

**“WE ARE NOT SCIENCE MUSEUMS BUT KE JI GUAN”:  
A STUDY OF KE JI GUAN IN CHINA AND THEIR  
VISITORS’ IDENTITY-RELATED MOTIVATIONS**

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I, Huiping Chu, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

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## **Abstract**

Research on Ke Ji Guan (one type of Informal Science Institution in China) is very rare, particularly relating to visitors' experiences. In addition to this practical perspective, John H Falk's theoretical framework – "Museum Experience Model" remains applied, tested, and improved in non-American environments. For these reasons I applied it to conduct surveys in Ke Ji Guan to explore who visits Ke Ji Guan, what their motivations are, and whether there are any correlations between visitors' demographics and their identity-related motivations.

I employed both quantitative and qualitative approaches within my research. I interviewed three senior Ke Ji Guan experts in China, which resulted in a picture of Ke Ji Guan's historical development and wider context. Among other conclusions, Ke Ji Guan were identified as an important governmental institution for science and technology popularisation.

Quantitatively, I carried out a visitor questionnaire survey (N=1249) in three Ke Ji Guan in Beijing, Shanghai and Shandong. In line with much western Informal Science Institution evidence, the typical portrait of a Ke Ji Guan visitor was female, less than 35 years old, well educated and accompanied by family members. I identified seven visitors' identity-related motivation categories based on conceptual mapping, they are: Explorers, Facilitators, Experience Seekers, Professional/Hobbyists, Convenience Users, Emotional Connection Seekers, and Pleasure Seekers. Some of them are similar to Falk's original categories, such as Explorers, Facilitators, Experience Seekers, and Professional/Hobbyists. However, when I conducted an Exploratory Factor Analysis, my data statistically produced another visitor classification scheme: Benefit Seekers, Science-related Fans, Convenience Users, Affirmation

Seekers, Opportunists, and Professionals.

My results demonstrate that although Chinese visitors share some characteristics with western Informal Science Institution visitors, they also show unique Chinese characteristics. Chinese traditional cultures such as Confucianism do have impacts on visitors' motivations to visit a Ke Ji Guan.

## **Impact Statement**

My research at the three selected Ke Ji Guan in China, as well as the wider expert interviews, could be beneficial to use both inside and outside the academia.

For the academic field of Science Communication, I clarified the relationship between Ke Ji Guan and the western concepts of Informal Science Institutions such as science museum and science centre, and described for the first time the historical development process of Ke Ji Guan. My work has provided a solid initial understanding of visitor experiences within Ke Ji Guan in China, preparing the way for deeper studies on visitors' perceptions. Also, my research indicates that John H. Falk's model of museum identity-related motivations worked in part within a Chinese context. The recommendations I made to Falk's theory based on my research findings could make the theory more applicable for wider uses.

For the direction of wider policy-making in China, my findings and observations showed that some Ke Ji Guan services need to improve to meet the standards of the policy of science popularisation in China, and there was an especial gap between Ke Ji Guan practice and governmental policy in terms of the target visitors reached. My suggestions will help the Chinese government do a better job at science education policy-making and shrink the gap between the governmental target and the Ke Ji Guan practice.

For the science education practice, there would also be likely benefits related to Ke Ji Guan being able to improve their offer and better meet the needs and expectations of visitors or satisfy the government intentions according to my

research findings about visitors demographics and identity-related motivations. More effective science education could be conducted. Some eastern Asia countries, such as Taiwan and Japan, share cultures and value traits with China. Their Informal Science Institution visitors may have similar motivations for attending with the Chinese visitors that were part of my study. Therefore my research findings may also be meaningful for them (at least partly). For western countries or associations, my Chinese findings can contribute partly to understanding Chinese visitors' actions at international Informal Science Institutions and then help those institutions provide better service.

My research on Chinese Ke Ji Guan visitors' identity-related motivations opens a window to the international science communication world. It makes a chance for the world to know the Informal Science Institutions in China and it could be an addition to the research on international Informal Science Institutions' visitor studies under different cultural backgrounds.

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# 1 Introduction

This chapter provides an overall picture of my research by introducing the research context, research questions, the outline of the thesis, and the definition of a particularly important concept: Ke Ji Guan.

## 1.1 Why this research is important

In this section, I will briefly review the status quo of academic research into visitors' museum experiences (particularly Falk's identity-related motivation hypothesis), and the relevant situation in China. I hope to highlight the significance of conducting my project. My specific research field will also be demonstrated.

Science communication has been regarded as very important to the general public for variety of reasons such as gaining technical skills as well as contributing to the general public enjoyment and wider lives (Bultitude, 2011). As traditional science communication providers, Informal Science Institutions such as science museums are playing a more and more important role in encouraging the public to engage in science (Amelung, 2015).

Science communication in its various different forms is no longer restricted to western society, and is now a global phenomenon. In China for example, under the *Outline of the National Scheme for Scientific Literacy (2006-2010-2020)*, popularisation of science and technology infrastructures including Ke Ji Guan (and mobile Ke Ji Guan)<sup>1</sup>, National Science Week (Day), visual museums, and science and technology halls, are all considered

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<sup>1</sup> In the official English version of this Outline, the term "science museum" was used rather than "Ke Ji Guan" as I do in this paragraph. The reason is, there is a confusing taxonomy of these terms (such as science museum, science centre, and Ke Ji Guan). Here I prefer to use the term "Ke Ji Guan" as they are actually employed in China. I will explain the reason in detail in Chapter 4, Section 4.4.

important initiatives to improve Chinese people's science education ("*Outline of the National Scheme for Scientific Literacy (2006-2010-2020)*," 2006). Among these Informal Science Institutions, Ke Ji Guan is considered a particularly key area of effort, with strong emphasis placed in the last 33 years on their development and growth ("*Outline of the National Scheme for Scientific Literacy (2006-2010-2020)*," 2006). According to the annual report of the China Association for Science and Technology, there were about 308 Ke Ji Guan in China at the end of 2013, with numbers expected to grow substantially after that (Li, Dong, & Gui, 2013).<sup>2</sup> However, due to a lack of local expert staff that can conduct professional research about Ke Ji Guan, studies about Ke Ji Guan visitors in China are rare. This means that there is little local and directly relevant information available to guide or suggest to Ke Ji Guan how their services should develop or improve (Li & Ren, 2011).

Within western contexts, for more than five decades visitor studies have had a fundamental impact on how museums understand their audiences (Jones, 2015). Studies involving museum visitors have been employed to improve museums' services, attract more visitors, and help the understanding of the influence of visit experiences (Jones, 2015). Along with the phenomena of museums themselves becoming more visitor-oriented from late twentieth century, more recently research within museum environments in the west began to shift from other topics (such as research focusing on collections) to visitor studies (Kotler & Kotler, 2000). The deeper understanding of visitor experiences has thus become vital within western museum contexts (Chan, 2009; Kelly, 2004). Returning to the China situation, with large financial commitment but attendance figures to even major attractions reportedly low (Caird, 2014), there is clearly work to be done to improve understanding of visitors' motivations, intentions and experiences. An improved insight into visitors' perceptions should help enhance the offer provided by the museums

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<sup>2</sup> These are old figures, but no more up-to-date numbers were publicