmen, Zhongshan.
3) Eleven peripheral cities: Chaozhou, Heyuan, Jieyang, Maoming, Meizhou, Qingyuan, Shanwei, Shaoguan, Yangjiang, Zhanjiang, Zhaoging.

Figure 5.2 Map of the PRD

Yangtze River Delta (YRD)

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.

The main industries of the YRD consist of its traditional industries, such as footwear, clothing and metal processing, and new emerged industries, such as IT, biomedical and automobile. Together with a large number of universities and institutes, its traditional industries offer a good basis for the development of manufacturing and design. 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

(Figure 5.3).

Figure 5.3: Creative industry parks in Shanghai

The Yangtze Delta region includes the following 16 cities which were designated by the Development Research Centre of the State Council of China in 1997:

- One special economic zone: Shanghai
- Eight cities in Jiangsu province: Nanjing, Suzhou, Yangzhou, Zhenjiang, Taizhou, Wuxi, Changzhou, Nantong.
- Seven cities in Zhejiang province: Hangzhou, Ningbo, Huzhou, Jiaxing, Zhoushan, Shaoxing, Taizhou.

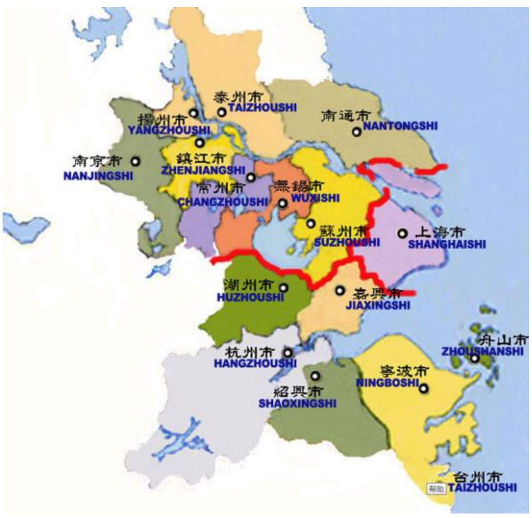

Figure 5.4: Map of the YRD

5.5.2 Survey samples

Quantitative sampling is selected as broadly as possible because of the research objective of describing overall situation of managing design in Chinese manufacturing industry. As Yin (2003) suggested, in general, convenience, access, and geographic proximity can be the main criteria for selecting a pilot case or cases. In this study, for generalizability, companies involved in the survey are from various product categories, ranging from household appliance, electrical product, electronic product, telecommunication, textiles, costume, foods, engineering, mechanism, to transportation. Companies with different sizes also were involved, including small, medium and large enterprises. According to the standard of *National Bureau of Statistics of China 2003*, about 40 per cent of samples are small size; more than 35 per cent are medium size; more than 20 per cent are large size companies. Furthermore, companies were selected according to the following criteria:

(1) They should be manufacturing-oriented.
(2) They employ design for product development.
(3) They have demands for design services, offered either by an internal design team or by an external design group.
(4) They have internal designers, or someone playing the role as designer, or someone responsible for managing external design resource, such as engineers.
(5) The location of these companies should be either in the PRD or the YRD.

All selected samples should match the five criteria at the same time.

To achieve convenient and accessible samples, two Chinese local universities took part in this research as collaborators. They are Guangzhou Academy of Fine Arts (GAFA) and Nanjing University of Science & Technology (NUST). They are responsible for liaison work through their networks of relations, implementation of surveys and recording data. In this way, questionnaires had been received efficiently to ensure reliability. In addition, to obtain data efficiently, three methods were utilized: emails, telephone interviews and face-to-face visits. The method employed for each sample varied in the specific conditions of samples. The staff managing design or design related issues in a company were responsible for answering the questions.

Figure 5.5: Some companies in the PRD

However, there is still no reply to some answers for three reasons. Firstly, as the primary survey of design issues in Chinese company, some companies lacked experience and knowledge to answer certain questionnaires. In most cases, this situation can be avoided by further communication with companies. Secondly, in some companies, design has been involved in an R&D department as an integral part. In this instance, the companies would not like to answer certain questions, which were considered as related to business secrets. Thirdly, since the recognition of design in some companies was still underdeveloped, some companies had no idea of the questions and preferred to leave blank. This led to missed answers in a questionnaire, which was finally judged as invalid. As a result, among 330 questionnaires collected, 117 are valid. There are 43 samples in the PRD (Figure 5.5) and 74 samples from the YRD (Figure 5.6).

Figure 5.6: Some companies in the YRD

5.5.3 Case samples

At the second stage, purposive samples were selected, based on questionnaires. Each company has certain characteristics which have been derived from analysis of questionnaires. The efficient selection of purposive samples can assist the theory-building of the research (Berg, 2004; Eisenhardt and Graebner, 2007). As a result, there are 80 companies interviewed in the two deltas. Among them, 31 companies are in the PRD, and 49 are in the YRD. Concerning generalizability, these companies were selected from different cities with diverse product categories. They are located in six cities in the PRD, including Guangzhou, Zhongshan, Foshan, Shenzhen, Chaozhou, Shantou, and ten cities in the YRD: Shanghai, Nanjing, Wuxi, Changzhou, Nantong, Suzhou, Taizhou (泰州), Taizhou (台州), Yangzhou, Hangzhou. Their product categories involve households, electronic products, mechanical and electrical products, power tools, home appliances, clothing. However, for the reasons of business secrets, some companies withdrew from the research at the point when they finally should confirm their interview records. The twelve cases for comparing are selected from the final list. The detailed of selecting cases is introduced in Chapter 7.

5.6 Data Collection

5.6.1 Introduction

The two research projects aim to study the design competitiveness of Chinese companies in the PRD and YRD. Each research team consists of a senior researcher who is familiar with the interviewee and has experience in conducting interviews. In addition, one or two assistant researchers were employed to responsible for text recording and liaison.

In addition to questionnaires and interviews, other complementary methods were utilized for collecting data. Documents as data for the study in this research refer to administrative documents, newspaper clippings and other articles appearing in the mass media and company's presentation documents, which can offer stable, unobtrusive, exact and broad coverage data for research (Yin, 2003). A field visit was conducted to directly observe the companies, in particular to compile data about the environment, work space, factory work, building, and decorations. During the observation process, photographs were taken and discussions were recorded.

5.6.2 The process of data collection

The process of data collection is divided into four stages by two sets of criteria, the PRD or YRD, and quantitative or qualitative. The relations among the four stages are demonstrated in figure 5.7. In the former two stages, firstly, data was only collected from the PRD through questionnaires and interviews, based on referencing previous design management research. When proceeding into stage two, however, more characteristics were explored. A further study of the same theme was planned to be conducted to offer triangulating information for theory-building. In this instance, the YRD was selected because of its similar importance in economy and design to the PRD in China.

There is an overlap of data collection with data analysis in the process, which is frequently utilized in building theory from case studies (Eisenhardt, 1989; Glaser and Strauss, 1967). The overlaps emerged at the joint of stages, which consisted of a loop of the whole data collection process.

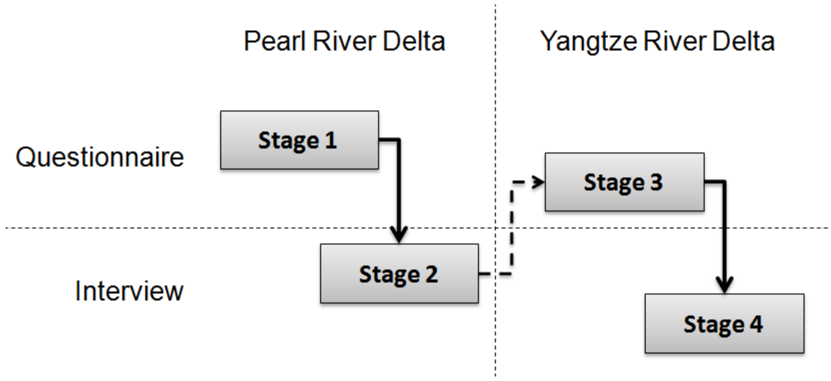

Figure 5.7: Four stages of data collection

Questionnaire

Questionnaires were conducted in the first stage of this research to offer basic and brief information about design function in enterprises. Data was collected by means of a questionnaire containing five categories: background, brand and market, managing design, investment of design, and design vision (Appendix D). Though questionnaire is considered as a quantitative research method, its data can be divided into two types: quantitative and qualitative. According to Stevens (cited by Glass and Hopkins, 1996, pp. 7-10), there are four types of variable: nominal variable, ordinal variable, interval variable and ratio variable. The first two types usually are considered as nonmetric data or qualitative data, while the last two types are metric data or quantitative data. Since the study is aim to collect first-hand information of managing design in enterprise to briefly understand the development of managing design in practice, the questionnaire consists of multiple-choice questions, categorical questions and numerical questions as nominal and ordinal variables, instead of the Likert scale type of questions. This is because respondents either have no clear idea of the answers, or would not like to give explicit information in most cases. In this instance, the three types of closed-ended questions were utilized to offer options for them and meet their requirement of keeping business secrets.

Concerning the three-level theory of design management content, topics listed in the questionnaires are shown by the grey part in figure 5.8. It covers main issues in the second level: design management in an organization, as well as topics related to strategy of a company in the first level.

Companies to be surveyed firstly were listed based on a discussion by the research teams. Then the questionnaire was sent out. Telephone and email were utilized as the complementary methods to achieve efficient and affect feedback.

Based on information from the questionnaires, typical enterprises were defined as purposive samples for in-depth interview. With the characteristics collected from these typical cases, theory is supposed to be built through a set of propositions as generalizability.

Interviews

Interviews are one of the most important sources of case study information (Yin, 2003). It is a highly efficient way to gather rich, empirical data, especially when the phenomenon of interest is highly episodic and infrequent (Eisenhardt *et al.*, 2007). With this method, interviewees can provide historical information and it allows researcher “control” over the line of questioning (Merriam, 1988; Bogdan and Biklen, 1992; Creswell, 1994).

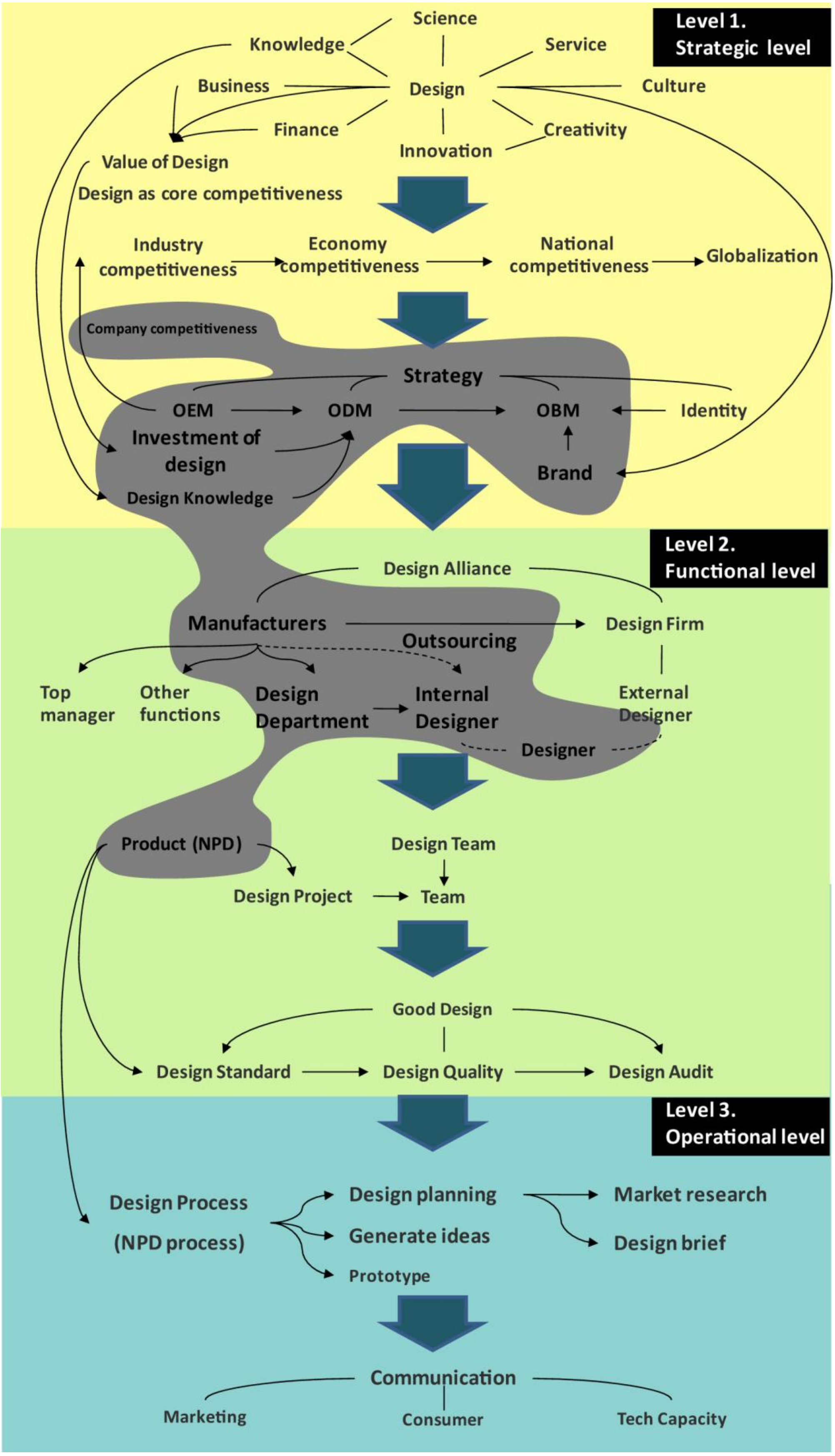

Figure 5.8: The content of design management covered by questions

In this research, in-depth interviews were conducted face-to-face not only for thick description of design development in these firms, but also for exploring the practical ways of managing it. Interviewees were those who were responsible for the design function in a company, though they varied in titles, ranging from design director, design manager to general manager.

It was conducted as a guided open interview, which is also called an open-ended interview, with semi-structured questions to achieve the first-hand information from the subjects. With it, interviewees are allowed or expected to offer the facts of a matter as well as their opinions about events, even it is no connection with the answer of the questions (Yin, 2003).

A basic question list was designed for interviews, which consisted of five categories, company background, new product development practice, development of design, design and brand building, as well as vision and perception of design (Appendix E).

Direct observation

Since the observations could be formal or casual activities and the reliability of the observation is the main concern (Yin, 2003), in this research, it was fulfilled when the investigators visited an enterprise. It is considered as a complementary research method to offer reliability data for a case study. It involved visiting a company's environment or manufacturing lines to obtain photo records.

Part III

Findings and Discussion

Chapter 6.

Findings I: Design in the Practice of Chinese Manufacturers

6.1 Introduction

The findings reported in this chapter offer an overview of design development in current Chinese enterprises. It includes main issues relating to managing design. The data was collected from valid questionnaires of 117 companies in the YRD and PRD. The software SPSS (Statistical Package for the Social Sciences) was utilized to analyze the data through calculating frequency distribution and crosstabulation. Section 6.2 shows the results of counting the frequency distribution of each answer. It describes basic information of managing design in the Chinese companies. In section 6.3, the background and characteristics of design development in manufacturing industry are revealed, based on crosstabulation.

6.2 Basic Situation of Design in Chinese Manufacturers: Frequency Analysis of Survey

In this section, basic information of managing design is reported in five parts: facts of companies, strategy of design, investment in design, design organization and design outsourcing. By analyzing the frequency distribution of each question's answers, the facts of design and its management in current Chinese enterprises were obtained.

6.2.1. Facts of companies

In this part, basic informations of samples are shown with two aims. Firstly, the validity of samples is verified through matching the requirements for various types of background in size, product category, ownership and business. Secondly, basic business information of business, including history, scale and brand, is explored.

Date of establishment

The establishment dates of companies range from the Qing dynasty (1830) to 2007. There is a marked growth trend of establishing new companies since the beginning of the 1990s. The number of new companies reaches a peak in 2003. In addition, 42.7 per cent of companies were established from 2000 to 2007 (Figure 6.1).

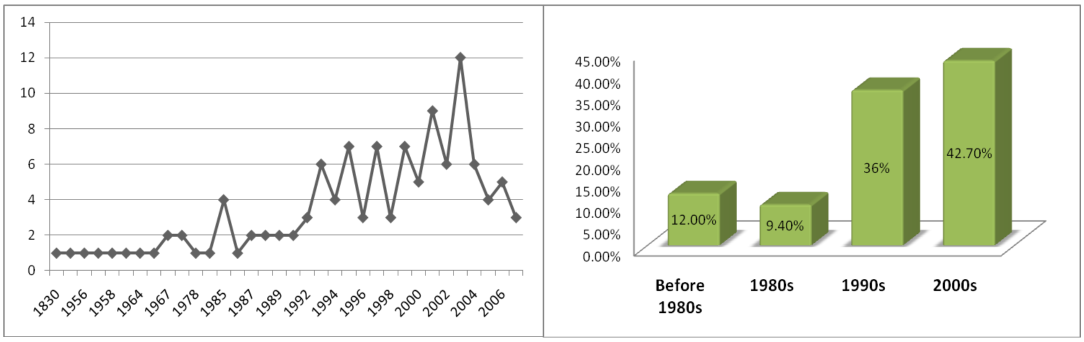

Figure 6.1: The establishment year of companies

Establishment of divisions and plants

The evidence is that the majority of surveyed companies do have not sub-divisions or plants. Only around 40 per cent of companies have established sub-divisions, while the number of companies with sub-plants is even less, only about 30 per cent (figure 6.2).

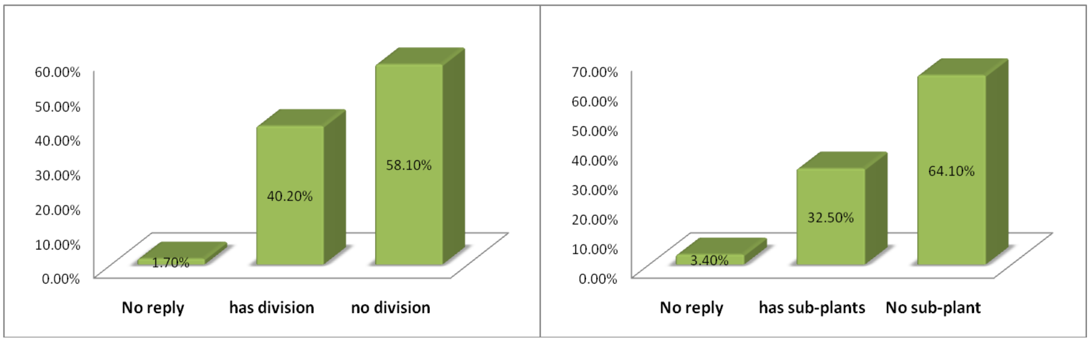

Figure 6.2: Sub-division and sub-plant

Company size

According to the definition of small, medium and large enterprise by National Bureau of Statistics of China, the surveyed companies cover all the sizes. Among them, about 40 per cent are small enterprises. Around 35 per cent of companies are medium size, while large-size enterprises take a small proportion with around 20 per cent (Figure 6.3).

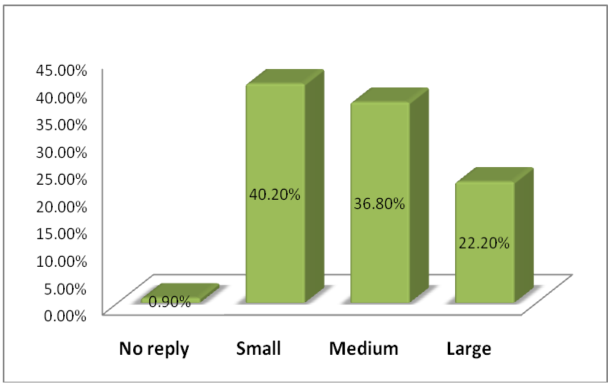

Figure 6.3: The scale of companies by number employees

Ownership

State-owned, private and mixed ownership are three types to divide ownership of a company in this study. However, in the questionnaires, partnership/joint venture was used to replace the mixed type, because as a new type, the concept of mixed ownership is not familiar to the majority of companies.

In this study, 72.6 per cent of companies are private, while partnership/joint venture takes second place with 22.2 per cent. This implies that among all the companies investing in design, the majority of them are private (Figure 6.4).

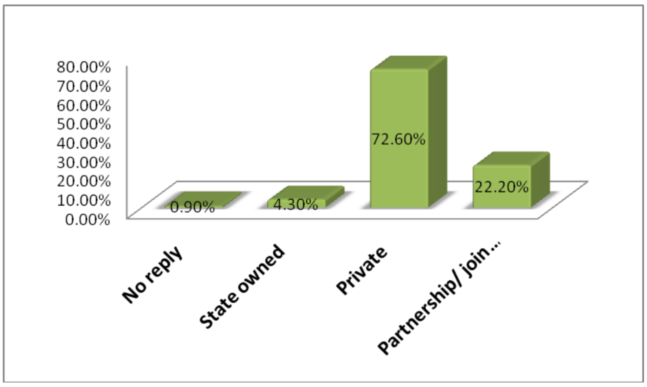

Figure 6.4: The ownership of surveyed companies

Business type

The majority of companies prefer to emphasize their business development in brands, because 67.5 per cent of them indicate their business type as OBM. Only about 11.1 per cent focus on ODM, while no more than 10 per cent are OEM. In addition, number of companies developing their business type in a mixed method is similar to OEM (Figure 6.5).

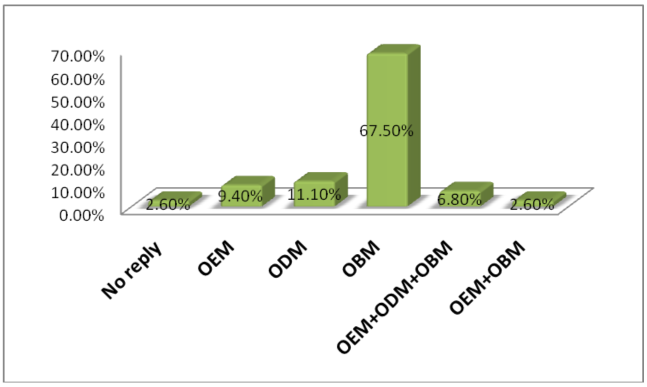

Figure 6.5: Business types

Ownership of brand

Among 117 valid samples, more than 70 per cent of companies confirmed that they had registered and owned at least one brand. About 20 per cent of companies did not answer this question, because some of them are OEM for other brands. Without recognition and experience of brand, they have no idea how to answer the question. Another reason is that they confuse definition of brand with company name, brand and product name (Figure 6.6).

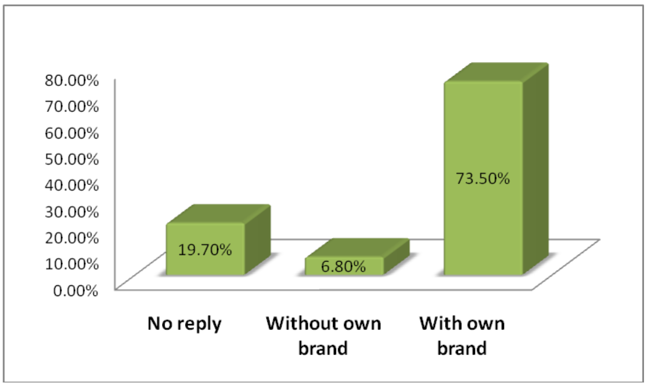

Figure 6.6: Ownership of brand

Product category

Companies were selected from various product categories which cover a wide scope. There are five options of product categories in the answer sheet: household, electrical, electronic, telecommunication and others products. The electrical, electronic, telecommunication and mixed products occupy similar proportion, ranging from 6 to 13.7 per cent. Household manufacturers take a higher ratio, about 25 per cent. In addition, nearly 40 per cent of the companies are in other product categories, besides the five categories (Figure 6.7).

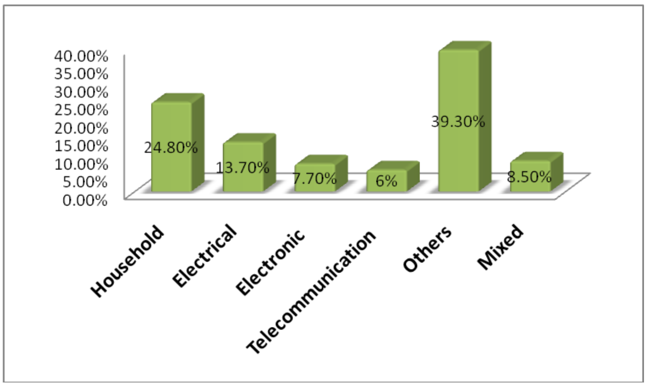

Figure 6.7: Distribution of product category

Core technology

Similar to the multiple categories of product, the companies demonstrate diverse positioning of their core technologies. Concerning the main five core technologies, including materials, mechanical engineering, electronic engineering, system production and others, they show an average distribution, ranging from 11.1 to 20.5 per cent. In addition, 23.9 per cent of companies expressed that their core technologies are outside the five options. And about 10 per cent of companies position their core technologies as mixed (Figure 6.8).

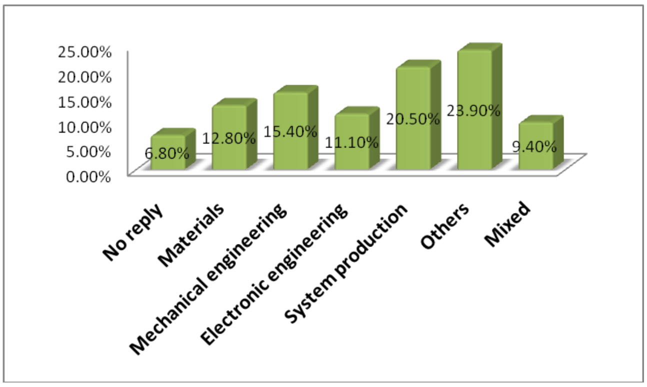

Figure 6.8: Distribution of core technologies

6.2.2. Strategy of design

This section consists of information at the strategic level of design management, which was collected through questions on business goals, evaluation of design contribution, and plans for development. To ensure the validity of answers, companies should not only reply whether they have goals and plans for development, but also indicate the detailed contents, such as design expertise and number of designers needed.

Business goals

For the majority of companies, business goals are considered as an important factor for business operations, 84.6 per cent of companies expressed that they had already set up explicit goals for their business development (Figure 6.9).

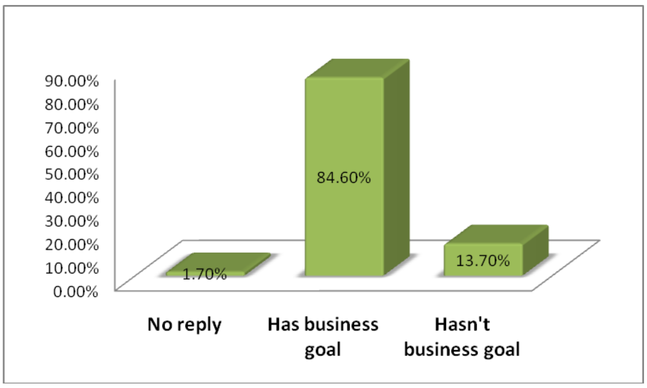

Figure 6.9: Business goals

Evaluation of design's contribution

The majority of companies prefer to evaluate the contribution of design through market performance and feedback. Growth of sales and marketing acceptance are viewed as two efficient ways of evaluation. Among them, more than half of companies would like to assess design's contribution by marketing acceptance, while nearly 30 per cent prefer to audit it by growth of sales. There even are about 15 per cent of companies utilizing the two indicators at the same time (Figure 6.10).

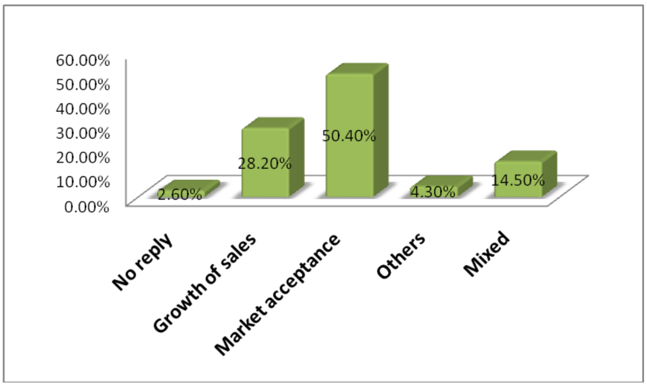

Figure 6.10: Method of accessing design's contribution

Plan for expansion of design

The majority of companies have recognized the importance of design and plan to develop design in their business development actively. About 75 per cent have planned for expanding design. Only nearly 20 per cent of enterprises expressed that they had no plan of developing design further (Figure 6.11).

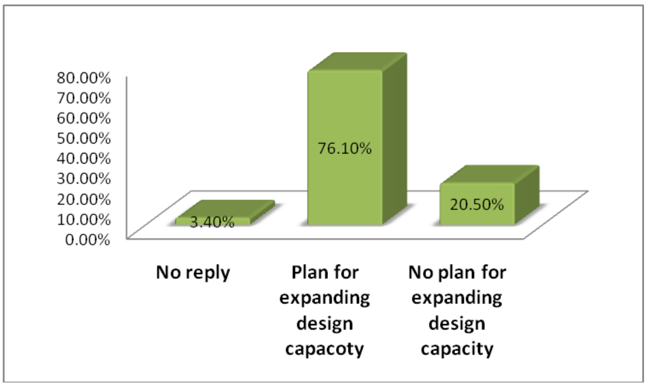

Figure 6.11: Plan for expanding design

Goals for internal design facilities

Around 65 per cent of companies answered that they had clear goals for their internal design facilities development, while nearly 30 per cent of enterprises had not their confirmed goals of it (figure 6.12).

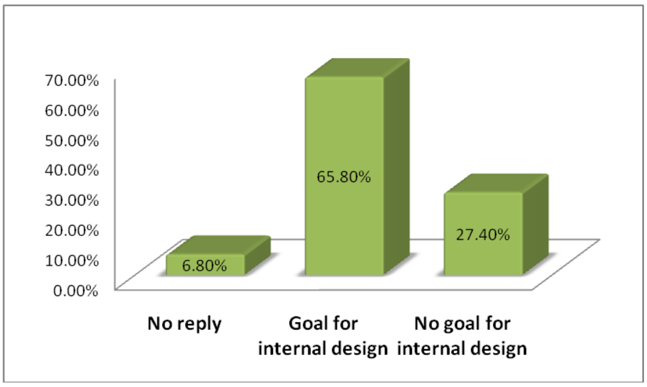

Figure 6.12: Goals for the internal design facilities

Needs of design expertise

In the current stage and the near future, industrial design is the most urgently needed design expertise in nearly 50 per cent of enterprises. In addition, mixed design professionals are also needed in about 30 per cent of companies (Figure 6.13).

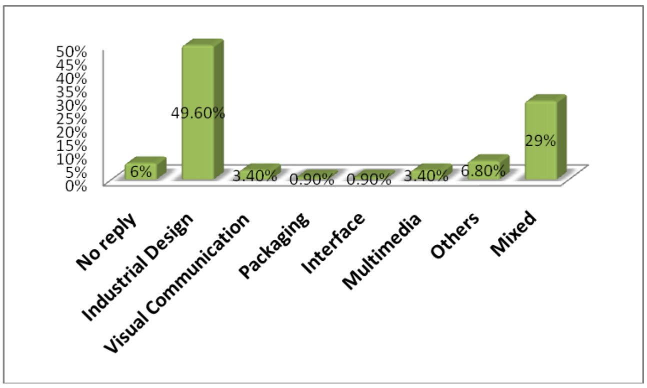

Figure 6.13: The most urgently needed design expertise

Concerning types of design personnel needed, senior designers are the most urgent, which take more than 50 per cent. In addition, mixed design professionals are demanded by more than 20 per cent of companies, while 12 per cent of companies focus on design managers. Companies seldom consider junior designers as urgent design personnel (Figure 6.14).

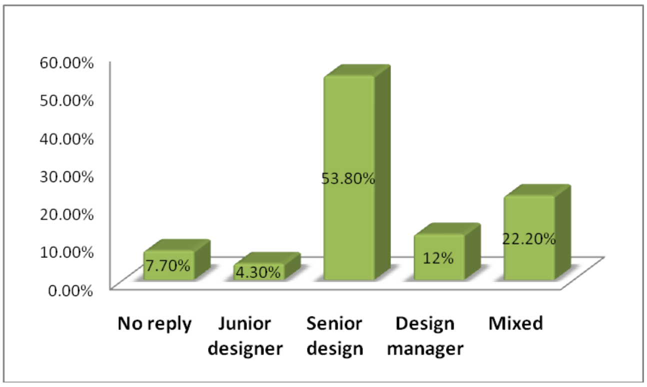

Figure 6.14: Rank of design personnel needed

For the exact number of design personnel needed in a company, about 30 per cent of companies have no clear plans. More than 40 per cent of companies considered the number being between 1 to 5 people (Figure 6.15). This shows that they lack clear ideas for developing internal design capacity through hiring internal designers.

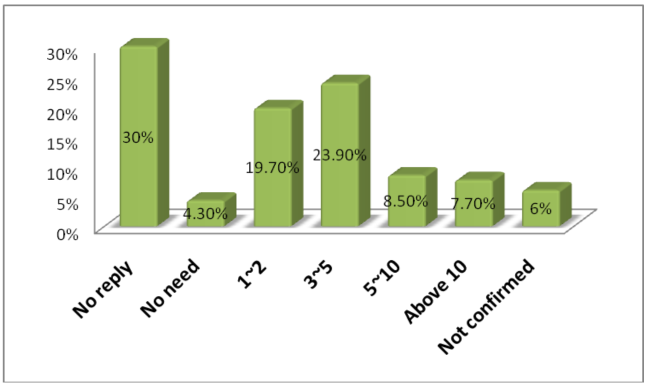

Figure 6.15: Number of such design personnel needed

6.2.3 Investment in design

In a company, its investment in design is demonstrated by two ways: firstly, at the project level, it refers to the utilization of design in product development; secondly, at the company level, it means the exact amount of investment in design issues.

Annual products developed by using design

Concerning annual products development, design varies in its functions in different companies. On the one hand, nearly 30 per cent of companies use design in no more than 10 per cent of their annual new products. On the other hand, about 20 per cent of companies utilize design in more than 60 per cent of annual new products. And more than 20 per cent of companies employ design in 20-40 per cent of their annual products development (Figure 6.16). This implies two significantly different ways of using design in new product development.

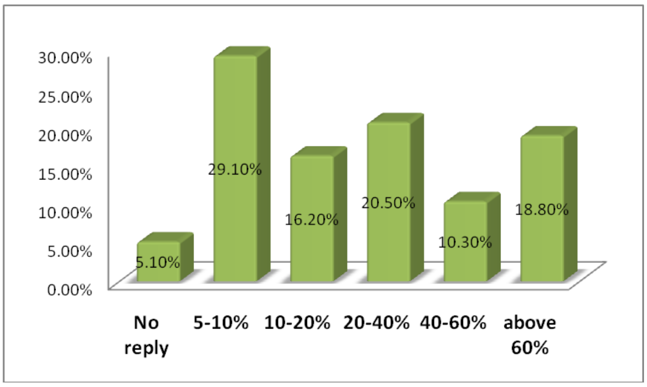

Figure 6.16: Product ranges developed annually with employment of design

Investment in design in new product development (NPD)

Around 45 per cent of companies invest in design at a level lower than 10 per cent of the total cost for a new product (Figure 6.17). In addition, in 82.9 per cent of companies, the investment is less than 40 per cent of total cost for a new product. This shows that the importance of design is still underestimated in practice of the most companies. According to Hollins and Pugh (1990), the investment in design should take 29.5 per cent of the total cost of a new product development.

Compared to it, few companies reach that level, while in about 65 per cent of companies, the investment in design is lower than 20 per cent of the total cost of a new product development.

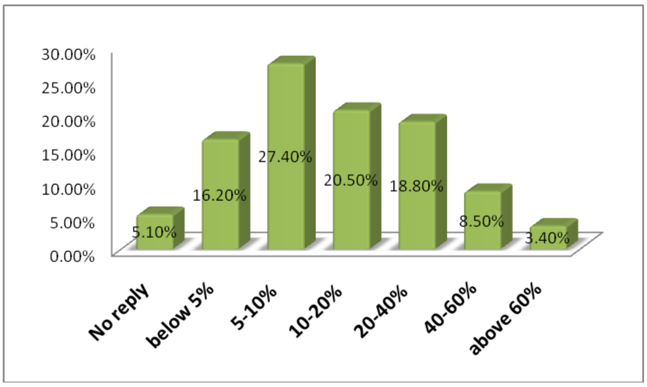

Figure 6.17: Investment in design in a typical product development process

Annual expenditure of design

Concerning the annual expenditure of design in a company, 72.7 per cent of the enterprises invested less than 2 million RMB (Figure 6.18). This demonstrates a limited investment in developing design capacity in these companies.

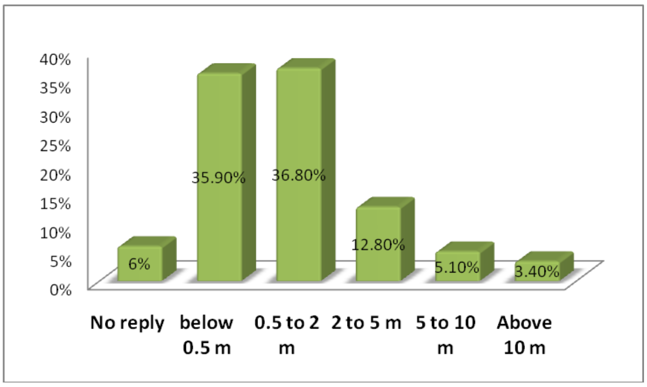

Figure 6.18: Annual expenditure in design (RMB)

6.2.4. Design organization

Topics involved in this part include the role of internal design departments, the role of design and its relations with other functional departments. The findings demonstrate the development, awareness and position of design in a company.

Establishment of internal design department

The establishment of an internal design department is considered as an efficient and direct criterion for evaluating development of internal design capacity. In the 117 samples, about 80 per cent have established an internal design department (Figure 6.19).

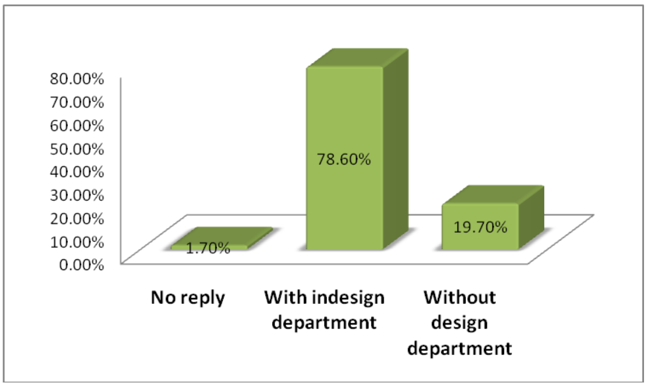

Figure 6.19: Design department established within the company

Decision maker of design

Top managers and function managers are the main decision makers on design matters. In 65.8 per cent of companies, top managers, which refer to general managers, presidents and other bosses of companies, are the final decision makers of design. 14.5 per cent of enterprises assign function managers, including technical directors, marketing managers, sales managers and product managers, as final decision makers of design (Figure 6.20).

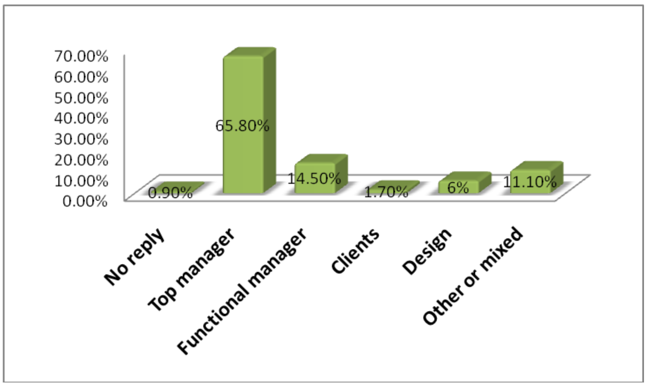

Figure 6.20: Final decision maker of design

Share information

In 92.3 per cent of companies, information and work related to design can be shared by various functional departments, such as marketing, sales and engineering departments. This shows that functional departments have been involved in design activities and keep certain relationships with design departments in most companies (Figure 6.21).

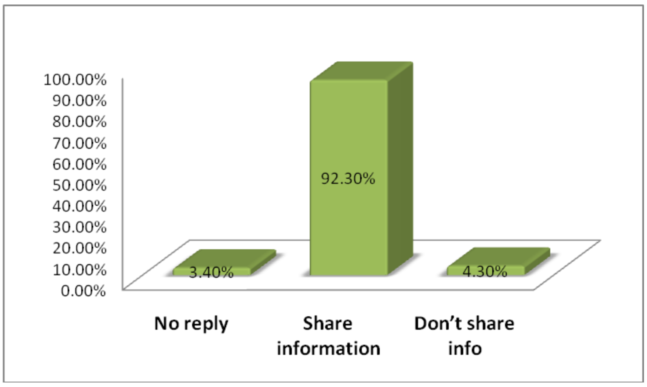

Figure 6.21: Other functional departments share information and work in cooperation with design

Top management's belief of design

It is demonstrated that the value and function of design had been widely and gradually recognized by the management level. In the survey, 96.6 per cent of companies express a belief of their top management that design can leverage the 'profitability' of their companies and their future growth (Figure 6.22).

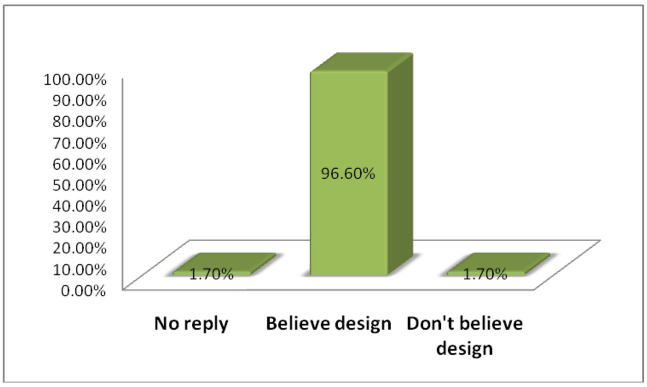

Figure 6.22: top management's belief of design

Design in NPD process

The survey shows that in most cases, design is utilized in product development processes influentially. In around 80 per cent of companies, design is involved in a product development process before its mid-stream. There are nearly 30 per cent of companies, which bring design in the process at the beginning. This shows that the contribution of design for product development has been broadly recognized, and design is involved in product planning in these companies.

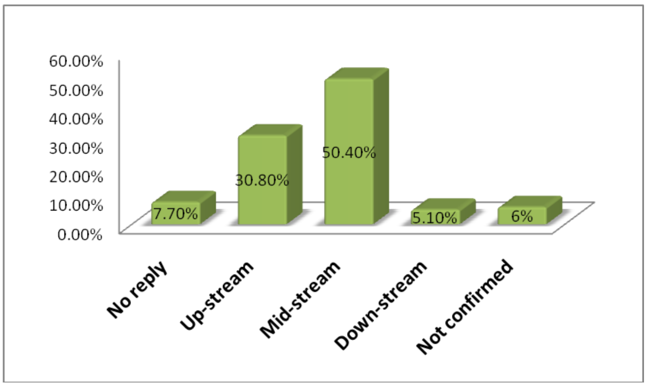

Figure 6.23: The stage design is brought into a product development process

6.2.5. Design outsourcing

In most Chinese companies, design outsourcing is a critical component of managing design and an important way to develop design capacity. The strategy of outsourcing design is influenced by two factors: design development and the ability of external designers. This study collected views from companies through questions of hiring external design, desired design service of external design and management of outsourcing.

Hiring external design

Most companies prefer to hire external designers (Figure 6.24). More than 60 per cent of companies express that they would like to outsource design, while only nearly 40 per cent of companies answered that they had not hired external design recently. However, the two attitudes toward external design are not distinct significantly. Since 78.6 per cent of companies already have their own internal design departments, the number of companies not hiring external design is very low. This implies that companies with their own internal design teams still prefer to hire external design.

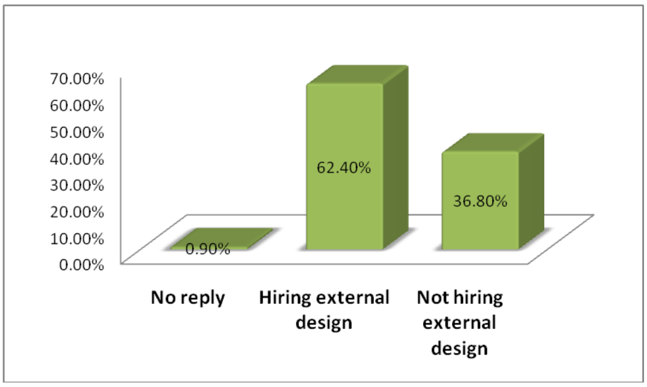

Figure 6.24: Hiring of external design consultancy/ freelance designer

Role of external design

Usually, external design is employed just for general styling design. Only about 25 per cent of companies have clearly indicated that they would hire external design as their strategic partner. However, there are about 15 per cent of enterprises that have no exact ideas of positioning external design in their product development processes (Figure 6.25).

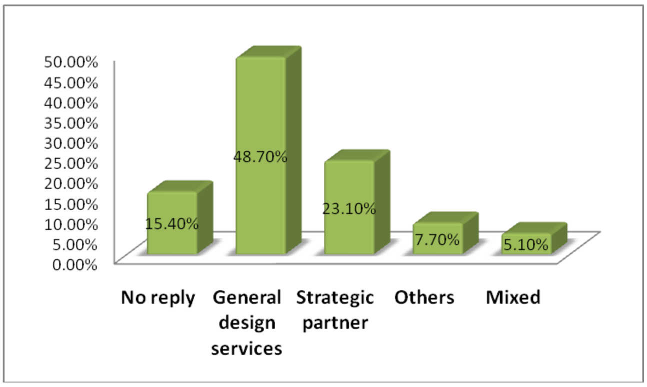

Figure 6.25: The role of external design

Design service needed

1) Type of general design service

Though general design service is the main objective for hiring an external design consultancy, the detailed design service varies in its content, which includes product styling, product engineering, conceptual design, as well as graphic and packaging design. About 40 per cent of companies hired external design for a mixed design service of above types. In addition, product styling is the independent design service needed by more than 20 per cent of companies (Figure 6.26).

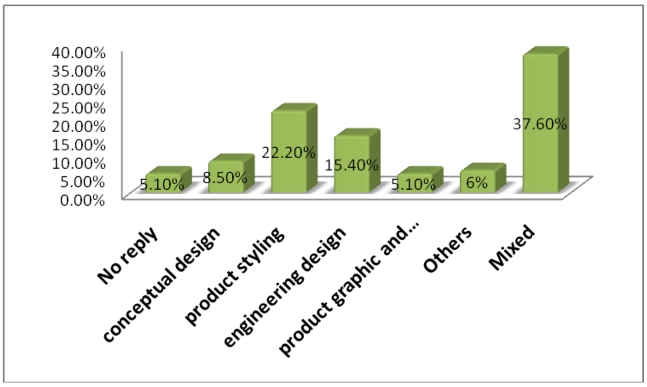

Figure 6.26: types of design service required from design consultancy

2) Other needed design service

Companies expressed a vague opinion of additional design services they need. More than 40 per cent of them selected mixed design services, which include user research, competitor research, product trend analysis, product design strategy and brand strategy (Figure 6.27).

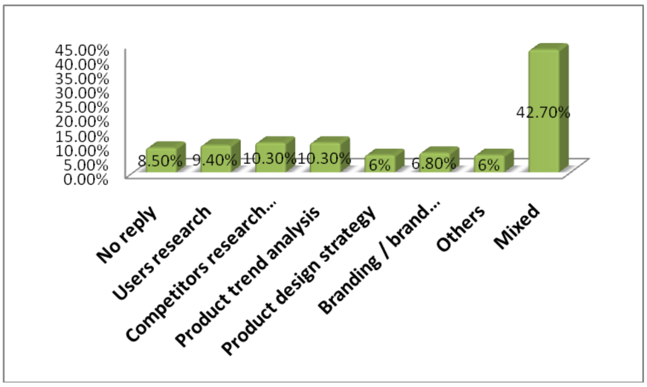

Figure 6.27: design related or supplementary service demanded by companies

Satisfaction of external design service

In about 55 per cent of companies, the design service offered by external design was considered as being appropriate for their needs. More than 15 per cent of companies have no reply to the question, while about 27 per cent of companies have clearly expressed their dissatisfactions about external design service.

Compared to 62.4 per cent of companies hiring external design, this result implies that most companies are satisfied with design service offered by external design. However, there are still some companies expressing their dissatisfactions with external design service. This needs to be studied further (Figure 6.28).

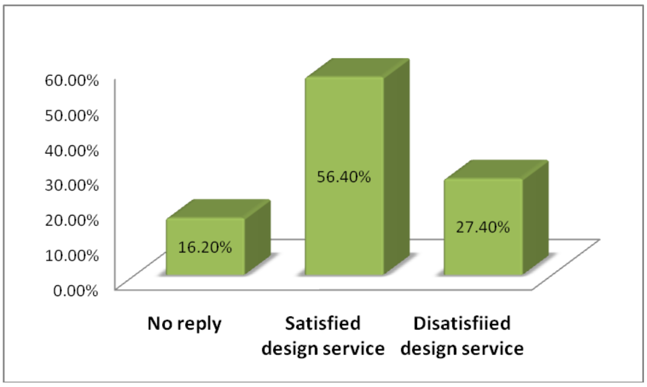

Figure 6.28: evaluation of design service offered by external design consultancy

Integrator of external design

Product managers are the main integrators of external design in more than 40 per cent of companies, while in-house designers are assigned as integrators in more than 20 per cent of companies. Engineers and other roles share a similar proportion (Figure 6.29). This implies that internal designers are at a lower position than product managers in organizing design work in many companies.

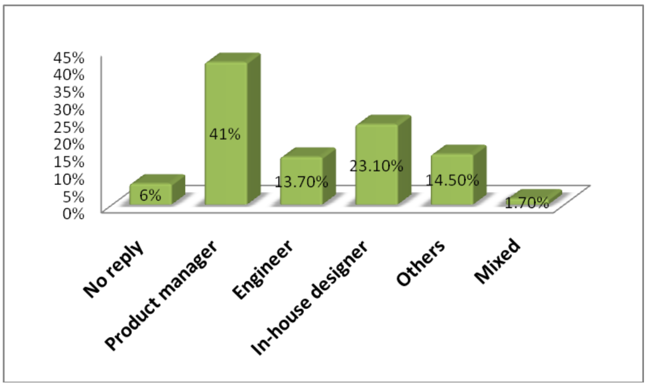

Figure 6.29: Integrator of external design

6.2.6 Summary

The 117 companies demonstrate their diverse background through their answers. They vary in year of establishment, size, ownership, business type, product category, and core technology. In this instance, the generalizability of the survey is identified.

According to the analysis of the answers, the basic situation of managing design in these companies is proposed in four aspects: design strategy, investment in design, design organization and design outsourcing.

Design strategy

The content of design strategy is obtained through questions about design plan, design evaluation and human resource of design in the survey.

A design plan is a part of business goals, which is considered as an important factor for business operations. Moreover, 75 per cent of companies have planned for expanding design. In addition, the majority of companies also have clear plans to realize the plans through statements of goals for developing internal design capacity, types of design expertise needed and the number of designers needed.

To evaluate the contribution of design, its business contribution is viewed as the most direct and efficient criteria. In most cases, it is represented by market performance, such as growth of sales and marketing acceptance.

For the issue of human resources related to design, the results show that industrial design is the most urgently needed design expertise in nearly half of the companies. In addition, mixed design professionals are also needed. This implies that styling design is still the main work content of internal designers. Concerning the level of design personnel, senior designers are needed by more than half of the companies. Furthermore, about 45 per cent of companies have explicitly expressed the exact number of designers needed, ranging from 1 to 5.

Design organization

Issues of design organization include design development in practice, design awareness in top managers and other functional departments.

In most cases, the establishment of an internal design department is considered as a direct criterion for evaluating design development in a company and the majority of companies have established their own internal design departments. In addition, design is utilized in a product development process from the beginning in some companies, while in other companies design enters product developing processes at mid-stream. This shows that the importance of design for a product development has been broadly recognized in practice.

Top managers also show their recognition of design in various aspects. Top managers and function managers usually are the final decision makers. In addition, the majority of top management believe design can leverage the 'profitability' of their companies. Besides top managers, other functional departments also have been involved into design activities and works in a company.

Design Outsourcing

As an important content of design management, issues of design outsourcing include attitudes toward external design, aims of hiring it, its limitations and management.

More than half of the companies would like to hire external design. For those companies hiring external designers, they usually employ external design consultancies for general styling design, instead of a more important role in product development. They emphasize service for practical design work, instead of strategic consultancy. This indicates the recognition of design in these companies is at a primary stage.

According to the feedback from respondents, the difficulty of managing external design is a key obstacle to use external design. And the service of external design is difficult to be evaluated within the management systems of some companies. In addition, some companies frequently complain the low quality service offered by local design consultancies, which influenced their strategies of outsourcing design significantly.

Furthermore, internal designers play a restricted role in organizing design work related to design outsourcing. In most cases, product managers are the major integrators of external design.

Design operation

Most of the surveyed companies would like to invest in design. This is shown by their utilization and investment in design in new product development, as well as amounts of annual expenditure on design. However, their investment in these items is considered as being lower than average levels. This demonstrates that in the practice of Chinese enterprises, though the majority of top managers express their good design awareness and recognition of design, their investment in design is still limited.

6.3 Characteristics of Design Development in Practice

The characteristics of design development in Chinese enterprises are obtained in this section, based on the result of preliminary data analysis in section 6.2. The findings consist of two parts: background of design development based on the common characters of samples; and the characteristics of design development, which have been achieved by analyzing design and management topics.

6.3.1 Background of design development

Common characteristics of samples are reported in this section. They were obtained by analyzing the business characters of samples. The characteristics consist of elements of enterprise background, such as establishment year, business type, ownership and competence.

1) Influence of politics and economy

The establishment year of companies demonstrates a close relation with events in the social and economic content (Hang, 2009). From the 1830s to 2000s, there are three booms of companies: 1985, 1990s, and 2000s (Figure 6.1), which relate to its political and economic background tightly.

The year of 1985 represents the end of the first stage of Deng Xiaoping's Open Policy. In this year, the direction and politics of the Open Policy had been confirmed based on its primary achievements in rural reform and through the book about Deng's theory of establishing socialist democratic politics with Chinese characteristics (Deng, 1985). After that, the second stage of the Open Policy started and the key emphasis was transformed to urban economic system reform, which directly led to the boom of Chinese enterprises.

After Deng Xiaoping's Southern Tour Speeches in 1992, the achievements of the Open Policy in the PRD were confirmed. This resulted in conducting the Open Policy in the YRD based on the successful experience of the PRD. According to it, since 1993, some cities along the Yangtze River were opened up for development, most notably the Pudong Area of Shanghai. During this period, a new generation of enterprises emerged in the PRD and YRD.

At the beginning of the new Millennium, joining the World Trade Organisation (WTO) became a key issue in China. At one hand, an increasing number of Chinese companies had been established based on the Open Policy, and most of them began to think of expanding their markets on a global basis. This would be facilitated by accession to the WTO. On the other hand, attracted by the growth of a huge consumer market in China and accessing to the WTO, foreign direct investment (FDI) increased. These two aspects interacted on each other and stimulated economic development in this period.

The above stages of Chinese development demonstrate a tight relationship between establishment of companies and political or economic events, which also indirectly influence design activities and development in these enterprises. Therefore, the influence is viewed as a basis for developing design in Chinese enterprises.

2) Private enterprises as leaders in developing design

Figure 6.4 shows that private is the main ownership and legal structure in around 75 per cent of companies, while other types only take a small share. Compared to other types of ownership, such as state-owned and partnership/joint venture, Chinese private enterprises lack support of policies, funds and resource. They usually face more fierce competition and have to struggle in building their own advantages of competition by various ways. This has led them to realize the value of design in business in advance. It can possibly explain why they are the leaders in developing design capacity in all companies.

3) OBM as a main business type

It is shown in Figure 6.5 that original brand manufacturing (OBM) is a main business type in 67.5 per cent of all companies. In addition, Figure 6.6 presents that 73.5 per cent of companies have their own brands. However, the two data implies a confused situation that not all companies with brands have developed a clear business strategy focusing on brand development. This shows that some of them just emphasize the importance of brand image, instead of recognizing its further value in influencing the total business system of a company.

Concerning the mixed ways of business type, it shows that OEM represents the early stage of business development and offers a basis for developing to other business type. Though many enterprises had transformed to business of ODM or OBM, OEM still exists as a basis for development and is frequently combined with ODM and OBM in various forms in different enterprises.

4) Vague definition of core technological competence

The core technological competence of samples is shown in Figure 6.8. In most companies, their core technological competence cannot be clearly defined. Among all core technological competence and capacities, system production is the main technological feature with 20.5 per cent of respondents. Others, such as materials, mechanical engineer and electronic engineering, occupy similar proportion, ranging from 11.1 to 15.4 per cent. In addition, some companies express their core technological competence as a mixture one. This implies that when these companies developed with high-speed, especially in the process of transforming from OEM to ODM and OBM, they seldom rely on one fixed core technology.

6.3.2. Relations in questions

To explore characteristics of design development in companies, two main resources are utilized based on results of analyzing questions in questionnaires. The first resource is the results of analyzing frequency distribution of the questions. Based on summarizing the common features shown in the results, characteristics of design development in the companies can be obtained. The second resource is the relations in the questions, which are achieved by calculating the association relationships between questions through SPSS. The relations also contribute to explore major characteristics of design development.

To obtain relations between two questions, SPSS is utilized. According to it, each question is viewed as a variable. Answers of questions are used to analyze association between each pair of variables. According to the options of questions, variables can be divided into two types in this study: nominal and ordinal variables. Nominal variable refers to a categorical variable, which has two or more categories without intrinsic ordering to them, such as establishment of in-house design department, hiring external design, decision makers of design, evaluation of designers' contribution, and so on. Ordinal variable includes two or more categories with a clear order of them (Glass *et. al.*, 1996). In this study, they are investment in design in NPD, annual expenditure of design, number of employee, annual products using design, and so on. According to this, there are total three types of relations among variables: nominal-by-nominal, nominal-by-ordinal, and ordinal-by-ordinal. Each type corresponds to distinct method of calculating relation between two variables. The results of it are reported in Appendix F.

As a result, 21 pairs of variables are explored being associated with each other. They are related to 16 variables (Figure 6. 30). Among them, five pairs are nominal-by-nominal; eight are nominal-by-ordinal; and eight are ordinal-by-ordinal. In addition, since there is not dependent and independent variables, directional measures are used to indicate the direction of association between two variables, which is demonstrated by the arrows between two questions in the Figure 6.30.

Furthermore, the relations network can be grouped into four topics, corresponding to the categories in the questionnaire. The four topics are: design strategy, design organization, design outsourcing, and design operation (Figure 6.30). This shows that the survey leads to a validity inference.

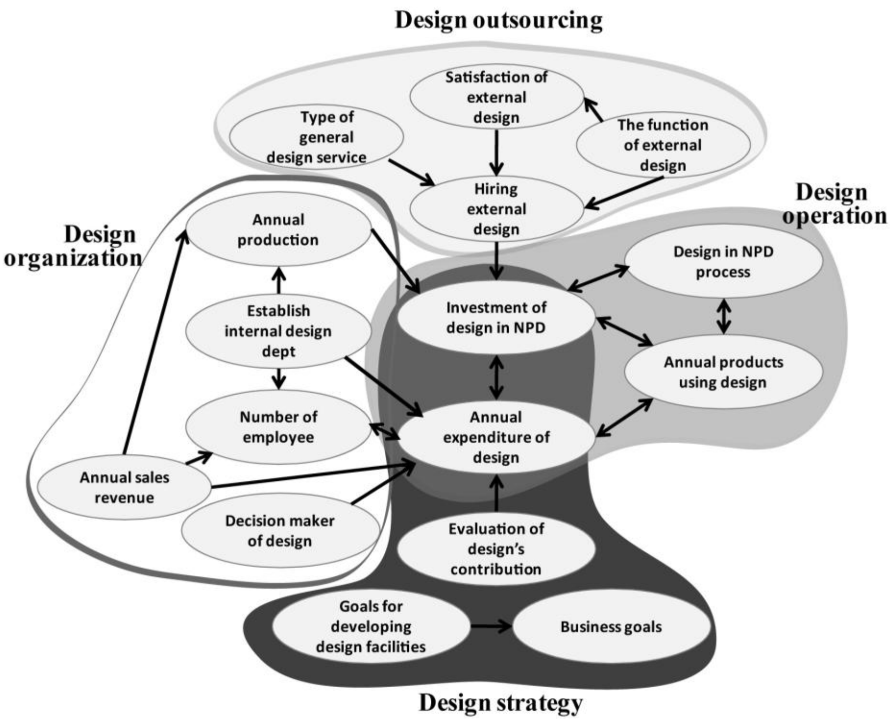

Figure 6.30: Relations in questions

In the next section, the characteristics of design development in Chinese companies are reported based on summarizing frequency distribution and relations in questions.

6.3.3 Characteristics of design development

In this section, nine characteristics of design development in the companies are reported. Among them, the first two are obtained from the findings in section 6.2, based on summarizing common features reported from different questions. Other seven characteristics are achieved from the relations in questions reported in section 6.3.2.

1) Silent design and low status of internal designer

Based on a pilot study, Dumas and Whitfield (1990) defined managers who were (a) active in design tasks; (b) contributed to the design process; and (c) frequently worked alongside professionally trained designers; while acknowledgement of their own contribution was, in general, absent, as “Silent Design.” In the samples, “silent design” is represented by top managers, functional managers and product managers.

It is top managers and functional managers who are responsible for decisions of design in about 80 per cent of companies. Among all the companies, only 6 per cent of them assigned in-house designers as final decision-makers of design (Figure 6.20). In addition, it is product managers that play the role of integrating external design in 41 per cent of companies. In-house designers are the second option as integrators, with only 23.1 per cent of companies assigning their designers as coordinators of outsourcing design (Figure 6.29).

The final decision-maker of design and integrator of external design are two indicators of the status of internal designers in a company. Concerning it, in-house designers have already been assigned certain work in managing design activities. However, they still do not play a key role and only take the second place. It is silent designers, such as top managers, functional managers and product managers, who are responsible for managing design in the majority of the companies.

2) Good awareness of design

Good awareness of design is shown in the majority of companies, based on answers of plans for expanding design, goals for internal design facilities development, and top management’s belief in design. In more than 75 per cent of companies, there is a plan for expanding design (Figure 6.11). More than 65 per cent of companies have goals for developing internal design facilities (Figure 6.12). And the most important is that the top management of nearly 97 per cent of companies have shown their belief of design as profit maker (Figure 6.22). This implies that not only have top management gained a good awareness of design, but also is planning to enhance design capacity as part of their future goals.

3) Use design more, invest in design more.

This characteristic is obtained from five relations within four variables: stage design brought in a NPD process, annual products developed by using design, annual expenditure of design, and investment in design in NPD (Figure 6.31). The results of analysis are reported in Appendix F, including F-2-D, F-2-G, F-2-H, F-3-C and F-3-E.

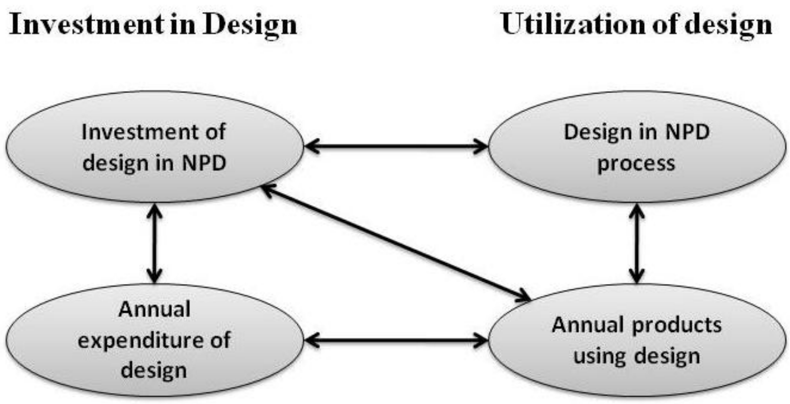

Figure 6.31: Relation between investment in design and utilization of design

The four variables can be divided into two topics: investment in design and utilization of design. The mutually promotive relationship between variables implies the same relation between the two topics. In the topic of investment in design, investment in design in NPD and annual expenditure of design are positive correlation, which means that the more investment in design in NPD corresponds to more expenditure of design. In the topic of utilizing design, the stage design brought in a NPD process and annual products developed by using design reflect each other. In most cases, the earlier stage design is brought in a NPD process, the fewer products are developed by using design. As a result, concerning the relation between two topics, the more utilization of design reflects the more investment in design, and vice versa.

Furthermore, since seldom companies bring design in their NPD at down-stream, up and mid-stream are the main categories to be analyzed. According to the Table 6.1, when design is brought in NPD process at mid-stream, companies usually invest in design more. This implies that design still cannot be involved in the up-stream of NPD process in most cases and design is mainly used for styling, instead of strategy and planning of products.

Table 6.1: Crosstabulation: design in NPD * investment in design in NPD

			Investment in design in NPD							Total
			No reply	A	B	C	D	E	F	
design in NPD	No reply	Count	4	2	2	1	0	0	0	9
		% within design in NPD	44.4%	22.2%	22.2%	11.1%	.0%	.0%	.0%	100.0%
		% within Investment of design in NPD	66.7%	10.5%	6.2%	4.2%	.0%	.0%	.0%	7.7%
		% of Total	3.4%	1.7%	1.7%	.9%	.0%	.0%	.0%	7.7%
	Up	Count	1	9	10	7	6	1	2	36
		% within design in NPD	2.8%	25.0%	27.8%	19.4%	16.7%	2.8%	5.6%	100.0%
		% within Investment of design in NPD	16.7%	47.4%	31.2%	29.2%	27.3%	10.0 %	50.0%	30.8%
		% of Total	.9%	7.7%	8.5%	6.0%	5.1%	.9%	1.7%	30.8%
	Mid	Count	1	8	14	16	9	9	2	59
		% within design in NPD	1.7%	13.6%	23.7%	27.1%	15.3%	15.3 %	3.4%	100.0%
		% within Investment of design in NPD	16.7%	42.1%	43.8%	66.7%	40.9%	90.0 %	50.0%	50.4%
		% of Total	.9%	6.8%	12.0%	13.7%	7.7%	7.7%	1.7%	50.4%
	Down	Count	0	0	5	0	1	0	0	6
		% within design in NPD	.0%	.0%	83.3%	.0%	16.7%	.0%	.0%	100.0%
		% within Investment of design in NPD	.0%	.0%	15.6%	.0%	4.5%	.0%	.0%	5.1%
		% of Total	.0%	.0%	4.3%	.0%	.9%	.0%	.0%	5.1%
	Not	Count	0	0	1	0	6	0	0	7
		% within design in NPD	.0%	.0%	14.3%	.0%	85.7%	.0%	.0%	100.0%
		% within Investment of design in NPD	.0%	.0%	3.1%	.0%	27.3%	.0%	.0%	6.0%
		% of Total	.0%	.0%	.9%	.0%	5.1%	.0%	.0%	6.0%
Total		Count	6	19	32	24	22	10	4	117
		% within design in NPD	5.1%	16.2%	27.4%	20.5%	18.8%	8.5%	3.4%	100.0%
		% within Investment of design in NPD	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0%
		% of Total	5.1%	16.2%	27.4%	20.5%	18.8%	8.5%	3.4%	100.0%

4) Silent designers lead to limited utilization and investment of design

According to the relation shown in the Figure 6.32, final decision-maker of design can directly influence annual expenditure of design and indirectly influence other variables about investment and utilization of design. Since top managers and functional managers are final decision-makers of design in most cases, they are silent designers in practice. However, the relation of the two variables is negative correlation: when top managers are final decision-maker of design, there is less expenditure of design in a company. Compared to the second characteristic - good awareness of design, the content of this characteristic demonstrates a confused issue. Although top managers already have good awareness of design and are involved in design activities as final decision-maker, they prefer to less investment in design. This is explained in Chapter Eight.

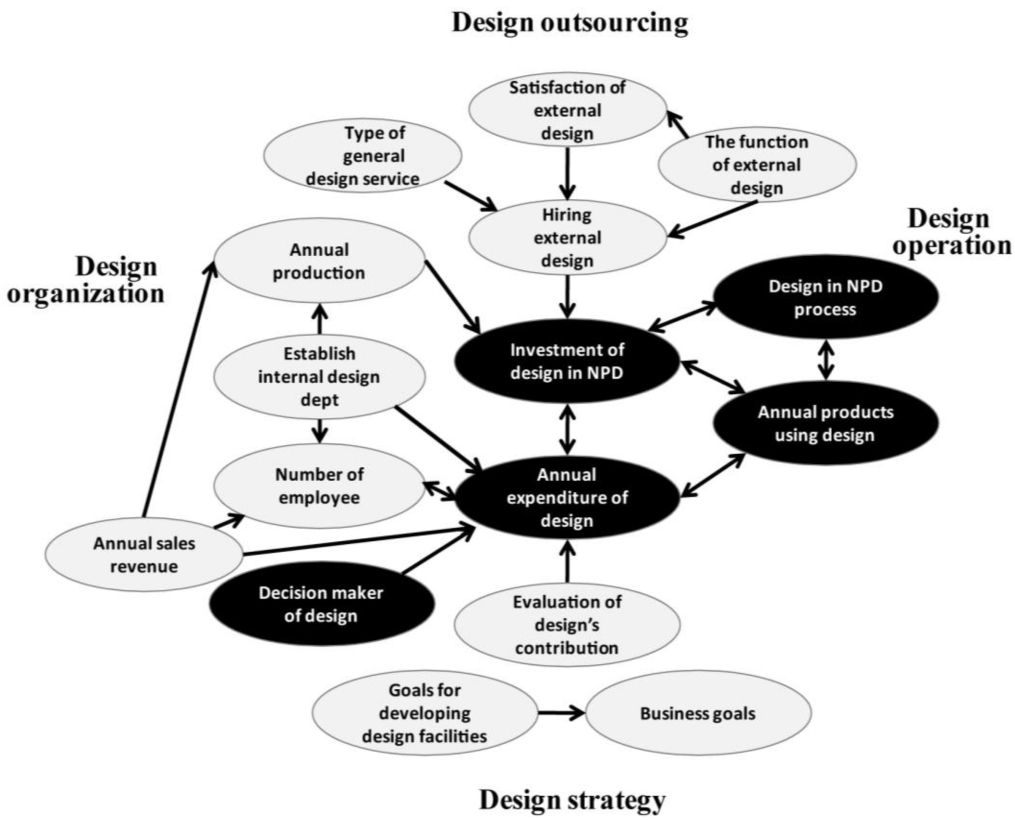

Figure 6.32: Relations in final decision maker of design and investment/utilization of design

5). In-house design department in larger companies, which usually use and invest in design actively.

In the survey, number of employee, annual sales revenue and annual production are questions for obtaining information to divide company size. However, responders prefer to answer the number of employee, instead of sales revenue and annual production, which are considered as business secret and cannot be revealed. In this instance, number of employee is used to divide company size in this study.

According to the relations diagram, it is the establishment of in-house design department that reflects larger-size companies and more expenditure of design (Figure 6.33). In addition, through the relation network between investment in design and utilization of design, the establishment of in-house design department also corresponds to more investment and utilization of design.

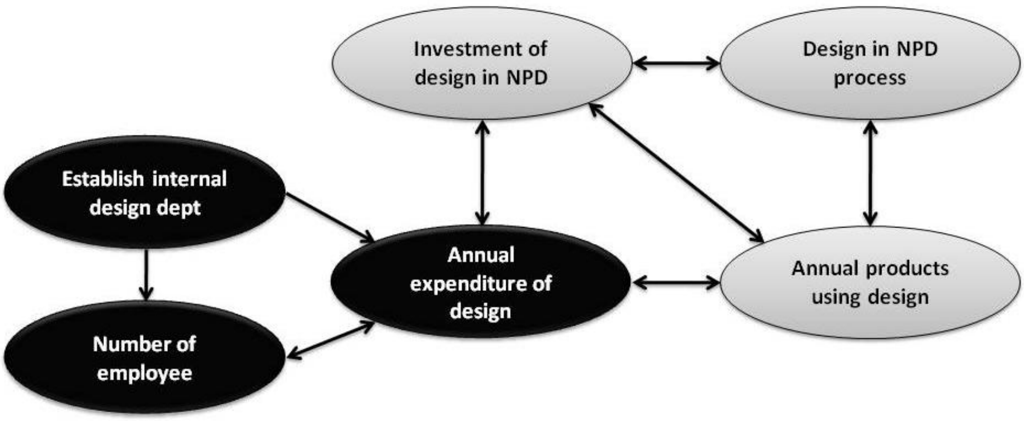

Figure 6.33: Relations in design department, company size and expenditure of design

6). Hiring external design implies more investment in design in NPD.

According to the analysis results reported in Appendix F-3-D, hiring external design and more investment in design in NPD process are positive correlation (Figure 6.34), which means the two variables can predicate each other. In addition, by knowing investment in design in NPD, we are able to realize a proportional reduction in error of 12.8 per cent in predicating hiring external design; by knowing hiring external design, we have 21.8 per cent of possibility to know investment in design in NPD. This means the direction of the relation is from hiring external design to the variable of investment. In simple words, hiring external design reflects more investment in design in NPD.

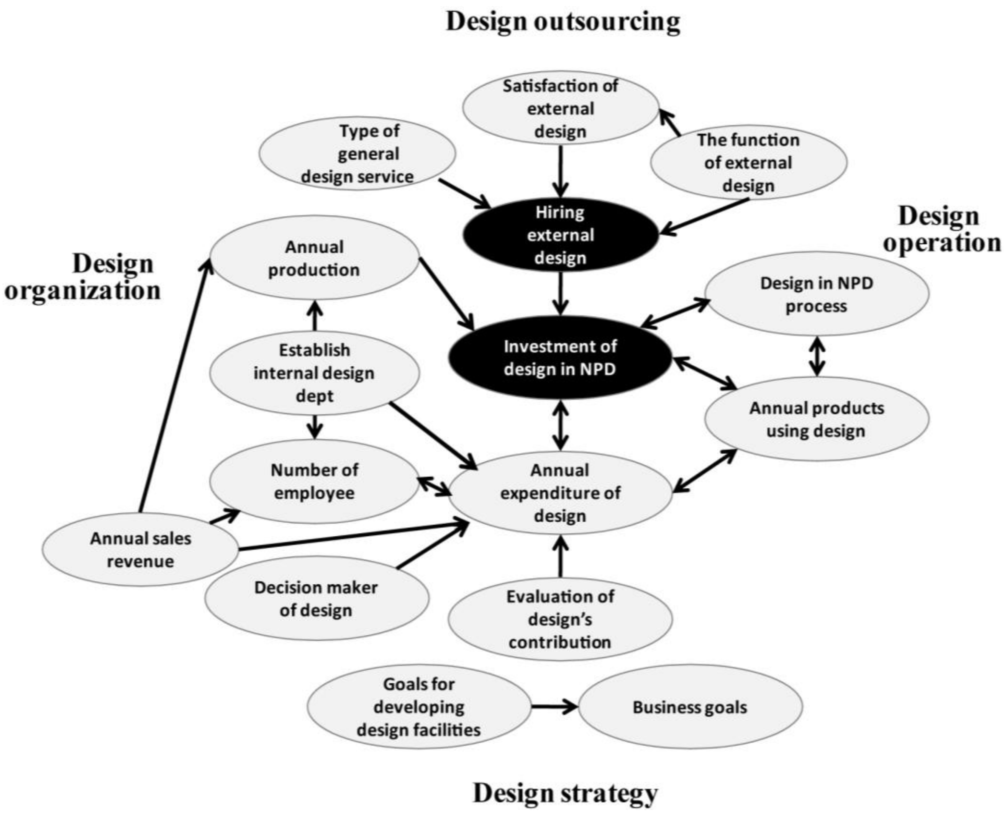

Figure 6.34: Relation between hiring external design and investment in design

7). Strategy of hiring external design is influenced by content and quality of design service offered by external design

According to analysis, strategy of hiring external design is mainly influenced by the role of external design, the design service offered by external design, and satisfaction of external design (Figure 6.35). Concerning the role of external design, companies hiring external design usually consider the role of external design as strategic partner (Appendix F-1-A). For the content of design service, external design offering various design service can lead to a strategy of hiring external design in a company (Appendix F-1-B). In addition, with satisfaction of external design, companies prefer to hiring external design (Appendix F-1-C). These demonstrate the importance of the content and quality of design service offered by external design: it can influence the strategy of hiring external design in a company.

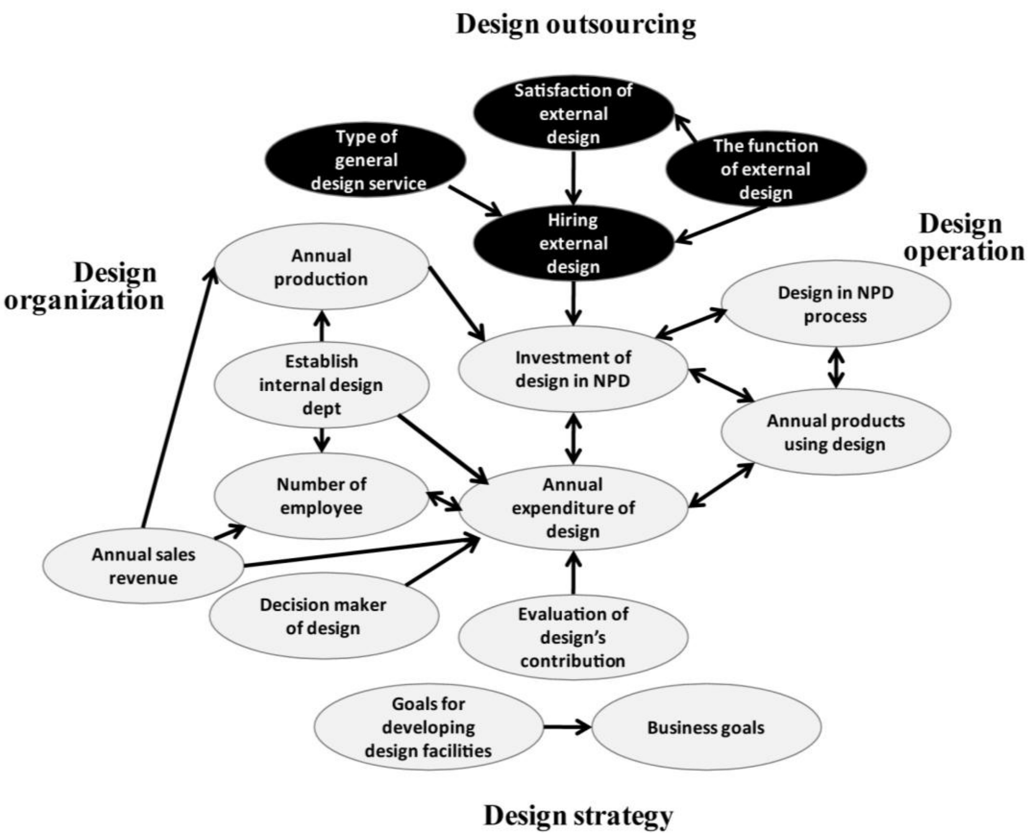

Figure 6.35: Factors influencing strategy of hiring external design

8). Market performance influences annual expenditure of design

In the questionnaire, there are three options for a company to evaluate its design's contribution: sales growth, market recognition and others. In the survey, it was designed that sales growth represented business value, while market recognition implied products' market performance. According to the results shown in

Appendix F-3-H, when market recognition is the main way of evaluating design's contribution, there is more expenditure of design in a company (Figure 6.36). In other words, good market performance corresponds to more expenditure of design.

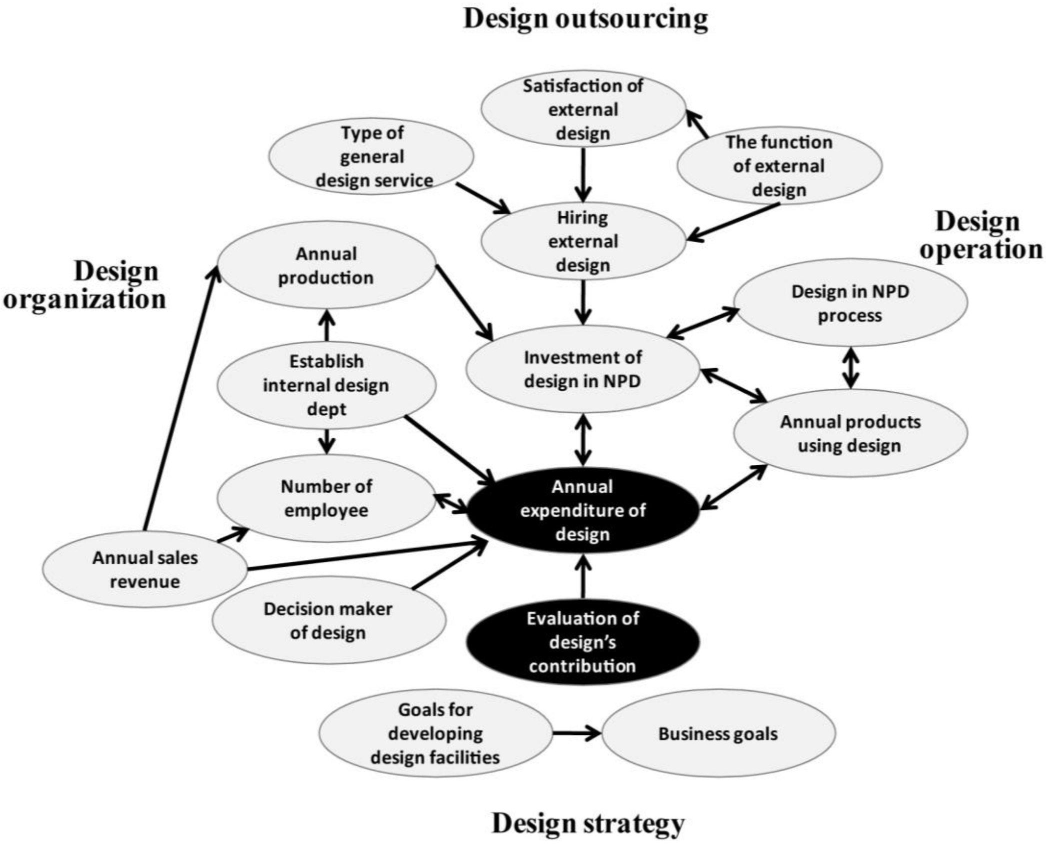

Figure 6.36: Market performance and annual expenditure of design

9). Design goals as a part of business goals.

Based on result in Appendix F-1-E, by knowing business goals, there is 30 per cent of possibility to predicate the existing of design goals in a company (Figure 6. 37). This implies that in some companies, design goals have been involved into consideration of making business goals.

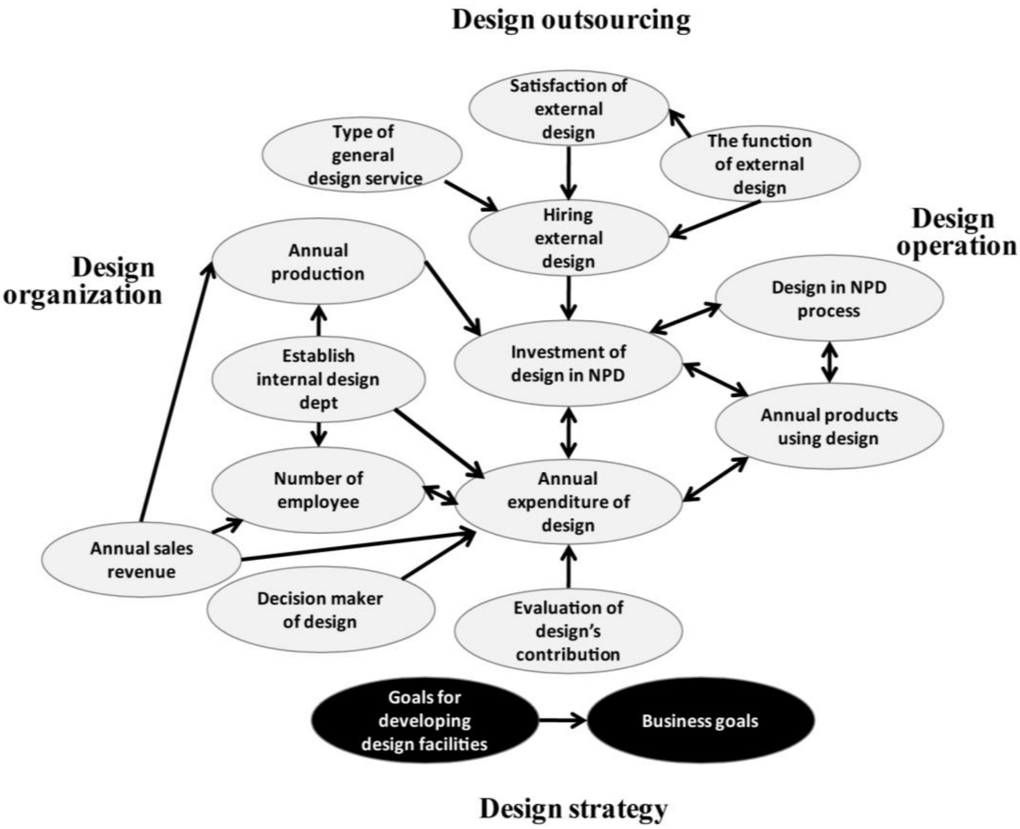

Figure 6. 37: Relation between business goals and design goals

6.4 Summary

A brief understanding of design in the practice of the companies is described in this chapter, based on the data analysis of questionnaires with SPSS. Two types of analysis are utilized: frequency distribution and crosstabulation. The main findings are divided into two parts to report. The first is the basic situation of design in Chinese manufacturers, which is based on the frequency distribution of questions in the survey. The second part is characteristics of design development in practice of the companies, which are contributed by crosstabulation.

The companies mainly were established after 1990, especially in the 2000s. They seldom have sub-plants or divisions. Most of them are small and medium private companies. In addition, the majority of companies have their own brands and focus on OBM business, although their understanding of branding in practice needs further clarification. These companies cover a wide scope of product categories and lack a confirmed core technology.

Concerning their strategies, most companies have clear business goals, design plans and methods of evaluating design. They would like to invest in design and utilize design in practice. However, the amount of the investment and applications of design might be limited. In the organizational structure of a company, an internal design department usually has been established. Top managers have good awareness of design and information related to design work could be shared among various functional departments. Design has been utilized in a new product development process, especially in the up and mid-stream. But, in most cases, it is top managers who are responsible for final decisions of design, instead of designers.

Since outsourcing design is an essential part of managing design in a company, most companies have coordinated with external designers. They employ them for general design service and as strategic partner. And the majority of the companies are satisfied with external design. However, similar to the role of final decision-maker of design in a company, in-house designers only play a secondary role in integrating external design, while product managers are assigned as controllers in most cases.

Besides the basic information, characteristics related to design development in the companies are revealed in two parts: background and nine characteristics. Concerning the background of the companies, it is usually influenced by economics and politics. Private and OBM companies play a leading role in developing design. In addition, they usually have vague definition of core technical competence because of their dynamic development process.

The nine characteristics correspond to the four categories of questions in questionnaire: design strategy, design organization, design outsourcing and design operation, which can be divided into the three levels of design management content. In the topic of design strategy, companies have shown good awareness of design; design goals are involved in the consideration of business goals in some companies; and market performance influences expenditure of design. Concerning design organization, it is reported that there are silent designers and low status of internal designers; the silent designers lead to limited investment in design; in-house design departments usually are established in larger companies, which use and invest in design actively. For design outsourcing, hiring external design implies more investment in design in NPD; strategy of hiring external design is influenced by content and quality of design service offered by external design. Concerning design operation, it is explored that use design more, invest in design more.

Chapter 7.

The Twelve Cases

7.1 Selection of the Cases

The twelve cases consist of six cases in the YRD and six cases in the PRD. Concerning the generalizability of case study, the twelve companies had been selected according to five rules:

a) Variation in their background, such as size, product category, ownership and business type;
b) Variation in ways of organizing design, including design awareness, establishment of internal design department and design as core competitiveness;
c) Representing main locations in the YRD and PRD;
d) Manufacturing-oriented;
e) Performing with some characteristics reported in Chapter Six.

All the cases should match the five rules at the same time. They also would like to take part in the research project and offer relevant information. In addition, certain cases were specially selected because they link to the traditional industries in the two deltas. Table 7.1 lists the twelve companies as cases in this study. Their diverse backgrounds are illustrated by Figure 7.1, which shows their performance according to rule (a) and (b). The representative locations of these companies are shown in Figure 7.2. Furthermore, their performance according to the characteristics in Finding I part is shown in Table 7.2.

Table 7.1: Twelve companies in case study

	Size	Ownership		History	Product category	Business type	Internal design	Outsourcing design
Breo	S-M	Private	Fixed	90s	Consume product	OEM, ODM, OBM	No	Yes
Canbo	L	mixed	Transformed	70s	Home appliance	OEM. OBM	Yes	Yes
Midea Microwave	L	mixed	Fixed	90s	Home appliance	OEM, ODM, OBM	Yes	Yes
Vatti	M-L	mixed	Transformed	90s	Home	OBM	Yes	Yes

					appliance			
TCL	L	mixed	Transformed	90s	Home appliance	OBM	Yes	Yes
Hisense Kelon	L	mixed	Transformed	80s	Home appliance	ODM, OBM	Yes	Seldom
Hiaward	S	Private	Fixed	90s	Instrument	OEM, ODM, OBM	No	Yes
Genvana	L	Private	Fixed	90s	Consume product	OEM, ODM, OBM	Yes	Seldom
Ted Golf	S	Private	Fixed	00s	Consume product	ODM+OBM	No	No
Muyang	M-L	Private	Transformed	60s	Instrument	OBM	Yes	Seldom
Ruyi	M	Private	Fixed	80s	Consume product	OEM, ODM, OBM	Yes	No
Heng Feng	L	Private	Fixed	90s	Consume product	OEM, OBM	Yes	Yes

Table 7.2: Performance of the twelve companies according to characteristics

		Breo	**Canbo**	**Media Microwave**	**Vatti**	**TCL**	**Hisense**	**Hiaward**	**Ruyi**	**Heng Feng**	**Genvana**	**Ted Golf**	**Muyang**
1	Limited investment of design	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Depends	Yes	Depends
2	In-house design departments established larger enterprises	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	Silent design and low status of internal designer	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	No	Yes	No
4	Silent design promotes design	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	Need for senior industrial designer	Yes	Yes	Yes	Yes	Yes	Yes	Depends	Depends	Yes	Yes	Yes	Yes
8	Good awareness of design	Not in all staff	Yes	Yes	Yes	Yes	Yes	Not in all staff	Not in all staff	Yes	Yes	Yes	Yes

Though the data of case study had been collected to allow triangulation through interviews, direct observation and documents, interview is still the main method to collect information, which was conducted in a semi-structured format. A person who was responsible for organizing design or related design work in each company is the subject of interview. Considering different conditions and situation of these enterprises, the leaders of design vary in their titles, from design manager, design director, R&D manager to general manager.

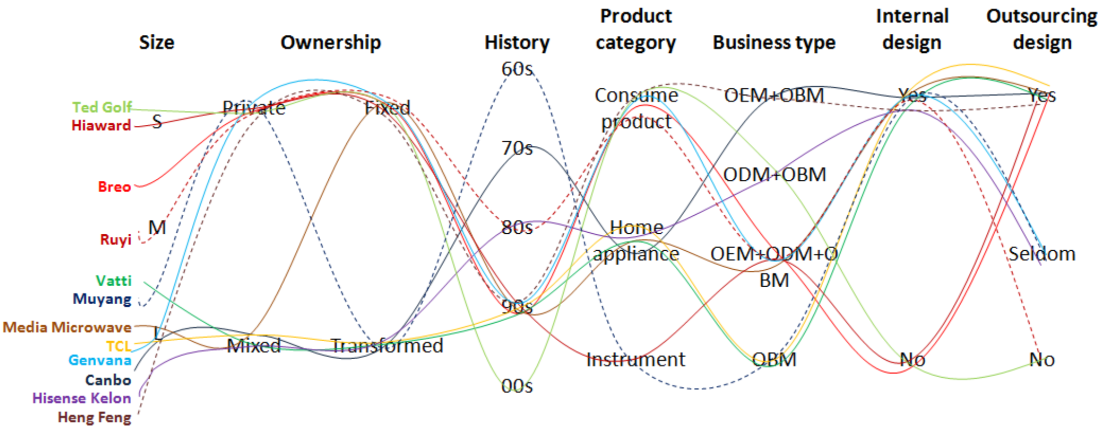

Figure 7.1: Diverse performance of criteria for selecting cases

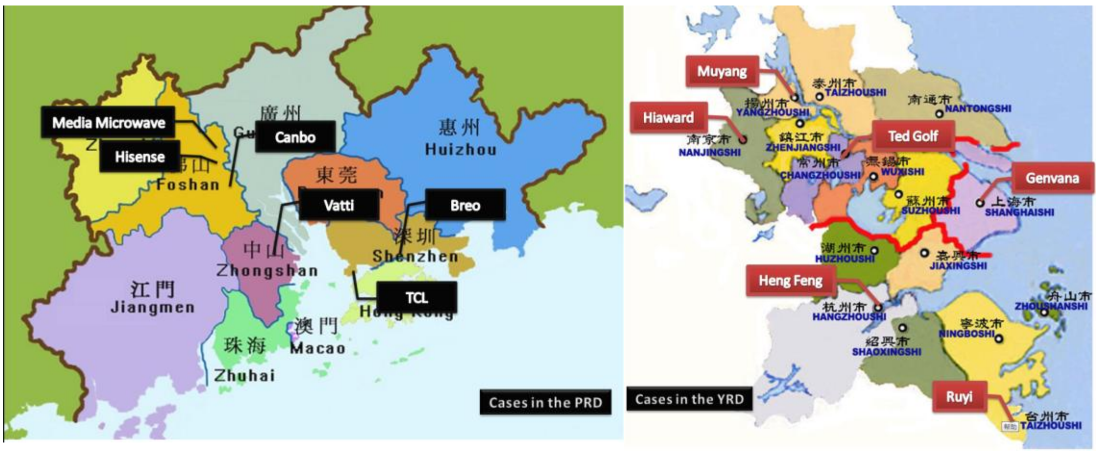

Figure 7.2: Locations of the twelve companies

7.2 Introduction of the Twelve Cases

Breo is a medium-size private enterprise. It is established in the 1990s and OBM is its only business type with designing, producing and selling eye massage product under the Breo brand. From its beginning, external design was utilized in new product development. Its internal design capacity has been improved gradually during the process of outsourcing design through accumulated experience. However, though top management has recognized the importance of design, its employees still lack design awareness. In this instance, Breo manages to improve it in various ways.

It is Canbo that produced the first electric sterilizing cabinet in the world. This is still its main product and business. Since the first product, external design has been employed on new product development, and the company has established its own design department. With its successful products, design has already been a critical factor of planning strategy.

Midea Microwave is a sub-division of the Midea Group. With OBM as its main business type, different brand strategies are conducted in China and overseas markets. For both markets, design awareness has been developed based on successful products contributed by design. Since the company has many design projects, its internal design department is only responsible for managing design, outsourcing design and some minor changes of products.

As a supporter of the 2008 Beijing Olympic Games, design at Vatti is in the context of brand strategy. Design characteristics are viewed as critical factor of promoting its brand and one of the core competitiveness factor, because it offers the only way of distinguishing and building characteristics of new products in long term. Until now, Vatti has established its own internal design department with 50 employees. Meanwhile, the company also collaborates with a foreign design consultancy to enhance its recognition and knowledge of creativity and design.

The internal design department of TCL might be the first one establishing its own brand in China and worldwide. It consists of two design teams: one in Shenzhen and another French team, which was acquired by the company in 2004 when TCL purchased Thomson. As an independent department, the design director is responsible for managing design work and reporting to top management. According to its business strategy of internationalization, its design management also focuses on internationalization. The company not only employs international designers, but also frequently exchanges information with the French team. Besides the two design teams, external design is employed as an efficient way to improve its own design capacity. The company has established a long-term strategic partner relation with a foreign design consultancy.

Though Hisense Group is a Qingdao – based enterprise, its design centre of white home appliances had been moved to Shunde after its purchase of the Kelon brand. With more than ten-years of development, its design centre has regularly managed design activities and its top management has totally believed the value created by design. In the company, nearly 90 per cent of projects are fulfilled by internal design team. The design work of other 10 per cent usually is outsourced through public bidding. However, the group requires its design team to take part in the bidding to compete with external design consultancies directly.

Hiward focuses on self – banking financial services. In this instance, its design work refers to interface design of software and design of ATMs. Though its general manager has realized the importance of design, it is still not an urgent issue of its product development for other staff in the company. There is an artist engineer who is responsible for interface design. Concerning ATM products, the design and production are all outsourced to other manufacturing suppliers. However, the company is planning to change the situation and develop its own design capacity to integrate its brand image.

Though Ruyi is a leading company in exporting wood toys in China, its internal design capacity is weak. This is because the company previously focused on OEM for clients from the America and Europe. At that time, its internal designers are responsible for communicating with clients, visualizing clients' ideas, and copying the samples. They lack experience of independently designing new products. As a result, the status of design is low in the organization and new product development. However, the top management has realized the importance of design during business development. They have been planning to enhance their internal design ability in the near future.

Heng Feng sells its outdoor leisure products both in China and overseas markets with its own brand. During its business development, design has been viewed as a factor of core competitiveness and efficient tool for brand identity. The company starts from OEM. Later, its ability of independent innovation was established based on experience accumulated in the manufacturing. An internal design team has been formed in the R&D department. In the near future, the company plans to develop its internal design capacity further, with establishment of its independent design firm. However, how to balance the investment and relationship between design and other functional departments is an important problem should be solved.

The recognition of design in Genvana goes through a developing process, which is mainly contributed by its international competitors. At the current stage, design is viewed as a main method of upgrading their brand image. Based on the recognition of design, Genvana not only has established its internal design department and outsourced design for good ideas, but also employed international designers.

Based on a flexible R&D process, Ted Golf produces the most advanced golf trolley in the world. Though top management realizes the importance of design in practice and takes part in the related work, the company still does not have its own design department or an internal designer. The reason is that the company cannot find qualified designers. As a result, all R&D work is fulfilled by engineers.

Muyang is a state-owned enterprise, which manufactures feed machinery. Concerning the character of its products, styling only takes second place, while function is the most important. However, design has already been utilized in previous product development and contributed to the success of products. The company using design goes through a process, which initially focused on colour design to distinguish its products with others in markets. In the next stage, Muyang plans to develop new styling for product identity, instead of focusing on the colour system.

7.3. Cases in the Pearl River Delta

7.3.1 Shenzhen Breeze Technology Co., Ltd.

Location	Shenzhen
Year of establishment	1996
Ownership	Private
Product category	Eye health product
Market	China and Asia

The history of Breo is also the path of personal career development of Mr. Ma Junqi, the general manager of the company. After graduating from institution in 1990, Ma tried various work, specializing as a sale representative. He moved to Shenzhen in 1993, where he sold water dispensers by doorstep selling. During this period, he discovered that a new type of healthcare instrument – an eye massager was welcome by his customers. It was usually brought as gift. He considered it as a good opportunity and began to study it. As a result, he improved the product and formally invested in it in 1996.

Because of his natural sensitivity to design, Ma employed professional designers for the styling of his products from the beginning. Furthermore, he personally managed the whole process of design, production and sale. As a result, a total new eye massager was launched to markets in 1996, based on the endeavours of Ma’s R&D team. It sold well. This directly led to the establishment of Breeze Healthcare Industry Co., Ltd in the same year as an enterprise specializing in research, development, manufacturing professional health care products.

In Breo, the major products of eye protection and treatment include eye massagers and brain massager, which integrate massage theory with traditional Chinese medicine and modern biological magnetism science. It effectively relieves eye tiredness, restores the muscle flexibility around eyes and provides relaxed and refreshing feeling for the eyes.

Today, Breo is progressing with high speed. In the past five years, its sales revenue increased more than 40 per cent every year. Its products have been sold to domestic and overseas markets with a balanced share. In the China market, Breo has built over 300 sale points in more than 100 first and second level cities in China, such as Beijing, Shanghai, Guangzhou, Wuhan, Xian, and so on. Its main sale channels are bookstores and shopping centres. In global markets, Breo has successfully penetrated into more than 68 countries and regions in the world, including Japan, Korea, India, Malaysia and America. However, the Asian market is still its core market at the current stage.

Breo also expands its market position step by step. Based on its first sales point in Shenzhen Book City, they set up other branches one by one in the following years from south to north of China. Since the market of eye massager is created by Breo, the company keeps a leading place both in home and overseas markets. In the local market, Breo has not met any challengers and competitors, though there are a lot of followers copying their products. To maintain the leadership, Breo continually innovates through improving design, technique, quality and performance of products.

Though Breo holds first place in the markets, its business scale is still small because of a limited market size of the whole product category. As the first brand of this product category in China, the business type of Breo is original brand manufacturing (OBM). However, original equipment manufacturing (OEM) and original design manufacturing (ODM) are still applied in its overseas markets. Currently, they do not plan to promote their own brand in overseas markets.

The objectives of the company are: to be the expert provider of eye care, both in China and global; to take care of the health of user's eyes; to build the No.1

international brand in the field through professional R&D, professional production, professional sales, and professional service.

Strategic design management

The company has a single brand: Breo, which was registered in 2007 to replace the original one: Breeze. The basic concept of the brand is “Simply Relax.” Its Chinese brand is “倍轻松 (Bei Qing Song),” which is based on Beijing dialect of Chinese to express a very relax feeling and registered in 1996. In addition, Breo has defined its brand values as faith, care, innovation and activity.

To the whole company, especially the top management, design is viewed as a critical factor to build brand identity. All the logos and text related to the brand are created by professional designers. The image of brand is established by logo design. For example, in planning for a new logo in 2007, a small button was added to express relax feeling which can be achieved by simply pushing a button. This is planned to be utilized as the second identified image of the brand, besides the logo.

Incremental development is the basic strategy of Breo both in innovation and marketing. Though its first generation product is very simple, it still sold very well at that time. There are two reasons for it. Firstly, its design was better than any other products on the markets at that time. Secondly, with simple functions, it was sold with the lowest price in the market, 168 RMB. Based on the two factors, Breo occupied a large market share instantly. From then on, they kept renewing their products every half year to give reasons for repeated purchases. Since there are limited new technologies that can be utilized for radical innovation of eye healthcare products, minor changes in function and an emphasis on design are the main methods of new product development.

To keep the leadership and protect intellectual property, in China and other foreign countries, Breo has registered many patents, including invention patents and design patents of eye massagers, the invention of vision frequency therapeutic equipment, design patent of ISEE 360, and certificate of utility model registration in Japan.

To prove its product quality, Breo has achieved various product certifications in different countries, including CE, ROHS, KFDA, FCC and FDA[1]. In addition, concerning quality management, they obtained certification of CMD and TUVISO13485.

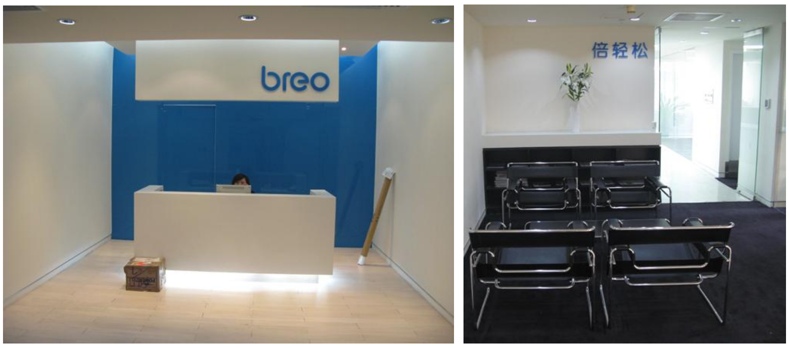

Figure 7.3 New offices of Breo

Figure 7.4: Successful products of Breo

As a personal hobby of Mr. Ma, design is involved in his life in diverse aspects, though he does not have educational background related to design. He likes to buy updated design books during his travels and studies good design by himself. As a

[1] CE: a mandatory conformity mark on many products placed on the single market in the European Economic Area (EEA); ROHS: the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations; KFDA: of the Korea Food and Drug Administration; FCC: The Federal Communications Commission (FCC) is the U.S. telecommunications regulator; FDA: U.S. Food and Drug Administration.

general manager, he prefers to consider design in the context of management, such as how to introduce design to management, how to promote design awareness of employees, how to involve design in product development, and how to transmit Breo's design characteristics to consumers.

Because of Mr. Ma's personal interest in design, design has already been recognized as an influential critical factor for the success of product and business since the first product. All employees already have a basic awareness of design and its function. Based on continuous innovation, design adds value of business through dividing markets, promoting business profits, connecting consumer with brands, and cultivating innovative culture in the enterprise.

A well-designed work environment is also viewed as an important factor of promoting design and innovation in a company. Concerning it, Breo moved to new offices for a better design environment, which involved a lot of considerations of interior design, such as materials, colours, interaction functions and furniture (Figure 7.3). With it, the design awareness of employees is supposed to be influenced and established during their ordinary work.

Functional design management

Because Breo understands the importance of human capital for a company, they focus their development on training their own talents. In the field of design, they hope to reach an international level in the near future based on internal trainings. To achieve it, improving the quality and quantity of talents is critical. Considering the quantity of employees, to maintain the rate of sales increase from 20 to 30 per cent per year, there is an urgent need for training sales and operational talents. The quality of employee refers to upgrade the design awareness in all employees.

In the view of top management, the function of industrial design is to generate good styling of products. It is important that the top management of an enterprise should have the basic awareness of design, the feeling of design and the knowledge of practicing design. However, in Breo, besides the top manager, leaders of other functional departments still have limited recognition of design, which is influenced by the laggard design conditions in China mainland.

Breo has about 800 employees, which are mainly divided into three functional parts: R&D, production and sales. The sale function takes a major part with about 500 salesmen. Concerning production, Breo has established its manufacturing ability with around 200 employees. The workers of R&D only take a small proportion with 12 researchers. Led by a technical director, there are three teams in R&D department: electric, structure and prototype.

Although till now all the design work has been fulfilled by external design, Breo plans to employ its own internal designers and establish an internal design department. However, the whole process of development takes time. The most critical reason for establishing an internal design department is to accumulate design experience. Though external design service is good enough to fulfil current design needs, the company still needs to build the design experience of internal designers. It uses records to form design knowledge in practice. With the records, even though a designer leaves, his or her knowledge and experience can be continued inside the company.

Furthermore, Breo can develop it’s internal design capacity through establishing it’s own design team. The internal design will focus on studying and communicating design with external design in design projects. Based on the accumulated experience in design practice, internal designers can understand design concepts, combine them with business concepts, and finally pass them to the whole company. At the same time, new knowledge of design can be obtained by the internal designers timely. According to this plan, Breo finally can achieve diverse design abilities during its business development.

In Breo, the role of design has been improved through outsourcing design to foreign freelance designers. Because of the small-scale product category, the company cannot employ experienced designers, who usually demand high salary and diverse design works. As a result, Breo has to rely on external design from the beginning.

Design outsourcing of Breo experiences three development phases. The company primarily co-operates with Chinese local designers, then with Hong Kong designers, and finally transferred to work with foreign designers. The reason for the changes is company's constantly upgraded demands for design service in different development stages. Foreign designers can offer high-quality design service in form of a team, which consists of the expertise of various professional specializations. Though there are some good local designers, they usually work individually, are limited in personal styles, and lack communication skills. Compared to local designers, designers in foreign design teams can work together with Breo's R&D team very well. Type and styling characteristics are the main criteria for selecting foreign designers. In the current stage, Breo usually develops one or two new products every year. In most cases, a foreign design team is assigned to complete it, co-operating with the internal R&D team.

Operational design management

Randomness within a basic framework is the main characteristic of Breo's design process. It is formulized based on its 12-years experience of business development. Eye massagers are produced easily because of its low-level technology and simple structure. Concerning it, the efficient way of developing new products is contributed by continued injection of new concepts and technology. To achieve this, Breo encourages positivism of all staff through a flexible process. With it, employees in various functional departments can propose their thoughts of new products in different stages. Though the process is viewed as chaos, it is efficient to develop new products for Breo. With it, expertise of research, design and market are all involved in concept generation. They communicate and exchange ideas of design in proposal stage. Meanwhile, customers are also invited in the process to offer their opinions and requirements of new products.

However, there also is a problem in the process. Too much flexibility results in a loose design process, instead of a systemic one. Even though Breo has recognized it, they still prefer to view the random design process as its advantage, instead of disadvantage. According to their opinions, for large-size company, a standardized design process is necessary to confirm unity and co-operation; for small company like Breo, products are developed based on their experience and intuition. The objective is simple: to win. A standardized and fixed process will slow down the speed of product development process and limit the engagement of various functional departments. The strategy of Breo in controlling quality and process is to offer an open environment, and encourage involvement of employees from various functional backgrounds.

Based on the current products, the next generation of products is developed with some minor changes in styling and functions as incremental innovation, Though every product is simple in function, it still has its own characteristics.

Breo considers that the origins of design concepts should not be limited in market investigation. It should be from everything. As SONY has said: "Design is everything." Since market research only offers information of the past, instead of the future, it has limited value for new product and new market development, especially for those products that never exist in markets. In addition, the result of market research varies in its content because of different researchers and motivation. In this regard, Breo prefers to emphasize discovering market opportunity actively. Once they notice some emerging fashion trends in the markets, they will try to apply them on new products or modified products. In most cases, employees of market and design can communicate efficiently with a simple and even random way to realize this.

However, traditional market research is still a complementary way of discovering new concepts in Breo. They utilize design methods both in market research and in concept generation, such as brain storming and user investigation. To support the applications of these methods, Breo has required technical employees to record the ideas generated in these design activities and pass the records to designers to form design briefs. Usually, it is the general manager himself who is responsible for this work.

In most cases, it is market developers and designers who make decisions and audit design. They work together tightly. An advantage of this design audit system is to decrease risk. Some new product development will be stopped if they are considered to be failure in the market. Till now, the company has released more than 10 products into the markets based on A similar number of failed products.

7.3.2 Canbo Electrical Co., Ltd.

Location	Shunde
Year of establishment	1976
Ownership	limited company
Product category	Sterilizing cabinet
Market	China and oversea

The origin of Canbo is the Xintan Iron Factory and Xintan Agricultural Equipment Factory, which were established in 1976. As a township enterprise, it manufactured accessories for agricultural equipments and the frames of automobiles. Based on the suggestion of his friend and study of Chinese living styling, Mr. Xiaojia Lou, the leader of Xintan Agricultural Equipment Factory, decided to invest in the sterilized cupboard project in 1986. One year later, they successfully researched and produced the first electric sterilized cupboard in the world. This represents the creation of a total new product category. In 1988, the first household sterilizing cabinet was released, and Canbo Electrical Co., Ltd. was formally established. From then on, the company has kept its position as the leading brand of sterilized cabinets, both in China and worldwide markets.

Figure 7.5: The first sterilizing cabinet

Currently, Canbo has 0.38 billion RMB fixed assets, more than 3000 employees, and 400 technical employees. Its products are developed from sterilized cabinets to cooking utensils, induction cookers, water heaters, ironware and accessories of automobiles. In addition, a combination of range hoods, gas cooking appliances and sterilized cabinets has led to a revolution of Chinese kitchen appliances by Canbo. During its development, top management has understood that industrial design plays a critical role in its development.

Canbo's products have been sold both in China and worldwide, especially Europe, America, Middle-East and South-east of Asia. Though the company has a leading position in the markets, its development of business is not always successful. In the beginning, as a totally new product, Canbo rapidly developed because of a lack of competitors and its advanced technologies. However, by 1997, its ownership as a township enterprise began to hinder its development, because it could not adapt to the macroeconomic environment. As a result, Canbo changed its ownership in 1999. After that, the company entered the second period of high-speed development. Its sales revenue increased significantly and its product types were extended to other kitchen appliances. In 2007, the sterilized cabinets of Canbo occupied 23 per cent of China markets as the leading brand. For home appliances, its sales have reached 1 million units with sales revenue of 0.56 billion RMB.

Concerning business development in Chinese home appliance enterprises, expansion of the business is their main objective. In this instance, how to respond the pressure of competition and market is the key issue in Canbo. For Canbo, its objectives focus on three levels: firstly, its sales revenue is mainly from OEM of ironware and OBM of kitchen appliance. In its OEM business, Canbo takes a passive position because they lack advanced technologies to distinguish it from other manufacturers. Because of this, OBM of kitchen appliances is the only opportunity of its future business development. This is the second-level objective. Although Canbo is a professional of kitchen appliances, it is only viewed as a second-level brand in all brands of home appliances in China markets, because of barriers of entering main sale channels, especial large chain stores, such as Suning and Guomei[2]. The third-level objective is the solution of the above problems: building a distinct advantage in OBM business through developing its own intellectual property. To solve the problems of sales channel and competition in markets, Canbo plans to focus on integrated kitchen appliances, establish a strategic partner relationship with cabinet manufacturers and set up its own sales channel with specialized shops.

In the plan, design plays a basic role, which powerfully supports the transformation of business types by integrating diverse resources. It not only can transfer from OEM to ODM through a unified styling of kitchen appliances, but also contributes to the establishment of sales channels by designing the interior and image of specialized shops.

[2] Leaders in China's 3C (Consumer appliances, Computer and Communication products) chain retailers of home appliances.

Strategic design management

When Canbo was developing its first sterilized cabinet in 1987, the company had already planned its own brand as Canbo. In 1988, the brand: Canbo (康宝), was registered when company was established. In the Chinese language, it means treasure of health. Design is employed to establish brand image and enhance brand management.

From its beginning, Canbo maintains a strategy of independent R&D and continuous innovation, which are applied in various aspects of the company. In every stage of development, there is a successful product in markets, which promotes continuing progress of business and market performance. For example, the 50L sterilized cabinet designed in 1992 keeps its significant selling record with the highest quantity and profit among all products. The upper sterilized cabinet released in 2000 offers a platform for a series of products. It also was a main source of sales income, from 2000 to 2003. At the end of 2003, the sunken sterilized cabinet was designed as a response to a new trend of interior design in Chinese families. It offers a new opportunity for business and product progress.

Figure 7.6: Environment and products of Canbo

For Canbo brand, its core competitiveness in kitchen appliances consists of its sales network and product leadership, which are realized through its ability of technique and design. Concerning its sales network, Canbo had more than 300 specialized shops in China and over 900 salesmen in 2007. The number of shops is planned to be 400 in 2008, and finally reaches 1000. With efficient sales channels, centralization of management control can be achieved for building product and brand image. In addition, consumer demands and market information can be collected efficiently.

According to the strategy of Canbo, the company maintains a high level of product innovation. This strategy is shaped based on two conditions: the reform of ownership in 1999 and recognition of design, which enhances relationship between design and brand in practice.

Design was introduced into Canbo in 1992 by collaboration with Guangzhou Academy of Fine Arts (GAFA) for product design and corporate identity design. As a result of the first collaboration, the 50L sterilized cabinet was sold so well that the demand even exceeded the capacity of supply and production. Without competitors, sale prices were defined by Canbo at that time. This led to high profits: although the unit sales price was only around 500RMB, the profit of each product could reach 100RMB.

The first system of corporate identity (CI) was completed by a design teacher in GAFA in 1992. It is the basis for establishing the brand image. Based on it, Canbo spent 800,000RMB to update its logo and CI system in 2001.

Design is a critical factor of brand and competitiveness in Canbo. Inside the company, design has already been promoted as an important characteristic. The content, styling and characteristics of good products are continued through design to distinguish its products from others in markets.

In business development, top management emphasizes the functions of industrial design and promotes awareness of design in all employees. Design not only is considered as an important factor for business development, but also combines product functions with engineering. The main value added by design is brand awareness and sales profits. Industrial design therefore plays an important role in the company. It can obtain high rewards and creates profit instantly, in an environment characterized by fierce competition and product homogenization. As a result, the ability of design and R&D is viewed as a critical factor to form Canbo's product leadership in markets.

Functional design management

In Canbo's organization structure, design functions are managed by the R&D centre. Because of it, internal designers work in the same office as the technical department, which also belongs to the R&D Centre. Their ordinary work is managed by technical leaders, while their professional work related to design is assigned according to the company's plan. With this organizational structure, both design & engineering and internal & external design can work together efficiently.

Considering the high investment in building an internal design team, Canbo only employs two internal designers at the current stage. With them, the company hopes to establish a good basis for developing and promoting design as a main factor of competitiveness. And in practical product development, a rational design process related to company's conditions is supposed to be formed through integrating internal designer's work.

To enhance designers' ability, Canbo actively encourages and supports internal designers to communicate with the external environment and study continuously. For example, the company assists their designers to apply for the examination of registered industrial designer in Guangzhou province to widen their view and enhance practical ability.

With the underdeveloped internal design capacity, the majority of design work is outsourced at the current stage. In practice, only 30 per cent of annual design projects, which usually are product modifications or graphic design, are completed by internal designers. Besides it, the internal designers also are responsible for communicating with external designers.

Based on long-term collaborating relationships with external designers, the company has accumulated experience to improve its design competitiveness and internal design capacity. However, the company has realized the limitations of this approach. The primary problem is informal management in Chinese design firms. These Chinese design firms usually do not keep their promises in contracts. This results in a waste of investment and delayed schedule of product development. To avoid these problems, Canbo insists on collaborating with large-size formal design consultancies with a long-term relationship in the current stage. However, this strategy leads to another problem. Since the majority of large-size design consultancies usually do not limit their service in an enterprise or a special category of product, they lack professional knowledge of a special product category. In this instance, their understanding of product is superficial. Based on the recognition of a shortage of outsourcing design, Canbo plans to develop its internal design capacity as a solution to compensate for these problems.

Concerning outsourcing design projects, these are controlled by the technical leader. Design proposals are displayed on the internal website to collect feedbacks from various functional departments. In addition, market feedback is achieved by salesmen. Sometimes, main distributors are also invited to take part in design evaluation. This is not only for obtaining their suggestions, but also to enhance their confidence in Canbo brand.

Operational design management

There are two ways of planning design concepts in Canbo. The first is based on the demands from consumers and markets, which are proposed by marketers. Once these demands are sent to sales department and designers, designers will analyze the informations, list the detailed information need to be studied and clarified further, and send the required information to salesmen, who will collect the information. In most cases, it is the product manager who lists the primary requirements of products, including definition, cost, investment, equipment and product lifecycle. Then the requirements will be sent to the vice-general manager for technical evaluation. Documents are passed from one functional department to another according to the linear process. For the R&D Centre, the sales department is its client.

Besides this method, there is another way of planning new products: hiring an external design consultancy to investigate markets and propose ideas for new products. According to their proposals, internal designers will plan products, communicate with other functions, and suggest details, such as price and positioning.

To control quality and decrease risk, Canbo has established a standardized design process, which consists of a series of decision points: salesmen decide function and styling by test; top management decides capital for product development; and other decisions of tooling and engineering design, and test production.

Design quality is a part of product quality and is controlled through three aspects: product positioning, evaluation of R&D processes, and engineering design. In the primary stage of design, the position of design, product and market should be precise, because it is the basis for design evaluation. The achievements of design are audited by comparing the match degree between a design proposal and its positioning. In the R&D stage, design should be creative, which is a critical criterion of evaluation. The level of creativity is evaluated by comparing with previous products and competitors’ products. In the process of transferring products into commodities, manufacturability should be identified, which relates to realization of design, cost control and product quality.

Only with a combination of three aspects can design quality be obtained in design and development processes. The quality of commodity also can be realized based on it. The three aspects connect and follow each other. The standards of evaluation have been recorded into formal documents in Canbo. In addition, for the management of outsourcing design, the detailed requirements of design are listed in contracts, which are also a design brief. In the implementation of design evaluation, the standards will be used to check design proposals strictly to control design quality.

7.3.3. Midea Microwave

Location:	Shunde
Year of establishment	1999
Ownership	limited liability company
Product category	Home appliance
Market	home and aboard

The organizational structure of Midea Microwave is divided into two parts, China and overseas markets, with a proportion of 3 to 7 in sales revenue. Each part conducts its own strategy of business and design, based on its own development path. Concerning business types, OBM predominates in local markets, while OEM and ODM are for overseas markets. The main ODM clients include Sanyo, Electrolux and Siemens. The company is planning to develop OBM in overseas markets through registering some test brands in different countries and regions to accumulate experience.

In fact, 60 per cent of microwaves in global markets are from China, especially from Galanz and Midea. The two brands also dominate the China markets, where Galanz is the No.1, with 50 per cent of market share and Midea is the No. 2, occupying 41 per cent of market share. According to the districts in China, the markets are divided into three parts: east, south, and west-north market. Among them, the main market is in the east distinct. Three sales departments are assigned to be responsible for the three districts. At the current stage, Europe is the main market for small ovens, where Media holds third place. Since the small oven is usually utilized to bake pizza and breads, its domestic market is still underdeveloped. Midea's competitors in overseas markets are LG and Galanz. For brand value, LG takes first place. For sales revenue, Galanz is the first, while Midea is second and LG is third.

In operation, its products usually sell through various agencies, such as shopping malls, without any direct contact with end users. However, this situation has been gradually changing under the leadership of Midea group. A system of specialized shops has been constructed to cover markets from first to third level, with unified image, design and standards to promote Midea brand.

In 2007, Midea Microwave sold 4 million units in local markets with sale revenues of 1.2 billion RMB. In overseas markets, 12 million units were sold with 3 billion RMB. According to its business objectives, Midea Microwave plans to surpass Galanz and take over the leading place in the next three years.

Figure 7.7: Product and environment of Midea Microwave

Strategic design management

The brand name of Midea comes from Chinese Pinyin: meide, referring to beautiful things. The slogan of the brand is 'my idea is your idea.' In 1998, a

Hong Kong design consultancy was employed to redesign the logo as 'MD,' which cost more than a hundred million RMB at that time. However, its gradually changed colour in the logo resulted in a high cost of printing, which finally had to be changed into pure colour.

In Midea Microwave, the main aim of developing design is to represent brand concepts. To achieve it, the strategy of developing design emphasizes establishing product identity and training designers.

The success of Midea Microwave is explained as its continuous consumer-oriented innovation in product, quality management and brand creation. They are the core of its business strategy.

Concerning design strategy, it emphasizes the importance of establishing product identity (PI) to quality, image and brand. Design and the three parts influence each other. The characteristics of a brand can be established by product quality and its styling. Brand image is built by PI and upgraded by product quality. These are the main content of Midea Microwave's objective of business development.

In domestic markets, the core competitiveness is contributed by three factors: market, channel and cost. Midea Group offers a powerful network of sales, which is a basic platform for various product categories.

Since OEM and ODM are the main business type in overseas markets, cost and design are important factors of core competitiveness. This is reflected in many requirements for design. Among a large number of overseas clients, the majority of them are distributors and buyers in different countries and regions, which vary in requirements for products and design. As a result, design plays an important role to match the diverse requirements from overseas clients.

Overall, design is considered as an advantage and a factor of core competitiveness in Midea Microwave. Brand approval is a critical value of business added by design, which expresses the image and position of the brand. According to the results of investigations, consumers think that the styling of Midea's products, which is usually viewed as an active young man, is better than Galanz, which is as an over forty-year old man. This implies that Midea has successfully transferred its value, concept and characteristics of brand to its consumers through design.

The function and value of design have been recognized by all employees because of its previous successful cases. The model of managing design has been gradually established through the R&D process, design organization and its management, which are displayed by establishment of a formal design process and the internal design team.

In Midea Microwave, the function of design is emphasized not only in the process of development, but also in advertisements for entering markets. Top management has realized the importance of design as an efficient way to distinguish their products from others. In addition, design can create value. This has been proven by the previous successful products and competition with international brands. As a result, top management emphasizes the development and application of industrial design, planning brand strategy and the role of design in it.

Functional design management

It is the product strategy department that is responsible for all design work in the company. From the beginning, the department went through many changes in its organizational structure responding to the shifting requirements of markets. These structures not only lead to a mature organization, but also cultivate its internal designers.

The leader of the product strategy department directly reports to the general manager. Within the department, there are three product sections: microwave, big oven (BBQ) and small oven. There are three functions in each product section: planning, industrial design and graphic design. Since there are many new product projects in the company, in most cases, the internal design team is only responsible for managing design issues, such as external design, design briefs and design audits. The implementation of design work is usually fulfilled by external design.

Midea Microwave offers various opportunities of study for its employees. The company has a training system for future managers. In addition, employees can suggest subjects according to their personal requirements for professional development. The arrangement of training schedules is also flexible to avoid conflict with work. .

The workload of design in Midea Microwave is so heavy that the majority of work is usually assigned to external design consultancies. The internal design team is responsible for controlling design projects and minor changes of design normally. Among all outsourced design projects, about half of them are assigned to Midea Industrial Design Company because of the convenient co-operation and the requirement of keeping business secrets.

Concerning the management of external design, Midea Microwave has established a regular operation model and process. There are two types of collaboration relationship: long-term and project by project. The main criteria for selecting external design are the type of product. According to different product types and aimed markets, internal design selects the most suitable external design resources in three options: Chinese local design consultancies, Midea Design Company and foreign design consultancies.

Operational design management

In the implementation of design, Midea Microwave follows a standardized design process to control design quality. In the process, it is the internal design team that primarily suggested product concepts. Then top management makes decisions according to practical conditions. The internal design team is responsible for managing design.

A series of design audits are the critical points to manage the process. The first audit is to evaluate design proposals from external designers by the internal design team. Then the sales department conducts the second audit. After that, the proposal is evaluated by R&D department to study technical and manufacturing possibilities. Once the proposal passes all these audits, the product will be confirmed for formal development. It is the leader of the R&D department who makes the final decision.

For the company, new ideas of products are contributed by market and design, being proposed by internal designers through market research. Marketing research is a main resource for identifying design requirements in markets, besides information from clients and sales.

Since the major clients of Midea are its agencies, the design team normally visits them directly. The internal designers also communicate with sales for first-hand information every month. In addition, a professional research consultancy is employed to understand markets and attitude of consumers. Based on these, some primary ideas are proposed. Then detailed information is collected and analyzed to form explicit concepts with defined product requirements. Finally, a design brief is completed and passed to external design. Within this process, the internal design team plays a key role in connecting the market with design by transferring market information into product concepts.

The design demands in overseas markets are usually from three sources. Firstly, it is proposed by ODM clients or other brands. Because different brands have their own characteristics of styling, they usually list their requirements and limitations in detail. In this instance, Midea can explicitly understand their brand strategy and record it as company's knowledge. Secondly, for some medium-size brands, Midea can communicate well with them and clearly understand their requirements. Design proposals are completed based on it. The third source of design requirements is directly from internal designers' study and analysis of documents.

In the design process, diverse design methods have been utilized to develop new products. These methods include user investigation, competition analysis, and brain storming. Sometime, external design teams are also involved in research and creative process.

To control the quality of product, various functions usually coordinated in the R&D process, based on a standardized process. However, some problems still exist. A typical difficulty of controlling design quality is the conflict between design and R&D department. In most cases, design proposals are modified for convenient manufacturing after they are sent to the R&D department. There are two reasons for it. Firstly, R&D department has to consider the cost, standards and quantity of production. In this instance, they prefer to modify design for low-cost and convenient production. Secondly, the majority of R&D employees lack awareness of design. This leads them to misunderstand design or ignore design details.

To solve this problem, the internal design team tries to coordinate and integrate different opinions during the design process. They define the scope of modifying design for each product as a reference. Then R&D department can change some details within the scope.

7.3.4 Vatti Gas Appliance Stock

Location:	Zhongshan
Year of establishment	1992
Ownership	Private to share-holder
Product category	kitchen appliances
Market	China and global

Zhongshan Vatti Gas Appliance Stock Co. Ltd is one of the largest share-holder corporations located in China mainland. The company owes the largest gas stove assembly line, the most advanced methods and instruments of quality control in Asia. Its annual productivity has reached 6,000,000 units.

Bearing CE, GS and UL approvals, the majority of its products are geared for export worldwide. Leading companies of Germany and Italy provide Vatti with the technologies and main accessories for its appliances, enabling Vatti to supply world-class consumer items. The company also employs advanced management systems, with more than 80 staff working on quality control to maintain global standards.

The development of Vatti is divided into four stages. The first stage started in 1992, when an original seven people co-established the company. After a six-year primary stage, the second stage began with the company being transferred to the leadership of professional managers from 1998 to 2001. At the end of 2001, the third stage began with a reform of shareholding. After three years preparation, Vatti was listed in the Shenzhen stock market at Sept, 2004, which represented its transformation of ownership from private to shareholding. As a public company, it started to change its organization in management during this period. The fourth stage started from April, 2006, when Vatti was nominated as the gas appliance supplier of the Beijing Olympics. This significantly influenced its business and brand strategy. From then on, the brand strategy of Vatti was tightly connected with the Beijing Olympics, with an Olympic Brand Strategy Centre set up under this situation to control all the related operations.

In the four stages, the sales revenues of Vatti have increased significantly after each shifting point. This demonstrates that the whole development direction of Vatti has been valid.

Vatti has gained its leading position in markets with 40 per cent of domestic market share. Its gas stove is the top brand in the industry and its water heater is named "Well known branded product of China." Its range hood is now in the top four in the markets. Other businesses including ovens and electrical stoves are steadily and speedily developing.

The major competitors of Vatti are Siemens and Fotile. Other local brands, especially those in Zhejiang Province cannot compete with Vatti. Represented by Siemens, international brands, such as Electrolux and Bosch, improved instantly, though they just entered in China market in the last five years. Their rapid progress is contributed by their international experience, diverse design resources and mature platforms. As the major competitors of Vatti in the near future, they threat Vatti in two aspects. Firstly, once they improve their understanding of China markets and consumers, they will develop faster and occupy more market share than before. Secondly, the medium-level consumers in the majority of Chinese cities prefer foreign brands, instead of local brands, because of the good name, quality, design and service of those foreign brands. Besides these international brands, another major local competitor is Fotile, which has rapidly progressed after transferring to modern markets from traditional markets in 2002. To win these brands, Vatti has to improve its design and technique capacity.

Strategic design management

In 2008, as supplier of the Beijing Olympics, Vatti planned to improve its brand performance in major Chinese cities, such as Beijing, Shanghai and Guangzhou. On the other hand, with this opportunity, Vatti will expand its global markets through transferring OEM to OBM. With new products released in 2008, the company managed to upgrade its sales structure of products to the medium and high level.

For the top management of Vatti, product design and innovation are important ways for the growth of the brand. Although many people consider it is advertisements which promote brand image, Vatti only views this as a superficial recognition, while an understanding of brand concept is the real critical factor. For the company, there is no successful or failure brand, because brand refers to the connection between consumer products and services offered by enterprise.

Design not only accompanies the growth of a brand, but also promotes changes of image. In this instance, a designer is a bridge to directly communicate with consumers. To connect Vatti's products with its brand, the company has conducted many studies. Some even are carried out by foreign design consultancies.

However, there is an imbalance between high investment in design and the low-price structure of products. Vatti's product prices are at low and medium level, focusing on the second and third-level markets. In the markets, low price is a critical factor for customers to decide their purchases. However, the low-price positioning is a barrier of upgrading brand image.

Figure 7.8: Work environment of Vatti

Vatti's business strategy includes three aspects, quality, R&D and human resources (HR). Vatti emphasizes quality as a basis of value and recognition. R&D refers to research and methods of meeting consumer's requirements. HR is considered being more important than business development.

From 2006 to 2008, the company's strategy and operation all focused on the Olympic Games. Differing from general opinions, which just view the Olympics as sports, Vatti thinks that its spirit is the core, which connects Vatti brand tightly with the Olympics. As an international event, its spirit not only means progress, but also includes heartfelt emotion, which is same as the content of Vatti's brand concepts. With this awareness, Vatti integrates innovation, honours, creativity, and business development in operation, according to its brand strategy.

Besides the brand strategy related to the Olympic Games, differentiation is another main content of Vatti's business strategy. Considering the nature of gas appliances in China, companies producing gas hot water heaters and gas stoves all utilize the basic production techniques of a hardware factory, which leads to a low quality of design and manufacturing. However, Vatti's strategy of differentiation emphasizes high quality of design and production. Based on it, Vatti can distinct itself from other manufacturers and aim to win the market.

The primary core competitiveness of Vatti is its capacity for brand operation and channel penetration. Since this product field is easy to enter and product quality is at a low level, the core problem of market competition is how to distinguish different brands. It is Vatti that firstly utilizes the concept and operation of brand to distinguish itself from other enterprises. The company has formed a professional brand image in consumers and markets. And its professionalism is explicitly expressed by Vatti's core techniques, especially technique of controlling burning. Its professional position was confirmed further, when the company was invited to take part in the writing of GB (Chinese Pinyin: Guo Biao; English: National Standards).

Since Vatti emphasized design from its beginning, design has already been an factor of its core competitiveness, which also is an advantage of Vatti's products. However, its competitors, such as Siemens, progress rapidly. This causes fiercer competition of products in markets. As a result, an advantage of design is also important to the content of future development.

During the process of developing Vatti's brand, design is viewed as a factor of core competitiveness to distinguish and build long-term characteristics of new products efficiently. Design promotes product and brand in styling, interaction, function, and human-based considerations of consumers.

In Vatti, the recognition of design goes through a process. At first, design was simply defined as product styling. Later, there was a qualitative change of recognition: design can assign life to a product and express the nature and character of a product. To fulfil the design works, designers have to understand product and consumer's requirements, based on an investigation of consumers, researching market competition, and formalized product concepts.

At the current stage, Vatti's general manager is the absolute leader of design. He even directly takes part in the design works as a creator. When the company was established by the original seven people, he was the most active and creative one. Though the rest of top management's awareness of design cannot reach such a good level, they still have showed a strong desire for creativity. With various educational backgrounds, advanced concepts and methods of promoting management are introduced to build recognition of design. To top management, design adds business value through building brand, distinguishing markets, increasing profits, and establishing creative culture. Furthermore, design is not limited in product styling, but involves the consideration of consumer's feeling in product development.

Functional design management

Vatti's R&D department, with a wide range of experience and expertise of design and manufacturing continuously develops products and brings new benefits for customers. With advanced research equipments, laboratories and manufacturing ability, researchers and designers are able to put their concepts, ideas and prototypes into reality. The Machinery/Equipment for R&D includes combustion ratio analyzers, CAD/CAM gas chromatography spectrometers, and microwave measurement systems

Vatti already has an internal design team with 50 employees, which is responsible for releasing 25 new items every year. The company also set up a product design centre in collaboration with SCHOTT AG for customized products.

After becoming Olympic supplier, Vatti established a strategic centre to integrate all Olympic products. It is the strategic centre which controls design and R&D in Vatti through core strategic planning. The new centre crosses the boundaries between products and markets, and focuses on knowledge management. It consists of experienced engineers and market managers who are familiar with sales channels and have knowledge of auditing design. Previously, the strategic centre consisted of three parts: product planning, advertising and brand, and product R&D. Product concepts are firstly defined by strategic planning according to the brand position. Then the concepts will be realized by R&D department. The brand and advertising section is responsible for plans of different product categories. R&D is responsible for research and development of products and techniques. The two sections are the basis for product planning. As a critical part, the product planning section is established based on Vatti's experience accumulated in practice. Planners have to be familiar with works of various functions, such as channels and sales, and multiple abilities, such as judging product design and communicating efficiently with techniques or engineers. The three sections are integrated in the centre to prepare new technique and to understand consumers and markets.

In the collaboration with foreign design consultancies, Vatti has accumulated its recognition and knowledge of creativity and design. Based on it, its way of organizing design has been changed: various product sections are integrated to enhance design capacity; the management of brand image and press release (PR) are combined.

Promoted by the general manager, Vatti began employing graduating students in 2003. To train them through on-job-training, a Vatti institution was established. All freshmen are trained in it to enhance their professional knowledge and establish basic concepts of brand. The training is also a process of selection: either freshmen or Vatti can select each other during it. With strict requirements, from the beginning of the institution, a low rate of selection is defined to make sure that the qualified students can be involved in company efficiently. As a result, only a limited number of students can complete their training and became formal staff of Vatti. In fact, these new employees even influence the whole work environment through their activity, emotion and passion. When they work with other staff, the whole management system is changed and upgraded gradually with their influence and interaction.

Another way of training internal designers is through cooperating with external design consultancies. Internal designers can accumulate experience related to company's practical conditions. And advanced knowledge of design operation also can be learned from external design. In addition, Vatti offers other opportunities for designers to study and to catch the latest trends in design development, such as attending design conferences, participating in competitions and communicating with other designers or expertise in exhibits and seminars,.

Vatti has developed an integrated system of R&D management. At the top management level, a good awareness of design and innovation has been built. At the operational management level, each function manager has clearly understood the work content and function of his/her division, including strategy, product planning and R&D. In addition, a systemic process has been formed based on the accumulated understanding and awareness.

Meanwhile, an external innovative system has been established through strategic co-operation with design consultancies. Vatti prefers to outsource design with a long-term relationship, instead of a short-term one based on one project.

The systemic process and external innovative system constitutes the whole content of innovation management. However, to operate it effectively, the management staffs should clearly understand it. Based on it, the model of new product development and design audit can be clearly defined.

Efficiency is a critical content emphasized by Vatti in its innovation management, which refers to efficient work, efficient teams, and efficient cost. With an elite team, an enterprise can grow rapidly. Compared to other large-size enterprises focusing on multiple product categories, such as Toyota, Sony, Haier and Midea, Vatti is limited to one product category in its advanced professional knowledge. The company aims to achieve maximum profit through this professionalism. Vatti believes that its work efficiency only can be upgraded through a significant change of the human resources structure. However, an enterprise cannot change all staff at one time. The only way Vatti can succeed in updating employees is to change them one by one in a process of incremental improvement.

The development of design capacity in Vatti is contributed by collaboration with strategic partners. Till now, Vatti has not employed any internal professional industrial designer, except graphic designers. All the design resources are from the third part: external design consultancy, which plays the role as a division of Vatti.

The company selects partners according to certain criteria: a higher quality than Vatti; an active team; leading profession; and leading management. In this instance, Vatti can upgrade itself through collaboration.

The system of managing design in Vatti is very clear. A good relation has been established with CBD (a Danish design consultancy),[3] which is a long-term strategic partner of the company. Instead of working as two separate parts, they work together as an integrated team with same objective.

Among all the products of Vatti, there are two types: tactical product and strategic product. Tactical products refer to medium and low level products, which usually are utilized to directly beat competitors and mainly are designed by internal graphic designers with some minor changes. They normally are completed in a short time and the whole process of design is controlled by Vatti itself. The strategic products are critical for brand, which not only can decide the future of brand, but also represent the brand image. These types of products are all designed by CBD, Vatti's strategic partner.

Operational design management

Innovation management is a critical feature of Vatti. In its content, the most important is product innovation. Product and its relation with a brand are the roots of an enterprise. However, the creativity of a product has to rely on an explicitly defined process, instead of random actions. In Vatti, industrial design has already been involved in R&D processes for every new product, although it varies in

[3] CBD A/S is a leading Danish Industrial Design company employing about 60 people worldwide.

workload.

Vatti has established its own R&D system, based on its experience. It starts from the technology R&D centre. Once new technologies have been obtained through researching and a product plan has been prepared, the strategic centre will decide which products can be developed with a confirmation from headquarters. Then engineers will be responsible for combining the requirements of technology and market.

The R&D system is formalized for two reasons: firstly, the brand direction of Vatti; secondly, to accumulate technologies based on understanding of consumers and markets. A new technology cannot be temporally created and directly verified through the markets. All new technologies are developed by R&D department in advance. Once they become mature and can be controlled, they will be utilized in new products for mass-production. All these are controlled by the section for product planning.

On one hand, Vatti develops new product concepts through emerging trends and fashion information from market observation. On the other hand, the company does not follow market trends in a simple way, though this already is a traditional way in this product field. They prefer to develop new products according to their own understanding of markets and consumers. Although these product concepts are still obtained through studying consumers and markets, the process is more complex with collaboration between diverse internal and external functions. Usually, it includes surveys of consumer satisfaction about brands and products in markets to understand detailed requirements. In addition, to understand consumers and markets, Vatti keeps a tight relationship with its competitors, although they usually are considered as enemies. Because the competitors work in a same professional field, it is important to study and communicate with them to exchange information and clarify brand definition. To be the global leader in this product field, Vatti should not only know consumer needs, but also grasp advanced technologies to keep its leading place in design, research, technique and resource control.

A design brief is fulfilled by the product planning section through organizing internal and external teams to plan product lines and families. As a result, a systemic chart is achieved to describe plans for new products in different categories. During its development, Vatti has experienced a process of getting ideas from personal subjective concepts to current management systems. Within it, a good idea can be realized by professionals, such as designers and engineers, under the control of the system. The design brief is a critical part in the operation of this system.

Furthermore, diverse methods have been employed in the process of new product development in Vatti, such as competition analysis and brain storming. Besides these, some tools are also applied in project management.

In Vatti, the design audit mainly consists of two aspects: consumer audit and engineering audit. The former involves analysis of consumer’s demands and attitudes toward design or products, as well as comparison with competitors. It usually is completed by internal staff, especially planners and salesmen. With their experience of consumers and markets, they can judge consumers and markets according to obtained information. Engineering audit refers to review the manufacturing possibility of designed new products, which includes various aspects, such as rational cost, material resources and possibility of mass production.

The process of design audit is also a process to realize strategy. According to the strategic plan, once a design brief is completed, it will be transferred to external design. After design proposals are presented by external design, they will be audited by a team including planners and engineers. Later, the confirmed proposals will be modified according to suggestions from the internal audit, and audited by consumers for further feedback.

7.3.5 TCL Multimedia Technology Holdings Ltd.

Location	Shenzhen
Year of establishment	1997
Product category	Multimedia products
Ownership	Listed company on stock market
Market	Global

TCL Multimedia is a holding company listed on the Hong Kong Stock Exchange (stock code: 1070), with operating subsidiaries located throughout the world. For convenience, TCL Multimedia and its operating subsidiaries are herein collectively referred to as "the Group".

The Group is one of the world's leading manufacturers of multimedia electronics, engaged in research and development, manufacturing and sales of TV and home networking products. Its core product is colour TV. Headquartered in Shenzhen, P.R.China, the Group has a number of production facilities all over the world. Split according to product characteristics and along geographical lines, the company consists of four business centres, namely China, North America, Europe and emerging market, and three business divisions, namely ROWA, Home Networking and Digital Imaging. Among the entire four regional business centres, China is the major one. In this market, the competitors of TCL are global brands, such as LG, Samsung, Panasonic and Sony, and Chinese brands, such as Hisense, Changhong and Skyworth.

The company's worldwide R&D centre is located in Shenzhen, and they have established laboratories in Singapore and Indianapolis in the USA. These R&D centres focus on production technology and services, structural development, functional cutting-edge technology, and CRT, PDP and LCD TV research. The company has 700 R&D staff worldwide, with state-of-the-art equipment and advanced expertise, developing hundreds of new products each year, many of them attaining a leading position internationally.

Figure 7.9: Successful products of TCL

With its internationalization, TCL has kept its leading place in TV products in China. In 2008, it was not only awarded the No. 1 brand of TV in China, but also listed as the No. 6 brand worldwide.

In the next ten years, TCL will keep endeavouring to build an integrated system of design capacity, quality ability, as well as the system of sales and consumer investigation. This means building TCL into a brand with the best creativity in China.

Strategic design management

Internationalization is the main developing direction of the TCL brand. It is realized through a multi-branding strategy. In 2004, via a series of acquisitions, TCL formally entered the global market of TV products with four brands: Thomson、RCA、TCL and ROWA, with a world-wide sales network. Its strategy of promoting these brands in different regions is expressed in detail as: TCL brand is mainly promoted in Asia and emerging market; Thomson brand focuses on European market; RCA is primarily extended in North America. Considering different requirements from markets, each brand can also be introduced other markets.

In 2005, TCL proposed its three-step strategy of internationalization, which consists of making up deficits, keeping health and growing. According to the strategy, at the end of 2007, TCL reconstructed its main industries through establishing four industrial groups as multimedia, communication, home appliance and others, as well as two industrial groups of real estate & investment and logistic & service. With the reformed business structure of '4+2,' the resource allocation is optimized to form a good basis for developing internationalization. At the same year, a new brand strategy was launched as 'The Creativity Life.'

The strategic direction in the two or three years after 2008 emphasizes enhancing the basis, continuing innovation and achieving new progress. Enhancing the basis refers to consolidating the basis of management and core capacity. Continuing innovation means breakthroughs by technology revolution, process and culture, as well as upgrading the management to international levels.

TCL always viewed product quality as a basis of brand image, which is a critical factor of brand recognition by consumers. A good brand image is the foundation of good quality products. Based on it, a brand can be accepted by consumers and markets. However, the process of forming a good brand image takes time. During this period, the functions of design in brand promotion have been clearly recognized by top management of TCL. After many years endeavour, a good understanding and awareness of design have been achieved in the whole company.

The advantages of TCL's international competition consist of following five aspects:

A. Brand

TCL Multimedia conducts a multi-branding strategy in global market with four brands: TCL、THOMSON、RCA and ROWA. In China, its brand value is evaluated as over 40 billion RMB, while the fame of ROWA also is increasing. In European and American markets, the company is promoted in the name of Thomson and RCA, both of which are brands that have a long history and good reputation in local markets.

B. Channel

In domestic markets, TCL owns powerful sales channels and good service networks. In overseas markets, the company avoids international trade barriers by integrating its international sales network and establishing good relations with clients in major regions and cities.

C. Excellent industrial design capacity

TCL has inherited rich experience from foreign design teams: Thim Tom. The design group of Thomson has high ability in industrial design and product development what enhances greatly TCL’s design capacity. The design team has obtained many awards, such as French Janus Awards and IF Awards.

D. R&D capacity of digital TV

TCL has an experienced R&D team, which is responsible for developing digital TV and integrated systems. There is even a special team focusing on R&D for North America markets.

E. A team with international business management capacity

In its process of internationalization, TCL has gradually accumulated professional managers with international vision and experience. They are a basis and support for the growth of TCL.

Design has been viewed as a characteristic of TCL. On the one hand, the company actively launches various activities to promote design and catches every opportunity to advertise its design capacity. There is a brand centre in the organization structure, which is responsible for releasing information and press related to TCL brand and design. The company also actively organizes competitions of industrial design as a way of promoting its capacity. On the other hand, more explicit works have been conducted, such as planning to rebuild the whole image of TCL brand through design language: product identity.

Functional design management

Although the design capacity of TCL has been established through two internal design teams: a Shenzhen team and a French team, its organization and management of design are still underdeveloped. The knowledge to develop them comes from two sources: accumulated experience in design practice; and knowledge spill-over in collaboration with external design consultancies.

Despite different locations of the two design teams, they communicate frequently. In China, the Shenzhen design team is managed by a design director, who is responsible for design projects, communication with French design team, communication with external design consultancies, design organization management and communication with other functions. In each team, there is a special designer assigned to exchange design information as a routine with explicit defined models.

The relation of these two teams varies in different stages corresponding to the company's development in business. At first, the design team was called Tim Thom, which aims at 'Designing your future, the best memory we can offer.' At the current stage, the Shenzhen team plays a key role in design activities with support from the French design team and external design consultancies. It consists of 26 employees with eight professional designers. This Shenzhen team is independent from the R&D system and directly reports to the head of the company. As an independent department, the team also can communicate with leaders of functional departments.

According to the objective of internationalization, product development projects all aim at global markets, instead of special markets. However, in most cases, products are primarily considered for Chinese local markets without special consideration for other regions or countries. Products for China markets usually are viewed as a basic platform for other new products developed by adding or eliminating certain functions to match special requirements in European or American markets.

Corresponding to its internationalization strategy, TCL has a global human resources vision. It includes three aspects: attracting talented individuals from all over the world, training for the world-class talents; and functioning as an international springboard for the career development of its employees.

Concerning the human resources management of internal design, internationalization is demonstrated by clear requirements for designers. The ability to communicate with English is considered as a primary skill of each internal designer, though the majority of Chinese local designers are not good at it. To attract international designers and local designers with international vision, TCL even posts advertisement for recruiting designers in overseas platforms. To upgrade the quality of the internal design teams, the company replaces the laggard designers by new ones within a fixed number every year.

At present, TCL no longer co-operates with Chinese local design firms anymore, because of their poor situation. In most cases, they lack clear characteristics and professionalism, are limited to styling design and compete on price, instead of studying design trends and upgrading their quality of design service. As a result, there is an increased gap between enterprises' increased requirements of design service and laggard design capacity in Chinese design firms.

Based on this situation, TCL only employs a famous international design consultancy as a long-term strategic partner. The top leader of the design consultancy has even been employed as design consultant of TCL. With it, TCL can develop its own design capacity through studying advanced experience and knowledge of design from its partner.

However, it takes a long time for TCL to select its partners. Before confirming the current one, TCL had visited and evaluated numbers of leading design consultancies worldwide. Salesmen even were invited to take part in the selection process to audit whether the external design firm had the same recognition and understanding of the TCL brand as them.

Operational design management

Based on years of experience accumulated in design practice, TCL has established its own design process. However, the company still keeps studying advanced knowledge and experience of process management through collaboration with leading design consultancies. In this way, the company can upgrade its management of design through combining what they have learned with its practical conditions.

In TCL, design teams play an active role in product development and are responsible for generating design concepts. During design process, they also invite other functions, especial marketers, to offer their opinions and suggestions.

Between the two design teams, regular exchanges of information related to design have become institutionalized. Updated news and information about design are collected, analyzed and shared by designers in the Chinese and French teams. A mature platform has been established to support their communication, which contains a standardized template, fixed communicators and communicating network.

There is a special project management department to control project process. Before the implementation of a project, a project manager will collect suggestions of function managers and make a schedule of the project based on it. This is the way of controlling design and product quality. Then the project manager controls the project according to the schedule and organizing audits in different stages. Besides R&D, other related functions are also involved in audits to control the quality.

7.3.6 Hisense Kelon Electrical Holdings Company Ltd.

Address	Shunde
Year of establishment	1984
Ownership	limited liability company
Product category	Home appliances
Market	global

Founded in 1969 as a small radio factory in China, Hisense has grown into a multibillion dollar global conglomerate with a workforce of over 60,000 worldwide. It is recognized as a world leading provider of flat panel TVs, household appliances, and mobile communications and a top ten player by large business intelligence and industry research institutions. Its products are sold in over 130 countries and regions throughout the world.

Hisense emphasizes innovation and quality. The company has a global R&D network with over 2500 engineers and a national-level R&D Centre, a post-doctoral research workstation, and a state-of-the-art multimedia technology laboratory. It has been the recipient of several recognitions and awards in the name of innovation, technology, design, and quality management. In addition, Hisense has partnerships with IBM, Hitachi, Whirlpool, and AMD for the development and marketing of air-conditioners, refrigerators, and information technology.

Hisense Kelon Electrical Holdings Company Ltd. and its subsidiaries are currently one of the largest manufacturers of household electrical appliances in China, and play an important role in the domestic and overseas refrigerator and air-conditioner markets. It is responsible for producing white home appliances for Hisense.

For white home appliances, Midea and Haier are the two main local competitors of Hisense in the China markets. In addition, Siemens is its main foreign competitor, despite of other Korean brands, such as Samsung and LG.

The mission of Hisense is to apply itself to the research and application of electronic and information technology, to meet customer’s needs with excellent products and service and to improve human society’s quality. To reach this lofty goal, Hisense will once again embark on a sustained effort, to implement technology and management innovation; improve market-orientation; increase R&D investment; and provide innovative products for the market place. The company strives to maintain a technological edge and achieve success in the international arena. Within 3-5 years, the company pledges to forge ahead as a leading 3C product manufacturer and maintain an excellent reputation with an outstanding international management team; produce core technologies; world-class manufacturing and distribution throughout the world and remain a leading producer of appliances, information technology and, communication technology.

Strategic design management

The brand name of Hisense was created in the 1990s, when the company planned to change its original name, Qingdao TV, which was criticized as a local brand, into a global one. In Chinese, the word "Hisense" can find its origin in the two idioms of "All rivers flow into the sea" and "Credit knows no bound". The first idiom implies the broad vision of the business and the second refers to the philosophy of the enterprise i.e. to be a credible business. In English, the word "Hisense" is a composition of two words of "High" and "Sense", which represent the "High Taste", "High Enjoyment" and "High Technology".

Hisense conducts a multi-branding strategy with its four brands: Hisense, Kelon, Ronshen and Savor. The former three brands are utilized for products, including white and browns home appliances. The latter refers to a service platform established by Hisense. According to the multi-branding strategy, the three product brands vary in their positioning, sales channels and design direction. Hisense is positioned as a high-end brand, while Kelon and Ronshen emphasize quantity of products.

Products of the three brands follow different approaches and have different product lines. Design is an important factor to divide the product image of these brands. In 2007, to plan the strategy, Hisense established a three-person team, including leaders of design, product and sales. External professional counsellors were also invited for their advices. As a result, the characteristics of each brand in design are defined. Hisense brand is positioned as steady; Ronshen emphasizes a feeling of affability, progress and richness; Kelon focuses on being virile, young and aggressive. It is the design centre and sales company that are responsible for the implementation and development of this strategy.

Hisense emphasizes "originality” in innovative design. The core of company’s competitive power is technology based on originality with independent intellectual property rights. They believe that only the follow-up improvement and derivative research and development based on that core can form a real advantage in the market.

Though Hisense considers its technology as an advantage, it is not prominent, compared to other brands, especial leading foreign brands. Concerning industrial design, although its importance has been recognized by top management, it still cannot be counted as a factor of core competitiveness. This is because of the company's strategy, which just emphasizes its leading technology, instead of industrial design in its publicity.

Within the whole company, the importance of industrial design has indeed already been recognized. For top management, industrial design is an efficient tool to upgrade brand value, add product value and establish brand characteristics. Compared to other core technologies, industrial design is considered as a short-term investment with low-input and high-output.

According to the design awareness of its top management, design is connected tightly with brand strategy. On the one hand, brand strategy guides the direction of product design. On the other hand, product design is an efficient method to enhance brand position and realize brand strategy.

Functional design management

In the white goods section, there are six product planning departments in three brands, including Hisense icebox, air condition, wash machine and freezer; Ronshen icebox and Kelon air condition. The six departments work on the same office floor and all report to Hisense sales company. In the current communication system, designers usually investigate markets together with salesmen, so they can exchange information and ideas instantly.

An efficient communication model has already been established between design and other functional departments in Hisense. However, the model works better in brown home appliance than in the white home appliance division.

In the brown home appliance section, product managers usually can communicate with design actively, because they usually have a rich experience of project management. In this instance, problems related to engineering possibility can be discussed and solved in design processes instantly with their efficient communication. As a result, the whole process goes well.

The situation of white goods is different. Previously, its project managers in the product planning department were only responsible for releasing project requirements and collecting design proposals, instead of being involved in the design process. Once design proposals were sent to them, they organize audits to discuss engineering possibility and cost. This work flow usually led to many problems in design proposals, because it lacked detailed consideration of requirements and information from engineering, production and marketing. However, based on those unsuccessful experiences, an efficient communication system has been established at the current stage.

The development of design in Hisense goes through three stages. At the beginning, the company imitated the design of foreign products through buying and analyzing them. At the second stage, Hisense tried to employ some graduated industrial designers from Beijing Institute of Technology in the 1980s. However, the majority of them had transferred their professions from design to others, because the company lacked recognition of design and would not like to really invest in design at that time. Only few of them still stay in Hisense and work as engineers, marketers and graphic designers. The real development stage of design in Hisense began from 1995, when top management started to realize the value of industrial design. The company hired three professional designers in 1997 and 1998. They are leaders of the design centre in Hisense now.

Concerning the training of internal designers, Hisense has groped towards evolving its own method in three aspects. Firstly, the company encourages designers to take part in various design activities and exhibitions. Secondly, internal training is offered to designers through 'learning-by-project.' Once a design project is completed, project leaders in design centre are required to summarize their experience of this project and report to others. In this instance, internal designers can share their practical experiences efficiently and novices can learn these experiences immediately. This is very useful for their practical work. Thirdly, in the design centre, each designer is responsible for studying a type of technique related to design, such as glass material, metal material and coating technique. Based on their research reports, a platform of sharing knowledge has been established. It is not only valuable for other designers, but also viewed as a training document for novices.

Hisense Industrial Design Centre is the core section of design and R&D in the Hisense Group, which was established in 2004. It is a centre of product and brand design. As a critical part of the company's innovation system, it focuses on the study of product styling, product exhibitions, and advanced design methods and techniques. The centre serves three brands of the group: Hisense, Kelon and Ronshen, with various product categories, such as multi-media products, home appliances, business instruments, communication products, and IT products. It has more than 50 professional designers and engineers. Its research scope covers market research, product concepts, engineering design, graphic design, material techniques and exhibitions.

Concerning organizational structure, the design centre previously belonged to the R&D centre. In 2009, it became an independent department, directly reporting to the Group. The centre is divided into four parts according to the different functions of 2008: a) *Home appliance design:* designing white home appliances, such as refrigerator, wash machine, air condition and small household appliances; b) *Multimedia design:* designing brown home appliances, especial TV; C) *Exhibition design:* designing exhibitions for the group, graphic design and advertisement design; D) *Engineer design:* offering engineering support to brown goods (the engineering design of white goods is responsible by each product department).

In the Hisense Group, 70 per cent of design projects are fulfilled by its internal design, while only 30 per cent of design projects are allowed to be outsourced through public bidding. However, the internal design centre is required to join the competition of bidding. In this way, the internal design capacity is supposed to be upgraded through the competitive pressure. In practice, the proportion of outsourced design projects only takes 10 per cent, because there is a good communication system between internal design and the product department. With the efficient communication, a design project can be fulfilled successfully since internal design can be involved in a project at its up-stream stage, and they understand requirements and markets better.

Operational design management

In Hisense, a confirmed design process has been established and the company endeavours to establish it as a standardized regulation. In addition, to generate design concepts, various design methods are utilized and communication among designers is encouraged in a design process.

The design concept of Hisense usually comes from two resources. One is marketing research and investigation; another follows design directions of target brands. In the design centre, there is a designer assigned to be responsible for collecting and analyzing marketing information. For each brand product, the company sets a target brand as its objective and main competitor. Salesmen usually collect the updated information of these brands and send it to design.

Since new products of Hisense are a part of annual planning and prepared one year ahead, designers not only take part in the planning process, but also work tightly with sales and marketing staff. In this instance, design can offer their advice actively of product direction for the next year, and grasp the design direction in their works.

In practical operation, a product design is fulfilled by a project team in the design centre. An experienced designer is assigned as project manager to be responsible for all the project works in the design centre and their quality of design.

The control of design quality also is realized by design audits. Design proposals are initially inside design teams, and then sales staffs are invited to offer advice for these proposals. After modifying design proposals according to this advice, they are presented to the company for final group evaluation. This process has been modified and improved in practical operation, and the company is planning to record the process into documents for standard implementation.

7.4 Cases in the Yangzte River Delta

7.4.1 Hiaward Information Technology

Location:	Nanjing
Year of establishment	1999
Ownership	private
Product category	ATM, Self-banking financial service
Market	China

Hiaward Information Technology Co., Ltd. was established in 1999 in Beijing by Mr. Rong Wang, together with his classmates and colleagues. In 1990, the Chinese government had begun to promote the Golden Projects[4], which includes the Golden Card Project. It was considered as a good opportunity of investing in financial information project and Hiaward aimed to serve banks with finance information engineering[5] corresponding to the Golden Card Project.

[4] The Golden Projects refer to the Chinese government's systematic acceleration of IT infrastructure deployment in state agencies, schools, and hospitals. Implementation of the three major Golden Projects - Golden Card, Golden Customs and Golden Tax - began in 1990. By 2003, implementation of the Golden Projects had involved spending of more than 10 billion RMB by government agencies alone. If spending by other organizations is factored in, the total demand for IT and communications products created by the Golden Projects amounts to over 100 billion RMB (US$12 billion).

[5] Information management and service of analyzing, designing, operating and maintaining information system for entities in bank, securities and insurance industries.

Since almost all the headquarters of banks are in Beijing, the company was located at Beijing from its beginning.

Concerning the business development of Hiaward, the company has experienced three main stages, based on its development of technology innovation. The first stage started in 2000. As the turning point of new century, many banks met problems from the Millennium Bug[6]. Hiaward caught the opportunity and solved problems by its upgraded software. Based on it, the company gradually developed its capacity for software R&D in the first stage. The second stage began from 2002, when China Minsheng Bank demanded a modification of its self-service system. At that time, the company researched and developed the first generation software to solve problems of self-service banking in technology, management and business development. It utilized internet techniques in a self-service system to offer a public platform for various softwares, which are usually utilized in different ATMs and made by different manufacturers. With the software, a bank can manage its self-service system easily. The third stage was from 2004 to 2008, when Hiaward developed electric counters to replace self-service banks with a broader service scope. Meanwhile, since the ten-year project of Golden Card was completed in 2004, there are more than 0.1 million ATM in China. This implies demands for a higher level quality of service, which is the key topic emphasized by the company in its third development stage.

With ten years development, the company has five divisions, 52 service stations and around 500 employees in China. However, Hiaward still is a small-size enterprise. Their staffs consist of 130 developers of software, 300 market servers, and salesmen.

The market of Hiaward covers the major regions of China, except for Tibet. There are around 230 banks which are served by Hiaward. The target market of the

[6] A problem for both digital (computer-related) and non-digital documentation and data storage situations which resulted from the practice of abbreviating a four-digit year to two digits.

company is stable and growing. In China, this product field is integrating. At present, Hiaward is listed fifth in this field. Its major competitors include Bluesky and EastSouth. The main challenge of Hiaward is innovation in its service and product, which also are the core content of competition. In the next five years, the company aims to become the leader of this industry as an independent operator to serves card holders. To reach this aim, Hiaward plans to occupy 35 per cent of the service market in hardware and in software of self-service financial. In addition, the added value service and consult service of financial IT are also included.

Strategic design management

Concerning the service offered by Hiaward, it is branded as XBANK, which is the result of integrated channels. In it, banks as clients are responsible for process design, while Hiaward is responsible for implementation as supplier. The brand represents a software platform of this service. Based on it, the company also produces series terminals: Automatic Teller Machines (ATMs).

Though the logo of the brand was not designed by professional designers at first, the company has realized the importance of design and plans to utilize design in promoting its brand image, including redesigning the logo. At the first stage, Hiaward plans to employ professional designers to redesign its logo. At the second stage, since the company focuses on service for banks, they prepare to launch a standardized service with brand identity systems. The entire image related to its service will be designed explicitly, with DHL used as an example.

The core competitiveness of Hiaward consists of software R&D, hardware of ATM and OEM business of self-service terminal products. The three aspects also are the content of its business. Each part produces similar profit. Besides the three forms of business content, the company began its new business as an outsourcing service for banks in 2008. With it, they can help banks to manage their retail channels.

Currently, the business of the company consists of three levels, on which it conducts different strategies to develop advantages. The basic level is hardware, which is outsourced to manufacturers. The middle level refers to software, which is the core, with leading technologies mastered by Hiaward. The top level involves various services for banks, in which the company plays a role as external operator of banks. Concerning this structure of strategy and business, the core competitiveness of Hiaward is its soft capacity, including the technology of software and service management.

Besides the two factors of core competitiveness, design is considered as another core competence of Hiaward. This is because both software and service need design. In software R&D, interface design is important. A good interface design not only can add service value to card-holder through improved convenience, but also influences the business of banks through a lower service cost.

Figure 7.10: Products and work environment of Hiaward

Concerning the characters and nature of Hiaward's service, the company thinks that industrial design is an efficient way to offer satisfied user experience, which is also the target of its business in bank service and software development. However, it is difficult to realize it in operation, because not all the staff can really understand it, a large number of investments needed for it, as well as a lack of professional talents and appropriate products.

Functional design management

There is not a design department in Hiaward at the current stage. The function of product design is all completed by external OEM-based manufacturers, who are suppliers of its ATM products. The company plans to set up one, however, depending on the development of its markets.

The company previously had established a design department, which was transferred to the Department of Business Research and Development to study customer and market demands now. The new department directly reports to the general manager. Its members usually have multiple professional backgrounds. Beside technology, they also have knowledge about the bank business, market research and customer communication. Since a single bank cannot offer too much detailed requirements for Hiaward's products and service, the department integrates diverse requirements from different bank clients, based on studying their business models, products and business trends.

In addition, there is a position called "artist engineer" in each R&D project team, who is responsible for interface design to ensure the usability and interaction of software platforms.

Operational design management

The original requirements of terminal instruments are defined by communicating with customers. In most cases, they express their explicit requirements of products, which are then summarized by Hiaward. According to this information, the company develops its products or requires its suppliers to improve their products and service.

Concepts for new product are generated from discussions in the R&D department, instead of user investigation. Opinions in discussion are based on usual communication with customers.

Since terminal instruments of service are sold to banks through public bidding, the design brief usually is listed as requirements for bidding. However, it just mentions some basic requirements, such as ergonomics, safety and reliability, because the biddings usually focus on mature products, which are already sold in markets. In most cases, design is not utilized in these products, only in new product development.

For a new product development project, the company has documents to regulate design implementation, which usually are defined through a discussion with the manufacturers as suppliers to consider production capacity. In this instance, the critical point of the design brief is to find a balance point between market requirement and production capacity.

In a new product development process, various functional departments, such as service, software R&D and market, take part in audits. The latter two usually play dominate roles.

Concerning the product quality, it is controlled by tests during the outsourced production process. The standards of the tests were established with a reference of GB and standards of manufacturers.

7.4.2. Ruyi Industry Co., Ltd.

Location	Huangyan, Zhejiang province
Year of establishment	1987
Ownership	private
Product	toys, crafts and garden tools
Market	China and oversea

Locating in Huangyan, Zhejiang Ruyi Industry Co., Ltd. is established in 1987 as a private enterprise. The company has fixed assets of 51.8 million RMB, more than 600 workers, 6 factories, 2 branch companies and a craft and toy institute. Ruyi manufactures products, such as wooden toys, gifts, plastic crafts, candle crafts, garden tools and machinery. The company is one of the first companies to have a wooden toys exportation license issued by the state inspection and quarantine department. Its sales revenue is about 20 million USD. Among them, export products occupy 6 million USD. The oversea markets of Ruyi include America, Canada, Europe, Japan, South Korea and Hong Kong. Since toys are the main products of the companies, its overseas markets are located in rich countries and regions, especially Europe. In these markets, its products can sell with higher price than underdeveloped markets.

Focusing on its core products, Ruyi develops its business in multiple ways. In addition, export products are the core of its business development, based on its advanced manufacturing ability. With increasing demand from export markets, its manufacturing ability is improved too.

The goals of Ruyi are demonstrated in two aspects: to expand the company through maintaining standards and creating new business; to enhance company capacity through maintaining characteristics and building the brand.

In implementation, innovation through design is the target of development in the next stage, which is based on the new requirements of clients and markets. On the one hand, consumers and clients upgrade their demands for products. On the other hand, concerning the nature of this product field, the life cycle of product is short. In this instance, continuous innovation is the main way to keep market share and to create new purchase opportunities. And design is the most essential tool to realize it.

Strategic design management

The company has paid much attention to brand building. In 2004, it had set up a plan of brand development. Besides registering trademarks in China, by the end of 2004, the company had registered "RUYU" and the picture of 18 kinds of games, toys, chess game apparatus, balls and other goods according to Madrid international application system. Now, the "RUYU" brand of the toy series has been awarded the title of *Famous Brand of Zhejiang*.

However, the brand is only used in local markets. In oversea markets, OEM is the main business type. The company seldom develops new products for overseas markets and has never sold products with its own brand in export markets.

Figure 7.11: Products of Ruyi

The core competitiveness of Ruyi is its brand. After its establishment in 1987, Ruyi has existed for more than twenty years. During the period, a good reputation for the brand has been established gradually based on its manufacturing capacity, product quality and credit.

Based on good manufacturing standards and high quality of products, the company's output can be sold with a higher price than most competitors. Even though its prices are 10-15 per cent higher than other products, the company still can keep its own clients with a good relationship. Some of them even have a history of more than ten years. This also is contributed by the good reputation of its service: the company offers instant and efficient after-sale service, as soon as problems are discovered or reported by users.

Concerning the product development project, the investment in design is very limited in Ruyi. The company has no special plan of investing in design or developing design capacity. At present, the investment in design is included into the whole cost of product R&D, without a special category.

Functional design management

The company has a flat organizational structure. In it, all the functional departments are at the same level and directly report to top manager. The R&D department is an independent department. The function of industrial design is included in it.

In the design team, there are about 6-7 designers, who are mainly responsible for product design and package design. Except for 1-2 designers focusing on package design, the others are all product designers. Most are very young. Their average experience is about 3-5 years. Some are graduated designers from design schools; others have moved from other functional departments with certain design related experience accumulated in practice. To enhance the professional ability of the designers, the company offers various training opportunities to them.

Furthermore, concerning the nature of wooden toys, a studio for prototyping has been established under the control of the design team. With it, designers can proposal their new concepts with prototypes. For OEM business, it can be utilized to copy samples offered by clients to confirm the styling and quality.

The company has not yet considered whether to outsource design, because product design is not important to its business development, and its design capacity is very weak. Previously, the company seldom designed products independently. In most cases, it is its clients who offer concepts and ideas for new products, with ideas then being confirmed and realized through communication between internal designers and clients. The function of internal designers is to visualize clients' ideas, instead of generating new ideas by themselves. Because of this, the internal designers usually lack experience of generating design concepts independently. In an overall view, the function of design is only considered as a part of R&D process, especially to communicate with clients.

For the same reason, the company also lacks experience of product innovation. They consider there is no need to look for external design at present. However, the company has gradually realized the value of design for business development. In the near future, the company hopes to upgrade its R&D ability through enhancing its internal design capacity.

Operational design management

A fixed process of product development has now been established in Ruyi. In it, there are two sources of new product concepts: one is from clients; another is from internal design. As previous stated, in most cases, it is clients who offer ideas for new products. Based on them, the internal design team presents design proposals with details. With the experience accumulated in projects, the company has established the database of related products, which could offer a basis for independent new product development. Sometimes, internal designers propose new ideas of products independently, based on information collected from various resources, such as the updated samples brought from foreign countries, studies of fashion colour and trend of gifts. Because of the large expenditure on travel, designers cannot frequently visit foreign countries to collect market information. It is marketing staff who collect the information about oversea markets for them, although some local fairs and exhibitions also are opportunities for designers to obtain product information.

Usually, various functional departments take part in the design audits, such as marketing, production and quality. Since safety is the most important issues of toys, it is specially emphasized in the audits of new products. Safety also is the main topic of product quality. Because the majority of its products are exported, its design quality usually is considered in the context of safety according to requirements in different countries. Since the beginning of 1997, the company has edited its own quality standards and other relevant documents according to the provisions of ISO 9001. By the end of 1997, they had got the certifications from Wantai Certification Co., Ltd. In recent years, other certificates, such as GS, LL, CE and ROHS, FSC, have been achieved by the company.

7.4.3. Heng Feng Group

Location	Hangzhou, Zhejiang province
Year of establishment	1993
Ownership	private
Product	Outdoor furniture, camping facilities
Market	China and oversea

Heng Feng was established in 1993. It focuses on manufacturing and exporting outdoor goods, such as fishing tackles, outdoor furniture, garden and camping facilities. Its head quarter is located in Hangzhou with its manufacturing factories nearby. Each factory is assigned to produce only one type of product. In addition, they have some coordinated manufacturers, which offer complementary products, such as knife and folks in a picnic kit.

The company produces more than 10,000 types of products and achieves sales revenue about 0.9 billion RMB per year. The headquarters is responsible for R&D, samples, sales, and prototypes with about 200 employees. Its products are sold in oversea markets, especially in Europe and America, such as America, Australia, Japan and Korea. In China, the company ranks the third place in the markets for this product category. The company total has nearly 4000 employees.

The mission of the company is to be the premier supplier of outdoor leisure products and service in the industry in China and to develop its business with its own value system.

Strategic design management

At present, the company faces the challenge and pressure from two directions: the financial crisis and the increased cost of raw materials. In this instance, it is very important to plan appropriate strategy to survive in this situation. Concerning business strategy, the company has changed its focus from export markets to local markets. In the near future, the company will not only expand its China markets, but also develop a business group through multiple paths. Corresponding to its business strategy, its design strategy is also transferred to local markets and the internal designers will begin to conduct research on China market soon.

The company views its advantages in four aspects: good human resources, advanced materials, strong design capacity and quality management. The company is equipped with well educated talents, which mainly have master and doctoral degrees. In addition, some professional talents even have the work or education experience in foreign countries and so can expand the view of their basic work. The company also manages to offer various training opportunities to them to enhance their professional ability. The strong design capacity of the company has been formed based on more than 120 professionals in design and technology in the R&D department. All the products of the company can match the diverse requirements of quality, such as BSI, UL (US), CE (EU) and AS (Australia). A strict management system of quality had been established in the company to ensure the quality according to these requirements. Besides it, the good quality of products are also contributed by the high quality of raw materials and advanced equipments.

Concerning the core competitiveness of the company, it relies on three factors: manufacturing, design and management. Because the company previously focused on OEM, they had accumulated experience of large-scale production. Based on it, the company has the ability to produce various types of products at the same time with good quality. In China, it is difficult to find manufacturers with this production ability. A good management experience has also been achieved to ensure quality and production on time. Good design ability refers to the quality of communication with clients. Based on it, good coordination relationship with clients has been established. Once clients come to the company, they can purchase products and service on a one-stop basis, because the company can offer diverse options with various high quality products.

Design awareness

From the beginning, innovation has been considered as an essential way of developing business. For Heng Feng, innovations are unlimited, while resources are always limited. Innovation is the best way to break the frame of resource constraint and to creatively solve problems in the company.

Design has been influentially utilized in new product development in Heng Feng. Every week, about 8-10 new products are designed. And the company has obtained patents for more than 80 products every year. To protect its products from copying, the company has assigned special employees to crack down on fake products in every main exhibition and trade fair. In addition, the company develops its own design capacity. However, it is not an independent and simple issue. It is limited and influenced by other factors, such as market position and brand development.

The origin of company is OEM. Later, with development of the business, the company registered its own brand. Now, it has been registered not only in China but also in America and Europe. There is only one brand for the company and its products: WEST FIELD. At current stage, it is used to develop OEM business.

From the point of view of brand building, the company is still at the primary stage, though they have achieved some good feedback in the form of business profit. The company has accumulated experience and resources for development at the next stage. Now, they have to plan deliberatively to exert the functions of the resources and experience. For Heng Feng, only with a recognized brand and strong design capacity could they take a leading place in markets. This led the company to transform its focus into product families, product identity and brand identity.

Figure 7.12: Products and work environment of Heng Feng

To develop its own brand, design is considered as an important tool. Because of it, the company plans to establish and develop its own design capacity, which starts from the establishment of an internal design department. According to the plan, an independent design firm will be set up, which will not only be responsible for designing new products, but also can capable of accepting design projects assigned by clients independently.

Currently, the investment in design consists of two parts: the cost of the internal design team and the cost of designing a new product. For the former, it takes a large share of the total investment in design. For the latter, prototyping and tooling are the main parts.

Functional design management

The company has established its independent industrial design department, which is under the control of R&D Centre. The R&D Centre is led by a product director, who has a parallel position with sales director and the sales department.

There are about 17 professional designers in the internal design department. The majority of them have education background of industrial design. The average work experience of them is about 4-5 years. Though the company is planning to offer more opportunities for training designers, to balance the investment in design with other functions is a critical problem. The company can not just emphasize the development of internal design, while ignoring other functions. If investing in design too much, it will cost more and cause a dissatisfied attitude from functional departments. On the other hand, without investment, the internal design capacity cannot be developed. The company therefore tries to find a way of developing all functions without adding too much investment.

Heng Feng plans to develop the scale of internal design further in the near future, supported by the improved recognition of brand in consumers and markets. In fact, among other Chinese companies in the product category, the internal design team of Heng Feng might be one of the strongest. However, compared to its foreign competitors, its development is only at a middle level. The majorities of its foreign competitors emphasize internal design capacity and would like to invest in design actively.

At present, the company also outsources its design work to foreign freelance designers, who mainly are American or European. They are employed to offer practical design proposals in new product development with free forms, either project-by-project or long-term. Their design proposals should meet the practical requirements of the markets and mass-production. Since the expenditure of hiring these freelance designers is very high, it is the boss of Heng Feng who is responsible for communicating and coordinating the external designers.

Operational design management

Based on the practical conditions of the company, Heng Feng had formed a basic process of product development, which includes market research, information analysis, confirmation of design direction, design proposal, design audit, prototype, test production, promotion, and reception of orders in exhibitions.

Internal designers are involved in the process from the beginning. The final decision-maker of design varies in projects, depending on the exact situations of each project. Small projects usually are decided by the internal design department, while large and important projects are controlled by the boss. Sometimes, clients also are involved in the design audits.

Design planning is based on market information in most cases. It is the marketing department that offers first-hand information of markets to design. And the two teams work together to discuss opportunities and generate ideas. Meanwhile, the internal design team also conducts market research by themselves. They collect market information through investigation, study competitors' products and visit foreign markets. Based on these, internal designers manage to discover market demands and product trends. Then design planning is completed according to their understanding of them.

To control the quality of product and design, the company had established its own standards. Concerning product quality, the standards are formed based on national standards in various countries. For design quality, documented policies of working process are established based on previous experience. The people, methods and procedure of a new product development are regulated in the documents.

7.4.4. Genvana Group

Location	Shanghai
Year of establishment	1992
Ownership	Private
Product category	stationary
Market	China, and oversea

The Genvana (Group) was established in 1992. At that time, OEM production of stationary products was its main business type. After that, the company went through a critical development period from 1999 to 2002. The year, 2002, represents a milestone in this product type. From then on, design was recognized as an important factor of the product and ten leading brands in China markets began to employ design in their new product development. In this instance, Genvana decided to move its sales and R&D departments to Shanghai to enhance their competitive capacity, since Shanghai is an information centre in China. From then on, Genvana entered a new phase of development and grew step by step.

The company is now one of the largest size manufacturers of stationary products in China market, based upon its advanced technology and equipment. Its main products include gel ink pens, ball pens, roller pens, mechanical pens, whiteboard markers, correction pens, permanent markers, highlight pens, pencil sharpeners, glues and eraser. Among the leading ten brands in this field, Genvana takes third place. It has two manufacturing centres, Shanghai and Shantou in Guangdong province. The Shanghai office is the headquarters for sales and marketing, which is responsible for marketing, research and design.

The market of Genvana is not only in China, but is also worldwide, such as Europe, America, and Asia. However, overseas markets only take about 10 per cent of market share. In it, Genvana sells its products to OEM clients at a low price and without any ideas about the final retail price. In the China markets, Genvana promotes its own brand through its products. The main competitors of Genvana are the other leading brands in this product field. However, its total sales revenue only occupies 10 per cent of the whole markets. The other 90 per cent are taken by small-size factories in Yiwu, Zhejiang province. This situation resulted from Chinese consumer's recognition of stationary as low-value and fast-consumption commodity. In addition, with the huge consumer market, there are about 0.8 billion peasants as consumers, who decide their purchase by price. Because of these, those small-size factories take a large market share with their low-price products.

However, the competition of low-price has changed since 2002. Consumers became more rational and began to notice other factors in addition to function and price, such as styling, materials, graphics and colour. With similar price, consumers prefer to select products with better styling. This influences sales and the market concepts of brands.

In this market, design is involved in product development as a critical factor to fulfil its market concept and position. In fact, considering the factory price, its products are low-value with prices ranging from 0.5 to 2 Yuan RMB.

Though Genvana is defined as a brand with low-price products, design is still employed as a key factor in competition. This has already been the feature of all brands in this product category. Its utilization of design is evident in two different stages. At the early stage, Genvana copied the designs of Korean and Japanese products, based upon its market analysis. At second stage, this situation has been totally changed, because foreign brands have entered the China markets. These foreign products are influential among undergraduate students and have implicitly changed the concept of these young consumers. They began to emphasize brand value, instead of price. In this instance, Genvana had to upgrade its brand value and develop products for a high-level market. To achieve this objective, design is essential.

In the current stage, the challenges of the company's development are two-fold: firstly, how to enhance research and design capacity; secondly, how to increase production ability. These two challenges are caused by a changing market trend: a shorter lifecycle of products. A few years ago, in Genvana's annual product plan, the ratio of old product to new product is 2 to 1. However, this proportion has now changed into 1:2. With rapidly shifting taste of consumers, the shorter lifecycle of products requires a shorter cycle of R&D and production, which in turn leads to a demand for new effort ability in design and manufacturing. So the explicit goals of business and design are to solve problems in these two aspects.

Strategic design management

The brand of Genvana has been registered, and is known as a Chinese publicly recognized brand in this product category. At present, the company is being managed to be famous brand.

There are four product lines within the Genvana brand: Shi Le Bi(史比乐), Tong Le (通乐)， Know(知道), Yong Wei (永威)。Each product line targets a distinct consumer market. Shi le Bi is focused on students; Tong Le is for circulation markets; Know emphasizes business markets; Yong Wei mainly involves products of highlighter pen and whiteboard marker.

The current financial crisis has not influenced Genvana. But for small-size manufacturers, it has resulted in decreased quantity of production. This is because those manufacturers normally rely on low-price strategy, which is based on cheap materials. Once the price of raw materials is increased and consumer's concepts transfer to urbanization contexts, those manufacturers have to face enhanced pressure, which is caused by higher priced materials and consumers' demand for design. In this instance, they cannot conduct a low-price strategy any more.

Genvana has also noticed the increased pressure. There are leading brands that can usually employ foreign designers to enhance their design capacity and design team. Following Genvana, there are those small brands which are planning to improve their competitive advantage in price. As a result, the competitiveness space of Genvana is compressed and its development becomes tougher in this situation.

Developing its own brand is the only way Genvana can survive. The company will not compete with small brands on price, because it means retrogression. Genvana must develop itself in a same pace of other leading brands. This implies maintaining a similar position on price and design as them.

The company plans to promote brand and product by exhibitions and sales events in universities. However, these endeavours are considered as superficial works, just like promotions or advertisements. Design and quality of product is the real core content in the company's development.

Figure 7.13: Products of Genvana

Functional design management

With 50-60 researchers, the R&D centre is equipped with advanced instruments of tooling from Germany and Sweden. Concerning industrial design, Mac computers and updated design software are provided. With a focus in research and design of function and styling, Genvana normally releases 20 new products per year.

Besides this, Genvana's ability in R&D and design are demonstrated in its OEM and ODM business. In most cases, the company can develop a new product according to the samples from OEM client in 7-10 days. And it takes 20-30 days for the team to design and produce a total new product according to the requirements of ODM client.

In Genvana, there are about 1000 employees in factories and 100 staff in the Shanghai headquarters. In the company's organizational structure, the R&D section is independent and directly reports to the general manager with a parallel position as other functional departments.

As a part of the R&D section, the internal design department has nine employees. In it, there are four product designers, three graphic designers, an assistant design manager, and a researcher. The product designers are responsible for styling and engineering. With an average five-year experience, their experience in this product category ranges from 2 to 20 years. They are familiar with various design software related to their work, such as Pro-E, Solid work and Rhino.

In Genvana, the investment in design is much higher than that of manufacturing. Concerning product design, the majority of work is focus on incremental modification, instead of developing totally new products. The ratio of incremental design to new design is 3 to 1. In most cases, design work refers to a modification of graphics and colour based on similar styling and tooling. In this way, a pen can be changed into a totally new look based on old moulds. As a result, the cost is therefore decreased because of the lower investment in manufacturing.

The company offers training opportunities for novices to learn manufacturing possibilities, which usually is conducted in a way of learning-by-doing. In Genvana, the junior designers have to work in the factory for one month to understand techniques, engineering and production, because internal designers are required having an overview of styling, structure, material and manufacturing. However, the majority of graduated students usually generate design ideas without knowledge of production processes, techniques and materials. As a result, their proposals cannot be produced. In most cases, new designers take at least six months to one year to grow into their roles. After the training, they generally can complete design and engineering work independently. The learning normally is in the process of projects. During the process, experienced designers teach junior designers about the detail information and knowledge of process and design.

Genvana has tried to outsource design in various types, but it is not successful and does not continued with this anymore, because it is difficult to find experienced designers in this product category. Meanwhile, the majority of design firms have no interest in servicing this design need, because of a low design fee. For the same reason, the opportunity of cooperation with design schools is even less. The company has not yet found any suitable way to solve this dilemma. Freelancers are viewed as helpless if they only can design good styling without any further understanding of manufacturing and market requirement.

Based on its experience, Genvana does not co-operate with Chinese designers and design firms anymore, because their service cannot match the company’s demand. At the current stage, Genvana has established a good relationship with Korean designers. An experienced Korean designer even works in the internal design team.

Operational design management

Though Genvana has established a formal design process based on its previous experience in project management and R&D, the process is still not a fixed one. Corresponding to fierce competition, the company adjusts its process every year for a shorter one. In 2004, the whole product design process took four months, but is compressed into 1.5 month now. Besides a shortened design process, the preparatory work of a project has been advanced to a half year. At the end of 2008, the design of new products, which should be on market in the first half year of 2009, was completed.

The main direction of new products is defined by the marketing department. Once they confirm the position and transfer the concept to the designers, a design team will research the requirements of market and design. Market research is very important for generating designer's concepts. To obtain inspiration of design, designers usually investigate different markets or use the internet.

To control the quality of products, Genvana employs 50-59 quality controllers, which are regularly trained by 17 technique employees. In this way, the product quality staff can achieve the updates of technology in this product field. The process of product quality control ranges from the materials checking, production, market launch.

To control design quality, design proposals usually are audited by the marketing and R&D departments and top management, based on their professional experience and comparison with competitive products. The company previously audits design by prototypes. Since the result was finally not found to be trustworthy, however, this method of evaluation was given up. At present, the proposed design usually is made into a prototype with coated colour and graphics, which is mixed with other competitive products without any brand identity, such as a logo. Then decision makers are required to select the best product according to their opinion. However, even though the design is evaluated in this way, only 30 per cent of products achieve success in markets. This implies that among 10 new products, only three sold well.

7.4.5. Ted Golf

Location	Changzhou
Year of establishment	2005
Ownership	Private
Product category	Golf trolley
Market	Oversea

Ted Golf was established by its general manager, Mr. Gong, in 2005. Before that, Gong ran a factory producing electric motors for treadmills and electric sofas. In 2004, when he visited Beijing, a friend showed him a golf trolley. Though Gong had no idea of golf sport and golf trolleys at that time, he still took one back to his office, where it stayed for 6 months. During this period, he began to collect related information and gradually realized the product represented a business opportunity. Previously, people drove a car from one hole to another when they played golf. But this was considered as lacking exercise and no help to health. Then European players began walking with golf trolleys. In this way, players can exercise their body by walking 6-8 Km for 18 holes. As a result, a golf trolley emerges as a new product to replace traditional cars in the sport.

Based on the understanding of golf sport and the potential of golf trolleys, Gong decided to establish Ted Golf as a test of this new product and its market in 2005. The company developed rapidly in a short time and as a result, Gong had to sell his previous factory and transfer his business to golf trolleys.

The rapid progress of Ted Golf is partly contributed by its electric engine technique, which was accumulated in the previous business: electric sofa. Ted Golf also invests a lot in the application technique of electric motors for new golf trolleys, which results in its tech-led range of golf trolleys becoming a world leader.

By 2008, Ted Golf had 120 employees and its annual sales revenue reached 25 million RMB. All its products are exported to overseas markets with a total annual purchase volume ranging from 2.5 Million to 5 Million USD.

Until now, ODM was the main business type of Ted Golf. And its ODM clients are worldwide, except for China. However, its market is totally different from its beginning. Then, a limited number of clients knew its products. The only aim of the company was to develop sales channels and occupy more market share. In the current stage, its situation has totally changed through an accumulated reputation in this field worldwide. The company has begun to consider protecting its quality, reputation and intellectual property. As a result, it was decided that its products would not be sold in China and south-east Asia and according to Ted's requirement, its agencies should only sell its products. In this way, Ted has developed its clients in North America, South America, Eastern Europe, Southeast Asia, Africa, Oceania, Mid East, Eastern Asia, and Western Europe.

For its two main markets in Europe and America, Ted Golf utilizes different brand strategies. For European market, the company just plans to maintain the current situation of ODM business. Once it occupies the American market, the company will transfer its focus to this market, since it is the core in terms of sales potential. The company plans to enter this new market as an OBM business. To decrease business risk and difficulties, Ted gave up its own Ted brand and registered another new brand in cooperation with its American partner, which selected it according to criteria such as its fame, network and work ability in the American golf field. Combined with Ted's advantages of design, quality and price, this collaboration is viewed as a win-win strategy for both partners.

However, it still is difficult to promote a new golf brand in the American market. On the one hand, the company has to develop new products with advanced technologies and also upgrade its product quality to promote the new brand. On the other hand, the new brand image needs to be released and established through a large number of investments for finding suitable spokesman with significant reputation.

In the ODM business, which focuses on European market, its product price is decided by their clients' brand fame. For a good brand, its product can be sold at a unit price of 3-400 ₤ in retail. For other brands, a same product may only be sold in 200 pound.

Since Ted Golf entered the golf field just a short time ago, the company still does not fully understand the character of this market and has no clear idea about business risk. In this instance, the company had to co-operate with professionals in various ways for their advice. In addition, with the fame of these professionals, the new brand name also could be introduced and promoted efficiently in the American market.

In a simple word, the business goal of Ted Golf is to be a famous enterprise in the golf field. This goal includes five detailed indicators: obtaining sales revenue of 0.2 billion RMB in 3 years; occupying 36 per cent marketing share; increasing employees' income by 2-4 times; achieving 30 millions RMB profits; attaining 1 million RMB of per capita output value. To fulfil these tough goals, Ted Gold has to rely on a motivation mechanism, which is connected to the income of employees.

Strategic design management

Ted Golf only considers its competitors in global market, instead of local competitors. Its recognition of the China market has grown with experience. In the beginning, the company had no idea of the market situation when they participated in Chinese exhibitions of golf equipment. In fact, though there is a huge golf consumer market in China, the number of manufacturers is limited, no more than 50. And in this narrow market, once Ted's new products were showed in exhibitions, they were copied immediately. As a result, the company gave up the China market and transferred its focus to the American and European market.

For Ted Golf, design is its core competitiveness and an advantage. Without recognition and application of design, the company cannot survive. In Ted Golf, design as core competitiveness explicitly refers to innovation in function, structure and the operation of products.

Functional design management

Ted Golf once planned to develop its own design capacity by employing internal designers. However, only three designers had ever been hired by the company, the longest one only stayed 7 months and his work could not match the quality requirement on a technical level. Since product structure is critical for designing a golf trolley, designers must study and understand its structure, function and relations among different parts. However, the majority of designers lack the recognition and can just do superficial styling work. As a result, Ted Golf has abandoned establishing its internal design department at this stage.

The current product development work is fulfilled by the product R&D department, which consists of four parts: structure, test, techniques, as well as control and electric technique. The members of this team have already worked together for a long time, after the establishment of Ted Golf. They learned by experience to accumulate knowledge in practice. In addition, to upgrade quality of staff, the company encourages employees to take part in various kinds of training and cooperation with universities or institutions.

At present, all the design and development work is completed by Ted Golf itself, instead of outsourcing. The company had ever considered looking for external designers, but there are some barriers. The major problem is the lack of experienced external designers in this product category. Since golf trolleys are a very narrow and professional product category, without at least 4-5 years experience, a designer or design firm has no idea of designing this type of product. Its design is tightly combined with other functions in a systemic engineering process. In this instance, it is impossible to find qualified external design resources in China at current stage.

Operational design management

Design is a primary factor in attracting clients. In most cases, the company achieves informations about market trend from international exhibitions and conventions. Based on it, new products are developed. It is good styling that firstly attracts attention of clients. Then clients then need to know further information about the product, such as specification, functions, performance and price. This finally leads to purchase.

To understand the market, Ted Golf invests in market research. The company primarily focuses its research on market volume, breakthrough design and techniques. Based on them, the company begins to plan and develop the product formally.

For a successful golf trolley, various factors are required, including styling, electric engine and usability. Concerning the character of a golf trolley, its styling is complex, combined with structure. Control of the electric engine is critical. For users, the control system should be operated easily and the styling of the engine should coordinate with the whole structure. Besides the above issues, a product should be strong and durable enough for easy usability.

In most cases, the characteristics of a golf trolley are demonstrated and identified by its structure and floor panel. Based on a confirmed body frames, products are usually upgraded by minor changes. The directions and requirements of modification are from two resources: feedbacks from clients and from market information. Based on the former resource, the company can define its product position by comparing with competitors. And the definition of position is finally reflected in products. Feedback from the marketing department is another main resource of upgrading products, especially applications of new techniques.

Generally, clients list the requirements in a design specification for a new product. Combining with clients' requirements and design specification, the chief engineer is responsible for establishing a design brief, which includes functional criteria for evaluation and price scope. This design brief not only guides the direction of design, but also offers a reference point for design audits.

To control product quality, Ted Golf focuses on independent innovation. The company develops and produces each part of a golf trolley itself, except for the battery cell. Concerning design quality, this limited by two factors: product cost and quality of the designer. A qualified designer can consider diverse factors for a product in his/her work. These factors range from styling, consumer need, operation, interaction, material, cost, manufacturing to client. In most cases, a higher-cost product implies better design quality and product quality.

To encourage the activity of innovation and design, as well as to protect intelligence property, the company actively applies for patents both in China and worldwide. Till now, Ted Golf has been granted three invention patents, six patents of practical new styling and four patents of product styling in China.

Ted Golf has a standardised R&D process with different product audits and design audits conducted in different stages. For product audits, professionals from different functional departments are involved. Each represents opinions and suggestions from their professional field. Production gives suggestions about manufacturing possibility and cost. Financial department counts total investment in a product. Marketers express their opinions in the view of marketing and consumer. Sometimes, Ted Gold's ODM clients are also invited to offer their suggestions. However, the standard of audit and its process are not fixed. It can be changed any time according to the transformation of the market.

For a design audit, in most cases, it is fulfilled inside the R&D team in an informal way. The team evaluates design every day. Suggestions are encouraged to be proposed to improve design with a flexible approach.

7.4.6. Muyang Group

Headquarter in Yangzhou, Jiangsu, Muyang Group Co. Ltd has grown into a well-known group corporation since its founding in 1967. Its activities cover

R&D, project design, manufacturing, installation and services in a multitude of industries including feed machinery and engineering, storage engineering, grain machinery and engineering, environmental protection, conveying equipment and automatic control systems. Its service and product represent the highest quality of this industry. The company keeps its leading place by improvement of technique.

Location	Yangzhou
Year of establishment	1967
Ownership	State-owned
Product category	Feed machinery
Market	China and oversea market

Through years of unrelenting efforts, Muyang has developed over 100 series (more than 600 models) of high quality feed and grain processing machines. Among Muyang products, 18 types are included in the National New and High Technology Products list. The company has over 100 patented technologies, which help to keep its leading position in China and it has earned various national and provincial awards for remarkable technological achievements.

Based on its 37-years development, Muyang has grown from a state-run company specialized in the manufacturing of feed machinery into a comprehensive group corporation whose business activities cover all areas of grain, oil, and feed milling industries. After the company changed its ownership into a private enterprise in 2006, it entered a new phase of developing.

Muyang currently has over 1250 employees, including 400 technicians and engineers. In addition, the company engages a considerable number of professors and specialists from various universities and research institutes to help R&D functions. The strong R&D capabilities and technological leading position are evidenced by launching 89 new products in 2004. In the same year, the Research and Engineering Centre, which cost 20 million RMB, was put into use. With its ecological, intellectual, environmental-friendly features, this centre greatly improves the working condition of all the technical teams and thereby enhances their work initiatives.

The clients of Muyang are divided into different groups by product categories. The company only focuses on middle and high-end markets in feed machinery.

Meticulous design, excellent workmanship and highly controlled engineering process plus comprehensives service efforts have won for Muyang valuable awards in the form of market recognition and customer goodwill. Satisfied clients include domestic top 10 feed manufacturers and overseas feed manufacturers. Muyang products and engineering projects have won wide recognition in various parts of the world.

In the 21st century, Muyang Group with its well-defined corporate spirit focusing on innovation, responsibility, operation, and high efficiency intends to continue its effort to achieve its goal of growing into a lead-world-class machine building and engineering corporation.

Strategic design management

In the company, all products are marked with Muyang brand, which was registered in 1996 when the Muyang group was established formally. The logo of the brand was redesigned in 2006 for a modern image.

During its development, production innovation was its core business concept, which has helped promote its business development significantly. To move away from a new product development process of imitation – digestion – absorption, the company began to enhance its technology capacity by employing graduated students and senior engineers to build whole product series. This innovation capacity is demonstrated by more than 200 patents in China and overseas. In this way, Muyang not only protects its intellectual property in global markets, but also gains respect from foreign competitors and clients.

The development of its technological innovation capacity is characterized by two aspects. One is the continued investment in innovation teams and tests of innovation systems. Another is based on collaboration with universities and institutes. Up to the present, Muyang has set up long-term research relations with around ten universities. They work tightly not only for market research projects, but also for national research project in certain leading technologies.

The core competitiveness of Muyang consists of three aspects: care of function, sales network and service. Firstly, the company has become the technological leader of this industry based on its attention of product functions during the design and development process of a product. With strong ability in basic R&D, the company keeps developing advanced technologies for the market to maintain its leading place. In this way, its competitors can only follow Muyang by copying or imitating its direction. In addition, supported by advanced technologies, the company has occupied a large market share with a good sales record, which is sustained by products with reliable functions and good performance.

The second advantage of the company is its sales networks in domestic and overseas markets. Before the establishment of this sales network, the company first built up its internal net of sales function. With the progress of sales team, a systemic regular was formed to divide business scope and control operation in different offices. This is the basis of its sales network.

The third advantage is its service which aims to solve clients' problems from their standpoint. Since the 1990s, the company began to emphasize distinguishing its service from other competitors. In its service process, Muyang manages to solve all kind of problems for clients as soon as possible, despite their cost. It is this strategy that wins clients for the company.

Overall, the cultural system of Muyang consists of three parts: integrated technology, management and service. The cultural system is a combined model of army and university. On the one hand, the company prefers to upgrade its implementation capacity by advocating a form of military culture. Every year, each employee is required to take part in military training to practice and upgrade his/her ideology of obedience and operation. Based on it, the implementation capacity of the team can be achieved. On the other hand, Muyang focuses on education and training of staff in university cultures. It even designs special training courses tailored to each employee with an explicit time span. No matter which functional departments an employee belongs to, he/she has to take part in the training, which varies in content, but can include training to be a professional manager, building team spirit, professional technique and usual etiquette.

In Muyang, recognition of industrial design value has also developed substantially. It started from the beginning of the 1990s, when the company began to invest in colour design by collaborating with a design school. From that time to 2003, there was not much progress in products' colour, because the first system had been accepted and confirmed by the major staff and clients. In 2006, when Muyang prepared its new five-year plan, a new colour system was evolved. In this instance, the company employed external design consultants to complete the new system.

In addition to colour, the recognition of product styling has also been changed in the last years. Previously, it was only considered in terms of usability, which is a basic function of a product. In recent years, with the enhanced awareness of design, however, the company began to invest more in the internal design function and required a higher quality of design.

The importance of industrial design has now been recognized by the company. In contrast to home appliance and light industrial products, the products of Muyang are feed machinery, which is a kind of traditional machinery product category. In this industry, customers care more about actual profits from a products' function, rather than styling. Concerning the nature of Muyang and its products, the company locates design as a supplementary factor in product development, instead of a critical factor. For its products, technology is the most important. Consideration, while styling design is only a secondary consideration, utilized to attract customers. It influences clients' recognition of the Muyang brand, inspires their desire to purchase and enhances their confidence in the Muyang brand.

Functional design management

Instead of independent innovation, the company prefers to collaborate with or study leading foreign technology and experience with an open attitude. In addition, Muyang also establishes co-operative relations with Chinese universities and institutes.

To improve design capacity, the top management plans to hire senior R&D researchers or collaborate with a qualified design consultancy to widen the view points of internal designers. According to this strategy, the human resources department is looking for expertise from foreign countries. According to the design awareness of top management, design should be integrated with other functions in the company, instead of an independent department. However, the company still seeks an efficient way of achieving this integration with senior staff, which lack design awareness.

Even though there are different attitudes and degrees of recognitions of design in Muyang, its top management insists on using design in the up-stream phase of a new product development process. In most cases, industrial designers are involved in a project at the design concept stage. Once the specification and requirements of a product are defined by engineers, designers begin to design styling, which should express the identified factors of Muyang. The company manages to establish its own identified system through these factors. Based on them, Muyang has applied for many patents for its best-selling products to occupy a larger market share. Furthermore, the product styling and colour have been upgraded in recent years, by professional designers employed by the company.

The work content of design in Muyang is divided into two types: one is design of a totally new product; another is modification of current products. The two types both utilize industrial design in the development process.

Because of the nature of feed machinery, it is difficult to divide industrial design and engineering design in a product. Sometimes, a product may just focus on engineering, structure and function, instead of styling. However, Muyang has insisted on investing in industrial design since 2003. Design is considered as an efficient method to distinguish it from other competitors of similar product performance. Till now, the company has had two professional designers: one is responsible for styling design; another for colour design. With design of colour and styling, the whole image of product and brand are upgraded, which is called a process of elaboration. As a result, the company achieves more market share.

To develop design as a characteristic of Muyang's product, the company works in three ways. Firstly, developing certain confirmed design factors, which can be influentially utilized in its products to build an identified image, even though the main structure of products are similar and fixed. Second is the utilization of a colour system as an efficient way of distinguishing Muyang's products from other competitive products in the market. In 2008, the system of colour identify was confirmed, which guide the colour design of all products. The third way refers to interaction design, which is completed by engineers, instead of industrial designers. Engineers consider operation, process and safety of the control panel and system, and manage to find an efficient solution to improve its reliability.

The company is planning to collaborate with external designers. However, the plan is limited by some barriers. First is the limitation of its location. In Jiangsu province, the basis of industrial design is weak. It is difficult for Muyang to find a qualified external design team. Second, concerning the character of feed machinery, its styling is tightly connected with its structure and there is not too much space for design creativity. However, the company still manages to introduce external design into its product development, despite of these practical limitations. Collaboration with external design not only can break the concept frame of the R&D team and bring new ideas in Muyang, but also can upgrade product profits by enhanced design capacity.

Operational design management

The company has established its fixed process of new product development, based on its management system. The process includes information collection, market research, proposals evaluation, detail design, prototype, and product test. Before being launched into the market, every product is tested in the production line with detailed data and reports. Only if the reports demonstrate a satisfied result, can the product be released to the market.

Concerning the development of a new product, engineers first define the basic idea and specification of the product. Then industrial designers take part in the project. They communicate with engineers based on 3D works. The design process is completed by designers, based on efficient communication with engineers. During this period, engineers still can modify structures according to the requirements of styling. For each project, the company requires designers to present at least two design proposals, so the auditors can compare and evaluate them.

The ideas of a new product are generated according to product lines. There is a team assigned to each product line, which is required to communicate with external teams, widen their view point and obtain users' suggestions as resources for new ideas. In most cases, the ideas for design concepts are from two sources.

One is based on improved product function and performance; another is contributed by analyzing competitive products. All this informations is finally summarized for planning objective and direction of products in next year.

Almost all design proposals are fulfilled by the R&D centre. In most cases, a new product is evaluated by designers, chief engineers, leaders of functional departments and expertise in R&D centre. To keep business secrets, the company prefers not to invite external expertise or customers to audits. External experts can only join project proposals audit and final audits of the co-operation project.

The control of quality is fulfilled in the process of audits. After design proposals are presented, internal experts will evaluate styling and the proposed structures. Industrial design first introduces the concepts, factors and origins of design. Then the proposals are displayed in 3D models for audits. If a proposal is confirmed by the majority, it will be passed to the next development stage.

Since the styling of feed machinery is tightly connected with its structure, the styling of each assembling part will influence the whole image of a product. The quality of the parts depends on the design and production level of Muyang, which usually lags behind foreign competitors. To solve this problem, the company plans to develop a design system to control the quality of material, design and product of these parts.

Chapter 8.

Findings II: Ways of Managing Design in Chinese Manufacturing Industry

8.1 Introduction

This chapter consists of four parts with an introduction and summary. They are also four levels of findings, including characteristics, an overview, six models and approach to managing design in Chinese manufacturing industry. In first part, the practice of managing design in the cases is compared according to the criteria listed in Appendix G. Concerning the three levels of design management content, which are utilized as the basis for these criteria, the content analyzed in the case studies is shown in the grey part of Figure 8.1. In this part, 26 characteristics of managing design are reported as the main findings.

In second part, an overview of managing design in Chinese manufacturing industry is obtained based on the 26 characteristics. In the third part, six models of managing design in Chinese manufacturers are proposed based on characteristics reported in previous chapters, which represent practical solutions developed by companies. These not only offer a reference for companies to position their management of design against existing practice, but also show the ways of developing design ability.

In the fourth part, an approach to design management in China is defined, based on comparing approaches of the other three countries: Britain, America and Japan.

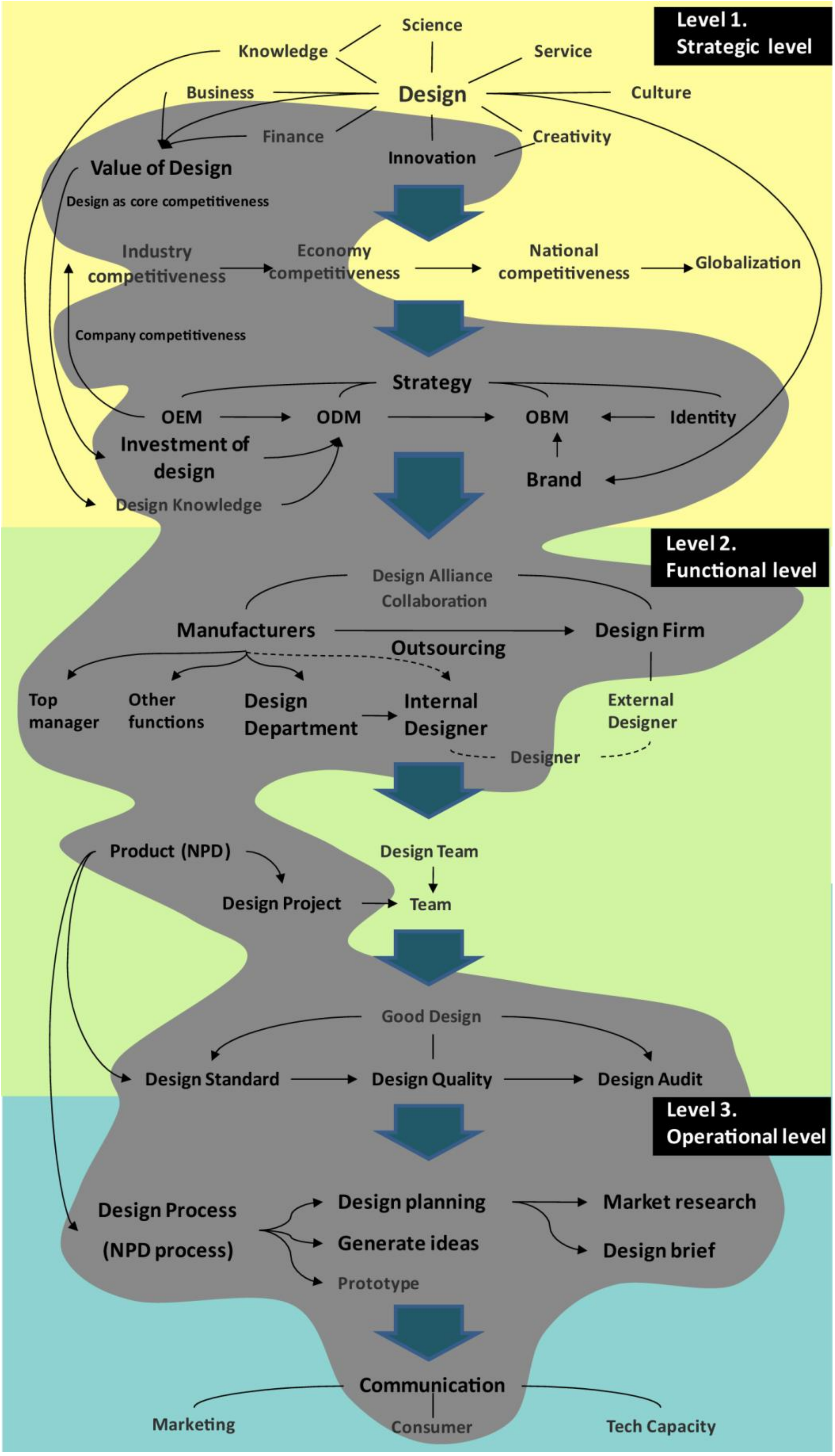

Figure 8.1: Content of design management covered by the case studies

8.2 Characteristics of Managing Design in Chinese Companies

In this section, the characteristics of managing design in Chinese manufacturing companies are proposed in four parts, which are the results of comparing the twelve cases with criteria of evaluating design management listed in table 8.1 (see detail content of each criterion in Appendix G). In the first part, features of ownership and design environment are reviewed as background factors influencing ways of managing design. In the other three parts, findings are proposed through three-level of design management content: strategic, functional and operational, according to the criteria.

Table 8.1: Criteria of evaluating design management

Level	Criteria
Strategic	Brand, Strategy, Investment in design, Innovation, Design awareness, Competitiveness
Functional	Managing internal design, Management of designer, Outsourcing design.
Operational	Design planning, Design brief, Design process, Design quality, Design audit.

8.2.1 Background

Since the twelve companies were selected for case study because of their leading place in markets and experience in using design, their practice of design management can also be viewed as representative of Chinese manufacturing industry.

In these cases, some political and economic topics in their background have been mentioned frequently. These are considered to significantly influence design development at company level for two reasons: changes of ownership and the laggard design environment.

Since the Open Policy was introduced in 1978, definitions of business ownership have been changed in different development stages of national economic policy. Various types of ownership have emerged, such as state-owned, town-owned, private, limited company, Sino-foreign joint venture, and listed company. In this instance, some companies also have changed their ownership according to national economic policies to utilize resources to a maximum degree, find new motivation for business development, upgrade its organizational structure and encourage innovation. Usually, these companies have a long history, which might be longer than the Open Policy. For examples, Canbo's origin is as a township company. Later, it was changed into a limited company in 1999; Muyang transformed from state-owned to private enterprise in 2006; Vatti went public and was listed in the Shenzhen stock market in 2004, though it started as a private company.

The underdeveloped design environment has been frequently mentioned by some companies as a main barrier to their design development. They complained that it resulted in a high cost of investing in design, bad design awareness and unqualified design firms. In the environment, there is no system to protect intellectual property efficiently. Some companies hesitate to invest in design because a newly designed product might be copied immediately. This implies a high cost of utilizing design in new product development. In addition, since industrial design was not introduced in China until 1980 and it was limited to the academic field, the general staff of companies usually lack design awareness. Companies have to spend time to teach them about design.

Though the first design firm emerged in 1987 in the PRD, most Chinese design firms are still limited to a general design service, especially styling, s. They only emphasize developing design skills of styling and competing in price, which block their development. As a result, when the Chinese manufacturers demand high quality design service for their rapid developing business, these Chinese design firms cannot meet their requirements.

8.2.2. Characteristics at strategic level

Brand

- *From logo as brand to brand strategy*

In most companies, design is viewed as an important way to realize business strategy and an efficient tool to promote brand development. Practice in these companies shows two levels of relationship between design and brand. Firstly, design is employed to create a brand image, especially logos. Secondly, design is integrated into brand strategy through establishing brand identity. At the primary stage, companies superficially view brand as a name, a logo or a stick-on label to distinguish their products or services from others in markets, without consciousness of its wider meaning. At the second stage, brand identity is utilized and recognized as part of strategy to represent quality across the full range of products and services. The two stages show a developing process of understanding and using brands in companies.

- *Focusing on single and regional brand, instead of multiple or global brand*

In terms of the two pairs of marketplace relationships, the majority of the companies have a single and regional brand, while only some large-size companies utilize multi-branding strategies, such as Midea, TCL and Hisense. In TCL and Hisense, multi-branding strategy is conducted to divide markets into different levels of price. In Midea, some new brands have been registered as a way of testing and accumulating experience in new markets, especially those overseas.

Though most companies have launched products both in Chinese and global markets, they usually only use their brand name in China. In overseas markets, their main business types still are OEM and ODM for client's brands. Only some large-size companies use their own brands both in China and overseas markets, such as TCL, Hisense and Vatti.

Strategy

- *Short-term planned strategy*

Most companies usually plan their business strategies either for one year or for the current development stage, while with the fluid state of development in China, few think of medium- to long-term strategies.

- *Brand, innovation and design as key elements of strategy*

Brand, innovation and design are three key elements frequently mentioned in strategies. To develop a brand, most companies have established their brand strategies, while some of them even identify brand development as the main content of business strategies, such as TCL and Ted Golf. In addition, innovation is also defined as a major form of business development.

In the design strategies or business strategies of some companies, design is viewed as a tool to create advantages in competitiveness to realize business strategy. As Borja de Mozota (2003) indicated, the function of these design strategies is to make the company's positioning visible.

Investment in design

- *Recognizing the function of design in adding business and brand value*

In the majority of companies, the value of design has been recognized as adding business and brand value. The function of design in adding brand value has directly been mentioned in Canbo, Vatti and Genvana. Other companies emphasize that design can add business value through developing new and innovative products or services, which could increase market share, attract consumers and obtain profits. Hisense even directly states that design can be viewed as a short-term, low-input and high-output investment. For example, Stamm (2003) states that design not only can increase desirability and product quality, but also can decrease the bargaining power of suppliers and buyers by high levels of differentiation.

- *Investment in internal design organization, instead of design projects*

Instead of directly investing in design at the project level, most companies prefer to invest in establishing internal design teams, such as internal design departments, internal designers, training designers and outsourcing designs. However, many companies complain at the high cost of this, which is mainly caused by the poor environment of design in China resulted from four factors: frequent movement of design talents, especially experienced designers; a lack of qualified designers; a lack of protection for intellectual property; and designers limited by their education to design home appliance and consumer product.

Innovation

- *Type of innovation influenced by regional characters*

In the majority of the YRD companies, technology innovation is especially emphasized, because of the leadership of R&D in the area. With numbers of universities and adequate talents, the YRD is famous in China for its R&D ability and technology companies. This regional advantage also significantly influences manufacturing industry. For manufacturers in the YRD, they prefer to develop their business focusing on technology, instead of labour.

- *Incremental innovation through design modification for brand reputation*

Most companies would like to rely on incremental and continuous innovation, rather than radical innovation or invention. Incremental innovation is known as design modification (Cooper and Press, 1995), and focused on brand reputation (Hollins and Pugh, 1990). To these companies, design is a way to realize incremental innovation in the two aspects. For example, Breo expresses that minor changes of functions and an emphasis on design are the main methods of its new product development. Ted Golf develops incremental innovation through focusing on technology and styling.

Design awareness

- *Good design awareness limited to top managers*

In these companies, design awareness refers to recognition of design. In most cases, top management have recognized the importance of design, while general employees, especially those in small enterprises, cannot. Again, the laggard design environment in China is stated as a main reason for a lack of design awareness in these staff.

- *A process of recognizing design*

Companies' recognition of design is usually accumulated based on successful products. At a primary stage, they just notice the function of design as styling. Once the design work contributes to the success of products in markets, functions of design in creating value and planning strategy are recognized by them. This is a process of recognizing design: from styling to strategy. As a result, the more successful products a company has, the better design awareness it has. For example, the top management of Midea Microwave did not realize the importance of design until its designed products showed the value of design through good performance in markets.

At the current stage, most companies have recognized the contributions of design to successful products, such as sustaining market share, upgrading brand value and realizing market positioning. However, design's contribution in presenting appropriate products to satisfy customers and improving the working environment to generate greater employee satisfaction are still not realized by them. This shows that they lack an overall recognition of design and their design awareness is still underdeveloped.

Competitiveness

- *Competitiveness realized through design*

The majority of companies not only define their core competitiveness in multiple sectors, but also explain the detailed content of single core competitiveness. Furthermore, they explicitly plan solutions to achieve the defined competitiveness.

The content of core competitiveness varies in enterprises of the YRD and PRD. In the PRD enterprises, design usually is viewed as a core competitiveness factor, while in the YRD, technology is considered to be so in most cases. However, they all view design as an efficient method to realize other aspects of competitiveness, such as product, technology and sales.

8.2.3. Characteristics at functional level

Managing internal design

- *Internal design department established in larger companies*

According to Ahopelto (2002), there were three options of organizing design in a company: hiring internal designers, outsourcing design and using the two alternatives side by side. Although the ways of organizing design in these companies cover all the three options, establishing their own design departments is the first choice for most companies, especially for medium and large-size companies.

Companies indicated three advantages of setting up an internal design department. Firstly, it can solve the problem of unqualified external designers and can accumulate design experience as well as control quality. At first, companies simply employed design firms as a source of completing design work. With the growth of business and increased market competition, the services of design firms, especially Chinese design firms, is considered as being unsuitable. They cannot meet the upgraded requirements of companies any more. As a result, companies prefer to establish their own design teams. In addition, to understand how to control design quality, a company has to obtain experience and knowledge about it.

An internal design team is the most suitable group to fulfil the task.

Secondly, in addition to functioning as an independent department, internal design also can be involved with other functional departments, such as an R&D centre, brand centre and product strategy department. In this way, companies can efficiently integrate the design function in product development processes. Thirdly, establishing internal design departments and hiring external designers are both ways of improving design awareness in a company.

Based on this recognition, companies without design teams have been planning to form one, despite the high cost. In addition, examples of the contribution of design to successful products and companies also stimulate companies to form their own internal design teams.

- *Establishment of internal design viewed as high-cost investment, especially to SMEs*

For the majority of companies, establishing internal design usually is considered as a high-cost investment for three reasons: high-cost of equipment; unqualified designers; and the laggard design environment.

Setting up an internal design team means a series of investments, including designers, computers, software, materials and machines. In addition, the investment in the human resource and assets is not one-off, but constant. This implies a large investment for a company, especially SMEs.

Since graduated designers usually lack experience, it takes time to train them into junior or senior designers. Meanwhile, experienced designers usually cost more and can easily move to another job. Once an experienced designer leaves, it means the loss of knowledge assets: design skills and experience of design implementation relating to companies' practical conditions.

The laggard design environment not only is complained about as the reason for unqualified graduated designers, but also is seen as an obstacle to developing design in a company. In the current environment, newly designed products lack protection and are copied soon after their launch on the market. This definitely adds to the cost of developing new product through using design. To avoid copying, Ted Golf even decides that they do not take part in any exhibition in China and do not sell products in China.

Since the latter two factors exist as characteristic of Chinese design, which cannot easily be changed at the current stage of design development, the high-cost caused by them cannot be avoided in the near future.

- *Problems of coordination with other functions*

In some cases, members of other functional departments still cannot understand design and do not like to cooperate with designers. Sometimes, this underdeveloped recognition of design means that design departments are expected to modify designs for convenient engineering design and manufacturing..

- *Documented design regulations*

Many companies use a similar way of monitoring design ability: documented design regulations. For them, the most important thing in developing design is to accumulate design experience and knowledge. To keep it as a knowledge asset, companies begin to assign a special person to record related experience and knowledge in design practice. After a period of accumulation, regulations of design implementation are formalized based on the analysis and summary of that information. Later, it is further combined with strategy and resource to formalize design policy.

The documented design regulations are viewed as a knowledge asset and the topmost secret of a company. Relating to practical conditions, it offers efficient solutions and can be passed on. Even though designers or design managers change, a system giving continuity of managing design is still in place. In most cases, it involves design process, responsibility of different roles, and managing and selecting design consultancies. Since not all the staff have realized the importance of design, the regulations are a device that enables design to be integrated into a company smoothly.

Management of designer

- *Offering training opportunities to designers*

In most cases, companies encourage designers to study and offer various training opportunities to them. They give two reasons for this: firstly, newly employed designers usually cannot match companies' demand in practice, especially fresh graduated students. In this instance, training is necessary. It can help them to adapt to their work and to the company earlier and sooner. Secondly, facing rapidly developing technologies, competitors and markets, internal designers have to constantly absorb new knowledge through training.

- *Existing of silent designers*

In these companies, not all the design work is completed by professional designers. Sometimes, the role of design might be played by other professionals. In instrument-product companies, designers usually refer to engineers, who can combine considerations of styling with structure. In those companies without internal designers or only with good design awareness in top management, the latter usually play an active role in promoting design and they even directly take part in design work sometimes. This is known as silent design, which has been identified as a great many people (many of them are managers) who are engaged in designing but are not designers (Dumas and Whitfield, 1990).

Outsourcing design

- *Outsourcing design as a way of improving internal design ability*

For companies without an internal design department, design work has to be outsourced to external design firms. In companies with internal design departments, outsourcing design is also used as an efficient way to upgrade its internal design ability. The advantages are: obtaining new ideas, learning from advanced professionals in various fields, studying experience and knowledge from design consultancies, as well as saving costs.

TCL, for example, continually coordinates with top design consultancies in the world. By doing so, they not only can study methods of generating ideas, but also can learn their ways of managing design. In the contracts of coordination, they even include clauses on such matters, such as sharing management documents and sending internal designers to work with the design consultancy. In Hisense, the top management directly requires the product section to outsource about 30 per cent of annual projects. In this way, the internal design department can feel the pressure of competition and manage satff to enhance their ability.

- *Strategy of outsourcing design influenced by product category*

Different product categories correspond to different market competition and design resources. For consumer products, breakthrough technology rarely happens. Technology and the functions of products usually are static. In this kind of market, new manufacturers can break in easily and new products are usually created through modifications of existing designs. In China, the rapidly growing consumer markets results in a large demand for these products. So there is a large amount of work, which attracts designers. In addition, the R&D cycle of these products is shorter than others. In this instance, designers can quickly and easily demonstrate their ability through launched products.

Compared to consumer products, companies producing instruments do not like to outsource design and usually have difficulty in finding design resources. Since the function of instruments is the most important aspect, styling takes second place. In addition, high price and low quantity for specialised markets are features of their business. Products are not produced by mass-production, but customized production according to the client's requirements of function. In this instance, design means a high-cost investment. Few designers work in this product category. This results in a lack of experienced designers and poor performance in utilizing design in these companies, which can neither find qualified external designers, nor establish design teams with the limited resources. As a result, they outsource the majority of their design work and manage it through established documents of regulations or guidelines.

- *Three trends of relationship between manufacturers and design consultancies*

In utilizing external design, all the companies have experienced a similar process. Three new trends in relationships between companies and their external design resources are revealed: a) the coordination relationship is changed from project-by-project to long-term; b) the needed design service is transformed from styling to strategy; c) companies prefer to employ foreign design consultancies instead of Chinese design firms.

Though some companies still use external design on a project-by-project basis, thus usually is employed for small projects or in a process of looking for appropriate coordination partners. Once the suitable design consultancies are found, they will confirm the relationship as a long-term one. Based on it, the two partners not only can establish stable and trusting relationships, but also can improve the efficiency of design projects.

With the increased recognition of design, companies prefer to involve it at the stage of strategy planning. To them, as a core competitiveness, design can offer good styling to a product, build brand image and product identity, as well as enhance brand reputation through a total solution. As a contribution to strategy, they would like to receive suggestions from design consultancies about product lines, markets and brand development based on long-term relationships.

Chinese design firms are usually limited in their professional design skills by an emphasis on styling design. In addition, they are frequently criticized as lacking credibility. As a result, when companies look for design consultancies as long-term strategic partners, they often prefer to work with foreign design consultancies. They praise these foreign consultancies for their plentiful experience, spirit of team-work and their wide range of professional expertise. Moreover, their international background and experience are very helpful for companies planning to expand into overseas markets. Even though the cost of their design services is much higher than Chinese design firms, the companies consider it merited because of its quality, efficiency and credibility.

8.2.4. Characteristics at operational level

Design planning

- *Design planning completed through a teamwork focusing on market research*

Although the way of defining design planning varies according to the practical conditions of companies, such as organizational structure, product character and recognition of design, it is generally carried out by a special team or internal/external design as partnership. In the team, professionals of design and marketing usually are involved.

To collect information for design planning, market research is the main method. In addition, other methods are also utilized, such as surveys, consultancy, feedback from markets or sales and competitive products. Just as Walsh *et. al.* (1992) demonstrated, successful firms preferred to utilize multiple resources in design planning, while less successful firms tended to use limited resources.

Design brief

- *Utilizing design brief*

In manufacturing companies, a design brief is used to input requirements for products and is used as a basis for evaluating the design process. As Jens Bernsen (1989) stated, the purpose of a design brief is to identify and communicate the goals of a project, as well as a frame of reference for evaluation. The content of a design brief is obtained from various resources, including the product line, client's requirement, customer's demand, product managers, design and planning departments.

Design process

- *Standardized design process in larger companies, while flexible one in SMEs*

Fixed frame-works for design processes have been established in most companies, especially in large-size enterprises. Some even make the process into a standardized one relating to the company's practical conditions.

In most cases, companies prefer to use linear processes in the implementation of design projects. Only some small-size companies use feedback loops in their design processes.

To avoid chaotic situations in a design process, companies explicitly define procedures and the responsibility of each function through documented design regulations for efficient management. To clarify the detail and arrange responsibility in implementation, a linear process usually is used. In it, information and works are passed from one function to another. It is especially useful when some staff lack design awareness. However, this linear emphasis can also be an obstacle to inter-disciplinary cooperation or working in parallel.

Small companies usually do not have their own internal design teams or internal designers. In this instance, the R&D team is responsible for new product development. To obtain new ideas and utilize resources to a maximum degree, these companies generally encourage staff of different professions to take part in the R&D process. Information and work are passed among different functions frequently without limitation. Design thinking is integrated into the whole process.

Design quality

- *A brand aiming of design quality*

The importance of design quality has been recognized by most companies, that aim to keep a leadership position. It offers a basis of value and recognition, as well as developing intellectual property. According to other studies, the objective of design quality is to meet product specifications and translate product features into reality (Gorb, 1990; Cooper and Press, 1995). Compared to this, the aim of emphasizing design quality in most companies is defined with a broader view.

- *Ways of controlling design quality relating to practical conditions*

According to their own practical conditions, these companies have developed different ways of controlling design quality, including registering patents, establishing standard process and documents of management. In addition, design audits are viewed as the most efficient way to control quality, while communication problems might be the main reason for unsatisfactory design quality.

Design audit

- *Using design audit to control quality of a product project*

In most companies, design audits are focused on the project level. They connect closely with design quality and refer to a series of evaluations in a design process. The contributions of design audits are described as controlling or decreasing risks, as well as realizing strategies, usability and reliability. Formal documents of design audits have been established in some companies.

- *Top managers as final decision-maker of design*

Though an audit team usually consists of various professionals, such as marketers, functional managers, top managers and internal designers, the final decision on design is generally determined by top managers. Even consumers are rarely considered to have an important role in design audits. Some companies are not eager to involve them due to a desire to keep business secrets.

8.3 An Overview of Managing Design in Chinese Manufacturing Industry

Based on the above characteristics of managing design in Chinese manufacturers, an overview of managing design in Chinese manufacturing industry can be achieved. It can be described by three features: 1) forming a basis for future development; 2) underdevelopment; 3) the influenced of the macro environment.

1) Forming a basis for future development

The current performance of companies in managing design shows that a basis for future development has been formed. The basis consists of four aspects: basic design awareness; basic design ability; basic design strategy; and basic ways of managing design.

Most companies have shown their awareness of design either in top managers or in the whole organization. Together with brand and innovation, design has been viewed as a key element for planning business strategy. Companies prefer to invest in design because they have recognized its effect in adding business and brand value. Concerning competitiveness, when companies adapt it to their own conditions, they have also understood that design is an efficient tool to realize it. This recognition of design at the current stage also shows the possibilities of understanding a broader range of design functions further into the future.

Basic design ability has been established by the majority of companies through various means. Though internal design departments are usually established in larger size companies, it does not mean a similarly negative attitude toward design ability in SMEs, which generally do not form internal design teams because of their high-cost. They usually outsource design or assign design work to another professional person who has certain knowledge related to design in their companies. However, most of them plan to set up their own design team once the conditions are suitable. In this instance, they view their current operation of design as a way of accumulating experience as a platform for future development.

Design modification as a way of realizing incremental innovation and accumulating brand reputation-this has been defined as the main content of design strategy in most companies. In it, design connects innovation, product and brand as a critical solution. This also defines the basic role of design in the business development of a company.

Ways of managing internal design activities have been established in the majority of companies. Generally, a standardized design process has been formed based on the practical conditions of a company. It is usually regulations for managing the design process. Various details are involved in it, such as design planning should be completed through teamwork and market research; a design brief should be used to define the requirements of a project; top managers are the final decision-makers of design. Besides design processes, other design activities are also documented in regulations, based on accumulated experience in practice. This implies that these companies have the basic knowledge of using design and experience of managing it. The basic design awareness, strategy, organization and ways of managing construct a platform for developing design ability and business.

2) Underdevelopment

Underdevelopment is another feature of companies' design practice. It is demonstrated through three aspects: underdeveloped design awareness; underdeveloped design ability; and underdeveloped recognition of brand and management.

Since at the current stage, not all employees in a company have good design awareness, there must be a process to promote it. Through awareness of successful products, top managers usually are the first group to recognize the contribution of design. They can transmit their recognition to functional managers and general staff through design policies, design projects and successful products.

Establishing and developing design ability also costs time. It only can be developed step by step. For companies without adequate design ability, it is usually silent designers who are responsible for design work, especially in making decisions. Among various ways of upgrading design ability, training internal designers and employing design consultancies are the most efficient.

To develop design ability, companies' knowledge of brand and management also need to be improved. At the current stage, some companies still consider brand as a logo and lack an understanding of brand image or brand identity. This blocks their market development. As a result, they just have regional brands, while only design-oriented companies have global brands.

3) The influenced of the macro environment

Economy, market, regional advantages and industry construct the macro background of companies, which influence the way of managing design in a company.

With the rapidly developing economy and markets in China, some products have very short life-cycles, such as communication products. As a result, companies in such sections can only plan short-term strategies, instead of a long-term ones.

These companies seldom have explicit design or business strategies for the next three or five years.

Types of innovation can be influenced by regional advantages, based on the tradition and history of the area. The YRD companies prefer to emphasize technology innovation more than the PRD companies because of its better R&D resources and leadership of technology in China.

Different product categories belong to different industries and are supported by different supply chains. Companies producing products in small industries, such as instruments, usually have difficulties in finding suitable professional personel.

The three features show the situation of design development in Chinese manufacturers at the three levels of design management content. At a strategic level, basic design awareness has been formed in top managers, who have established basic concepts of design strategy. However, the recognition of design is still underdeveloped. At a functional level, basic design ability has been established and it keeps progressing with the growth of a business. At the operational level, basic solutions of managing design have been developed by companies based on their practice and accumulated experience. To improve it in the future, companies' recognition and knowledge of brands and management need to be upgraded.

Factors of the macro environment related to economies, markets, regional characters and characters of product categories evidently cannot change in the short term. Compared to rapidly developing business conditions, they are static. Since underdevelopment is the feature of design development at the current stage, companies should consider how to balance the underdeveloped design ability and the static macro environment in planning strategies. This is intended as the contribution of the overview of managing design in Chinese manufacturing industry in this study. It offers explicit reference for companies to plan their future development.

8.4 Models of Managing Design Management

8.4.1 Six models

According to seven identified criteria of evaluating performance on design management in Chinese manufacturers, such as design awareness, internal design, external design, company size, design process and design as core competitiveness, cases with similar performance have been grouped into six models in this section. The features and performance of each model are introduced in this section. Table 8.2 lists the brief performance of the six models according to the criteria.

Table 8.2: Six models of managing design

Size	Product	Design awareness	Design and competitiveness	Internal design	Design works assigned to	Design process is	Case
Model A. Design by no-designer							
Small	Luxury sports	in top management	Design is a competitiveness factor	Without internal design	Engineer	Flexible	Ted Golf
Model B. External design as internal design							
Middle	Eye massage	in top management	Design is a competitiveness factor	Without internal design	External design	Flexible	Breo
Model C. B2B							
Small	Bank financial service	in top management	Design is not a competitiveness factor	Without internal design	External design	Standardized	Hiaward
Model D. Design follower							
Middle	Wood toy	in whole company	Design is not a competitiveness factor	With internal design	Internal design	Standardized	Ruyi
Large	Stationary						Genvana
Large	White home appliance						Hisense
Middle	Feed machine						Muyang
Model E. Styling-focused							
Large	Sterilizing cabinet	in whole company	Design is a competitiveness factor	With internal design	External design	Standardized	Canbo
Large	Microwave						Midea Microwave
Model F. Design-oriented							
Large	Outdoor goods	in whole company	Yes	Yes	External & internal	Standardized	Heng Feng
Large	Kitchen home appliance						Vatti
Large	Multi-media home appliance						TCL

Model A. Design by no-designer

Case: Ted Golf

The main characters of companies in this model are: small-size; good design awareness limited to top management; no internal design team; function of design replaced by other functional staff, such as engineers, instead of outsourcing; design as a core competitiveness; flexible design process; and small industry (Figure 8.2).

Although companies in this model have a short history and are small sized, they have recognized the value of design. This is demonstrated by the good awareness in top management with design viewed as a competitive factor.

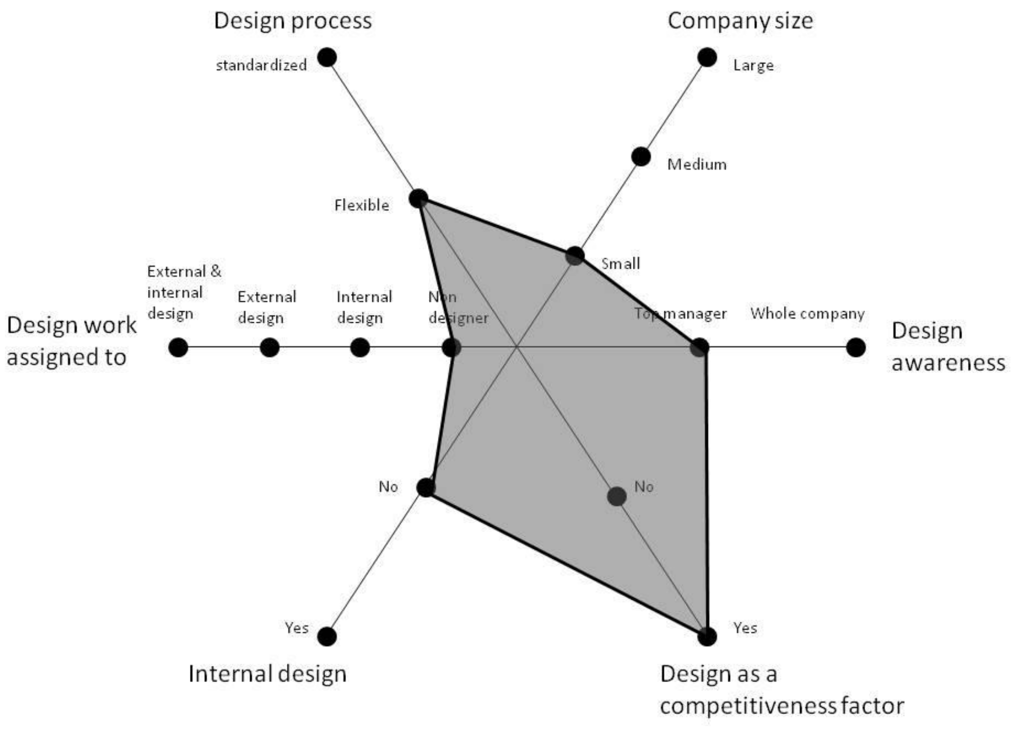

Figure 8.2: Positioning diagram of Model A.

However, there are still no internal designers in the companies because of four factors:

1) Good design awareness is limited to top management and does not reach every employee. Since not all employees have realized the importance of design, establishing design ability is not viewed as a critical issue for business development. *2) A lack of enough financial support due to limited scale and short history.* For small-size companies, their business is usually at primary stage. This not only means underdeveloped design awareness, but also limited finance. Since establishing an internal design department is a high-cost investment in China, it seems impractical to invest in it at the current stage. *3) A small space for styling because of the character of products.* Styling usually is not a critical factor of products produced by companies in this model, since function and structure are the most important elements and in this instance, styling has to follow them. *4) A lack of professional designers specializing in products of small industries.* Small industry implies limited demand for design work and limited design resources can be utilized. Since companies have difficulty in finding experienced designers, they have to train designers themselves. This is another cause of high-cost investment.

Under these conditions, to realize the value of design, top management promotes design thinking to other functional staff, who can play the role of designers. Only in this way can styling be efficiently integrated into the function and structure of products. In addition, flexible processes are established and developed to utilize available personal to a maximum degree for new ideas.

Model B. External design as internal design

Case: Breo

The main characteristics of companies in this model are: small-size; good design awareness limited to top management; no internal design; design works outsourced to external design; design viewed as a core competitiveness; and a flexible design process (Figure 8.3).

Similar to companies in Model A, companies in this model are also small-size with design awareness limited to top managers. As a result, though design is viewed as a competitiveness factor in business development, companies still lack ability to invest in it. In this instance, they have to utilize their limited internal resource to a maximum degree through flexible processes.

However, differing from Model A, companies in this model prefer to outsource design and are not in a small industry. In fact, the two factors interact. Though there are engineers in the companies who can cover design work, companies prefer to look for external design instead of relying on engineers. This is because companies are in a large industry, which implies adequate design resources, including experienced designers and design firms. There are various options of outsourcing design with low cost.

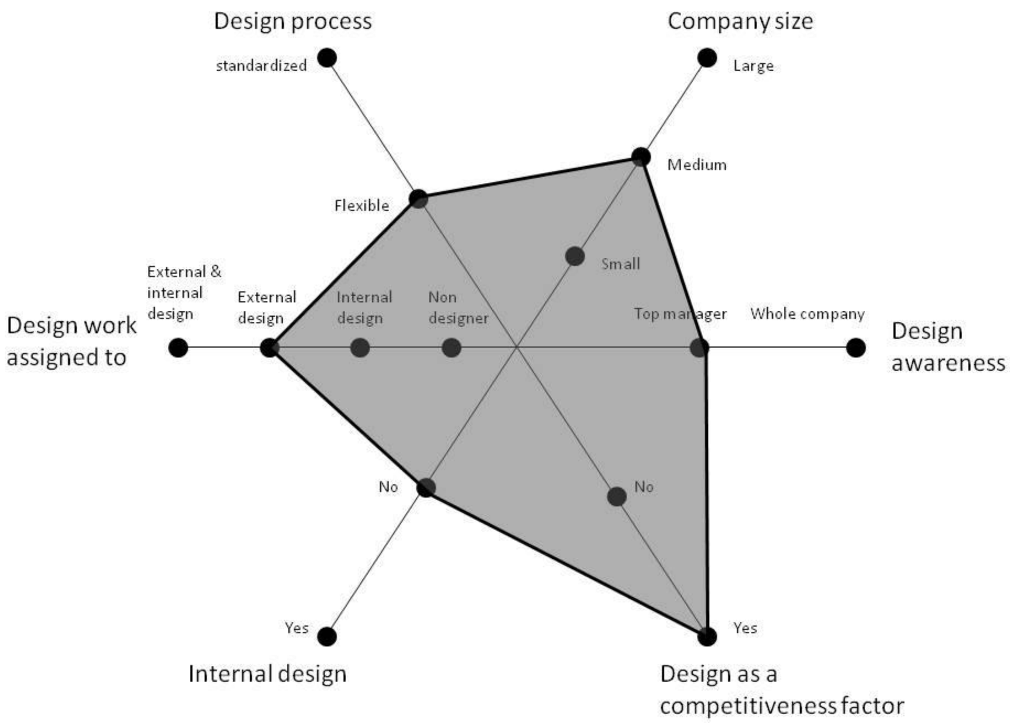

Figure 8.3: Positioning diagram of Model B.

Because they are limited in business scale, companies in this model would like to collaborate with freelance designers, instead of design firms. There are two reasons for this. Firstly, freelance designers cost less than design firms; secondly, they can join companies' R&D team and work with them tightly. In the practice of these companies, freelance designers work in a way as internal designers. They can offer their professional opinions in any stage of a product development process at any time. This meets the requirements of flexible processes.

Furthermore, cooperation with freelance designers means that companies have more space to select appropriate designers within limited budgets. Companies also can select different designers for different projects according to the specialism of designers and types of products. For example, a foreign designer might be considered to be helpful for designing products launched in overseas markets.

Model C. B2B

Cases: Hiaward

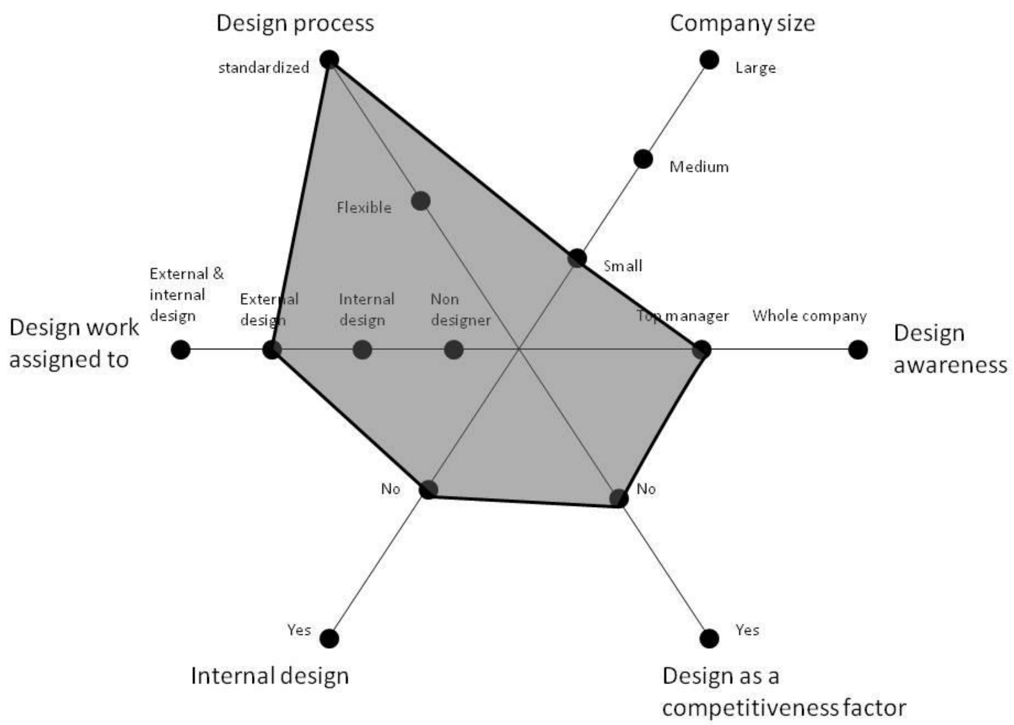

Figure 8.4: Positioning diagram of Model C.

The main characters of companies in this model are: good design awareness in top management; design is not viewed as a core competitiveness factor; no internal design; outsourcing design; and a standardized design process (Figure 8.4).

Differing from other models, products manufactured by companies in this model are various types of instruments, instead of consumer products, such as home appliances, communication products, IT products and so on. The instruments are usually bought by other companies as manufacturing equipment. This means that these companies do not directly serve terminal consumers, but other business entities. In simple terms, its business model is B2B (business to business), instead of B2C (business to consumer).

For instrument products, styling is less important than function and structure. Design work in the model usually refers to package design, interface design, corporate identity and advertisement, instead of product styling. In this instance, though their top management understands the role and value of design, design does not play an essential role in their business, and is not viewed as a core competitiveness factor. There is no need to establish an internal design department in these companies, because they can employ design firms to complete their design work conveniently. Since the role of design is not so important to a product, a standardized design process generally is utilized to control schedule and quality of outcomes. Meanwhile, because design is involved in product development processes as a subsidiary function, companies would not like to invest too much in it at the current stage. However, with development of the business, corporate identity might be viewed as an important factor for brand building in the future, which will need more investment in design.

Model D. Design follower

Cases: Genvana, Hisense. Muyang, Ruyi

The characters of companies in this model are: good design awareness in the whole company; design is not viewed as a core competitiveness factor; design work completed by internal design; and standardized design process (Figure 8.5).

Though companies in this model have shown good design awareness in their staff and internal design departments have been established in them, design is only considered in terms of general styling work, instead of as a core competitiveness factor. This results from their negative attitude toward developing internal design ability.

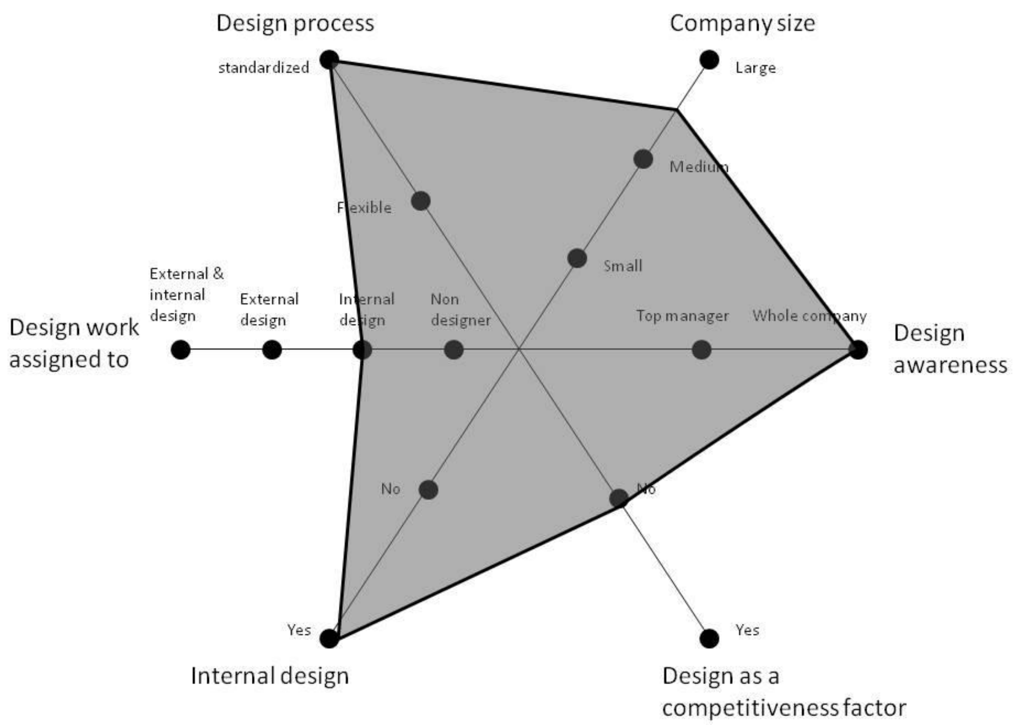

Figure 8.5: Positioning diagram of Model D.

Companies in this model generally do not take a leading place in markets. In fact, they begin to establish internal design teams just because their competitors all have done so. As a result, they are easily satisfied with their current design ability, and do not wish to invest more in developing it.

Good design awareness of all staff is the result of its industry environment, in which the importance of design has been demonstrated and confirmed through successful products and market competition. Contributed by the design function, leading companies have won markets through successful products. As a result, the value of design is well known in the product category. As followers in such markets, companies in this model only utilize design for styling and emphasize developing design ability to a limited degree. Design neither is integrated into business strategy, nor is viewed as an element of core competitiveness.

Model E. Styling-focused

Cases: Canbo, Midea Microwave

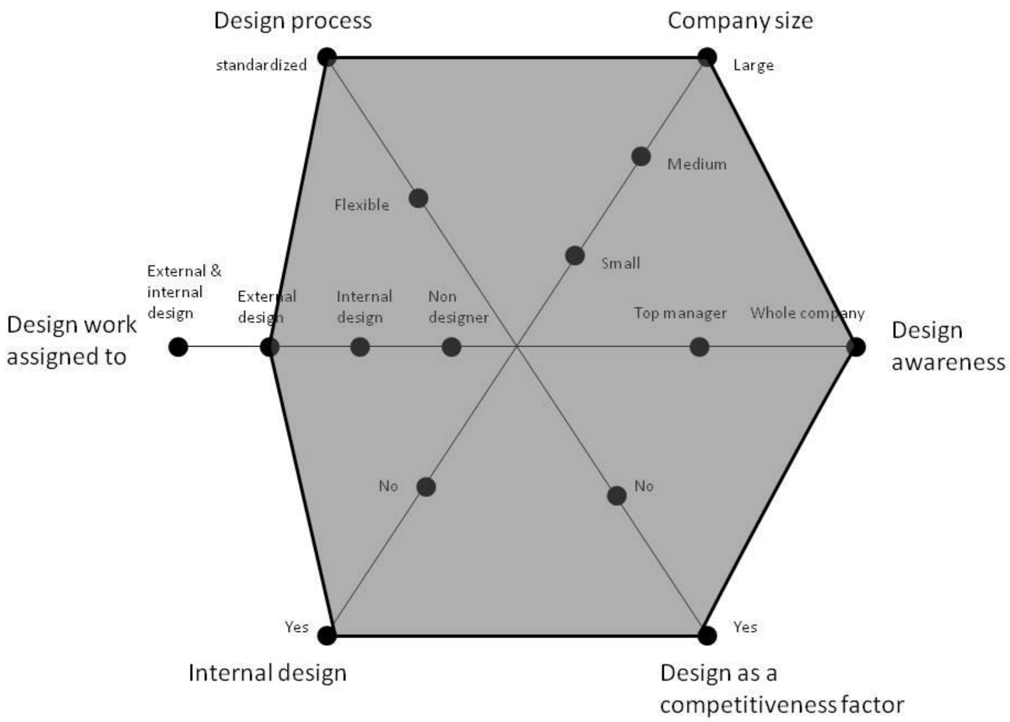

Figure 8.6: Positioning diagram of Model E.

In this model, companies usually are medium or large size and there is good design awareness in the whole company. Based on it, design is viewed as a core competitiveness factor and internal design departments have already been set up. However, most design work still is outsourced, according to their design strategies (Figure 8.6).

Companies in this model usually focus on one type of product, instead of covering broad product categories. Within the product type, they develop their skills well and generally take leading positions in markets. Canbo and Midea Microwave are cases involved in this model. Instead of a wide scope of products, they just produce a special kind of home appliance: one is sterilizing cabinet; another is microwave. And they both occupy a leading place in their product markets in China. Canbo is the No.1 brand of sterilizing cabinets, while Midea is the No.2 in microwave markets.

Without breakthrough technology, continuous innovation in styling and product concepts are viewed as essential to keep their leading place. Based on one specification, a family of products is established to cover various consumers and markets. Also because there are not sophisticated technologies to be applied in developing new products, the cycle of product development is very short. This leads to a large quantity demand for design work. If all the work is completed by internal design, a large scale internal design team would be established. This means a large amount of investment in establishment, operation and management. As a result, the companies prefer to outsource the majority of their design work as the most efficient way to solve the demand for styling. Equipped with experienced designers, the internal design departments just focus on managing design projects and external design, as well as communicating with external design and other functional departments.

Model F. Design-oriented

Cases: Heng Feng, Vatti, TCL

Companies in this model not only have excellent performance in markets, but also represent the leading development of design in Chinese enterprises. The function and value of design are recognized by all the employees and are emphasized especially by their top management. The work of internal design is connected tightly with corporate strategy. Though their internal design ability has been well-developed, they still collaborate with external design consultancies to enhance their design ability and to expand overseas markets (Figure 8.7). Usually, a long-term relationship with external design is established. Design consultancy is considered as a strategic partner, instead of a styling supplier. Because of intense demand on external design, their partners usually are foreign design consultancies with experience of strategic planning.

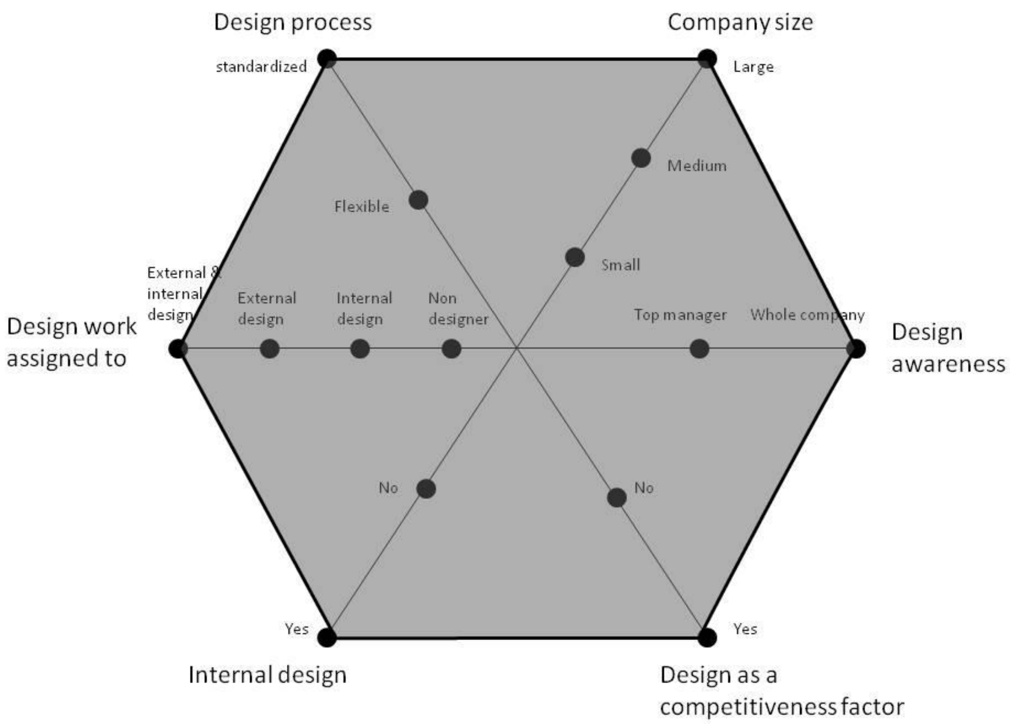

Figure 8.7: Positioning diagram of Model F.

During the process of developing a new product, design takes a leading role in planning projects, generating ideas, controlling quality, managing projects and coordinating other functional departments. In the practice of these companies, design is so important that top-level managers are directly responsible for design work and related issues. In this instance, companies in this model can be viewed as design-oriented. As Tore Kristensen defined, 'design oriented means that the firm's core values are infused by design ideas and design is institutionalized into the firm's strategic orientation. In addition, the firm has a top level manager responsible for design (Kristensen, 1998, p232-3).'

8.4.2 Ways of developing design ability

In the six models, there are two relating to special situations: Model A and C. Companies in them do not produce general consumer products, but products for small industries or instruments. Since companies in the other four models all produce general consumer products, it implies that they have same external environment and can represent basic ways of developing design ability. As a result, a three-stage approach to developing design ability can be obtained based on an analysis of relations among the four models: Model B, D, E and F.

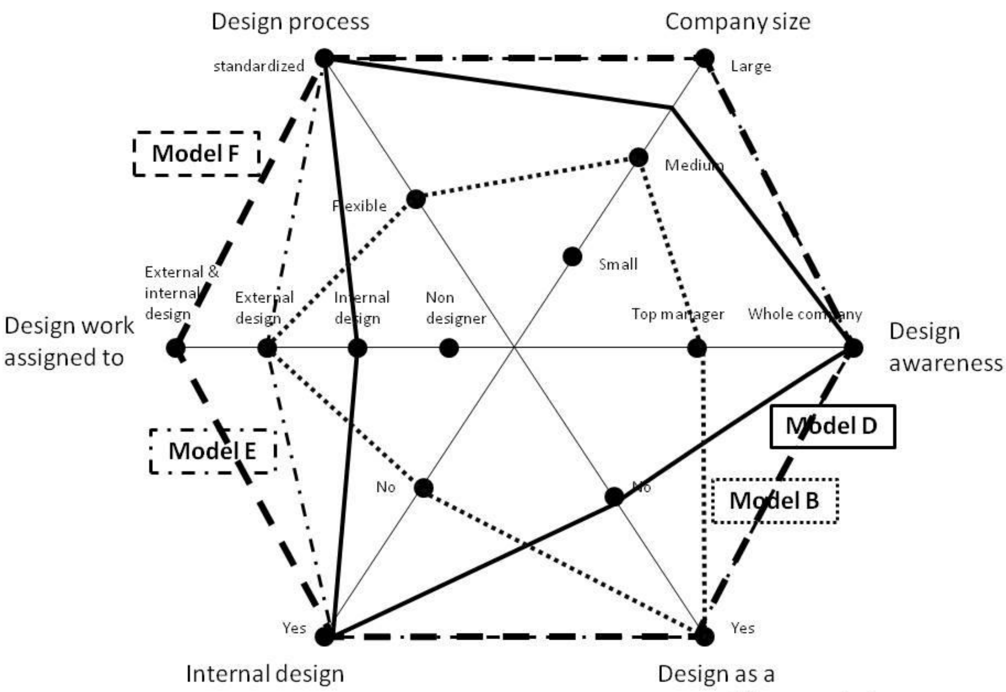

Figure 8.8: Coverage of four models

Based on combining the four positioning diagrams and studying their coverage relationship (Figure 8.8), it can be found that the four models are at three levels (Figure 8.9), which reflect three stages of design development. The first level consists of two models: Model B – external design as internal design and Model D – design follower. Despite difference of company size, their other five factors are all different. The second level is Model E-styling-focused. In this model, the function of design is limited to styling. The third level is Model F-design-oriented, which represents the best design ability and a critical role of design in a company. This finding shows that the four models demonstrate a three-stage process of developing design ability with two start-points. In this instance, two ways are evident: the first is from Model B, the second one from Model D.

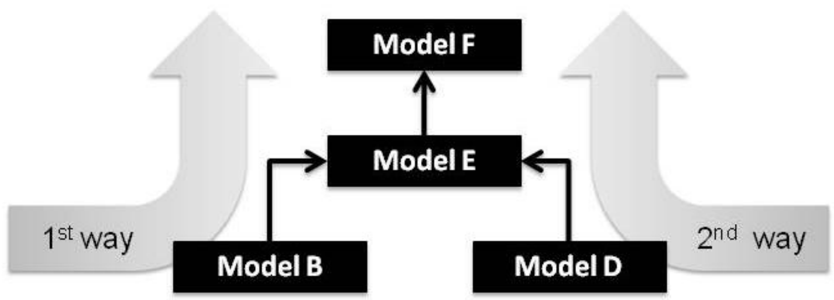

Figure 8.9: Two ways of developing design ability

The first way starts from companies in Model B, in which top managers have good design awareness and view design as a significant competitiveness factor. However, because as medium-size companies they still cannot afford the high-cost of investment in design, their solution is to outsource design instead of establishing their own internal design departments. To use external design to a maximum degree, they prefer to employ freelance designers who can work tightly with them. To achieve the objective, a flexible design process is used. When the companies develop to the second level, their scale grows bigger and good design awareness has been expanded to all staff. Based on progress in the business, the companies can establish their own design departments. To manage them efficiently, the flexible design process is changed to a standardized one. When they develop into the third level, the focus of their design ability is not styling ability any more, but strategy planning. To study experience and expand their knowledge, they outsource some design work to leading design consultancies.

Differing from the first way, the second way begins from Model D, in which companies usually have a negative attitude toward design. Though they have recognized the value of design, established internal design department and formed a standardized design process, they do not view design as their core competitiveness factor. This is because compared to other competitors in their product categories, they are design followers and their design ability is low. If these companies plan to upgrade to Level Two, they must change their attitude toward design into an active one. Once they move to the second level as Model E, they will follow the same routine of development to the third level as the first way.

The six models and the two ways show the directions of developing design ability in a company. The six models offer a reference for companies to evaluate and find their own locations in their ways of developing design ability. With the three levels, they can define their development stages accurately. Based on the two ways, they can plan their own solution of developing design ability.

8.5 Approach to Managing Design

According to these findings, it can be argued that Chinese manufacturers have developed their own ways of managing design and there is a Chinese approach to design management, which is different from other countries, such as the UK, U.S.A. and Japan.

Though the UK is the original source of the Industrial Revolution, it gradually lost its leadership of technology and advantages in industries, especially manufacturing industry since the beginning of twentieth century. As a result, its design management tends to be a separate part of management relating to design, instead of a tight relationship with manufacturing. This is because its manufacturers lack recognition of design and endeavours to develop design from the government or academic field are theory-oriented. Though the British government actively promotes the utilization of design in industries through its agencies, they neither can offer suggestions for design policies, nor can be involved in the practice of industries. At the current stage, there is an increased gap between practice of manufacturers and the design management discipline in the UK.

In the America, design has been integrated into industries from its beginning, and has developed as a part of business. It is viewed as a function of general management in manufacturing companies. With its world leadership in technology, America has a well-developed manufacturing industry, which offers a solid basis for design development. Based on it, the concepts of design management are developed constantly. However, the American government seldom promotes the utilization of design.

Differing from the above countries, modern industrial design was not introduced into Japan until the 1950s. Though it was developed from observing Western countries through overseas study projects in the beginning, the theories and knowledge systems have been adopted to Japanese local conditions during their development. Based on a series of promotions by the Japanese government, design management concepts emerged to solve the problems of design efficiency in the 1960s. It was integrated into Japanese innovation management, which finally contributed to 'Japanese Miracle' and the success of Japanese export industry.

The history of modern industrial design in China is short. It was scholars who introduced the concepts of industrial design after they returned from their overseas studies at the beginning of the 1980s. From then on, industrial design has developed in academic fields without a tight linkage to practice in industries. This is the basis for the emergence of design management in China, which is also limited to the academic field and seldom related to practice. In the past 30 years, the economy, manufacturing and export industries of China grew rapidly. After the Beijing Olympic Games and the financial crisis in 2008, the role of China in the world economy became even more significant. According to the findings in this study, Chinese manufacturers have formed their own ways of managing design, developing internal design ability and utilizing design in product development during the period. However, the Chinese government only has established some agencies to promote design, which are always not very effective, with widespread complaints about their ineffectiveness in the design field and from manufacturers. They neither can contribute to establishing design policies, nor be involved in design practice in industries. However, the role of government seems to be changing in recent years, especially in 2010. The Chinese government released two policies to encourage utilization of design within two months. This may represent a new stage both for development of industrial design and design management.

There are similarities and differences of design development and the emergence of design management between China and the three countries. This can be analyzed through four main criteria: the role of government, design in industries, design education and design management. In addition, two criteria are used as reference: criteria of manufacturing industry is used as a basis for understanding design in industries; management is utilized as a reference for its relationship with design management. Figure 8.10 illustrates the main performance of the four approaches: British, American, Japanese and Chinese. Based on it, the approach to managing design in China can be explored.

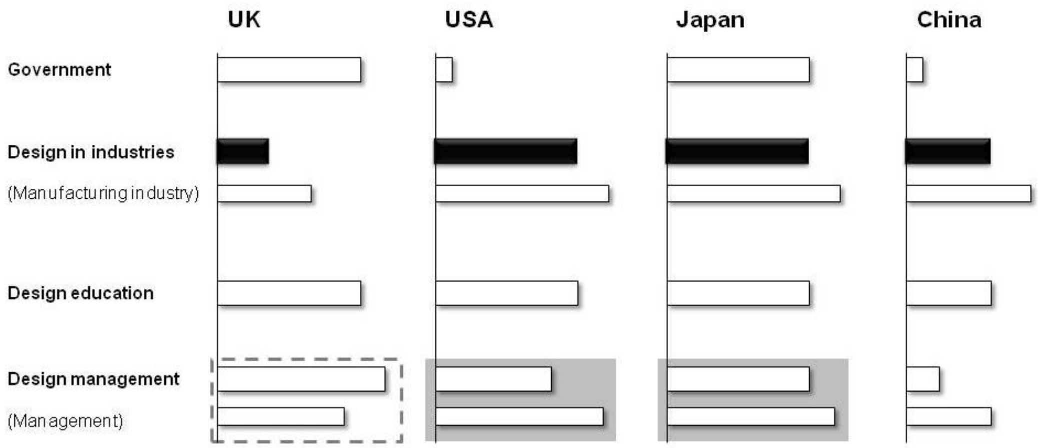

Figure 8.10: Approaches to design management in four countries

1) Transformed role of government in design promotions

Previously, the role of Chinese government in promoting design development has been similar to that the American government, which is seldom involved in professional or practical activities relating to design. The only aspect in which the Chinese government has been performing better than the American is in the establishment of some agencies: such as China Industrial Design Association (CIDA). However, in its operations, CIDA neither can support design studies relating to Chinese local conditions in the academic field efficiently, nor can lead or take part in practical design work in design field or industries.

The situation changed since 2007, when CIDA sent a proposal to the State Council for policies of promoting design. It received an active reaction from Premier Wen. From then on, the role of government in developing design becomes stronger than before. This is shown by two documents: *Advice for Directions about Promoting Development of Industrial Design* (March 16, 2010) released by the Ministry of Industry and Information Technology (MIIT), and *Notice of Recognizing National Innovative Products in 2010 (April 15, 2010)* by the National Development and Reform Commission, Ministry of Science and Technology, and Ministry of Finance.

This implies two issues. Firstly, the Chinese government intend to play a critical role in design development in the future because the importance of design has been recognized by the nation. Based on it, a series of regulations and measures will be released and conducted. Secondly, the role of the Chinese government will become similar to that of the British and Japanese governments, which offer powerful support for design. However, since the operational ways of promoting design in the two countries are different, they lead to significantly different results. Differing from the UK, in which design policies are framed by government but seldom influence design practice efficiently, the Japanese government has a tight and natural relationship with industries. Generally, a design policy is released based on good communication between government and industries. It has evolved and reflected suggestions from various constituencies. As a result, these design policies can help to effectively integrate design in the practice of industries.

Considering the two different ways of operation, though the Chinese government is changing its role to a stronger one than before, its final effect is not a confirmed one. Nevertheless, the operational approaches of the British and Japanese governments offer a reference for the Chinese government.

2) Underdeveloped role of design in manufacturing industry

In Chinese manufacturing industry, its way of utilizing design is totally different from other three countries. The America and Japan have well-developed manufacturing industry, in which design plays an important role, is utilized adequately and contributes to the success in world markets. In the UK, its previous leadership of technology and industries does not exist any more. Though

Chinese manufacturing industry did not develop until the Open Policy, it has grown rapidly in the last 30 years. This feature is similar to Japanese manufacturing industry, which developed spectacularly after WWII. Though it is hard to predict the future position of Chinese manufacturing in the world, it can be confirmed that at the current stage, Chinese manufacturing industry is still developing. And it has its own features of this development stage based on comparisons with other three countries.

Chinese manufacturers have shown their recognition of design in this study, though it is limited to top managers in some companies. However, design is not influentially utilized in product development process in Chinese manufacturers, compared to the American and Japanese manufacturers, which emphasize the design function in all product projects.

According to the findings of this study, Chinese manufacturers have developed their own ways of managing and utilizing design in practice. Since design has not been used in companies sufficiently at the current stage, with good design awareness, it can be anticipated that the role and function of design will keep on developing. In this instance, current characteristics and models of managing design in manufacturing industry can be thought of not as an end-state, but as the basis for future development.

3) Design education limited in borrowed knowledge system

Design education is emphasized by all the three countries used for comparison. For the UK and America, they have a solid basis for it because modern design concepts and practice emerged from them. The origin of Japanese design education is similar to China, in that it borrowed from Western knowledge systems and developed in a short time. In Japan, the formal education of industrial design started in the 1950s, after scholars and practitioners returned from overseas study projects. They were sent to design schools and institutes in Europe and

America to study industrial design with a compressed schedule. Later, some of them established the earliest industrial design programmes in universities and schools in Japan. In the development of design education, educators keep a tight relationship with practice in industries. In fact, some of them are experienced design practitioners, who established their own consultancies, such as Kenji Ekuan and GK Design as well as Takuo Hirano and Hirano Design, both in Tokyo. They adopted the Western education system to local conditions to supply professional design personal needed by Japanese companies. In simple words, starting from borrowed Western theories, knowledge system and design education, Japanese design education developed its own way which connects with its local conditions and has contributed to the success of its manufacturing industry in the world.

Compared to Japanese design education, Chinese industrial design education has not only borrowed from Western examples, but has not succeeded yet in adequately relating to Chinese local conditions. The same problem exists in design management education in China. This can be proved by the publications of design management in recent years. The concepts of design management introduced into China in 2000 were limited to the educational field and were based on Western theories. All the books published with titles relating to design management are edited by teachers based on translation of Western knowledge, especially from the UK and America. In 2009, four books named design management have been published, which only vary in the order of materials.

This borrowed knowledge system is the major inadequacy of Chinese design education. It cannot be solved in a short time and will block design development in Chinese manufacturing. Because of a lack of adaptation to local conditions, graduated students usually cannot be involved in practical design works without further training by companies. This increases the cost of investing in design. Meanwhile, when companies plan to develop their design ability based on a transformed focus from styling to strategy, they do not find powerful support from the educational field.

4) Uncertain direction of design management development

In China, design management consists of foreign theories and knowledge. With ten years development, it is still limited to academic and educational field. However, this situation might be changed soon because of the nation's recognition of design and the development of design ability in Chinese companies. Concerning its future development, the directions of the other three countries can be a reference for China, but only as a point of reference, not a system to be followed in detail.

In the UK, design management has developed as an independent discipline from general management. It is theory-oriented, instead of integrating into the practice of industries because of its declining manufacturing industry. Compared to the UK, design management in America and Japan are involved in the context of management, instead of an independent discipline, although they vary in their focus. In America, the management of design is integrated into the management profession as a whole with an emphasis on design thinking by managers in recent years. In Japan, companies emphasize design efficiency as the aim of studying design management from the beginning.

8.6 Summary

Four levels of findings are reported in this chapter as a result of comparing the twelve cases. They also are four-levels of understanding the management of design in Chinese manufacturers, ranging from micro to macro (Figure 8.11).

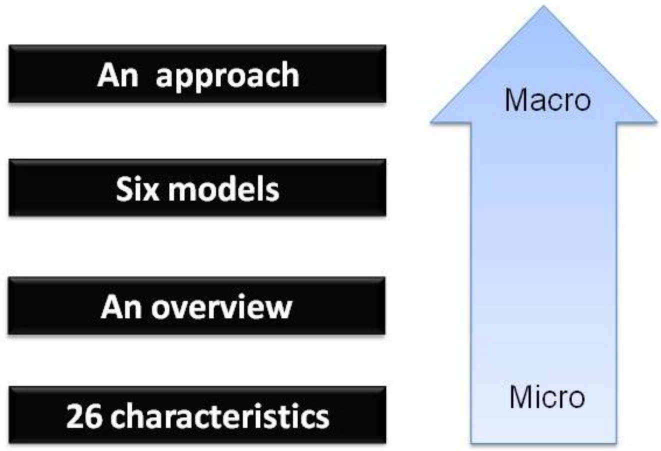

Figure 8.11: Four-level understanding of managing design

By comparing the twelve cases according to fourteen criteria of evaluating design management, 26 characteristics of managing design in Chinese manufacturing industry are explored. They give in-depth and detailed descriptions of the current design management situation. From this analysis, an overview of managing design is achieved. According to the previous two levels findings, six models are proposed. Though the models may not cover all the solutions developed in practice, they can be viewed as a reference for all Chinese manufacturers. Finally, the approach to managing design is the fourth level finding, which reviews design management in China. With it, companies not only have a historic view of design management evolution, but also can know the macro environment influencing their development further.

In this instance, as the first study of design management in China, this study has proposed the ways of managing design in Chinese manufacturing industry with in-depth and broad information. This not only gives an overall understanding of design management in China, but also forms a basis for future and further studies of related topics.

Part IV

Conclusion

Chapter 9.

Conclusion and Future Works

9.1 Key Findings

The results and findings of this study offer five aspects of information: research methods of design management, a database of managing design in Chinese manufacturing industry, characteristics, six models and the approach to design management in China.

1) Research methods of design management

Based on reviewing previous studies relating to design management, an evolutionary path of research methods is revealed. It starts with quantitative research supported by government for macro objectives, such as innovation in industries or national competitiveness, and then develops to qualitative research focusing on in-depth studies of topics at company or project level by academics. A combined approach has emerged in recent years, which manages to combine the advantages of the previous two. The transformation of the research methods not only represents the development of the knowledge body of design management, but also reflects the epistemology in different stages. With this recognition, researchers can select appropriate research methods according to the development stage and knowledge of design management.

2) A database of managing design in manufacturing industry

A database of managing design in Chinese manufacturing industry has been established based on the questionnaires of 117 companies in the PRD and YRD. The results of quantitative analysis not only describe the basic situation of design development in Chinese manufacturing, but also form a reference for future studies in this field. In addition, the twelve cases show in-depth and rich information of practical solutions formed and developed in the companies. They also demonstrate top management’s thoughts and experience in developing design capacity, relating to diverse conditions. The database and cases not only are the first records of managing design in Chinese manufacturing industry, but also offer first-hand information for further studies.

3) Characteristics

As the result of comparing cases, 26 characteristics are reported based on 14 criteria. These offer explicit information on managing design by Chinese manufacturers with in-depth description and comparison. With them, an overview of design development in Chinese manufacturing industry has been obtained. They not only show the achievements of previous design development in practice and provide a platform for further development, but also indicate the main issues of development in the near future: design awareness, design ability and knowledge of management. In addition, the influence of design management methods from the macro environment is also explored. With these findings, the current development stage of design management has been clearly defined. Referencing it, a company can locate itself easily and accurately.

4) Six models

Six models of managing design in Chinese manufacturing industry have been revealed. They not only imply six solutions of organizing design, but also represent three basic stages of developing design ability. With the models, a company can identify its own practice of managing design, and adjust it. Furthermore, they can review other ways of developing design ability according to the two ways and plan its future development.

5) Approach to design management in China

The approach to design management in China proposed in this thesis offers a basis for theory-building in this research field. As a first study of design management in China, it reviews the conditions and background of developing design management in a broad context, especially combining the macro conditions, such as economy and politics, with the micro background, such as internal design and design consultancies. Through comparing with approaches typical of Britain, America and Japan, the features of Chinese approaches have been explored.

9.2 Contributions

Concerning the five parts of information achieved in this study, they contribute the understanding of design management in China in four categories: government, design practitioners in industries, design education and design management. Table 9.1 shows the relationship between the two parts.

Table 9.1: Contributions of the research to four categories.

	Government	Design practitioners in industries			Design education	Design management
		Top managers	Design manager	Designers		
Research methods					★	★
Database	★					★
Characteristics			★	★		★
Models	★	★	★		★	★
Approach	★					★

For the Chinese government, they can make policies based on information such as the database, models and approach, which offer an overview of design management in industry, and can serve as a basis for policy-making. On the other hand, once the models and approach are known, a company can easily understand the implications and aims of national design policies. In this instance, they can plan their strategies efficiently according to it.

Top managers, design managers and designers are three levels of people who are involved in practical design activities in industries. This information can help them in different aspects. With models of managing design, top managers can locate their business more accurately than before. Based on information of characteristics and models, design managers can evaluate their own ways of managing design and clearly define their advantages and disadvantages, as well as enhance their internal design ability. Designers can better understand design development in companies and the practical requirements of companies from the characteristics. Then they can find opportunities for personal development and decide the direction of their career.

In the education field, research methods of design management can be used as materials both for teachers and students to form a historic view of them. Information of models not only can give teachers knowledge relating to Chinese practice, but also can help students to understand the development of practice and define their future work area. In this way, it contributes to bridging the gap between Western theories and Chinese practice in design management education.

As an initial study of design management practice in Chinese manufacturing industry, this thesis offers an overview, which could contribute to theory building in multiple ways. Research methods offer a historic view of the way of studying design management in the academic field. The database gives first-hand information of design management in Chinese manufacturing industry. It not only is the basis for further studies, but also is the source for other researchers to study design management in China. The characteristics show the situation of managing design with in-depth description according to the 14 criteria in three levels of design management content. The six models indicate the main solution of managing design developed by Chinese manufacturers in their practice. It also demonstrates a basic way of developing design ability with three stages. Finally, the approach introduces the background of design management development in China with an overview.

9.3 Further study

As the primary study of design management in Chinese manufacturing industry, there are various opportunities for its further study, according to research scope, methods and timeline. Concerning the research scope, studies of service industry or manufacturers in other geographic areas could be subjects for the next stage studies. For methods, more cases and quantitative questionnaire could be conducted based on this thesis. For a timeline, a historic view of companies' way of developing design capacity and management design can be obtained through re-visiting or re-interviewing the samples.

Starting from agricultural society, the fast-growth of the Chinese economy after the Open Policy is mainly contributed by the secondary industry: manufacturing. After more than thirty years development, a solid basis for the Chinese economy has been formed and previous manufacturers have established their own brands in business expansion. In this instance, service industry begins to take a larger share than ever. Based on an overview of Chinese design management in manufacturing industry offered by this research, studying design management in Chinese service industry could be subject for research in the next stage.

The YRD and PRD are selected geographic areas of this study because of their importance in the economy and design development in China. In the next stage of research, other leading areas can be involved for an overview of design management in China. Since the geographic area of China is huge and there are diverse traditional industries in different areas, it is essential to collect information from various locations to achieve an accurate understanding. The economic zone around the Bohai Sea rim could be the next target. Besides it, other cities, such as Chongqing and Xian, also can be included in the study to represent the middle and west part of China.

Even in manufacturing industry, studies of different product categories can be conducted to explore different ways of managing design. Because of differences in design resources, companies producing consumer products and instruments have demonstrated different models in developing design ability in this thesis. A comparison study can be conducted to further clarify the difference in the future.

Different research methods can also be conducted based on this thesis. Concerning large scale quantitative research, interval and ratio measurements can be designed in questionnaires to obtain accurate feedback from companies. The scope and contents of questions can be planned based on the current situation proposed by this study. In addition, other research methods can be used to study the twelve companies as the second stage of the study. Since information relating to design management in a company is obtained from interviewing the top managers or management team of design in a company in this study, interviewing other persons in different positions, functions and managerial levels can be an efficient way to collect in-depth information from different viewpoints in a company. Concerning the timeline, the 117 companies in the survey and the twelve cases could be restudied after a certain time span to follow their development, especially their performance and strategies in the financial crisis. These are all possible directions of further studies in the future.

In summary, as a first study of design management in China, this thesis offers a basis for further studies in this research field. In addition, through reviewing a large quantity of literature, comparisons with approaches to design management in different countries, and large scale surveys, an overview of design management in China with wide scope in relations and contexts is in the process of formation. This implies many opportunities for further studies.

Appendices

Appendix A.
Design Management Education in the Western Countries

Country / University	MA	MBA	BA	Certificate
UK				
Brunel University	Master of Design, Strategy and Innovation; MA Design Branding and Strategy.		BSc Industrial Design; BSc Product Design; BSc Product Design Engineering; BSc Virtual Product Design; BA Industrial Design and Technology; BSc Multimedia Technology and Design and Broadcast Media (Design and Technology).	
De Montfort University	Master of Design Innovation (MA/MSc/PGDip/PGCert)		BA of Design Management and Innovation	
Middlesex University	MDES In Product Design, Innovation and Management			
Staffordshire University	Master of Design Management		BA Honours of Design Studies MSc/PgDip Design & Manufacturing Management	
University of Central England (UCE)	Master of Design Management		BA Management of Design and Communications	
The University College for the Creative Arts	MA Innovation & Brand Management		BA Hons Advertising & Brand Management	
University of Salford	MSc/PgDip Design Management; MA International Business & Management for Designers			
University of the Arts London	MA / Postgraduate Diploma in Design Management			BA (Hons) Design Management for the Creative Industries
University of Teeside			BA (Hons) Design Marketing	
UMIST – University of Manchester Institute for Science and Technology			BSc (Hons) Design Management for Fashion Retailing; BSc (Hons) Textile Design and Design Management.	
University of Greenwich			BSc Design and Construction Management	
Northbrook College			BA (Hons) Marketing and Design for Business	
London Guildhall University			BA Honours of Design Studies	
US				
Illinois Institute of Technology	The Master of Design Degree (MDes)	Master of Design/Master of Business Administration (MDes/MBA)		
Northwestern University	Master of Product Development			
Pratt Institute	Masters of Professional Studies (MPS) in Design Management			
Suffolk University, Sawyer School of Management		The Executive MBA with Concentration in Innovation and Design Management		
Parsons School of Design			BBA Design and Management	
The Fashion Institute of Technology			BFA in Packaging Design	
American University of Sharjah			BA of Design Management	
Italy				

Bocconi University	Master in Fashion, Experience, and Design Management			
MIP, the Business School of the Politecnico di Milano		MBA—Design Management Stream		
Domus Academy		MBA		
France				
ESAC Penninghen & EPITA	Master in Management Science, Specialized in Strategy & Design			
Spain				
Eurpoeo di design in Barcelona	Master of Design Management			
Netherlands				
INHOLLAND University/INHOLLAND Graduate School	Master of Design Management (MDM)			
TU Delft	Master of Science Strategic Product Design			
New Zealand				
Unitec Institute of Technology	Master of Design Management			
Germany				
Zollverein School of Management and Design		Fulltime MBA		
Switzerland				
The Lucerne School of Art and Design			BA Design Management, International	
Canada				
George Brown College				Certificate program
Ryerson Polytechnic University				Certificate program

Appendix B.
Previous Studies of Design Management

No.	Study	Research Method			Research Approach		
		Case Study	Survey	interview	Quan	Qual	Combined
1	Rothwell, R., Freeman, C., Horsley, A., Jervis, V.T.P., Robertson, A.B., Townsend, J. (1974)	Y			Y		
2	Robertson, A. (1977)	Y				Y	
3	Topalian, A. (1979).		Y		Y		
4	Corfield, K. G. (1979)	Y			Y		
5	Rothwell, R. and Zegveld, W. (1982)		Y		Y		
6	Walsh, V. and Roy, R. (1983)		Y		Y		
7	Borja de Mozota, B. (1985)	Y				Y	
8	Roy, R., Salaman, G.. and Walsh, V. (1986)		Y		Y		
9	Walsh, V. and Roy, R. and Bruce, M. (1988)		Y		Y		
10	Hart, S. and Service, L. (1988)		Y		Y		
11	Ughanwa, D.O. and Baker, M.J. (1989)	Y	Y				Y
12	Hart, S., Service, L. and Baker, M. J. (1989)			Y	Y		
13	Hollins, B, and Pugh, S. (1990).		Y		Y		
14	Roy, R. (1990)		Y		Y		
15	Rothwell, R. (1990)	Y				Y	
16	Dumas,A. and Whitfield, A. (1990)	Y	Y				Y
17	Potter, S., Roy, R., Capon, C. H., Bruce, M., Walsh, V. and Lewis, J. (1991)		Y	Y			Y
18	Arbonies, Angel L (1991)		Y		Y		
19	DMI (1992)	Y				Y	
20	Walsh, V., Roy, R. and Bruce, M. (1992)		Y		Y		
21	Cooper, R. (1993)		Y		Y		
22	Teng, C. L. (1994)		Y	Y			Y
23	Walsh, V. (1995)		Y	Y			Y
24	Lovering,T. (1995)	Y				Y	
25	Press, M. (1995)		Y	Y			Y
26	Svengren, L. (1995)	Y				Y	
27	Price and Alun (1995)		Y		Y		
28	Riedel, J., Roy, R., and Potter, S. (1996)		Y		Y		
29	Teng, C. L. (1996)		Y	Y			Y
30	Guimaraes, L., Penny, J. and Moody, S. (1996)		Y	Y			Y
31	Sentence, A. and Clarke, J. (1997)		Y		Y		
32	Hertenstein, J. and Platt, M. (1997)	Y				Y	
33	Teng, C. L. (1997)		Y	Y			Y
34	Thackara, J. (1997)	Y				Y	
35	Paul, J. and Fricke, P. (1999)	Y				Y	
36	Hertenstein, J., Platt, M. and Brown, D. (2001)		Y		Y		
37	Gemser, G. and Leenders, M. (2001)		Y		Y		
38	Borja de Mozota, B. (2002)		Y	Y			Y
39	METI (2003)	Y				Y	
40	Park (2005)		Y		Y		

Appendix C.
Companies in the Survey

C-1. Survey samples in the Pearl River Delta

No.	Company Name	City
1	Guangzhou YICHANG Technology Co., Ltd.	Guangzhou
2	CELLon (China) Co., Ltd. (Broken at 29 Jun, 2006)	Shenzhen
3	SHANHE Group	Zhongshan
4	Media Microwave Co., Ltd.	Foshan,Shunde
5	Guangdong VANWARD Co. Ltd	Foshan,Shunde
6	Guangdong YILONG Co. Ltd	Foshan,Shunde
7	Guangdong CHANGQING Group.	Zhongshan
8	NANTE Electric Co.Ltd	Foshan,Shunde
9	HEHONG Co.Ltd	Shenzhen
10	HUAYI Lighting Group	Zhongshan
11	Guangzhou Radio	Guangzhou
12	Chaozhou SONGFA Ceramic Co.Ltd	Chaozhou
13	Nanhai EAGO Bath product Co.Ltd	Nanhai,Foshan
14	Guangdong BESCO Co.Ltd	Guangzhou
15	Guangzhou AUDI Co.Ltd	Shantou,Guangzhou
16	TCL mobile communication Inc	Huizhou
17	ZHENG YE electronics Co.Ltd	Dongguan
18	Datang Hesheng Ceramics Co., Ltd	Foshan
19	BBK Electronics Co., Ltd	Dongguan
20	Guangdong JOINSUN electronics limited company	Guangzhou
21	Guangdong Kerong Electrical Appliances Co., Ltd	Foshan,Shunde
22	Guangdong Longde Group	Zhongshan
23	Media Induction Cooker Co.Ltd	Foshan,Shunde
24	Guangdong Xinbao Electrical Appliances Holdings Co., Ltd	Foshan,Shunde
25	Guangdong Yangcheng Electronic Co., Ltd.	Guangzhou
26	Guangzhou Gema Technical Services Ltd.	Guangzhou
27	Guangzhou Haige Communications Group	Guangzhou
28	Jiayue Industrial Corp.	Guangzhou
29	Guangzhou Kangyi Electronics Co.,Ltd	Foshan,Shunde
30	ARNO houseware Company	Guangzhou
31	Eagle-stationery	Panyu
32	Jiangmen Dihao Motorcycle Co., Ltd.	Jiangmen
33	Techway Electric Technology Ltd.	Jiangmen
34	JRDC (Shenzhen) Inc.	Shenzhen
35	Midea Design Company	Foshan,Shunde
36	Zhongshan Jeanful Electrical Appliance Co., Ltd.	Zhongshan
37	Hexing Furniture Co., Ltd.	Zhongshan
38	Zhongshan Longjun Kitchen Appliance Co., Ltd.	Zhongshan
39	Zhongshan Jianhui Electrical Appliance Co., Ltd.	Zhongshan
40	Zhongshan Chaoren Electrical Appliance Co., Ltd.	Zhongshan
41	Zhongshan Royalstar Kitchen & Bath Appliance Co., Ltd	Zhongshan
42	Guangdong Xinhui Meida Nylon Co., Ltd.	Jiangmen

43	Shenzhen Angel Drinking Water Equipment Co .,Ltd.	Shenzhen

C-2. Survey samples in the Yangzte River Delta

No.	Company Name	City	Province
1	Zhenjiang Dongfang Air conditioning cooling accessories	Zhenjiang	Jiangsu
2	Zhenjiang Rongfa Plastics Co., Ltd.	Zhenjiang	Jiangsu
3	Ultraview Technology limited	Yangzhou	Jiangsu
4	Yangzhou Xie Fu-chun Cosmetics Co., Ltd.	Yangzhou	Jiangsu
5	Yangzhou Yaxing Coach Co., Ltd.	Yangzhou	Jiangsu
6	Jiangsu Yang of the NC machine tools Ltd.	Yangzhou	Jiangsu
7	Yee Fung Jiangsu Communication Equipment Co., Ltd.	Yangzhou	Jiangsu
8	Jiangsu Muyang Group	Yangzhou	Jiangsu
9	Suzhou Fabo Electronic Technology Co., Ltd	Suzhou	Jiangsu
10	Suzhou mountains Electric Technology Co., Ltd.	Suzhou	Jiangsu
11	Samsung-Suzhou	Suzhou	Jiangsu
12	Nanjing as Granville Electronics Co., Ltd.	Nanjing	Jiangsu
13	NUST Engineering Electronics Co	Nanjing	Jiangsu
14	Jiangsu Henggong Machinery Co., Ltd.	Kunshan	Jiangsu
15	Goodbaby Group	Kunshan	Jiangsu
16	Sanyi heavy machine Ltd.	Kunshan	Jiangsu
17	Changjiang Run Fa Group Co., Ltd	Zhangjiagang	Jiangsu
18	Hua Fang Group Co., Ltd	Zhangjiagang	Jiangsu
19	Jiangsu Jinling Sports Equipment Co., Ltd.	Zhangjiagang	Jiangsu
20	Zhangjiagang Horse Group	Zhangjiagang	Jiangsu
21	Pan Hua Co., Ltd	Zhangjiagang	Jiangsu
22	Jiangsu full Electrical and Mechanical Services Co., Ltd.	Zhangjiagang	Jiangsu
23	Jiangsu Yinhe Electronics Co., Ltd.	Zhangjiagang	Jiangsu
24	Nantong Erkang medical supplies Ltd.	Nantong	Jiangsu
25	Nantong HUAHAI Digital Technology Co., Ltd.	Nantong	Jiangsu
26	Nantong Xingchen Arts & Crafts Co., Ltd.	Nantong	Jiangsu
27	Wuxi Gangqi electronic Co., Ltd.	Wuxi	Jiangsu
28	Jiangsu Hongdou Group	Wuxi	Jiangsu
29	Jiangsu Jianianhua science and technology Co., Ltd.	Wuxi	Jiangsu
30	Wuxi Jiate auto-vehicle Co., Ltd.	Wuxi	Jiangsu
31	Lianmao electronic science and technology Co., Ltd.	Wuxi	Jiangsu
32	Wuxi Lianqi network technology Co., Ltd.	Wuxi	Jiangsu
33	Jiangsu Xinri electromotion vehicle Co., Ltd.	Wuxi	Jiangsu
34	Jinagsu Yadi development of science and technology Co., Ltd.	Wuxi	Jiangsu
35	Wuxi Yipude science and technology Co., Ltd.	Wuxi	Jiangsu
36	Jiangsu Zhongxing motorcycle Co., Ltd.	Wuxi	Jiangsu
37	Changzhou jinzhen plastic rubber product Factory	Changzhou	Jiangsu
38	Changzhou Saidi Electric Product Co.,Ltd.	Changzhou	Jiangsu
39	Changzhou Huajian Ecological science and technology Co.,Ltd.	Changzhou	Jiangsu

40	Changzhou Tianhong Medical Device Co.,Ltd.	Changzhou	Jiangsu
41	Changzhou Jinqi CNC Co., Ltd.	Changzhou	Jiangsu
42	Huaqin communications	Shanghai	Shanghai
43	Shanghai Yanfeng Visteon Automotive	Shanghai	Shanghai
44	AURORA office equipment Shanghai Co., Ltd.	Shanghai	Shanghai
45	Shanghai Genvana	Shanghai	Shanghai
46	Zhejiang Jiyou fallow products Co., Ltd.	Huzhou	Zhejiang
47	Zhejiang Senlaite industrail commerce science and technology Co., Ltd.	Huzhou	Zhejiang
48	Zhejiang Qiushi information electronical Co., Ltd.	Huzhou	Zhejiang
49	Aori Motor Co., Ltd.	Shengzhou	Zhejiang
50	Zhejiang Tianle Group	Shengzhou	Zhejiang
51	Zhejiang Forming Machinery Co., Ltd.	Shengzhou	Zhejiang
52	Ningbo Huxin family electrical equipment technology Co., Ltd,	Ningbo	Zhejiang
53	Ningbo Pan-protective Ltd.	Ningbo	Zhejiang
54	Ningbo East-ho cast Co., Ltd.	Ningbo	Zhejiang
55	Ningbo Huarui Electric Co., Ltd.	Ningbo	Zhejiang
56	Wong Electrical Co., Ltd	Ningbo	Zhejiang
57	Cixing Group	Ningbo	Zhejiang
58	Taizhou Aori intelligent Machinery Co., Ltd.	Taizhou	Zhejiang
59	Zhejiang Hongji Toys manufacture Co., Ltd.	Taizhou	Zhejiang
60	Taizhou Shengda art work Co., Ltd.	Taizhou	Zhejiang
61	Huangyan Ouli art work plant	Taizhou	Zhejiang
62	Zhejiang Ruyi industry Co., Ltd.	Taizhou	Zhejiang
63	Taizhou Lisheng art work Co., Ltd.	Taizhou	Zhejiang
64	Huangyan Yilong art work plant	Taizhou	Zhejiang
65	Huangyan Henglong art work Co., Ltd.	Taizhou	Zhejiang
66	Huangyan Kaifeng art work plant	Taizhou	Zhejiang
67	Taizhou Haiyuan art works&gifts plant	Taizhou	Zhejiang
68	Hangzhou Sihai import and export trade Co.Ltd.	Hangzhou	Zhejiang
69	Meitong commodity Co., Ltd.	Hangzhou	Zhejiang
70	Hangzhou Lesheng Hardware appliances Co., Ltd.	Hangzhou	Zhejiang
71	Hangzhou Fangxiang down products Co., Ltd.	Hangzhou	Zhejiang
72	Hangzhou Lianda umbrella dyeing and finishing Co., Ltd.	Hangzhou	Zhejiang
73	Zhejiang Wanyu garment Co., Ltd.	Hangzhou	Zhejiang
74	Hangzhou Minsheng ceramic Co., Ltd.	Hangzhou	Zhejiang

Appendix D. Questionnaire

Time ________________ Interviewee ______________

Position ______________ Division _________________ Location _______________

1、 Date of establishment _________________

2、 Numbers of division and plants and their locations if any: A) yes B) no

3、 Numbers of division and plants：________ Location：_____________________

4、 Number of employees：

A) below 100 B) 100-300 C) 300-1000 D) 1000-2000 E) 2000 above

5、 Net annual production (quantity) of products：

A) below 0.1 million B) 0.1 million – 0.3 million C) 0.3 million – 0.6 million

D) 0.6 million – 1 million E) 1 million above

6、 Net annual sales revenue：

A) below 10 millions B) 10-30 millions C) 30-60 millions

D) 60-100 millions E) 100 millions above

6、Ownership and legal structure:

A) State owned B) Partnership/ join venture C) Limited Company D) List Corporation

7、Type of business ： A) OEM B) ODM C) OBM

8、Ownership of Brand if any: <yes/no> *(name of brand, local or aboard)*________________

9、Product category：

A) household B) electrical C) electronic D) telecommunication E) others_____

10、Core technological competence/ capability：

A) materials B) mechanical engineering C) electronic engineering

D) system production E) Others _________________

11、Major market/s：____________ *(e.g. China, South Asia, East Asia, Europe, N. America, S, America, Others? Your answer could be more than one)*

12、Design Department established within the company? A) yes B) no

13、Hiring of external design consultancy/ freelance designer？ A) yes B) no

14、What is their role?

A) general design services B) strategic partner C) Others____________

15、What kinds of design service/s that your company required from Design Consultancy /

Firms?

A) conceptual design B) product styling C) engineering design

D) product graphic and packaging design E) others____________________

16、Is there any design related or supplementary service you are looking for?

A) users research B) competitors research and analysis C) product trend analysis

D) product design strategy E) branding / brand strategy F)

Others____________________

17、Do external design consultant service meet the needs of the company? A) yes B) no

if no, what was the inadequacy of services rendered________________________________

18、Who is responsible for integrating their work?

A) product manager B) engineer C) in-house designer D) others _____

19、Product ranges developed annually with employment of design (in term of %)：

A) 5-10% B) 10-20% C) 20-40% D) 40-60% E) above 60%

20、Generally, in product development processes, when is design brought in ?

A) Up-stream— market identification /design orientation (e.g. market / consumer research)

B) Mid-stream – product development (e.g. function improvement and design embodiment)

C) Down-stream – preproduction services (e.g. details design control and engineering)

21、Who (within the whole company) has the final say of the choice of new design?__________

22、Investment (in term of %) of design in a typical product development process?

A) below 5% B) 5-10% C) 10-20% D) 20-40% E) 40-60% F) above 60%

23、Annual expenditure in design (HK$)?

A) below 0.5 million B) 0.5 million to 2 millions C) 2 millions to 5 millions

D) 5 millions to 10 millions E) above 10 millions

24、Do functions such marketing, sales and engineering share information and work in cooperation with design? A) yes B) no

25、Does top management believe design can leverage ‘profitability’ of the company and hence future growth ? <yes/on> in what way ___________________________________

26、How is the contribution of design to the company assessed?

A) growth of sales B) market acceptance / recognition C) others______________

27、Is there clear goals and mission set for the internal Design faculties? A) yes B) no

If so, what are they? ____

28、Is there clear business goals and future plans for the firm? <yes/no>

If so, what are they?____

29、Any plan for the expansion of design capacity of the company? <yes/no>

If so, what are they?____

30、The most urgently needed design expertise for the company now and in the near future?

A) Industrial Design B) Visual Communication C) Packaging

D) Interface E) multimedia F) Others__________________

31、 Rank of design personnel needed：

A) Junior designer B) senior design C) design manager

32、Number of such design personnel needed: ______________________________

Name of Company / Division：

Company Address：

Telephone No.：

Fax No.：

Website：

Telephone No. of Interviewee：

Correspondence email：

Appendix E.
Interview Questions

I) Initial Reference

01. Name of company: ____

02. Address: ____

03. Date of interview: ____________________ ___________________________

II) Interviewee Data

04. Name: ____

05. Position: ____

06. Department/Division: ___________________________________

07. Brief personal background of interviewee (*note: nationality, education, expertise, etc.*).

08. Career development of interviewee (*note: if related to design management, former and current responsibility….*).

III) History/Market/Business of Company:

09. Brief history and major phases of development of the company. *(Note: family-owned business/new business; origin of business; significant turning point.)*

10. What is/are the core competitive advantage/s of the company in your view? *(Note: technology, design capability, business network, marketing, distribution channels, cost control, or others.)*

11. Major market(s), and why are these markets targeted? *(Note: [a] geographical; [b] market segment; [c] targeted customers.)*

12. Is the company's business secure in the target market(s)? Who are the key challengers/competitors?

IV) New Product Development Practice:

13. What is the most successful product (or product line) developed by the company so far? (*Note: products that leverage the company's development and its application of design.*)

14. How did the concept come about? Who (or what process) initiated the original idea? (*Note: marketing people, design team, engineers*)

15. In what way did the company obtain the information needed to initiate and develop the product? Who defined the design briefs/specifications? (*Note: client, buyers, proper market research, etc.*)

16. Was there a decision-making process involved? If yes, who was behind this process?

17. Are similar new product development processes (NPD)/design and decision processes being practiced today?

18. Are proper design processes and methods developed and employed for NPD practices? (*Note: user research, competition analysis, collective brainstorming, etc.*)

V) Development of Design:

19. Was design introduced to enhance business practices in your company? (Note: given that the company should have been hiring design firms or designers for their NPD processes.)

20. Has the role/function of design evolved?

21. How has the quality of design been ensured and sustained? Has any formulated process/system/policy been developed?

22. Has the design capacity been developed and formalized? (Note: for example, has a proper design department been established?)

23. How is the design team/department structured? (Note: internal structure, and what is its relationship with other departments?)

24. Are designers in your company encouraged/supported to reach out? (Note: attend conferences, participate in competitions, offer academic services, etc.?)

25. Are designers encouraged to pursue further educational qualifications?

26. Is design being promoted or featured in the company? (Note: promoted externally or internally as added value.)

VI) Design & Brand Building:

27. Has the company established its own brand(s)?

28. When and why was/were the specific brand(s) created?

29. Is there a strategic relationship between/among these brands? If yes, what is it?

30. Has design been employed in the development of this/these brand(s)?

31. What is your view on product design and its relationship to brand building? (*Note: are well-designed products a significant means of brand building?*)

VII) Vision & Perception of Design:

32. Do you view design as one of the core competitive advantages of your company?

33. If yes, what is the most significant value that design adds to the business? (*Note: consumer – brand recognition; market – differentiation; business – direct profit making; company – innovation culture nourishment, pushing technical progress, etc.*)

34. Is it important for management to be knowledgeable about design/design practice in your view?

35. What is "industrial design" in the eyes of senior management? (*Note: product function/application engineering, structural process to identify opportunities and anticipate user's needs, product's aesthetic and interactive experience*)

36. Which firms do you admire in respect to their use of design?

37. What will be the next major challenge for the company in your view? (*Note: to be the market leader, explore new markets, business expansion, etc.*)

38. Where would you like to see the firm in five years? Are the firm's business orientation and development path clear, in your view?

39. Is the government supporting local SMEs in your view?

40. What is your opinion about the role of government in assisting local SMEs? Any suggestions?

(END)

Appendix F.
Crosstabulation of Questions

F-1. Nominal by Nominal

A. outsourcing design * The role of external design

Crosstabulation

			The role of external design					Total
			No reply	A	B	C	Mixed	
outsourcing design	No reply	Count	1	0	0	0	0	1
		% within outsourcing design	100.0%	.0%	.0%	.0%	.0%	100.0%
		% within The role of external design	5.6%	.0%	.0%	.0%	.0%	.9%
		% of Total	.9%	.0%	.0%	.0%	.0%	.9%
	A Hiring external design	Count	1	37	23	6	6	73
		% within outsourcing design	1.4%	50.7%	31.5%	8.2%	8.2%	100.0%
		% within The role of external design	5.6%	64.9%	85.2%	66.7%	100.0%	62.4%
		% of Total	.9%	31.6%	19.7%	5.1%	5.1%	62.4%
	B. Not hiring external design	Count	16	20	4	3	0	43
		% within outsourcing design	37.2%	46.5%	9.3%	7.0%	.0%	100.0%
		% within The role of external design	88.9%	35.1%	14.8%	33.3%	.0%	36.8%
		% of Total	13.7%	17.1%	3.4%	2.6%	.0%	36.8%
Total		Count	18	57	27	9	6	117
		% within outsourcing design	15.4%	48.7%	23.1%	7.7%	5.1%	100.0%
		% within The role of external design	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	15.4%	48.7%	23.1%	7.7%	5.1%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	37.637a	8	0
Likelihood Ratio	41.168	8	0
N of Valid Cases	117		

a. 8 cells (53.3%) have expected count less than 5. The minimum expected count is .05.

Directional Measures

			Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Nominal by Nominal	Lambda	Symmetric	0.154	0.033	4.024	0
		outsourcing design Dependent	0.341	0.076	3.863	0
		The role of external design Dependent	0.017	0.017	1.004	0.315
	Goodman and Kruskal tau	outsourcing design Dependent	0.273	0.055		.000c
		The role of external design Dependent	0.077	0.021		.000c
	Uncertainty Coefficient	Symmetric	0.173	0.04	4.098	0
		outsourcing design Dependent	0.25	0.058	4.098	0
		The role of external design Dependent	0.133	0.031	4.098	0

b. Not assuming the null hypothesis.

c. Using the asymptotic standard error assuming the null hypothesis.

d. Based on chi-square approximation

e. Likelihood ratio chi-square probability.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	0.567	0
	Cramer's V	0.401	0
	Contingency Coefficient	0.493	0
N of Valid Cases		117	

Results:

1) The two variables are significantly associated with each other, based on a two-tailed significance level of $p=0<0.05$.
2) By knowing the role of external design, we are able to realize a proportional reduction in error of 34.1 percent in predicating outsourcing design.
3) The relationship of the two variables is strong, with contingency coefficient of 0.493.

B. outsourcing design * design service from external design

Crosstabulation

			design service from external design							Total
			No reply	A	B	C	D	E	M	
outsourcing design	No reply	Count	1	0	0	0	0	0	0	1
		% within outsourcing design	100.0%	.0%	.0%	.0%	.0%	.0%	.0%	100.0%
		% within design service from external design	16.7%	.0%	.0%	.0%	.0%	.0%	.0%	.9%
		% of Total	.9%	.0%	.0%	.0%	.0%	.0%	.0%	.9%
	A Hiring external design	Count	0	9	16	9	3	4	32	73
		% within outsourcing design	.0%	12.3%	21.9%	12.3%	4.1%	5.5%	43.8%	100.0%
		% within design service from external design	.0%	90.0%	61.5%	50.0%	50.0%	57.1%	72.7%	62.4%
		% of Total	.0%	7.7%	13.7%	7.7%	2.6%	3.4%	27.4%	62.4%
	B. Not hiring external design	Count	5	1	10	9	3	3	12	43
		% within outsourcing design	11.6%	2.3%	23.3%	20.9%	7.0%	7.0%	27.9%	100.0%
		% within design service from external design	83.3%	10.0%	38.5%	50.0%	50.0%	42.9%	27.3%	36.8%
		% of Total	4.3%	.9%	8.5%	7.7%	2.6%	2.6%	10.3%	36.8%
Total		Count	6	10	26	18	6	7	44	117
		% within outsourcing design	5.1%	8.5%	22.2%	15.4%	5.1%	6.0%	37.6%	100.0%
		% within design service from external design	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	5.1%	8.5%	22.2%	15.4%	5.1%	6.0%	37.6%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	32.646a	12	0.001
Likelihood Ratio	23.528	12	0.024
N of Valid Cases	117		

a. 14 cells (66.7%) have expected count less than 5. The minimum expected count is .05.

Directional Measures

			Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Nominal by Nominal	Lambda	Symmetric	0.051	0.02	2.515	0.012
		outsourcing design Dependent	0.114	0.048	2.285	0.022
		design service from external design Dependent	0.014	0.014	1.004	0.315
	Goodman and Kruskal tau	outsourcing design Dependent	0.126	0.039		.004c
		design service from external design Dependent	0.03	0.011		.053c
	Uncertainty Coefficient	Symmetric	0.085	0.029	2.807	0.024
		outsourcing design Dependent	0.143	0.046	2.807	0.024
		design service from external design Dependent	0.06	0.021	2.807	0.024

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on chi-square approximation

d. Likelihood ratio chi-square probability.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	0.528	0.001
	Cramer's V	0.374	0.001
	Contingency Coefficient	0.467	0.001
N of Valid Cases		117	

Results:

1) The two variables are significantly associated with each other, based on a two-tailed significance level of p=0.001<0.05.
2) By knowing the design service from external design, we are able to realize a proportional reduction in error of 11.4 percent in predicating outsourcing design.
3) The relationship of the two variables is strong, with contingency coefficient of

0.467.

C. outsourcing design * external design meet the needs

Crosstabulation

			external design meet the needs			Total
			No reply	A	B	
outsourcing design	No reply	Count	1	0	0	1
		% within outsourcing design	100.0%	.0%	.0%	100.0 %
		% within external design meet the needs	5.3%	.0%	.0%	.9%
		% of Total	.9%	.0%	.0%	.9%
	A. Hiring external design	Count	4	51	18	73
		% within outsourcing design	5.5%	69.9%	24.7%	100.0 %
		% within external design meet the needs	21.1%	77.3%	56.2%	62.4%
		% of Total	3.4%	43.6%	15.4%	62.4%
	B. Not hiring external design	Count	14	15	14	43
		% within outsourcing design	32.6%	34.9%	32.6%	100.0 %
		% within external design meet the needs	73.7%	22.7%	43.8%	36.8%
		% of Total	12.0%	12.8%	12.0%	36.8%
Total		Count	19	66	32	117
		% within outsourcing design	16.2%	56.4%	27.4%	100.0 %
		% within external design meet the needs	100.0%	100.0%	100.0%	100.0 %
		% of Total	16.2%	56.4%	27.4%	100.0 %

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	23.908a	4	0
Likelihood Ratio	22.967	4	0
N of Valid Cases	117		

a. 3 cells (33.3%) have expected count less than 5. The minimum expected count is .16.

Directional Measures

			Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Nominal by Nominal	Lambda	Symmetric	0.116	0.041	2.595	0.009
		outsourcing design Dependent	0.227	0.085	2.415	0.016
		external design meet the needs Dependent	0.02	0.019	1.004	0.315
	Goodman and Kruskal tau	outsourcing design Dependent	0.16	0.063		.000c
		external design meet the needs Dependent	0.097	0.037		.000c
	Uncertainty Coefficient	Symmetric	0.117	0.044	2.562	0
		outsourcing design Dependent	0.14	0.052	2.562	0
		external design meet the needs Dependent	0.101	0.039	2.562	0

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on chi-square approximation

d. Likelihood ratio chi-square probability.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	0.452	0
	Cramer's V	0.32	0
	Contingency Coefficient	0.412	0
N of Valid Cases		117	

Results:

1) The two variables are significantly associated with each other, based on a two-tailed significance level of $p=0<0.05$.
2) By knowing satisfaction of external design, we are able to realize a proportional reduction in error of 22.7 percent in predicating outsourcing design.
3) The relationship of the two variables is strong, with contingency coefficient of 0.412.

D. The role of external design * external design meet the needs

Crosstabulation

			external design meet the needs			Total
			No reply	A	B	
The role of external design	No reply	Count	14	3	1	18
		% within The role of external design	77.8%	16.7%	5.6%	100.0%
		% within external design meet the needs	73.7%	4.5%	3.1%	15.4%
		% of Total	12.0%	2.6%	.9%	15.4%
	A	Count	2	37	18	57
		% within The role of external design	3.5%	64.9%	31.6%	100.0%
		% within external design meet the needs	10.5%	56.1%	56.2%	48.7%
		% of Total	1.7%	31.6%	15.4%	48.7%
	B	Count	2	19	6	27
		% within The role of external design	7.4%	70.4%	22.2%	100.0%
		% within external design meet the needs	10.5%	28.8%	18.8%	23.1%
		% of Total	1.7%	16.2%	5.1%	23.1%
	C	Count	1	3	5	9
		% within The role of external design	11.1%	33.3%	55.6%	100.0%
		% within external design meet the needs	5.3%	4.5%	15.6%	7.7%
		% of Total	.9%	2.6%	4.3%	7.7%
	M	Count	0	4	2	6
		% within The role of external design	.0%	66.7%	33.3%	100.0%
		% within external design meet the needs	.0%	6.1%	6.2%	5.1%
		% of Total	.0%	3.4%	1.7%	5.1%
Total		Count	19	66	32	117

	% within The role of external design	16.2%	56.4%	27.4%	100.0%
	% within external design meet the needs	100.0%	100.0%	100.0%	100.0%
	% of Total	16.2%	56.4%	27.4%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	64.201a	8	0
Likelihood Ratio	50.861	8	0
N of Valid Cases	117		

a. 8 cells (53.3%) have expected count less than 5. The minimum expected count is .97.

Directional Measures

			Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Nominal by Nominal	Lambda	Symmetric	0.225	0.065	3.133	0.002
		The role of external design Dependent	0.2	0.06	3.122	0.002
		external design meet the needs Dependent	0.255	0.085	2.679	0.007
	Goodman and Kruskal tau	The role of external design Dependent	0.151	0.041		.000c
		external design meet the needs Dependent	0.209	0.056		.000c
	Uncertainty Coefficient	Symmetric	0.189	0.049	3.682	0
		The role of external design Dependent	0.164	0.044	3.682	0
		external design meet the needs Dependent	0.223	0.058	3.682	0

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on chi-square approximation

d. Likelihood ratio chi-square probability.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	0.741	0
	Cramer's V	0.524	0
	Contingency Coefficient	0.595	0
N of Valid Cases		117	

Results:

1) The two variables are significantly associated with each other, based on a two-tailed significance level of p=0<0.05.
2) By knowing satisfaction of external design, we are able to realize a proportional reduction in error of 20 per cent in predicating the role of external design; by knowing the role of external design, we can predicate the

satisfaction of external design with a possibility of 25.5 per cent.

3) The relationship of the two variables is strong, with contingency coefficient of 0.595.

E. goals and mission for the internal Design * business goals and future plans for the firm

Crosstabulation

			business goals and future plans for the firm			Total
			No reply	A	B	
goals and mission for the internal Design	No reply	Count	1	6	1	8
		% within goals and mission for the internal Design	12.5%	75.0%	12.5%	100.0%
		% within business goals and future plans for the firm	50.0%	6.1%	6.2%	6.8%
		% of Total	.9%	5.1%	.9%	6.8%
	A	Count	0	75	2	77
		% within goals and mission for the internal Design	.0%	97.4%	2.6%	100.0%
		% within business goals and future plans for the firm	.0%	75.8%	12.5%	65.8%
		% of Total	.0%	64.1%	1.7%	65.8%
	B	Count	1	18	13	32
		% within goals and mission for the internal Design	3.1%	56.2%	40.6%	100.0%
		% within business goals and future plans for the firm	50.0%	18.2%	81.2%	27.4%
		% of Total	.9%	15.4%	11.1%	27.4%
Total		Count	2	99	16	117
		% within goals and mission for the internal Design	1.7%	84.6%	13.7%	100.0%
		% within business goals and future plans for the firm	100.0%	100.0%	100.0%	100.0%
		% of Total	1.7%	84.6%	13.7%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	35.672a	4	0
Likelihood Ratio	31.634	4	0
N of Valid Cases	117		

a. 5 cells (55.6%) have expected count less than 5. The minimum expected count is .14.

Directional Measures

			Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Nominal by Nominal	Lambda	Symmetric	0.207	0.052	3.122	0.002
		goals and mission for the internal Design Dependent	0.3	0.084	3.122	0.002

		business goals and future plans for the firm Dependent	0	0	.c	.c
	Goodman and Kruskal tau	goals and mission for the internal Design Dependent	0.217	0.063		0
		business goals and future plans for the firm Dependent	0.235	0.078		0
	Uncertainty Coefficient	Symmetric	0.209	0.064	3.006	.000e
		goals and mission for the internal Design Dependent	0.166	0.056	3.006	.000e
		business goals and future plans for the firm Dependent	0.28	0.078	3.006	.000e

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on chi-square approximation

d. Likelihood ratio chi-square probability.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	0.552	0
	Cramer's V	0.39	0
	Contingency Coefficient	0.483	0
N of Valid Cases		117	

Results:

1) The two variables are significantly associated with each other, based on a two-tailed significance level of *p*=0<0.05.
2) By knowing business goals and future plans for the firm, we are able to realize a proportional reduction in error of 30 per cent in predicating goals and mission for the internal design. However, knowing goals and mission for the internal design is not helpful of predicating business goals and future plans for the firm.
3) The relationship of the two variables is strong, with contingency coefficient of 0.483.

F-2. Ordinal by Ordinal

A. Number of employees * Net annual sales revenue

Crosstabulation

	Net annual sales revenue						Total
	No reply	A	B	C	D	E	

Number of employees	No reply	Count	0	0	0	0	0	1	1
		% within Number of employees	.0%	.0%	.0%	.0%	.0%	100.0%	100.0%
		% within Net annual sales revenue	.0%	.0%	.0%	.0%	.0%	1.7%	.9%
		% of Total	.0%	.0%	.0%	.0%	.0%	.9%	.9%
	A	Count	0	15	6	1	2	0	24
		% within Number of employees	.0%	62.5%	25.0%	4.2%	8.3%	.0%	100.0%
		% within Net annual sales revenue	.0%	93.8%	37.5%	10.0%	12.5%	.0%	20.5%
		% of Total	.0%	12.8%	5.1%	.9%	1.7%	.0%	20.5%
	B	Count	0	0	7	7	7	2	23
		% within Number of employees	.0%	.0%	30.4%	30.4%	30.4%	8.7%	100.0%
		% within Net annual sales revenue	.0%	.0%	43.8%	70.0%	43.8%	3.4%	19.7%
		% of Total	.0%	.0%	6.0%	6.0%	6.0%	1.7%	19.7%
	C	Count	0	1	3	2	7	18	31
		% within Number of employees	.0%	3.2%	9.7%	6.5%	22.6%	58.1%	100.0%
		% within Net annual sales revenue	.0%	6.2%	18.8%	20.0%	43.8%	31.0%	26.5%
		% of Total	.0%	.9%	2.6%	1.7%	6.0%	15.4%	26.5%
	D	Count	0	0	0	0	0	12	12
		% within Number of employees	.0%	.0%	.0%	.0%	.0%	100.0%	100.0%
		% within Net annual sales revenue	.0%	.0%	.0%	.0%	.0%	20.7%	10.3%
		% of Total	.0%	.0%	.0%	.0%	.0%	10.3%	10.3%
	E	Count	1	0	0	0	0	25	26
		% within Number of employees	3.8%	.0%	.0%	.0%	.0%	96.2%	100.0%
		% within Net annual sales revenue	100.0%	.0%	.0%	.0%	.0%	43.1%	22.2%
		% of Total	.9%	.0%	.0%	.0%	.0%	21.4%	22.2%
Total		Count	1	16	16	10	16	58	117
		% within Number of employees	.9%	13.7%	13.7%	8.5%	13.7%	49.6%	100.0%
		% within Net annual sales revenue	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	.9%	13.7%	13.7%	8.5%	13.7%	49.6%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.364E2a	25	0
Likelihood Ratio	143.63	25	0
N of Valid Cases	117		

a. 31 cells (86.1%) have expected count less than 5. The minimum expected count is .01.

Directional Measures

			Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Ordinal by Ordinal	Somers' d	Symmetric	0.682	0.05	12.943	0
		Number of employees Dependent	0.731	0.056	12.943	0
		Net annual sales revenue Dependent	0.64	0.05	12.943	0

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Symmetric Measures

		Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Ordinal by Ordinal	Kendall's tau-b	0.684	0.05	12.943	0
	Kendall's tau-c	0.606	0.047	12.943	0
	Gamma	0.848	0.058	12.943	0
N of Valid Cases		117			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Results:

1) The two variables are significantly associated with each other, based on a two-tailed significance level of p=0<0.05.
2) By knowing net annual sales revenue, we are able to realize a proportional reduction in error of 73.1 per cent in predicating scale of employee; by knowing scale of employee, we have 64 per cent of possibility to know net annual sales revenue.
3) The relationship of the two variables is very strong, with Gamma of 0.848.

B. Net annual production (quantity) of products * Net annual sales revenue

Crosstabulation

			Net annual sales revenue						Total
			No reply	A	B	C	D	E	
Net annual production (quantity) of products	No reply	Count	0	1	1	2	0	4	8
		% within Net annual production (quantity) of products	.0%	12.5%	12.5%	25.0%	.0%	50.0%	100.0%
		% within Net annual sales revenue	.0%	6.2%	6.2%	20.0%	.0%	6.9%	6.8%
		% of Total	.0%	.9%	.9%	1.7%	.0%	3.4%	6.8%
	A	Count	0	5	3	2	4	4	18
		% within Net annual production (quantity) of products	.0%	27.8%	16.7%	11.1%	22.2%	22.2%	100.0%
		% within Net annual sales revenue	.0%	31.2%	18.8%	20.0%	25.0%	6.9%	15.4%
		% of Total	.0%	4.3%	2.6%	1.7%	3.4%	3.4%	15.4%
	B	Count	0	3	2	0	0	8	13
		% within Net annual production (quantity) of products	.0%	23.1%	15.4%	.0%	.0%	61.5%	100.0%
		% within Net annual sales revenue	.0%	18.8%	12.5%	.0%	.0%	13.8%	11.1%
		% of Total	.0%	2.6%	1.7%	.0%	.0%	6.8%	11.1%
	BD	Count	0	0	1	0	0	0	1
		% within Net annual	.0%	.0%	100.0%	.0%	.0%	.0%	100.0%

		production (quantity) of products							
		% within Net annual sales revenue	.0%	.0%	6.2%	.0%	.0%	.0%	.9%
		% of Total	.0%	.0%	.9%	.0%	.0%	.0%	.9%
	C	Count	0	1	3	1	3	1	9
		% within Net annual production (quantity) of products	.0%	11.1%	33.3%	11.1%	33.3%	11.1%	100.0%
		% within Net annual sales revenue	.0%	6.2%	18.8%	10.0%	18.8%	1.7%	7.7%
		% of Total	.0%	.9%	2.6%	.9%	2.6%	.9%	7.7%
	D	Count	1	3	3	2	0	2	11
		% within Net annual production (quantity) of products	9.1%	27.3%	27.3%	18.2%	.0%	18.2%	100.0%
		% within Net annual sales revenue	100.0%	18.8%	18.8%	20.0%	.0%	3.4%	9.4%
		% of Total	.9%	2.6%	2.6%	1.7%	.0%	1.7%	9.4%
	E	Count	0	3	3	3	9	39	57
		% within Net annual production (quantity) of products	.0%	5.3%	5.3%	5.3%	15.8%	68.4%	100.0%
		% within Net annual sales revenue	.0%	18.8%	18.8%	30.0%	56.2%	67.2%	48.7%
		% of Total	.0%	2.6%	2.6%	2.6%	7.7%	33.3%	48.7%
Total		Count	1	16	16	10	16	58	117
		% within Net annual production (quantity) of products	.9%	13.7%	13.7%	8.5%	13.7%	49.6%	100.0%
		% within Net annual sales revenue	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	.9%	13.7%	13.7%	8.5%	13.7%	49.6%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	56.903a	30	0.002
Likelihood Ratio	55.025	30	0.004
N of Valid Cases	117		

a. 35 cells (83.3%) have expected count less than 5. The minimum expected count is .01.

Directional Measures

			Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Ordinal by Ordinal	Somers' d	Symmetric	0.281	0.071	4.001	0
		Net annual production (quantity) of products Dependent	0.284	0.071	4.001	0
		Net annual sales revenue Dependent	0.278	0.073	4.001	0

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Symmetric Measures

		Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Ordinal by Ordinal	Kendall's tau-b	0.281	0.071	4.001	0
	Kendall's tau-c	0.236	0.059	4.001	0

	Gamma	0.369	0.089	4.001	0
N of Valid Cases		117			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Results:

1) The two variables are significantly associated with each other, based on a two-tailed significance level of $p=0.002<0.05$.
2) By knowing net annual sales revenue, we are able to realize a proportional reduction in error of 27.8 per cent in predicating net annual production (quantity) of products; by knowing net annual production (quantity) of products, we have 28.4 per cent of possibility to know net annual sales revenue.
3) The relationship of the two variables is not too strong, with Gamma of 0.369.

C. Net annual production (quantity) of products * Investment of design in NPD Crosstabulation

			Investment in design in NPD							Total
			No reply	A	B	C	D	E	F	
Net annual production (quantity) of products	No reply	Count	3	1	0	2	1	1	0	8
		% within Net annual production (quantity) of products	37.5%	12.5%	.0%	25.0%	12.5%	12.5%	.0%	100.0%
		% within Investment in design in NPD	50.0%	5.3%	.0%	8.3%	4.5%	10.0%	.0%	6.8%
		% of Total	2.6%	.9%	.0%	1.7%	.9%	.9%	.0%	6.8%
	A	Count	1	3	9	3	1	1	0	18
		% within Net annual production (quantity) of products	5.6%	16.7%	50.0%	16.7%	5.6%	5.6%	.0%	100.0%
		% within Investment in design in NPD	16.7%	15.8%	28.1%	12.5%	4.5%	10.0%	.0%	15.4%
		% of Total	.9%	2.6%	7.7%	2.6%	.9%	.9%	.0%	15.4%
	B	Count	2	2	4	2	2	1	0	13
		% within Net annual production (quantity) of products	15.4%	15.4%	30.8%	15.4%	15.4%	7.7%	.0%	100.0%
		% within Investment in design in NPD	33.3%	10.5%	12.5%	8.3%	9.1%	10.0%	.0%	11.1%
		% of Total	1.7%	1.7%	3.4%	1.7%	1.7%	.9%	.0%	11.1%
	BD	Count	0	0	0	0	1	0	0	1
		% within Net annual production (quantity) of products	.0%	.0%	.0%	.0%	100.0%	.0%	.0%	100.0%
		% within Investment in design in NPD	.0%	.0%	.0%	.0%	4.5%	.0%	.0%	.9%
		% of Total	.0%	.0%	.0%	.0%	.9%	.0%	.0%	.9%
	C	Count	0	0	4	4	0	1	0	9
		% within Net annual production (quantity) of products	.0%	.0%	44.4%	44.4%	.0%	11.1%	.0%	100.0%

		% within Investment in design in NPD	.0%	.0%	12.5%	16.7%	.0%	10.0%	.0%	7.7%
		% of Total	.0%	.0%	3.4%	3.4%	.0%	.9%	.0%	7.7%
	D	Count	0	3	1	3	3	0	1	11
		% within Net annual production (quantity) of products	.0%	27.3%	9.1%	27.3%	27.3%	.0%	9.1%	100.0%
		% within Investment in design in NPD	.0%	15.8%	3.1%	12.5%	13.6%	.0%	25.0%	9.4%
		% of Total	.0%	2.6%	.9%	2.6%	2.6%	.0%	.9%	9.4%
	E	Count	0	10	14	10	14	6	3	57
		% within Net annual production (quantity) of products	.0%	17.5%	24.6%	17.5%	24.6%	10.5%	5.3%	100.0%
		% within Investment in design in NPD	.0%	52.6%	43.8%	41.7%	63.6%	60.0%	75.0%	48.7%
		% of Total	.0%	8.5%	12.0%	8.5%	12.0%	5.1%	2.6%	48.7%
Total		Count	6	19	32	24	22	10	4	117
		% within Net annual production (quantity) of products	5.1%	16.2%	27.4%	20.5%	18.8%	8.5%	3.4%	100.0%
		% within Investment in design in NPD	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	5.1%	16.2%	27.4%	20.5%	18.8%	8.5%	3.4%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	51.079a	36	0.049
Likelihood Ratio	50.45	36	0.056
N of Valid Cases	117		

a. 45 cells (91.8%) have expected count less than 5. The minimum expected count is .03.

Directional Measures

			Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Ordinal by Ordinal	Somers' d	Symmetric	0.191	0.076	2.504	0.012
		Net annual production (quantity) of products Dependent	0.179	0.071	2.504	0.012
		Investment in design in NPD Dependent	0.205	0.082	2.504	0.012

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Symmetric Measures

		Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Ordinal by Ordinal	Kendall's tau-b	0.192	0.076	2.504	0.012
	Kendall's tau-c	0.169	0.068	2.504	0.012
	Gamma	0.25	0.098	2.504	0.012
N of Valid Cases		117			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Results:

1) The two variables are significantly associated with each other, based on a two-tailed significance level of $p=0.049<0.05$.
2) By knowing investment in design in NPD, we are able to realize a proportional reduction in error of 17.9 per cent in predicating net annual production (quantity) of products; by knowing net annual production (quantity) of products, we have 20.5 per cent of possibility to know investment in design in NPD.
3) The relationship of the two variables is not too strong, with Gamma of 0.25.

D. Product ranges developed annually with employment of design * Investment in design in NPD

Crosstabulation

			Investment in design in NPD							Total
			No reply	A	B	C	D	E	F	
Product ranges developed annually with employment of design	No reply	Count	5	0	1	0	0	0	0	6
		% within Product ranges developed annually with employment of design	83.3%	.0%	16.7%	.0%	.0%	.0%	.0%	100.0%
		% within Investment in design in NPD	83.3%	.0%	3.1%	.0%	.0%	.0%	.0%	5.1%
		% of Total	4.3%	.0%	.9%	.0%	.0%	.0%	.0%	5.1%
	A	Count	0	12	16	4	2	0	0	34
		% within Product ranges developed annually with employment of design	.0%	35.3%	47.1%	11.8%	5.9%	.0%	.0%	100.0%
		% within Investment in design in NPD	.0%	63.2%	50.0%	16.7%	9.1%	.0%	.0%	29.1%
		% of Total	.0%	10.3%	13.7%	3.4%	1.7%	.0%	.0%	29.1%
	B	Count	0	2	7	5	5	0	0	19
		% within Product ranges developed annually with employment of design	.0%	10.5%	36.8%	26.3%	26.3%	.0%	.0%	100.0%
		% within Investment in design in NPD	.0%	10.5%	21.9%	20.8%	22.7%	.0%	.0%	16.2%
		% of Total	.0%	1.7%	6.0%	4.3%	4.3%	.0%	.0%	16.2%
	C	Count	0	1	4	3	12	4	0	24
		% within Product ranges developed annually with employment of design	.0%	4.2%	16.7%	12.5%	50.0%	16.7%	.0%	100.0%
		% within Investment in design in NPD	.0%	5.3%	12.5%	12.5%	54.5%	40.0%	.0%	20.5%
		% of Total	.0%	.9%	3.4%	2.6%	10.3%	3.4%	.0%	20.5%
	D	Count	1	0	2	5	1	2	1	12
		% within Product ranges developed annually with employment of design	8.3%	.0%	16.7%	41.7%	8.3%	16.7%	8.3%	100.0%

		% within Investment in design in NPD	16.7%	.0%	6.2%	20.8%	4.5%	20.0%	25.0%	10.3%
		% of Total	.9%	.0%	1.7%	4.3%	.9%	1.7%	.9%	10.3%
	E	Count	0	4	2	7	2	4	3	22
		% within Product ranges developed annually with employment of design	.0%	18.2%	9.1%	31.8%	9.1%	18.2%	13.6%	100.0%
		% within Investment in design in NPD	.0%	21.1%	6.2%	29.2%	9.1%	40.0%	75.0%	18.8%
		% of Total	.0%	3.4%	1.7%	6.0%	1.7%	3.4%	2.6%	18.8%
Total		Count	6	19	32	24	22	10	4	117
		% within Product ranges developed annually with employment of design	5.1%	16.2%	27.4%	20.5%	18.8%	8.5%	3.4%	100.0%
		% within Investment in design in NPD	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	5.1%	16.2%	27.4%	20.5%	18.8%	8.5%	3.4%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.470E2a	30	0
Likelihood Ratio	104.217	30	0
N of Valid Cases	117		

a. 35 cells (83.3%) have expected count less than 5. The minimum expected count is .21.

Directional Measures

			Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Ordinal by Ordinal	Somers' d	Symmetric	0.439	0.068	6.346	0
		Product ranges developed annually with employment of design Dependent	0.436	0.067	6.346	0
		Investment in design in NPD Dependent	0.442	0.07	6.346	0

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Symmetric Measures

		Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Ordinal by Ordinal	Kendall's tau-b	0.439	0.068	6.346	0
	Kendall's tau-c	0.424	0.067	6.346	0
	Gamma	0.525	0.079	6.346	0
N of Valid Cases		117			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Results:

1) The two variables are significantly associated with each other, based on a

two-tailed significance level of $p=0<0.05$.

2) By knowing investment in design in NPD, we are able to realize a proportional reduction in error of 43.6 per cent in predicating product ranges developed annually with employment of design; by knowing product ranges developed annually with employment of design, we have 44.2 per cent of possibility to know investment in design in NPD.
3) The relationship of the two variables is strong, with Gamma of 0.525.

E. Number of employees * Annual expenditure in design (RMB)

Crosstabulation

			Annual expenditure in design (RMB)						Total
			No reply	A	B	C	D	E	
Number of employees	No reply	Count	0	0	0	0	0	0	1
		% within Number of employees	.0%	.0%	100.0%	.0%	.0%	.0%	100.0%
		% within Annual expenditure in design (RMB)	.0%	.0%	2.3%	.0%	.0%	.0%	.9%
		% of Total	.0%	.0%	.9%	.0%	.0%	.0%	.9%
	A	Count	4	14	4	1	1	0	24
		% within Number of employees	16.7%	58.3%	16.7%	4.2%	4.2%	.0%	100.0%
		% within Annual expenditure in design(RMB)	57.1%	33.3%	9.3%	6.7%	16.7%	.0%	20.5%
		% of Total	3.4%	12.0%	3.4%	.9%	.9%	.0%	20.5%
	B	Count	0	15	7	1	0	0	23
		% within Number of employees	.0%	65.2%	30.4%	4.3%	.0%	.0%	100.0%
		% within Annual expenditure in design (RMB)	.0%	35.7%	16.3%	6.7%	.0%	.0%	19.7%
		% of Total	.0%	12.8%	6.0%	.9%	.0%	.0%	19.7%
	C	Count	1	8	11	7	3	1	31
		% within Number of employees	3.2%	25.8%	35.5%	22.6%	9.7%	3.2%	100.0%
		% within Annual expenditure in design (RMB)	14.3%	19.0%	25.6%	46.7%	50.0%	25.0%	26.5%
		% of Total	.9%	6.8%	9.4%	6.0%	2.6%	.9%	26.5%
	D	Count	0	2	7	2	1	0	12
		% within Number of employees	.0%	16.7%	58.3%	16.7%	8.3%	.0%	100.0%
		% within Annual expenditure in design (RMB)	.0%	4.8%	16.3%	13.3%	16.7%	.0%	10.3%
		% of Total	.0%	1.7%	6.0%	1.7%	.9%	.0%	10.3%
	E	Count	2	3	13	4	1	3	26
		% within Number of employees	7.7%	11.5%	50.0%	15.4%	3.8%	11.5%	100.0%
		% within Annual expenditure in design (RMB)	28.6%	7.1%	30.2%	26.7%	16.7%	75.0%	22.2%
		% of Total	1.7%	2.6%	11.1%	3.4%	.9%	2.6%	22.2%
Total		Count	7	42	43	15	6	4	117
		% within Number of employees	6.0%	35.9%	36.8%	12.8%	5.1%	3.4%	100.0%
		% within Annual expenditure in design (RMB)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

	% of Total	6.0%	35.9%	36.8%	12.8%	5.1%	3.4%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	44.958a	25	0.008
Likelihood Ratio	48.041	25	0.004
N of Valid Cases	117		

a. 28 cells (77.8%) have expected count less than 5. The minimum expected count is .03.

Directional Measures

			Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Ordinal by Ordinal	Somers' d	Symmetric	0.345	0.07	4.92	0
		Number of employees Dependent	0.363	0.074	4.92	0
		Annual expenditure in design (RMB) Dependent	0.328	0.067	4.92	0

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Symmetric Measures

		Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Ordinal by Ordinal	Kendall's tau-b	0.345	0.07	4.92	0
	Kendall's tau-c	0.311	0.063	4.92	0
	Gamma	0.45	0.09	4.92	0
N of Valid Cases		117			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Results:

1) The two variables are significantly associated with each other, based on a two-tailed significance level of p=0.008<0.05.
2) By knowing annual expenditure in design (RMB), we are able to realize a proportional reduction in error of 36.3 per cent in predicating scale of employees; by knowing scale of employees, we have 32.8 per cent of possibility to know annual expenditure in design (RMB).
3) The relationship of the two variables is strong, with Gamma of 0.45.

F. Net annual sales revenue * Annual expenditure in design (RMB)

Crosstabulation

			Annual expenditure in design (RMB)						Total
			No reply	A	B	C	D	E	
Net annual sales revenue	No reply	Count	1	0	0	0	0	0	1
		% within Net annual sales revenue	100.0%	.0%	.0%	.0%	.0%	.0%	100.0%
		% within Annual expenditure in design (RMB)	14.3%	.0%	.0%	.0%	.0%	.0%	.9%
		% of Total	.9%	.0%	.0%	.0%	.0%	.0%	.9%
	A	Count	3	9	2	1	1	0	16
		% within Net annual sales revenue	18.8%	56.2%	12.5%	6.2%	6.2%	.0%	100.0%
		% within Annual expenditure in design (RMB)	42.9%	21.4%	4.7%	6.7%	16.7%	.0%	13.7%
		% of Total	2.6%	7.7%	1.7%	.9%	.9%	.0%	13.7%
	B	Count	1	9	5	1	0	0	16
		% within Net annual sales revenue	6.2%	56.2%	31.2%	6.2%	.0%	.0%	100.0%
		% within Annual expenditure in design (RMB)	14.3%	21.4%	11.6%	6.7%	.0%	.0%	13.7%
		% of Total	.9%	7.7%	4.3%	.9%	.0%	.0%	13.7%
	C	Count	0	5	5	0	0	0	10
		% within Net annual sales revenue	.0%	50.0%	50.0%	.0%	.0%	.0%	100.0%
		% within Annual expenditure in design (RMB)	.0%	11.9%	11.6%	.0%	.0%	.0%	8.5%
		% of Total	.0%	4.3%	4.3%	.0%	.0%	.0%	8.5%
	D	Count	0	8	3	5	0	0	16
		% within Net annual sales revenue	.0%	50.0%	18.8%	31.2%	.0%	.0%	100.0%
		% within Annual expenditure in design (RMB)	.0%	19.0%	7.0%	33.3%	.0%	.0%	13.7%
		% of Total	.0%	6.8%	2.6%	4.3%	.0%	.0%	13.7%
	E	Count	2	11	28	8	5	4	58
		% within Net annual sales revenue	3.4%	19.0%	48.3%	13.8%	8.6%	6.9%	100.0%
		% within Annual expenditure in design (RMB)	28.6%	26.2%	65.1%	53.3%	83.3%	100.0%	49.6%
		% of Total	1.7%	9.4%	23.9%	6.8%	4.3%	3.4%	49.6%
Total		Count	7	42	43	15	6	4	117
		% within Net annual sales revenue	6.0%	35.9%	36.8%	12.8%	5.1%	3.4%	100.0%
		% within Annual expenditure in design (RMB)	100.0%	100.0 %	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	6.0%	35.9%	36.8%	12.8%	5.1%	3.4%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	52.944a	25	0.001
Likelihood Ratio	47.904	25	0.004
N of Valid Cases	117		

a. 27 cells (75.0%) have expected count less than 5. The minimum expected count is .03.

Directional Measures

			Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Ordinal by Ordinal	Somers' d	Symmetric	0.362	0.072	4.917	0
		Net annual sales revenue Dependent	0.357	0.072	4.917	0
		Annual expenditure in design (RMB) Dependent	0.368	0.074	4.917	0

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Symmetric Measures

		Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Ordinal by Ordinal	Kendall's tau-b	0.362	0.072	4.917	0
	Kendall's tau-c	0.305	0.062	4.917	0
	Gamma	0.505	0.097	4.917	0
N of Valid Cases		117			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Results:

1) The two variables are significantly associated with each other, based on a two-tailed significance level of $p=0.001<0.05$.
2) By knowing annual expenditure in design (RMB), we are able to realize a proportional reduction in error of 35.7 per cent in predicating net annual sales revenue; by knowing net annual sales revenue, we have 36.8 per cent of possibility to know annual expenditure in design (RMB).
3) The relationship of the two variables is strong, with Gamma of 0.505.

G. Product ranges developed annually with employment of design * Annual expenditure in design (RMB)

Crosstabulation

			Annual expenditure in design (RMB)						Total
			No reply	A	B	C	D	E	
Product ranges developed annually with	No reply	Count	5	0	0	1	0	0	6
		% within Product ranges developed annually with employment of design	83.3%	.0%	.0%	16.7%	.0%	.0%	100.0%
		% within Annual expenditure	71.4%	.0%	.0%	6.7%	.0%	.0%	5.1%

employment of design		in design (RMB)							
		% of Total	4.3%	.0%	.0%	.9%	.0%	.0%	5.1%
	A	Count	0	18	14	2	0	0	34
		% within Product ranges developed annually with employment of design	.0%	52.9%	41.2%	5.9%	.0%	.0%	100.0%
		% within Annual expenditure in design (RMB)	.0%	42.9%	32.6%	13.3%	.0%	.0%	29.1%
		% of Total	.0%	15.4%	12.0%	1.7%	.0%	.0%	29.1%
	B	Count	0	7	9	1	1	1	19
		% within Product ranges developed annually with employment of design	.0%	36.8%	47.4%	5.3%	5.3%	5.3%	100.0%
		% within Annual expenditure in design (RMB)	.0%	16.7%	20.9%	6.7%	16.7%	25.0%	16.2%
		% of Total	.0%	6.0%	7.7%	.9%	.9%	.9%	16.2%
	C	Count	0	8	9	4	2	1	24
		% within Product ranges developed annually with employment of design	.0%	33.3%	37.5%	16.7%	8.3%	4.2%	100.0%
		% within Annual expenditure in design (RMB)	.0%	19.0%	20.9%	26.7%	33.3%	25.0%	20.5%
		% of Total	.0%	6.8%	7.7%	3.4%	1.7%	.9%	20.5%
	D	Count	0	4	4	1	2	1	12
		% within Product ranges developed annually with employment of design	.0%	33.3%	33.3%	8.3%	16.7%	8.3%	100.0%
		% within Annual expenditure in design (RMB)	.0%	9.5%	9.3%	6.7%	33.3%	25.0%	10.3%
		% of Total	.0%	3.4%	3.4%	.9%	1.7%	.9%	10.3%
	E	Count	2	5	7	6	1	1	22
		% within Product ranges developed annually with employment of design	9.1%	22.7%	31.8%	27.3%	4.5%	4.5%	100.0%
		% within Annual expenditure in design (RMB)	28.6%	11.9%	16.3%	40.0%	16.7%	25.0%	18.8%
		% of Total	1.7%	4.3%	6.0%	5.1%	.9%	.9%	18.8%
Total		Count	7	42	43	15	6	4	117
		% within Product ranges developed annually with employment of design	6.0%	35.9%	36.8%	12.8%	5.1%	3.4%	100.0%
		% within Annual expenditure in design (RMB)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	6.0%	35.9%	36.8%	12.8%	5.1%	3.4%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	89.307a	25	0
Likelihood Ratio	57.328	25	0
N of Valid Cases	117		

a. 28 cells (77.8%) have expected count less than 5. The minimum expected count is .21.

Directional Measures

			Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Ordinal by Ordinal	Somers' d	Symmetric	0.259	0.08	3.204	0.001
		Q26. Product ranges developed annually with employment of design Dependent	0.274	0.084	3.204	0.001

		Q30. Annual expenditure in design (RMB) Dependent	0.245	0.076	3.204	0.001

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Symmetric Measures

		Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Ordinal by Ordinal	Kendall's tau-b	0.259	0.08	3.204	0.001
	Kendall's tau-c	0.235	0.073	3.204	0.001
	Gamma	0.335	0.1	3.204	0.001
N of Valid Cases		117			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Results:

1) The two variables are significantly associated with each other, based on a two-tailed significance level of *p*=0 <0.05.
2) By knowing annual expenditure in design (RMB), we are able to realize a proportional reduction in error of 27.4 per cent in predicating product ranges developed annually with employment of design; by knowing product ranges developed annually with employment of design, we have 24.5 per cent of possibility to know annual expenditure in design (RMB).
3) The relationship of the two variables is not too strong, with Gamma of 0.335.

H. Investment in design in NPD * Annual expenditure in design (RMB)

Crosstabulation

			Annual expenditure in design (RMB)						Total
			No reply	A	B	C	D	E	
Investment of design in NPD	No reply	Count	4	1		1	0	0	6
		% within Investment in design in NPD	66.7%	16.7%	.0%	16.7%	.0%	.0%	100.0%
		% within Annual expenditure in design (RMB)	57.1%	2.4%	.0%	6.7%	.0%	.0%	5.1%
		% of Total	3.4%	.9%	.0%	.9%	.0%	.0%	5.1%
	A	Count	0	11	5	3	0	0	19
		% within Investment in design in NPD	.0%	57.9%	26.3%	15.8%	.0%	.0%	100.0%
		% within Annual expenditure in design (RMB)	.0%	26.2%	11.6%	20.0%	.0%	.0%	16.2%
		% of Total	.0%	9.4%	4.3%	2.6%	.0%	.0%	16.2%

	B	Count	1	13	14	1	2	1	32
		% within Investment in design in NPD	3.1%	40.6%	43.8%	3.1%	6.2%	3.1%	100.0%
		% within Annual expenditure in design (RMB)	14.3%	31.0%	32.6%	6.7%	33.3%	25.0%	27.4%
		% of Total	.9%	11.1%	12.0%	.9%	1.7%	.9%	27.4%
	C	Count	0	11	9	3	0	1	24
		% within Investment in design in NPD	.0%	45.8%	37.5%	12.5%	.0%	4.2%	100.0%
		% within Annual expenditure in design (RMB)	.0%	26.2%	20.9%	20.0%	.0%	25.0%	20.5%
		% of Total	.0%	9.4%	7.7%	2.6%	.0%	.9%	20.5%
	D	Count	0	5	9	4	2	2	22
		% within Investment in design in NPD	.0%	22.7%	40.9%	18.2%	9.1%	9.1%	100.0%
		% within Annual expenditure in design (RMB)	.0%	11.9%	20.9%	26.7%	33.3%	50.0%	18.8%
		% of Total	.0%	4.3%	7.7%	3.4%	1.7%	1.7%	18.8%
	E	Count	0	1	5	2	2	0	10
		% within Investment in design in NPD	.0%	10.0%	50.0%	20.0%	20.0%	.0%	100.0%
		% within Annual expenditure in design (RMB)	.0%	2.4%	11.6%	13.3%	33.3%	.0%	8.5%
		% of Total	.0%	.9%	4.3%	1.7%	1.7%	.0%	8.5%
	F	Count	2	0	1	1	0	0	4
		% within Investment in design in NPD	50.0%	.0%	25.0%	25.0%	.0%	.0%	100.0%
		% within Annual expenditure in design (RMB)	28.6%	.0%	2.3%	6.7%	.0%	.0%	3.4%
		% of Total	1.7%	.0%	.9%	.9%	.0%	.0%	3.4%
Total		Count	7	42	43	15	6	4	117
		% within Investment in design in NPD	6.0%	35.9%	36.8%	12.8%	5.1%	3.4%	100.0%
		% within Annual expenditure in design (RMB)	100.0 %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	6.0%	35.9%	36.8%	12.8%	5.1%	3.4%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	82.283a	30	0
Likelihood Ratio	60.427	30	0.001
N of Valid Cases	117		

a. 34 cells (81.0%) have expected count less than 5. The minimum expected count is .14.

Directional Measures

			Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Ordinal by Ordinal	Somers' d	Symmetric	0.258	0.08	3.207	0.001
		Investment in design in NPD Dependent	0.276	0.086	3.207	0.001
		Annual expenditure in design (RMB) Dependent	0.243	0.075	3.207	0.001

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Symmetric Measures

		Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Ordinal by Ordinal	Kendall's tau-b	0.259	0.08	3.207	0.001
	Kendall's tau-c	0.236	0.074	3.207	0.001
	Gamma	0.333	0.102	3.207	0.001
N of Valid Cases		117			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Results:

1) The two variables are significantly associated with each other, based on a two-tailed significance level of *p*=0 <0.05.
2) By knowing annual expenditure in design (RMB), we are able to realize a proportional reduction in error of 27.6 per cent in predicating investment in design in NPD; by knowing investment in design in NPD, we have 24.3 per cent of possibility to know annual expenditure in design (RMB).
3) The relationship of the two variables is not too strong, with Gamma of 0.333.

F-3. Nominal by Ordinal

A. Number of employees * In-house design

Crosstabulation

			In-house design				Total
			No reply	A	B	NA	
Number of employees	No reply	Count	0	1	0	0	1
		% within Number of employees	.0%	100.0%	.0%	.0%	100.0%
		% within In-house design	.0%	1.1%	.0%	.0%	.9%
		% of Total	.0%	.9%	.0%	.0%	.9%
	A	Count	2	11	11	0	24
		% within Number of employees	8.3%	45.8%	45.8%	.0%	100.0%
		% within In-house design	100.0%	12.0%	50.0%	.0%	20.5%
		% of Total	1.7%	9.4%	9.4%	.0%	20.5%
	B	Count	0	18	5	0	23
		% within Number of employees	.0%	78.3%	21.7%	.0%	100.0%
		% within In-house design	.0%	19.6%	22.7%	.0%	19.7%
		% of Total	.0%	15.4%	4.3%	.0%	19.7%
	C	Count	0	28	2	1	31
		% within Number of employees	.0%	90.3%	6.5%	3.2%	100.0%
		% within In-house design	.0%	30.4%	9.1%	100.0%	26.5%
		% of Total	.0%	23.9%	1.7%	.9%	26.5%
	D	Count	0	11	1	0	12
		% within Number of employees	.0%	91.7%	8.3%	.0%	100.0%
		% within In-house design	.0%	12.0%	4.5%	.0%	10.3%
		% of Total	.0%	9.4%	.9%	.0%	10.3%
	E	Count	0	23	3	0	26
		% within Number of employees	.0%	88.5%	11.5%	.0%	100.0%
		% within In-house design	.0%	25.0%	13.6%	.0%	22.2%

		% of Total	.0%	19.7%	2.6%	.0%	22.2%
Total		Count	2	92	22	1	117
		% within Number of employees	1.7%	78.6%	18.8%	.9%	100.0%
		% within In-house design	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	1.7%	78.6%	18.8%	.9%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	28.547a	15	0.018
Likelihood Ratio	26.198	15	0.036
N of Valid Cases	117		

a. 18 cells (75.0%) have expected count less than 5. The minimum expected count is .01.

Directional Measures

			Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Nominal by Nominal	Lambda	Symmetric	0.099	0.031	2.943	0.003
		Number of employees Dependent	0.128	0.042	2.943	0.003
		In-house design Dependent	0	0	.c	.c
	Goodman and Kruskal tau	Number of employees Dependent	0.065	0.02		0.001
		In-house design Dependent	0.153	0.069		0
	Uncertainty Coefficient	Symmetric	0.101	0.035	2.78	.036e
		Number of employees Dependent	0.07	0.025	2.78	.036e
		In-house design Dependent	0.182	0.057	2.78	.036e
Ordinal by Ordinal	Somers' d	Symmetric	-0.179	0.083	-2.109	0.035
		Number of employees Dependent	-0.293	0.137	-2.109	0.035
		In-house design Dependent	-0.129	0.061	-2.109	0.035

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Cannot be computed because the asymptotic standard error equals zero.

d. Based on chi-square approximation

e. Likelihood ratio chi-square probability.

Symmetric Measures

		Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Nominal by Nominal	Phi	0.494			0.018
	Cramer's V	0.285			0.018
	Contingency Coefficient	0.443			0.018
Ordinal by Ordinal	Kendall's tau-b	-0.194	0.091	-2.109	0.035
	Kendall's tau-c	-0.135	0.064	-2.109	0.035
	Gamma	-0.357	0.163	-2.109	0.035
N of Valid Cases		117			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Results:

1) The two variables are significantly associated with each other, based on a two-tailed significance level of p=0.018 <0.05.
2) Since whether in-house design department has been established can be represented by 0 and 1, the variable can be considered as ordinal variable. Based on it, by knowing the establishment of in-house design department, we are able to realize a proportional reduction in error of 29.3 per cent in predicating scale of employees; by knowing scale of employees, we have 12.9 per cent of possibility to know the establishment of in-house design department.
3) The establishment of in-house design department and scale of employees are positive correlation (A represents has in-house design department, while B represent has not). It implies that in-house design departments usually are established in larger companies.
4) The relationship of the two variables is not too strong, with Gamma of -0.357.

B. Net annual production (quantity) of products * In-house design

Crosstabulation

			In-house design				Total
			No reply	A	B	NA	
Net annual production (quantity) of products	No reply	Count	0	5	2	1	8
		% within Net annual production (quantity) of products	.0%	62.5%	25.0%	12.5%	100.0%
		% within In-house design	.0%	5.4%	9.1%	100.0%	6.8%
		% of Total	.0%	4.3%	1.7%	.9%	6.8%
	A	Count	1	13	4	0	18
		% within Net annual production (quantity) of products	5.6%	72.2%	22.2%	.0%	100.0%
		% within In-house design	50.0%	14.1%	18.2%	.0%	15.4%
		% of Total	.9%	11.1%	3.4%	.0%	15.4%
	B	Count	1	7	5	0	13
		% within Net annual production (quantity) of products	7.7%	53.8%	38.5%	.0%	100.0%
		% within In-house design	50.0%	7.6%	22.7%	.0%	11.1%
		% of Total	.9%	6.0%	4.3%	.0%	11.1%
	BD	Count	0	1	0	0	1
		% within Net annual production (quantity) of products	.0%	100.0%	.0%	.0%	100.0%
		% within In-house design	.0%	1.1%	.0%	.0%	.9%
		% of Total	.0%	.9%	.0%	.0%	.9%
	C	Count	0	7	2	0	9
		% within Net annual production	.0%	77.8%	22.2%	.0%	100.0%

		(quantity) of products					
		% within In-house design	.0%	7.6%	9.1%	.0%	7.7%
		% of Total	.0%	6.0%	1.7%	.0%	7.7%
	D	Count	0	7	4	0	11
		% within Net annual production (quantity) of products	.0%	63.6%	36.4%	.0%	100.0%
		% within In-house design	.0%	7.6%	18.2%	.0%	9.4%
		% of Total	.0%	6.0%	3.4%	.0%	9.4%
	E	Count	0	52	5	0	57
		% within Net annual production (quantity) of products	.0%	91.2%	8.8%	.0%	100.0%
		% within In-house design	.0%	56.5%	22.7%	.0%	48.7%
		% of Total	.0%	44.4%	4.3%	.0%	48.7%
Total		Count	2	92	22	1	117
		% within Net annual production (quantity) of products	1.7%	78.6%	18.8%	.9%	100.0%
		% within In-house design	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	1.7%	78.6%	18.8%	.9%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	30.318a	18	0.034
Likelihood Ratio	21.692	18	0.246
N of Valid Cases	117		

a. 21 cells (75.0%) have expected count less than 5. The minimum expected count is .01.

Directional Measures

			Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Nominal by Nominal	Lambda	Symmetric	0.024	0.04	0.578	0.563
		Net annual production (quantity) of products Dependent	0.033	0.057	0.578	0.563
		In-house design Dependent	0	0	.c	.c
	Goodman and Kruskal tau	Net annual production (quantity) of products Dependent	0.06	0.02		0.001
		In-house design Dependent	0.099	0.051		0.011
	Uncertainty Coefficient	Symmetric	0.087	0.034	2.41	.246e
		Net annual production (quantity) of products Dependent	0.061	0.025	2.41	.246e
		In-house design Dependent	0.151	0.054	2.41	.246e
Ordinal by Ordinal	Somers' d	Symmetric	-0.169	0.08	-2.079	0.038
		Net annual production (quantity) of products Dependent	-0.257	0.12	-2.079	0.038
		In-house design Dependent	-0.126	0.061	-2.079	0.038

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Cannot be computed because the asymptotic standard error equals zero.

d. Based on chi-square approximation

e. Likelihood ratio chi-square probability.

Symmetric Measures

		Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Nominal by Nominal	Phi	0.509			0.034
	Cramer's V	0.294			0.034
	Contingency Coefficient	0.454			0.034
Ordinal by Ordinal	Kendall's tau-b	-0.18	0.085	-2.079	0.038
	Kendall's tau-c	-0.119	0.057	-2.079	0.038
	Gamma	-0.315	0.139	-2.079	0.038
N of Valid Cases		117			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Results:

1) The two variables are associated with each other, based on a two-tailed significance level of $p=0.034 <0.05$.
2) Since whether in-house design department has been established can be represented by 0 and 1, the variable can be considered as ordinal variable. Based on it, by knowing the establishment of in-house design department, we are able to realize a proportional reduction in error of 25.7 per cent in predicating net annual production (quantity) of products; by knowing net annual production (quantity) of products, we have 12.6 per cent of possibility to know the establishment of in-house design department.
3) The establishment of in-house design department and scale of employees are positive correlation (A represents has in-house design department, while B represent has not). It implies that in-house design departments usually are established in larger companies.
4) The relationship of the two variables is not too strong, with Gamma of -0.315.

C. Product ranges developed annually with employment of design * Design in NPD

Crosstabulation

	design in NPD					Total
	No reply	A	B	C	Not	

Product ranges developed annually with employment of design	No reply	Count	4	1	1	0	0	6
		% within Product ranges developed annually with employment of design	66.7%	16.7%	16.7%	.0%	.0%	100.0%
		% within design in NPD	44.4%	2.8%	1.7%	.0%	.0%	5.1%
		% of Total	3.4%	.9%	.9%	.0%	.0%	5.1%
	A	Count	3	13	14	3	1	34
		% within Product ranges developed annually with employment of design	8.8%	38.2%	41.2%	8.8%	2.9%	100.0%
		% within design in NPD	33.3%	36.1%	23.7%	50.0%	14.3%	29.1%
		% of Total	2.6%	11.1%	12.0%	2.6%	.9%	29.1%
	B	Count	1	8	6	3	1	19
		% within Product ranges developed annually with employment of design	5.3%	42.1%	31.6%	15.8%	5.3%	100.0%
		% within design in NPD	11.1%	22.2%	10.2%	50.0%	14.3%	16.2%
		% of Total	.9%	6.8%	5.1%	2.6%	.9%	16.2%
	C	Count	0	4	18	0	2	24
		% within Product ranges developed annually with employment of design	.0%	16.7%	75.0%	.0%	8.3%	100.0%
		% within design in NPD	.0%	11.1%	30.5%	.0%	28.6%	20.5%
		% of Total	.0%	3.4%	15.4%	.0%	1.7%	20.5%
	D	Count	1	1	8	0	2	12
		% within Product ranges developed annually with employment of design	8.3%	8.3%	66.7%	.0%	16.7%	100.0%
		% within design in NPD	11.1%	2.8%	13.6%	.0%	28.6%	10.3%
		% of Total	.9%	.9%	6.8%	.0%	1.7%	10.3%
	E	Count	0	9	12	0	1	22
		% within Product ranges developed annually with employment of design	.0%	40.9%	54.5%	.0%	4.5%	100.0%
		% within design in NPD	.0%	25.0%	20.3%	.0%	14.3%	18.8%
		% of Total	.0%	7.7%	10.3%	.0%	.9%	18.8%
Total		Count	9	36	59	6	7	117
		% within Product ranges developed annually with employment of design	7.7%	30.8%	50.4%	5.1%	6.0%	100.0%
		% within design in NPD	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	7.7%	30.8%	50.4%	5.1%	6.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	55.656a	20	0
Likelihood Ratio	44.887	20	0.001
N of Valid Cases	117		

a. 21 cells (70.0%) have expected count less than 5. The minimum expected count is .31.

Directional Measures

			Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Nominal by Nominal	Lambda	Symmetric	0.078	0.057	1.334	0.182
		Product ranges developed annually with employment of design Dependent	0.072	0.075	0.929	0.353
		design in NPD Dependent	0.086	0.072	1.154	0.249
	Goodman and Kruskal tau	Product ranges developed annually with employment of design Dependent	0.066	0.019		.008c

		design in NPD Dependent	0.111	0.039		.000c
	Uncertainty Coefficient	Symmetric	0.132	0.033	3.82	0.001
		Product ranges developed annually with employment of design Dependent	0.114	0.029	3.82	0.001
		design in NPD Dependent	0.156	0.038	3.82	0.001
Ordinal by Ordinal	Somers' d	Symmetric	0.169	0.08	2.086	0.037
		Product ranges developed annually with employment of design Dependent	0.19	0.09	2.086	0.037
		design in NPD Dependent	0.152	0.073	2.086	0.037

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on chi-square approximation

d. Likelihood ratio chi-square probability.

Symmetric Measures

		Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Nominal by Nominal	Phi	0.69			0
	Cramer's V	0.345			0
	Contingency Coefficient	0.568			0
Ordinal by Ordinal	Kendall's tau-b	0.17	0.081	2.086	0.037
	Kendall's tau-c	0.152	0.073	2.086	0.037
	Gamma	0.233	0.109	2.086	0.037
N of Valid Cases		117			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Results:

1) The two variables are associated with each other, based on a two-tailed significance level of $p=0<0.05$.
2) Since the stage design brought in NPD can be represented by 0, 1 and 2, the variable can be considered as ordinal variable. Based on it, by knowing the stage design brought in NPD, we are able to realize a proportional reduction in error of 19 per cent in predicating product ranges developed annually with employment of design; by knowing product ranges developed annually with employment of design, we have 15.2 per cent of possibility to know the stage design brought in NPD.
3) The stage design brought in NPD and product ranges developed annually with employment of design are positive correlation.

4) The relationship of the two variables is not too strong, with Gamma of 0.233.

D. Outsourcing design * Investment in design in NPD

Crosstabulation

			Investment in design in NPD							Total
			No reply	A	B	C	D	E	F	
outsourcing design	No reply	Count	0	0	0	0	0	0	1	1
		% within outsourcing design	.0%	.0%	.0%	.0%	.0%	.0%	100.0%	100.0%
		% within Investment of design in NPD	.0%	.0%	.0%	.0%	.0%	.0%	25.0%	.9%
		% of Total	.0%	.0%	.0%	.0%	.0%	.0%	.9%	.9%
	A	Count	4	7	20	18	16	6	2	73
		% within outsourcing design	5.5%	9.6%	27.4%	24.7%	21.9%	8.2%	2.7%	100.0%
		% within Investment of design in NPD	66.7 %	36.8%	62.5%	75.0%	72.7%	60.0%	50.0%	62.4%
		% of Total	3.4%	6.0%	17.1%	15.4%	13.7%	5.1%	1.7%	62.4%
	B	Count	2	12	12	6	6	4	1	43
		% within outsourcing design	4.7%	27.9%	27.9%	14.0%	14.0%	9.3%	2.3%	100.0%
		% within Investment of design in NPD	33.3 %	63.2%	37.5%	25.0%	27.3%	40.0%	25.0%	36.8%
		% of Total	1.7%	10.3%	10.3%	5.1%	5.1%	3.4%	.9%	36.8%
Total		Count	6	19	32	24	22	10	4	117
		% within outsourcing design	5.1%	16.2%	27.4%	20.5%	18.8%	8.5%	3.4%	100.0%
		% within Investment of design in NPD	100. 0%	100.0 %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	5.1%	16.2%	27.4%	20.5%	18.8%	8.5%	3.4%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	36.599a	12	0
Likelihood Ratio	14.94	12	0.245
N of Valid Cases	117		

a. 12 cells (57.1%) have expected count less than 5. The minimum expected count is .03.

Directional Measures

			Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Nominal by Nominal	Lambda	Symmetric	0.047	0.063	0.729	0.466
		outsourcing design Dependent	0.114	0.093	1.154	0.249
		Investment of design in NPD Dependent	0.012	0.058	0.2	0.841
	Goodman and Kruskal tau	outsourcing design Dependent	0.074	0.047		.145c
		Investment of design in NPD Dependent	0.027	0.011		.100c

	Uncertainty Coefficient	Symmetric	0.052	0.03	1.709	0.245
		outsourcing design Dependent	0.091	0.05	1.709	0.245
		Investment in design in NPD Dependent	0.036	0.021	1.709	0.245
Ordinal by Ordinal	Somers' d	Symmetric	-0.161	0.081	-1.962	0.05
		outsourcing design Dependent	-0.128	0.065	-1.962	0.05
		Investment in design in NPD Dependent	-0.218	0.109	-1.962	0.05

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on chi-square approximation

d. Likelihood ratio chi-square probability.

Symmetric Measures

		Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Nominal by Nominal	Phi	0.559			0
	Cramer's V	0.395			0
	Contingency Coefficient	0.488			0
Ordinal by Ordinal	Kendall's tau-b	-0.167	0.084	-1.962	0.05
	Kendall's tau-c	-0.155	0.079	-1.962	0.05
	Gamma	-0.263	0.131	-1.962	0.05
N of Valid Cases		117			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Results:

1) The two variables are associated with each other, based on a two-tailed significance level of p=0<0.05.
2) Since whether outsource design can be represented by 0 and 1, the variable can be considered as ordinal variable. Based on it, by knowing investment in design in NPD, we are able to realize a proportional reduction in error of 12.8 per cent in predicating hiring external design; by knowing hiring external design, we have 21.8 per cent of possibility to know investment in design in NPD.
3) The investment in design in NPD and hiring external design are positive correlation (in outsourcing design, A represents outsourcing, while B

represents not outsourcing). This implies that companies hiring external design usually invest more in design in the new product development than companies not hiring external design.

4) The relationship of the two variables is not too strong, with Gamma of -0.263.

E. Design in NPD * Investment in design in NPD

Crosstabulation

			Investment in design in NPD							Total
			No reply	A	B	C	D	E	F	
design in NPD	No reply	Count	4	2	2	1	0	0	0	9
		% within design in NPD	44.4%	22.2%	22.2%	11.1%	.0%	.0%	.0%	100.0%
		% within Investment of design in NPD	66.7%	10.5%	6.2%	4.2%	.0%	.0%	.0%	7.7%
		% of Total	3.4%	1.7%	1.7%	.9%	.0%	.0%	.0%	7.7%
	Up	Count	1	9	10	7	6	1	2	36
		% within design in NPD	2.8%	25.0%	27.8%	19.4%	16.7%	2.8%	5.6%	100.0%
		% within Investment of design in NPD	16.7%	47.4%	31.2%	29.2%	27.3%	10.0%	50.0%	30.8%
		% of Total	.9%	7.7%	8.5%	6.0%	5.1%	.9%	1.7%	30.8%
	Mid	Count	1	8	14	16	9	9	2	59
		% within design in NPD	1.7%	13.6%	23.7%	27.1%	15.3%	15.3%	3.4%	100.0%
		% within Investment of design in NPD	16.7%	42.1%	43.8%	66.7%	40.9%	90.0%	50.0%	50.4%
		% of Total	.9%	6.8%	12.0%	13.7%	7.7%	7.7%	1.7%	50.4%
	Down	Count	0	0	5	0	1	0	0	6
		% within design in NPD	.0%	.0%	83.3%	.0%	16.7%	.0%	.0%	100.0%
		% within Investment of design in NPD	.0%	.0%	15.6%	.0%	4.5%	.0%	.0%	5.1%
		% of Total	.0%	.0%	4.3%	.0%	.9%	.0%	.0%	5.1%
	Not	Count	0	0	1	0	6	0	0	7
		% within design in NPD	.0%	.0%	14.3%	.0%	85.7%	.0%	.0%	100.0%
		% within Investment of design in NPD	.0%	.0%	3.1%	.0%	27.3%	.0%	.0%	6.0%
		% of Total	.0%	.0%	.9%	.0%	5.1%	.0%	.0%	6.0%
Total		Count	6	19	32	24	22	10	4	117
		% within design in NPD	5.1%	16.2%	27.4%	20.5%	18.8%	8.5%	3.4%	100.0%
		% within Investment of design in NPD	100.0 %	100.0%	100.0%	100.0 %	100.0%	100.0%	100.0%	100.0%
		% of Total	5.1%	16.2%	27.4%	20.5%	18.8%	8.5%	3.4%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	72.302a	24	0
Likelihood Ratio	55.11	24	0
N of Valid Cases	117		

a. 26 cells (74.3%) have expected count less than 5. The minimum expected count is .21.

Directional Measures

			Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Nominal by Nominal	Lambda	Symmetric	0.091	0.058	1.496	0.135
		design in NPD Dependent	0.069	0.085	0.787	0.432
		Investment of design in NPD Dependent	0.106	0.073	1.384	0.166
	Goodman and Kruskal tau	design in NPD Dependent	0.117	0.038		.000c
		Investment of design in NPD Dependent	0.098	0.025		.000c
	Uncertainty Coefficient	Symmetric	0.157	0.035	4.173	0
		design in NPD Dependent	0.192	0.041	4.173	0
		Investment of design in NPD Dependent	0.133	0.031	4.173	0
Ordinal by Ordinal	Somers' d	Symmetric	0.258	0.072	3.507	0
		design in NPD Dependent	0.231	0.065	3.507	0
		Investment in design in NPD Dependent	0.293	0.08	3.507	0

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on chi-square approximation

d. Likelihood ratio chi-square probability.

Symmetric Measures

		Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Nominal by Nominal	Phi	0.786			0
	Cramer's V	0.393			0
	Contingency Coefficient	0.618			0
Ordinal by Ordinal	Kendall's tau-b	0.26	0.072	3.507	0
	Kendall's tau-c	0.234	0.067	3.507	0
	Gamma	0.356	0.095	3.507	0
N of Valid Cases		117			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Results:

1) The two variables are associated with each other, based on a two-tailed significance level of $p=0<0.05$.
2) Since the stage design brought in NPD can be represented by 0, 1 and 2, the variable can be considered as ordinal variable. Based on it, by knowing investment in design in NPD, we are able to realize a proportional reduction in

error of 23.1 per cent in predicating the stage design brought in NPD; by knowing the stage design brought in NPD, we have 29.3 per cent of possibility to know investment in design in NPD.

3) The investment in design in NPD and the stage design brought in NPD are positive correlation.
4) The relationship of the two variables is not too strong, with Gamma of 0.356.

F. In-house design *Annual expenditure in design (RMB)

Crosstabulation

			Annual expenditure in design (RMB)						Total
			No reply	A	B	C	D	E	
In-house design	No reply	Count	1	0	1	0	0	0	2
		% within In-house design	50.0%	.0%	50.0%	.0%	.0%	.0%	100.0%
		% within Annual expenditure in design (RMB)	14.3%	.0%	2.3%	.0%	.0%	.0%	1.7%
		% of Total	.9%	.0%	.9%	.0%	.0%	.0%	1.7%
	A	Count	3	26	38	15	6	4	92
		% within In-house design	3.3%	28.3%	41.3%	16.3%	6.5%	4.3%	100.0%
		% within Annual expenditure in design (RMB)	42.9%	61.9%	88.4%	100.0%	100.0%	100.0%	78.6%
		% of Total	2.6%	22.2%	32.5%	12.8%	5.1%	3.4%	78.6%
	B	Count	2	16	4	0	0	0	22
		% within In-house design	9.1%	72.7%	18.2%	.0%	.0%	.0%	100.0%
		% within Annual expenditure in design (RMB)	28.6%	38.1%	9.3%	.0%	.0%	.0%	18.8%
		% of Total	1.7%	13.7%	3.4%	.0%	.0%	.0%	18.8%
	NA	Count	1	0	0	0	0	0	1
		% within In-house design	100.0%	.0%	.0%	.0%	.0%	.0%	100.0%
		% within Annual expenditure in design (RMB)	14.3%	.0%	.0%	.0%	.0%	.0%	.9%
		% of Total	.9%	.0%	.0%	.0%	.0%	.0%	.9%
Total		Count	7	42	43	15	6	4	117
		% within In-house design	6.0%	35.9%	36.8%	12.8%	5.1%	3.4%	100.0%
		% within Annual expenditure in design (RMB)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	6.0%	35.9%	36.8%	12.8%	5.1%	3.4%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	43.470a	15	0
Likelihood Ratio	33.946	15	0.003
N of Valid Cases	117		

a. 18 cells (75.0%) have expected count less than 5. The minimum expected count is .03.

Directional Measures

	Value	Asymp. Std.	Approx.	Approx.

				Errora	Tb	Sig.
Nominal by Nominal	Lambda	Symmetric	0.131	0.042	2.8	0.005
		In-house design Dependent	0	0	.c	.c
		Annual expenditure in design (RMB) Dependent	0.176	0.059	2.8	0.005
	Goodman and Kruskal tau	In-house design Dependent	0.168	0.055		0
		Annual expenditure in design (RMB) Dependent	0.084	0.028		0
	Uncertainty Coefficient	Symmetric	0.142	0.038	3.399	.003e
		In-house design Dependent	0.236	0.055	3.399	.003e
		Annual expenditure in design (RMB) Dependent	0.101	0.029	3.399	.003e
Ordinal by Ordinal	Somers' d	Symmetric	-0.316	0.07	-4.05	0
		In-house design Dependent	-0.235	0.058	-4.05	0
		Annual expenditure in design (RMB) Dependent	-0.484	0.103	-4.05	0

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Cannot be computed because the asymptotic standard error equals zero.

d. Based on chi-square approximation

e. Likelihood ratio chi-square probability.

Symmetric Measures

		Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Nominal by Nominal	Phi	0.61			0
	Cramer's V	0.352			0
	Contingency Coefficient	0.52			0
Ordinal by Ordinal	Kendall's tau-b	-0.337	0.074	-4.05	0
	Kendall's tau-c	-0.223	0.055	-4.05	0
	Gamma	-0.658	0.132	-4.05	0
N of Valid Cases		117			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Results:

1) The two variables are associated with each other, based on a two-tailed significance level of p=0<0.05.
2) Since whether establish in-house design department can be represented by 0 and 1, the variable can be considered as ordinal variable. Based on it, by knowing annual expenditure in design, we are able to realize a proportional reduction in error of 23.5 per cent in predicating establishment in-house design department; by knowing establishment in-house design department, we

have 48.4 per cent of possibility to know annual expenditure in design.

3) The establishment of in-house design department and annual expenditure in design are positive correlation (in in-house design department, A represents establishment of in-house design department, while B represents no in-house design department). This shows that companies with their own in-house design department will invest more in design facilities every year.
4) The relationship of the two variables is strong, with Gamma of -0.658.

G. Who make the final decision of design * Annual expenditure in design (RMB)

Crosstabulation

			Annual expenditure in design (RMB)						Total
			No reply	A	B	C	D	E	
Who make the final decision of design	No reply	Count	1	0	0	0	0	0	1
		% within Who make the final decision of design	100.0%	.0%	.0%	.0%	.0%	.0%	100.0%
		% within Annual expenditure in design (RMB)	14.3%	.0%	.0%	.0%	.0%	.0%	.9%
		% of Total	.9%	.0%	.0%	.0%	.0%	.0%	.9%
	Client	Count	0	0	0	1	1	0	2
		% within Who make the final decision of design	.0%	.0%	.0%	50.0%	50.0%	.0%	100.0%
		% within Annual expenditure in design (RMB)	.0%	.0%	.0%	6.7%	16.7%	.0%	1.7%
		% of Total	.0%	.0%	.0%	.9%	.9%	.0%	1.7%
	Design	Count	0	1	3	1	2	0	7
		% within Who make the final decision of design	.0%	14.3%	42.9%	14.3%	28.6%	.0%	100.0%
		% within Annual expenditure in design (RMB)	.0%	2.4%	7.0%	6.7%	33.3%	.0%	6.0%
		% of Total	.0%	.9%	2.6%	.9%	1.7%	.0%	6.0%
	Functional manager	Count	1	4	7	3	0	2	17
		% within Who make the final decision of design	5.9%	23.5%	41.2%	17.6%	.0%	11.8%	100.0%
		% within Annual expenditure in design (RMB)	14.3%	9.5%	16.3%	20.0%	.0%	50.0%	14.5%
		% of Total	.9%	3.4%	6.0%	2.6%	.0%	1.7%	14.5%
	Mixed	Count	0	6	1	2	0	1	10
		% within Who make the final decision of design	.0%	60.0%	10.0%	20.0%	.0%	10.0%	100.0%
		% within Annual expenditure in design (RMB)	.0%	14.3%	2.3%	13.3%	.0%	25.0%	8.5%
		% of Total	.0%	5.1%	.9%	1.7%	.0%	.9%	8.5%
	Other	Count	0	0	2	1	0	0	3
		% within Who make the final decision of design	.0%	.0%	66.7%	33.3%	.0%	.0%	100.0%
		% within Annual expenditure in design (RMB)	.0%	.0%	4.7%	6.7%	.0%	.0%	2.6%
		% of Total	.0%	.0%	1.7%	.9%	.0%	.0%	2.6%
	Top manager	Count	5	31	30	7	3	1	77
		% within Who make the final decision of design	6.5%	40.3%	39.0%	9.1%	3.9%	1.3%	100.0%

		% within Annual expenditure in design (RMB)	71.4%	73.8%	69.8%	46.7%	50.0%	25.0%	65.8%
		% of Total	4.3%	26.5%	25.6%	6.0%	2.6%	.9%	65.8%
Total		Count	7	42	43	15	6	4	117
		% within Who make the final decision of design	6.0%	35.9%	36.8%	12.8%	5.1%	3.4%	100.0%
		% within Annual expenditure in design (RMB)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	6.0%	35.9%	36.8%	12.8%	5.1%	3.4%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	54.170a	30	0.004
Likelihood Ratio	38.927	30	0.127
N of Valid Cases	117		

a. 37 cells (88.1%) have expected count less than 5. The minimum expected count is .03.

Directional Measures

			Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Nominal by Nominal	Lambda	Symmetric	0.079	0.071	1.058	0.29
		Who make the final decision of design Dependent	0.025	0.043	0.578	0.563
		Annual expenditure in design (RMB) Dependent	0.108	0.107	0.96	0.337
	Goodman and Kruskal tau	Who make the final decision of design Dependent	0.064	0.03		.040c
		Annual expenditure in design (RMB) Dependent	0.075	0.018		.053c
	Uncertainty Coefficient	Symmetric	0.129	0.034	3.456	0.127
		Who make the final decision of design Dependent	0.146	0.037	3.456	0.127
		Annual expenditure in design (RMB) Dependent	0.116	0.032	3.456	0.127
Ordinal by Ordinal	Somers' d	Symmetric	-0.187	0.082	-2.234	0.025
		Who make the final decision of design Dependent	-0.164	0.073	-2.234	0.025
		Annual expenditure in design (RMB) Dependent	-0.219	0.096	-2.234	0.025

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on chi-square approximation

d. Likelihood ratio chi-square probability.

Symmetric Measures

		Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Nominal by Nominal	Phi	0.68			0.004
	Cramer's V	0.304			0.004

	Contingency Coefficient	0.563			0.004
Ordinal by Ordinal	Kendall's tau-b	-0.189	0.083	-2.234	0.025
	Kendall's tau-c	-0.14	0.063	-2.234	0.025
	Gamma	-0.293	0.125	-2.234	0.025
N of Valid Cases		117			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Results:

1) The two variables are associated with each other, based on a two-tailed significance level of $p=0.004<0.05$.
2) If the two variables are viewed as nominal variables, by knowing final decision maker of design, we are able to realize a proportional reduction in error of 10.8 per cent in predicating annual expenditure of design. If variables are viewed as ordinal, by knowing final decision maker of design, we have 21.9 per cent of possibility to know annual expenditure of design.
3) Viewed as nominal variables, the relationship of the two variables is strong, with Contingency Coefficient of 0.563. Viewed as ordinal variables, the relationship is not strong, with Gamma of -0.293.

H. Annual expenditure in design (RMB) * Design's contribution to the company assessed

Crosstabulation

			design's contribution to the company assessed					Total
			No reply	A	B	C	M	
Annual expenditure in design (RMB)	No reply	Count	1	2	2	0	2	7
		% within Annual expenditure in design (RMB)	14.3%	28.6%	28.6%	.0%	28.6%	100.0%
		% within design's contribution to the company assessed	33.3%	6.1%	3.4%	.0%	11.8%	6.0%
		% of Total	.9%	1.7%	1.7%	.0%	1.7%	6.0%
	A	Count	0	18	21	0	3	42
		% within Annual expenditure in design (RMB)	.0%	42.9%	50.0%	.0%	7.1%	100.0%
		% within design's contribution to the company assessed	.0%	54.5%	35.6%	.0%	17.6%	35.9%
		% of Total	.0%	15.4%	17.9%	.0%	2.6%	35.9%
	B	Count	1	11	19	4	8	43
		% within Annual expenditure in design (RMB)	2.3%	25.6%	44.2%	9.3%	18.6%	100.0%
		% within design's contribution	33.3%	33.3%	32.2%	80.0%	47.1%	36.8%

		to the company assessed						
		% of Total	.9%	9.4%	16.2%	3.4%	6.8%	36.8%
	C	Count	1	1	9	0	4	15
		% within Annual expenditure in design (HK$)	6.7%	6.7%	60.0%	.0%	26.7%	100.0%
		% within design's contribution to the company assessed	33.3%	3.0%	15.3%	.0%	23.5%	12.8%
		% of Total	.9%	.9%	7.7%	.0%	3.4%	12.8%
	D	Count	0	1	5	0	0	6
		% within Annual expenditure in design (RMB)	.0%	16.7%	83.3%	.0%	.0%	100.0%
		% within design's contribution to the company assessed	.0%	3.0%	8.5%	.0%	.0%	5.1%
		% of Total	.0%	.9%	4.3%	.0%	.0%	5.1%
	E	Count	0	0	3	1	0	4
		% within Annual expenditure in design (RMB)	.0%	.0%	75.0%	25.0%	.0%	100.0%
		% within design's contribution to the company assessed	.0%	.0%	5.1%	20.0%	.0%	3.4%
		% of Total	.0%	.0%	2.6%	.9%	.0%	3.4%
Total		Count	3	33	59	5	17	117
		% within Annual expenditure in design (RMB)	2.6%	28.2%	50.4%	4.3%	14.5%	100.0%
		% within design's contribution to the company assessed	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	2.6%	28.2%	50.4%	4.3%	14.5%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	31.845a	20	0.045
Likelihood Ratio	34.074	20	0.026
N of Valid Cases	117		

a. 23 cells (76.7%) have expected count less than 5. The minimum expected count is .10.

Directional Measures

			Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Nominal by Nominal	Lambda	Symmetric	0.068	0.063	1.044	0.296
		Annual expenditure in design (RMB) Dependent	0.122	0.107	1.073	0.283
		design's contribution to the company assessed Dependent	0	0.034	0	1
	Goodman and Kruskal tau	Annual expenditure in design (RMB) Dependent	0.066	0.021		.008c
		design's contribution to the company assessed Dependent	0.066	0.022		.058c
	Uncertainty Coefficient	Symmetric	0.11	0.027	3.817	0.026
		Annual expenditure in design (RMB) Dependent	0.101	0.026	3.817	0.026
		design's contribution to the company assessed Dependent	0.12	0.029	3.817	0.026
Ordinal by Ordinal	Somers' d	Symmetric	0.19	0.074	2.557	0.011
		Annual expenditure in design (RMB) Dependent	0.201	0.078	2.557	0.011
		design's contribution to the company assessed Dependent	0.181	0.071	2.557	0.011

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on chi-square approximation

d. Likelihood ratio chi-square probability.

Symmetric Measures

		Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.
Nominal by Nominal	Phi	0.522			0.045
	Cramer's V	0.261			0.045
	Contingency Coefficient	0.463			0.045
Ordinal by Ordinal	Kendall's tau-b	0.191	0.074	2.557	0.011
	Kendall's tau-c	0.161	0.063	2.557	0.011
	Gamma	0.278	0.108	2.557	0.011
N of Valid Cases		117			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Results:

1) The two variables are associated with each other, based on a two-tailed significance level of p=0.045<0.05.
2) If the two variables are viewed as nominal variables, by knowing the criteria of assessing design's contribution to the company, we are able to realize a proportional reduction in error of 12.2 per cent in predicating annual expenditure of design. If variables are viewed as ordinal, by knowing the criteria of assessing design's contribution to the company, we have 20.1 per cent of possibility to know annual expenditure of design.
3) Viewed as nominal variables, the relationship of the two variables is strong, with Contingency Coefficient of 0.463. Viewed as ordinal variables, the relationship is not strong, with Gamma of 0.278.

Appendix G.
Criteria for Evaluating Design Management

Based on the three-level theory of design management, criteria were selected to describe the design development and managing design in the companies in this study. In addition, there were others, which were used to illustrate the basic background of the companies, such as size, ownership, product category, business type and marketing.

Basic Information

Criteria in this part include size, ownership, product category, business type and marketing. These are used to describe the basic facts of companies. It also constructs the background of design management in a company and could help to divide models.

Size

There are three categories of size: large, medium and small. According to the National Bureau of Statistics of China, the size of industrial manufacturing-oriented enterprises can be divided according to the number of employees, the volume of annual sale and assets value. The detailed standards are:

A) more than 2000 employees (large size); 300 to 2000 employees (medium size); fewer than 300 employees (small size).
B) annual sales more than 0.3 billion (large size); between 30 million to 0.3 billion (medium size); below 30 millions (small size).
C) assets value more than 0.4 billion (large size); between 40 million to 0.4 billion (medium size); below 40 million (small size).

In practice, a company usually cannot meet the three standards of a same type at the same time. In addition, annual sales and assets value generally increase significantly in a year. So the three criteria of a company may not lead to the same size overall. In this instance, number of employees was utilized as the main criterion to divide the size of companies in this study, because it is more stable and easier to be counted than the other two.

Business type

Design is a complex activity. It has been considered as a new paradigm (Bruce and Jevnaker, 1998), as an in-between process (Jevnaker, 1998), as a creative art (Press and Cooper, 2003), as approaches to solve problem and as a management process (Borja de Mozota, 2003). All these roles of design were integrated into different levels of corporate activity when John Heskett (2004) studied the relationship between design and value creation at the corporate level. These levels of corporate activity, also functioning as business types, are original equipment manufacturer (OEM), original design manufacturer (ODM), original brand manufacturer (OBM) and original strategy manufacturer (OSM).

Ownership

According to *The Regulations of the People's Republic of China for Controlling the Registration of Enterprises as Legal Persons*, which was released in 1988, there are six types of enterprise according to the legal person:

1) enterprises owned by the whole people;
2) enterprises under collective ownership;
3) jointly operated enterprises;
4) Chinese-foreign equity joint ventures, Chinese-foreign contractual joint ventures and foreign-capital enterprises established within the territory of the People's Republic of China;
5) privately operated enterprises;
6) Other enterprises required by the law to register as legal persons.

In addition, as a new type of ownership, mixed ownership was proposed in the Third Plenary Session of the 11th Central Committee of the Communist Party of China (C.P.C.) in 2003, based on the economic development in China. It refers to enterprise with two or more types of ownership, such as Sino-foreign joint ventures, jointly operated enterprises and Limited Corporations.

Accordingly, three types of ownership had been utilized in this study finally. They are: state-owned, including enterprises owned by the whole people and enterprises under collective ownership; mixed ownership; private operated enterprises.

Marketing

The information on marketing includes the scope and occupation of a market, as well as market strategy. According to Borja de Mozota (2003), marketing is the process of matching customer needs with wants-satisfying goods and services. During the process of marketing, design is considered as a fundamental role because it can distinguish products through styling and so influence consumers.

Product category

In this study, product category directly reflects the main product produced by companies. The product categories emerging from the study can briefly be divided into three types: consumer products, home appliances and instruments. Other products are, of course, relevant, but do not appear in such large number.

Level 1. Strategic design management

Criteria in this section are all related to the vision of a company, including innovation, competitiveness, strategy, investment of design, design awareness and brand.

Brand

Though there are various definitions of brand, the majority of them can be viewed in two categories: one focuses on the performance as a name or symbol to distinguish products or service with others (Borja de Mozota, 2003; Haigh, 1996; Press and Cooper, 2003); another emphasizes the reputation formalized by brand, which can represent the behaviour of a company and its services (Allen, 2000). In addition, brand type can be described through three pairs of marketplace relationships: single brand/multiple brands; regional/global brand; manufacturer brand/distribute brand.

Design and brand enhance each other. Usually, the launch of a brand can contribute to the utilization of design. And design is viewed as an essential way of promoting brand development. To realize differentiation in brand development and positioning, design has to be used as an efficient tool (Borja de Mozota, 2003).

Strategy

Based on the company's competitive context, strategy is supposed to identify the long-term competitive advantages for a company (Cooper and Press, 1995; Borja de Mozota, 2003). Cooper and Press (1995) summarized four purposes of strategy: setting direction, concentrating effort, providing consistency and ensuring flexibility. These also are the main content of strategy. In the literature of design management, strategy implies the same meaning as in business and management professional discourse.

Strategy itself is based on competitive analysis and the effects of competitive direction in a company. The relationship between strategy and competition is described by Porter (1980) as three basic strategies of competition: differentiation, overall cost leadership and focus.

There are two distinctive approaches to strategy development: planned and emergent strategy. The former is developed according organization structure, while the latter allows all levels of the organization offer suggestions and reactions (Stamm, 2003).

Usually, design strategy has a tight relationship with brand strategy. It refers to the allocation of resources granted to designers by management in order to make the company's positioning visible (Borja de Mozota, 1990). Design can contribute to strategic goals (Cooper and Press, 1995). Managing design at a strategic level means to manage the contribution of design in the strategy formulation process (Borja de Mozota, 2003).

Investment in design

To invest in design, a company first should understand the value of design. In the studies of design management, there are various statements of the value of design. Best (2006) thought that the value of design was demonstrated in connecting customer needs and business needs. Mike Press and Rachel Cooper (2003) studied the effect of design in a macro view: lifestyle and economic impacts. In lifestyle part, design was considered to improve aesthetics, usability, awareness, performance, perception and environment. Concerning its economic impacts, it included improved sales, profits and economy.

Stamm (2003) stated the value of design with five aspects: creating barriers to entry by providing product differentiation and creating emotional switching costs; reducing suppliers' bargaining power by high levels of differentiation, enhancing product quality, and increasing hurdles for possible substitutes; reducing buyers' bargaining power again by higher levels of differentiation, increased desirability and product quality, and decreasing price sensitivity by preventing direct comparability (due to differentiation and quality); reducing customers' receptivity to substitutes and decrease price sensitivity; reducing the impact of the number of players and excess capacity. In addition, Jerrard and Hands (2008) expressed the contribution of design in a broad view. It included: a reduction in production and manufacturing costs, and the minimization of the use of expensive materials; stronger customer loyalty, often by designing in features that offer real, tangible benefits to customers; the development of new and innovative products and services that could increase market share in highly competitive markets; reducing customer complaints through better design of information; changing the perception of the organisation by embedding features of the way the customer experiences business in line with the brand.

Investment in design has usually been discussed at management level, in terms of calculating investment in design functions in a company and their return. It also can be considered at project level, which means the cost of a project (Borja de Mozota, 2003). Hollins and Pugh (1990) had even stated an exact proportion of investment in each phase of new product development. According to it, the investment in design, including concept and detail design phases, took 29.5 per cent of the total cost of a new product development.

Innovation

Innovation can be viewed as the implementation of creative ideas (Cooper and Press, 1995; Stamm, 2003), or the first application of new product or industry processes (Walsh, *et. al*., 1992). It is neither an economic mechanism, nor a technical process. It is above all a social phenomenon through which individuals, companies, and societies can express their creativity, needs, and desires (Thackara, 1997).

Because of a wide scope of innovation in business development, there are various ways to divide innovation levels. Concerning product innovation, it can be divided into four levels: breakthrough, platform, derivative and enhancement (Stamm, 2003). Furthermore, according to the technology and marketing strategy, product innovation also can be sorted into four categories: new-to-the-world products, line extensions, me-too-products and product modification (Olson, Walker and Ruekert, 1995).

The systemic view of innovation was offered by Bettina Von Stamm (2003). In her book *Managing Innovation, Design Creativity*, twelve types of innovation were listed according to the levels and categories (see table 2.3).

Table 2.3: Types of innovation

	Product	Service	Process	Business model
Transformation	Cars instead of horses	Internet banking	Pilkington's floating glass	Internet
Radical	Hydrogen powered cars	A new kind of mortgage	Gas-filled thermo glass panes	Online sales and distribution of computers
Incremental	New car model	Different mortgage feature	Differently coloured glass	Selling in business parks instead of town centres

Innovation usually occurs in two ways, either radically, with new ideas, new materials and new technology, or incrementally, through known design modifications. These represent the two levels of innovation: breakthrough or radical innovation and incremental or low innovation (Cooper and Press, 1995; Press and Cooper, 2003). Radical innovation usually is useful for new entrants in an industry (Borja de Mozota, 2003). However, in practice, successful products and services are not always radical innovations. Frequently, increasing market share may rely on incremental and continuous evolutionary improvements, rather than radical innovation or invention.

Design plays different roles in different types of innovation. For radical innovation, design not only translates technological breakthrough to commercial use, but also gives higher priority to the training of consumer and the staff. For incremental innovation, design usually focuses on brand reputation and after-sales service (Hollins and Pugh, 1990; Roy and Potter, 1990).

Design awareness

Design awareness referred to two facets:

A) recognition that design represents an identifiable set of activities with an important contribution to long term profitability, and thus needs to be managed rigorously.

B) an awareness of design activities within an organisation and how these relate one to another (Topalian, 1990, pp117-127).

Peter Gorb (1990b) indicated that to describe the attitude toward design in a company, an efficient way was through reviewing the organization structure and other functional managers' relationship with design. According to the study of silent design by Angela Dumas and Allan Whitfield (1990), functional managers also were viewed as important roles in forming design awareness in a company, though their attitudes and practice toward design varied. This opinion is supported by Roy (1990). According to his study, in commercially successful firms, the senior staff usually had a broad understanding of design and can realize how design decision did not just determine concept, form and performance, but also influenced all the other factors that contributed to a product's competitiveness in the market.

In addition, the content of design awareness varies in the types of service a company offers. For product-based companies, their design awareness was expressed by the technology and styling of a product. For service-based companies, design of operating systems and environment was the main areas of design attention (Oakley, 1990c).

The role of design in business is the visual expression of the values and beliefs of an organization (Best, 2006). A similar opinion was expressed by Sir Brian Corby. He stated that the strategic role of design in a company was three-fold: enhancing customer satisfaction; leading to greater employee satisfaction and motivation; creating more interest in its service (Cooper and Press, 1995). Borja de Mozota (2003) described the role of design in two aspects: first is as an interface between the consumer, the society at large, and the company. The second is to widen the external space of innovation.

Competitiveness

There are three ways to improve competitiveness: product innovation, good product design and process innovation. Product innovation can be achieved through new technologies, materials, inventions and design ideas that offer unique features or performance to the user. Good product design can offer enhanced value to the purchaser in terms of performance, appearance, reliability, ergonomics, while at the same time permitting economic manufacture. Process innovation introduces or adopts new or improved methods of manufacture to allow high-value goods to be made at a competitive cost (Walsh, *et. al.*, 1992).

Usually, the commercially successful firms did not view competitiveness in terms of a single-dimension. They prefer to identify more precisely sectors their products are aimed at and employ in-house or external expertise to meet the requirements of customers in those sectors (Roy, 1990).

Design is crucial to industrial and commercial competitiveness (Blaich, 1988). It not only is a main factor in contributing to competitiveness, but is also connected with price and non-price factors in competitiveness. Tore Kristensen (1998) directly showed three ways that design can contribute to sustainable competitive advantage: with organizational culture; a linkage between other functions; and improving operations. Best (2006) indicated that design is an efficient way to make products and services more distinctive. Furthermore, design and design management also have much to offer the product and service development process, from initial research ideas, to supply-chain management, to the point of sales. In these ways, design thinking can and does enable valuable competitive advantage for organizations.

Level 2. Functional Design Management

Criteria relating to organization issues are involved into this part. It covers internal and external design. In internal design, internal design departments, designers and the management of them are included. For external design, it refers to outsource management, relation between internal and external design, as well as selection of external design.

Management of internal design

To organize design activities, a company has three options: hiring its own designers; buying outside design services; using these two alternatives side by side (Ahopelto, 2002).

Based on a study of eleven internal design departments of French enterprises, the reasons for establishing design department in a firm were shown in two facets. Firstly, it can help increase competitiveness when sales were lagging or the image of the firm was deteriorating. Secondly, design was considered by the firm’s directors as a cultural attributes (Bauhain, 1990).

Before establishing an internal design department, a company should carefully plan its design resource to meet the desired objectives. There are many factors that should be involved in consideration, including the total number of staff required; the category breakdown of the staff requirement; number of staff to be directly employed by the company; number of consultant, freelance or contract staff required; and need for new skills to meet planned business (Cooper and Press, 1995).

In addition, there are diverse selections for the location of internal design department: within marketing, within the technical domain, an independent design department, a combination of the above. An organization might also decide not to have any explicit designers at all (Stamm, 2003).

Though design is viewed as an independent function in management structure, it should coordinate with other functions and tasks (Dumas and Mintzberg, 1989; Gorb, 1990b; Cooper and Press, 1995). The attitude toward design in other functional departments of a company forms the work environment of the design function. The relationship between design and work environment also is involved in the criteria to study design management, service the work environment usually is considered as an important factor of managing design. As Best (2006) indicated, a high-quality working environment is another way that design can add value to an organization.

Whether design is being used or misused largely depends on the organizational attitude to design, and how well design policies are defined, documented and communicated. Documenting an organization’s attitude to design helps everyone to understand the operation of design at the various levels. This documentation usually takes the form of design policies, procedures and guidelines. These help the integration of design into the way a company thinks and acts, both in long-term strategy and in ordinary decisions (Cooper and Press, 1995; Best 2006).

Efficient communication is considered as an essential factor of business success. Communication of design in a company includes diverse types, such as internal and external communication networks; communication between marketing staff and designer; communication between stakeholders, between designer and marketer, and among all levels of a company (Gardiner and Rothwell, 1985; Hollins and Pugh, 1990; Cooper and Press, 1995).

Design managers play an essential role in managing design in a company. They are responsible for investigating the requirements of a new product, finding designers (or teams of designers) and other specialists who can aid designing, and set up and operate an easily understood network of communication between all parties concerned in the new product. They are also responsible for coordinating projects until a prototype reaches the production line and the design of packaging or supporting printed matter is complete (Farr, 1966; Morris, 1998). Facing the changed future, the requirements of design managers also changes. Design managers need to be multi-talented people. They not only should communicate with finance and marketing, but also will know how to manage people and brands. And, in order to simplify and communicate a very complex problem, they will know how to manage design (Hall, 1990).

Management of designer

Dominique Bauhain (1990) stated four reasons for permanently employing designers in a firm: the amount of work; the complexity of the product; management preferences; pressure exerted by an external partner.

Inside a company, there are various locations of internal designers according to different organization structures and development. Internal design could be located inside a product development department; within the research and development staff; with a link to the marketing and sales departments; more directly as a resource under the top management; or within a cross-functional team set up by the client (Jevnaker, 1998).

Silent design is a special phenomenon in managing design. Based on a pilot study, Dumas and Whitfield (1990) defined silent design as a great many people (many of them managers) who are engaged in designing but who are not designers; quite often they are not aware that they are designing, and do not necessarily agree that what they do is designing once they are made aware of it.

Design outsourcing

There are various issues included in this criterion, such as outsourcing management, reasons for using design consultancies, factors for choosing a design consultancy, success and failure of outsourcing, internal vs. external design, and relationship management. The externalization of design in product innovation is a new fundamental direction for design management. It is certainly one of the most interesting topics in building a competitive advantage through design management (Borja de Mozota, 2003). And in practice, the consultant design is viewed as a powerful stimulus to the staff designers to enhance their own design capacity (Black, 1974).

Outsourcing

Based on a survey, the main reasons for using a consultant in British manufacturing were described as: lacking in-house skill in general, to gain a wider perspective or to prevent 'staleness', for speed, for specialist work, to save money and did not say (Walsh, *et. al.*,1992). Since there was a trend of increasing outsourcing in the 1990s, Margaret Bruce and Barney Morris (1998) revealed the reasons for it in four aspects. Firstly, the increasing complexity of products and their shorter life-cycles demand expertise from a range of different sources. Secondly, the use of technology in the design process has facilitated a change in practice. Thirdly, design expertise is being used by service organizations, which are moving away from more traditional in-house design practices towards buying in design expertise. Finally, the development of the "virtual organisation" or "network organisation" or "value-added organisation" means that companies utilize a network of suppliers to carry out value-added functions.

According to Cooper and Press (1995), the advantages of outsourcing design were cost benefits, the benefits of choosing the most appropriate design skills for the job, and maintaining freshness of ideas. In addition, based on a survey conducted by Wind River, five strategic benefits of outsourcing were introduced. It included time to profitability, product robustness and reliability, product features set, controlled costs and optimal use of resources (Stamm, 2003).

Although the main function of a consultant designer is to stimulate internal design development, there still are disadvantages in using them. The disadvantages are in two aspects: designers' lack of understanding of the company and its culture, and the creation of barriers to effective communications. As a result, many companies prefer to combine internal and external design in practice. And in most cases, external consultants are usually employed to undertake the most innovative and creative aspects of the design work, while other internal designers implement the design or do the minor design servicing work (Black, 1974).

Selecting external design

The factors of choosing design suppliers involved matching design capability to the design project; matching inter-firm technologies; matching customer experience with the consultancy's own insight; active vs. passive expertise; dependence, propriety information, trust and control (Bruce and Morris, 1998).

In smaller-scale industry, where the employment of staff designers of the highest quality is not an economic solution, the engagement of a consultant is essential (Black, 1974).

Internal-external relation

Concerning the relation between external design consultancy and internal design, it varies in project, firm and even product category. Some organizations develop a relationship with selected consultancies and rotate their use depending on the needs of the project. Other companies engage design consultancies on an "as and when" basis, but there is a danger here, unless a policy for selection is established (Cooper and Press, 1995).

However, no matter based on what conditions, the relation has to be managed carefully to ensure that they are truly working together. The tension between fear of giving away commercially sensitive information and the need to build up an open and trusting relationship is particularly acute (Bruce and Cooper, 1994)

A long-term relationship between company and its outside partners is encouraged, because it could establish a trust relationship, instead of as a source of opportunism. Furthermore, the long-term relationship has many merits for both sides. It decreases the costs of project and reduces conflict; project can be controlled easily; and a knowledge management system can be established based on exchanging information (Borja de Mozota, 2003).

In managing the relationship, many actions might lead to failure and should be avoided. It includes teaming up with the wrong partner; start looking too late in the process; wrong expectations; treating a strategic partner like a 'body shop'; poor supervision; internal barriers; bad contracts (Stamm, 2003).

Level 3. Operational Design Management

Criteria in this level all are involved in project. It includes design planning, process, quality and audit.

Design planning

In the criterion, sources of design planning and design brief are the main content. For the source and method part, it consists of information source, market research and tools for developing concepts. For the design brief, it mainly involved description of its purpose, content and relation with design management.

Resource/methods

Based on a study of commercially successful firms, Walsh (1992) reported that there were diverse sources of information for product planning and design. These included customer feedback, service report, trade shows, technical literature, market survey, developments in related industries, competitors' products, user groups/customer panels and workshops involving engineers, marketers, customers and users. Furthermore, they indicated that successful firms usually preferred to employ multi-sources, while less successful firms tended to use limited sources, such as senior management's 'feel for market,' sales/market statistics and sales force feedback.

Market research is the main method of design planning. Stamm (2003) indicated that there were various approaches to it. In traditional way, there are two approaches: quantitative and qualitative. Quantitative approach refers to survey and questionnaire by mail, the telephone, in person, either in home or office, or 'on the street' and more recently, via email or on the internet. Qualitative ones usually are conducted through interviews, focus group and observation.

Design brief

Previous studies of design briefs consisted of diverse aspects, ranging from its purpose, importance, content and relation with design management. Jens Bernsen (1990) stated that a design brief had a dual purpose: identifying and communicating the goals of the project; and serving as a frame of reference for the evaluation of solutions. In addition, Cooper and Press (1995) indicated another aim of a design brief as conveying competitor information. Furthermore, Peter Phillip (2004) acknowledged that design briefs could be used for four purposes: a written agreement/contract; a roadmap; a business plan; a project-tracking tool. In this instance, the role of design brief can be viewed either as a statement of the problem, a tool, or a checklist (Bernstein, 1988). On the other hand, the simplicity or complexity of a design brief not only implied design awareness in a company, but also demonstrated its development of design management (Roy, 1990).

In implementation, the content and form of a design brief varied in project, firm and client without a uniformed format. A good brief should contain at least four key elements: background to the company; corporate strategy and its relationship to the brief; the design problem-attribute definition; consumer and market information (Bruce and Cooper, 1997).

Design process

The design process can be viewed as an interactive process between knowledge and the skills of designer, as well as information inputs about a specific situation (Derek Clements-Croome, 2004).

Usually, design process is a linear style. However, some scholars suggested that design process should consist of many feedback loops, instead of linear progression. With these feedback loops, problems in the process could be solved by further adaptation to particular conditions of a project or a client (Best, 2006). In addition, Mark Oakley (1990c) suggested a spiral model process, which consisted of formation, evolution, transfer and reaction. Takeuchi and Nonaka (1986) explicitly stated the trend of changing linear and sequential process to one that was integrated and dynamic. In their opinions, traditional design processes can be described as a relay race or Chinese whispers. In it, information was passed one by one without sufficient explanation, while in an integrated and dynamic process using the metaphor of a rugby game, information is passed among different departments easily and sufficiently.

Design quality

Quality is defined as satisfying customers' expectations, as well as understanding and anticipating their needs. In practice, it includes quality audit and quality management (Cooper and Press, 1995). Furthermore, Peter Gorb (1990a) defined quality as the extent to which a product meets the specification drawn up for its manufacture; and where the product is mass produced, consistently meets that specification.

In practice, the importance and contribution of design quality had been recognized. In 1984, Margaret Thatcher, the Prime Minister of the United Kingdom from 1979 to 1990, stated that "Quality of design, production and marketing wins markets. Only satisfied customers will repeat orders and make British goods and services their first choice (Ughanwa and Baker, 1989, p208)."

It was considered that quality played an important role in determining the quality features of the products or service required by customers. And during this procedure, the role of design is to help translate those features into reality (Cooper and Press, 1995).

Design audit

The use of the term "audit" has become wide-ranging, and encompasses every aspect of an organisation. According to different content and themes, there are different types of audit. And based on previous studies, various methods of design audit also had been established for different purposes.

Concepts

In most cases, audits could be used to form strategic alliances between units, develop a deeper-level communication, and understand complementary competence (Jerrard and Hands, 2008). Concerning design audits, their objective is to advise and direct strategic change; improve overall standard of product design as compared to competitors; develop a design policy manual; monitor policy implementation; and improve design standards (Cooper and Press, 1995).

There are various types of design audit based on different criteria. According to the content and issues, there are four levels: environmental issues, corporate culture, the "management" of the design and design projects, and physical manifestation of design. Concerning the time and frequency of audit, there are one-off, annual audit, anytime, pre-project and post-project (Cooper and Press, 1995).

Method

Contributed by previous studies, numbers of methods for design audit had been invented. These include a check-list devised by the Department of Trade and Industry (DTI) of the British government; Kotler and Rath' s study of how a corporation's design sensitivity and design management effectiveness can be measured; The Council of National Academic Awards; Topalian's extensive checklist; The Design Council Design Audits, based on BS7000, which involved five topics: objectives, planning, communications, implementation and evaluation in three levels: corporate level, project level and design activity level (Cooper and Press, 1995).

Team

In organizational structures, different levels are responsible for different kinds of design audit. Top management is responsible for auditing achievement of targets and comparing design performance against design strategy. For functional management, they should evaluate design process, product and return on investment. For design function, they might evaluate design outcome against brief objectives, use in the market and effectiveness (Cooper and Press, 1995).

There are some indicators of a good design audit: specificity, measurability, reliability, rigor, comprehensiveness, continuity. However, there also are some specific problems in design audits, such as an understanding of social and economic measures; a conceptualization of generic questions to specific situations; the process of obtaining and categorizing diverse information; difficulties in equating innovation and change with compliance and benchmarking; the absence of precise performance indicators; the interpretation of audit results (Pearce, Raynard and Zadek, 1996).

Appendix H.
Comparison of Cases

H-1. Facts of the companies

	Business Type	Marketing	Size	Ownership	Product
PRD					
Breo	China market: (OBM) Overseas market: (OEM) and (ODM).	Home and aboard markets with balanced share. Breo takes first place of eye healthcare electric product in China.	S	Private	Eye message
Canbo	OEM of ironware and OBM of kitchen appliance.	keeps a leading place	L	limited company	Electric sterilizing cabinet
Media Microwave	China market: OBM Overseas market: OEM and ODM	China and overseas markets. Take the second place.	L	limited liability company	Microwave
Vatti	from OEM to OBM	Vatti have gained constantly the No. 1 position in domestic market.	M	Private to share-holder	kitchen appliances
TCL Multimedia	OBM	four business centres in China and oversea	L	Listed company on stock market	TV
Hisense	China market: OBM; Overseas business is transformed from ODM to OBM in 2009.	Domestic market and brown goods are the main markets	L	limited liability company	White home appliance
YRD					
Hiward	Its business type involves OEM, ODM and OBM.	The major regions of China, except of Tibet. At current stage, Hiaward lists the fifth in this field.	S	Private	ATM & self-banking financial service
Ruyi	China market: OBM Overseas market: OEM and ODM	China and overseas markets.	M	Private	Wooden toys
Heng Feng	OEM, OBM	China and overseas markets	L	Private	Outdoor furniture, camping facilities
Genvana	OEM, ODM and OBM; emphasize OEM in overseas markets and on OBM in China.	China and the worldwide, Overseas market only takes about 10 per cent of market share.	L	Private	stationary
Ted Golf	Till now, ODM is the main business type	Only in global market; its clients are in the worldwide.	S	Private	Golf trolley
Muyang	OBM	The clients are divided into different groups by product categories; Focus on middle and high-end; Market both in China and oversea.	M	State-owned	Feed machinery

H-2. Strategic design management I

	Innovation	Company competitiveness	Brand
PRD			
Breo	Incremental innovation: Minor change in function and an emphasis on design are the main methods of new product development	Design is a factor of competitiveness and advantage	Single brand: Design plays a critical role in building brand identity.
Canbo	Independent R&D and continuous innovation	Core competitiveness: sales network and product leading, which is realized by the contribution of technique and design.	Single brand Design is employed to establish brand image and enhance brand management.
Media Microwave	Factors of its success: continuous consumer-oriented innovation in product, quality management and brand creation.	Design as an advantage and a factor of core competitiveness. In domestic market (OBM): market, channel and cost. In overseas market (OEM and ODM): the cost and design of product.	Multiple brands Design is utilized to design logo
Vatti	Efficient innovation management: efficient	The primary core competitiveness: its	Single brand:

	work, efficient team, or efficient cost	capacity of brand operation and channel penetration. As core competitiveness in Vatti. Design also is an advantage of Vatti's products.	good product design and innovation are an important way for the growth of brand.
TCL Multimedia	Continuing innovation: breakthrough by technology revolution, process and culture, as well as upgrading the management into international level.	The advantages of TCL's international competition: A) Brand; B) Channel; C) Excellent industrial design capacity; D) R&D capacity of digital TV; E) A team with international business management capacity.	Multi-branding strategy; Internationalization is the main developing direction of TCL brand.
Hisense	Emphasize technology innovation	Technology is its advantage. Though the importance of design has been recognized by top management, it still cannot be counted as core competitiveness.	Multi-branding strategy Design is an important factor to divide the image of different brand products.
YRD			
Hiward	Technology innovation. Innovative service and products are the main challenge faced by the company.	Core competitiveness: Software R&D, hardware of ATM, and OEM business of self-service terminal products.	Single brand: The logo of the brand is not designed by professional designer.
Ruyi	Emphasis on continuous innovation. The innovation by design is the focus of the next stage development.	Core competitiveness: brand, based on its manufacturing capacity, product quality and credit	Single brand: It is only used in China's markets.
Heng Feng	Innovation is emphasized by design ability. Innovation is considered as an essential way of developing business.	Good human resource, advanced materials, strong design ability and quality management.	Single brand: The company will continue to invest in design for brand building and development
Genvana	previously copied designs of Korean and Japanese; in recent years, changed to emphasize on brand value, instead of price	Core competitiveness: advanced technology and instruments	Four product lines under the name of Genvana. Design is utilized in the four product lines.
Ted Golf	Incremental innovation both in technology and styling in normal products. Apply new technology as radical innovation.	Electric engine technique. Design is a factor of its core competitiveness and an advantage. This explicitly refers to innovation of design.	Since ODM is the main business type of Ted Golf, the company has not its own brand.
Muyang	The development of its tech-innovation capacity: One is the continued investment of innovation team and test of innovation system; Another is based on collaboration with universities and institutes.	Core competitiveness: care of function, sales network and service.	Single brand The logo of the brand was redesigned in 2006 to form a modern image.

H-3. Strategic design management II

	Strategy		Investment of Design		Design Awareness
	Business strategy	**Design strategy**	**Value of design**	**investment**	
PRD					
Breo	Different strategy in China and overseas market.	Design plays a critical role in building brand identity.	Design contributes value of business by continuous innovation.	Employed professional designer for the styling; Moved to new office	Good in Top management
Canbo	Independent R&D and continuous innovation.	Transfer OBM to ODM via unified styling of kitchen appliances.	Industrial design obtains high rewards and creates profit instantly; the main value added by design is recognition of brand and direct profits.	High investment of building internal design team	Good Inside company
Media Microwave	China and overseas market conduct different strategies in business and design.	Transfer brand concepts via design. Emphasize on establishing product identity and training designers.	Brand approval is critical value of business added by design. Design expresses image and position of brand.	Establish its own internal design department Invest training of internal designers.	Good in all employees & top management in overseas market
Vatti	enhanced and	distinct itself from other	The value of business is	To connect Vatti's	Good in the

	improved designs for kitchen appliances includes three aspects, quality, R&D and HR.	manufacturers via good quality of design and production to win in the market. Keeping advantage of design is important content of future development.	added by design. It contributes to the growth of business, recognition of brand, divided market, higher profits, and cultivating creative culture.	products with its brand, the company has conducted many studies. Some are fulfilled by foreign design consultancy.	top management, & In the operation management level
TCL Multimedia	An integrated system of design ability, quality ability, as well as the system of sales and consumer investigation.	Design capacity is a way to formalize advantage of TCL's international competition.	Design is an important way of building brand image.	Established two internal design teams; Employ international designer.	Good in top management.
Hisense	research and application of electronic and information technology. Meet the customer's need with excellent product and service.	Company's strategy just emphasizes its leading technology, instead of industrial design in its propaganda.	A short-term investment with low-input and high-output. Design is an efficient tool to upgrade brand value, add product value and establish brand characteristics.	Establish its design centre.	Good In the whole company,
YRD					
Hiward	Innovation of its service and product. Launch standardized service with brand identity system.	Utilizing design to improve quality of service. Integrate image of service brand by design	Industrial design is efficient way to offer satisfied user experience.	Not invest in design now.	Not all the staff can really understand it.
Ruyi	Develop business in multiple ways with a core product. Export products as core business.	Establishing its own design ability of independent design.	The value and contribution of design are evaluated through sales achievement of products.	The company has not special plan of investing in design.	Not all the staff can really understand it.
Heng Feng	The company not only will expand its China market, but also develop to group by multiple paths.	The company plans to establish and develop its own design ability. The design strategy also is transformed to local market.	Design is considered as an important tool to develop its own brand.	Start from the establishment of internal design department.	Design is influentially utilized in new product development.
Genvana	Enhance research and design capacity. Increase production ability.	Utilize design as an critical way to maintain its market place and face international competitors.	Design is recognized as an important factor of product and an efficient method to upgrade its brand value and enter a higher level market.	The investment of design is much higher than that of manufacturing. Employ foreign designer.	Goods design awareness,
Ted Golf	Be a famous enterprise in golf field Brand strategy.	Build its own design team through engineers, who can combine the consideration of styling with functions.	Be tech-led of golf trolley product in the worldwide	Invested the technique; Looking for external design.	Good recognition and application of design,
Muyang	Growing into a lead-world-class machine building and engineering corporation by focusing on innovation, responsibility, operation, and high efficiency.	1. Developing certain confirmed design factors, 2. Utilizing of color system as an efficient way of distinguishing Muyang's products 3. Interaction design.	For its product, technique is the first place. And design of styling is only the second place, which is utilized to attract customers.	Invest industrial design since 2003. Two professional designers.	Recognized by the company.

H-4. Functional design management

	Internal Design			External Design	
	Internal design team	**Internal designer**	**Managing design**	**Selecting criteria**	**Relation/role**
PRD					
Breo	No internal design department Design is fulfilled by external design	Plan to employ internal designer to accumulate design experience. Difficult in employing appropriate designer	General manager responsible of design; Majority design work outsourced.	business development stage, product type, the quality of external design	The role of design keeps progress via outsourcing design from foreign freelance designer.
Canbo	Internal design team as a part of R&D centre, belonged to technique department.	Only two internal designer; Encourage designer to study	The major design work are outsourced; Began to establish internal design team to solve the problem of unqualified external design	Outsourcing design as a way to improve design capacity	Prefer a long-term relationship with large-size formal design consultancy
Media Microwave	Product strategy department as internal design department, reporting to general manager.	Offer training opportunity to designer	Design work are fulfilled by external design; Established model of managing design.	Select external design according to product type	Two types collaboration: long-term relation or project by project.
Vatti	strategic centre which controls design and R&D; a design team with 50 employees; Design capacity focuses on collaboration with strategic partner.	Training internal designer via Vatti Institution and collaborative project	general manager as design leader; The major design work is completed by external design consultancy; A clear system to manage design; Improve design capacity by outsourcing design	Criteria of selecting external design: a higher level of quality than Vatti, an active team, and leading profession and management.	a long-term relationship and strategic partner: CBD
TCL Multimedia	Two internal design teams Shenzhen design team is an independent department, directly reporting to headquarter.	Internationalization; Study design knowledge through communication between two design teams.	A system of managing internal design; A brand centre responsible for brand and design; A project management department to control project; Internationalization of human resource of design; Develop internal design ability by study from external design.	Experience different stage in outsourcing design: from local to global design consultancy	A long-term relationship with international famous design consultancy as strategic partner
Hisense	Internal design centre An efficient communication between design and other functional departments	A system of training designers	70% project by internal design, 30% outsource to external design through biding. In fact, about 90% are completed by internal design.	The way of selecting external design: public biding	Project-by-project; for styling service. In practice, only nearly 10% are outsourced.
YRD					
Hiward	Previous has one, now no internal design department	Artist engineer=internal designer	The function of product design is completed by external outsourcing manufacturers, which involve three OEM-based enterprises.	Design service offered by manufacturers as suppliers.	Long-term relationships with suppliers.
Ruyi	An industrial design team in the R&D department;	The internal designers play the role of visualization of clients' ideas, instead of creating by themselves.	Enhance the professional ability of the designers; manage to generate design ideas by internal designers independently.	Not outsource design	Not outsource design
Heng Feng	Industrial design department is under the control of R&D Centre.	17 designers with average 4-5 work experience.	How to balance the investment in design with other functions is the most important issue in the development of internal design.	Outsources its design works to foreign freelance designers from America or Europe.	The relationships are in free forms: project-by-project or long-term.
Genvana	Internal design	9 internal designers,	Training: learning-by-doing	Transfer from local	Manage to

	department belongs to R&D centre, report to general manager	average five-year experience, a Korean designer	Had ever tried to outsource design. All failed	design consultancy to Korean designer.	develop long-term relationship.
Ted Golf	No internal design department	Lacking experienced designer	R&D department responsible for all new product development; A confirmed human resource management system.	Not outsource design	Not outsource design
Muyang	Internal design department, not communicating well with other functional departments	Designers are involved in projects for styling and expressing the identified factors of products.	Planning to outsource design; Location and product category are the main barriers of outsourcing design.	Not outsource design	Not outsource design

H-5. Operational design management I

	Design process	Design Planning		
		Team	**Resource/method**	**Design brief**
PRD				
Breo	Chaos design process; Within a basic frame; Design is utilized in NPD.	Research, design and market; Customer.	Not be limited in market investigation; Discovering market opportunity actively; Methods: brain storm and user investigation.	With a flexible process, there is not a fixed design brief.
Canbo	Combining company's conditions; Integrating internal designer's work.	External design consultancy; marketers	Demands from consumers and markets collected by marketers; designers list the further information need to be collected by marketers.	Product manager lists primary requirements. Then sent to vice general manager for technique evaluation.
Media Microwave	Standardized design process.	Internal design team. Sometime, external design teams are also involved into research and creation.	ideas=market + design; Marketing research; Professional research consultancy is employed; Study and analysis of documents.	By designers. According to annual product planning.
Vatti	Industrial design has already been involved into R&D process with different workload. Diverse methods	New strategic centre of Olympic, product planning.	Emerging trend and fashion informations in market. According to its own understanding of market and consumer. Survey of satisfaction of consumer. Keeps tight relationship with their competitors.	Product planning department organize internal and external team to plan product lines and family.
TCL Multimedia	Established its own design process.	Design team and other functions, especial marketers.	Internal designer study design trends and informations; two design teams exchange design related information through a mature platform.	Defined by internal design teams, combing suggestions from other functional departments.
Hisense	A confirmed design process recorded into standardized regulation. Designer manages the process.	Consist of internal designers, salesmen and marketers.	Marketing research and investigation; follow design directions of target brands	Design, sales and marketing staff work together to define it.
YRD				
Hiward	A standardized process; Design in the process at up or mid stream.	R&D department	From discussion in R&D department, instead of user investigation. Opinions of discussion are based on usual communication with customers.	Listed as requirements of bidding. A discussion with factory and customers.
Ruyi	A fixed process	Clients, design team and market department.	Two sources of new product concepts: one is from clients; another is from internal design. database of related products;	Usually defined by clients.

			collect overseas market information by market person.	
Heng Feng	A basic process relating to the practical conditions.	Market and design department.	Internal designers collect market information through investigation, studying competitors' products and visit foreign markets.	Proposed by design team, based on discussion with market department.
Genvana	Formal design process basing on its previous experience Not a fixed one. Adjusts its process every year for a shorter one.	Market department.	Market/consumer feedback	Defined by market department.
Ted Golf	A standardized one Flexible for creating new ideas everyday	Market and engineering departments.	Market research. Feedbacks from clients and from market informations.	Clients list the requirements of input conditions; Chief engineer defined the design brief.
Muyang	design in the up-stream Fixed process of new product development, basing on its management system.	A team assigned to each product line, external team, and users.	Improving product function and performance; analyzing competitive products. The ideas of new product are generated according product line.	The product-line team defined the design brief, based on user's suggestions.

H-6. Operational design management II

	Design quality	Design Audit	
	Content/contribution	**Team**	**Content/contribution**
PRD			
Breo	Certifications; Diverse types of patent in China and other foreign countries. To keep their leadership and protect intelligent property.	Market developer and designer work together tightly.	Decrease risk
Canbo	Product quality. Product positioning, evaluation in R&D process, and engineering design.	Leader of technique.	Series of decision points: internal website; market feedbacks.
Media Microwave	Standardized design process to control and management design quality.	Leader of R&D	Series of decision points. Design audits are the critical points of control.
Vatti	A basis of value and recognition. Vatti's strategy of differentiation to win in the market.	Planners, salesmen and engineers.	Consumer audit and engineering audit. A process of realizing strategy at the same time.
TCL Multimedia	Brand image, brand recognition	Salesmen	Design quality in the view of different functional departments.
Hisense	Project manager design audits.	Project managers	The engineering possibility and cost. Series of decision points.
YRD			
Hiward	tests documents to regulate	various functional departments technology and market department	Design quality in the view of different functional departments.
Ruyi	It is considered in the content of safety according to the quality requirement in different countries.	Marketing, production and quality department.	Safety; Design quality in the view of different functional departments.
Heng Feng	To control the design quality, documented policies of working process are established based on previous experience.	Vary in projects; Internal designers for small projects; Boss for larger projects.	According to the requirements of products.
Genvana	Employs 50-59 professionals of quality. training for them	Market department, R&D department and top management,	Made into prototype; mixed with other competitive products.

Ted Golf	Independent innovation by itself Design quality: it is limited by two factors: product cost and quality of designer.	Professionals from different function departments	Inside R&D team in an informal way. Everyday.
Muyang	Audits.	Designer, chief engineers, leaders of functional departments and expertise in R&D centre. external expertise	Styling and possibility of structure.

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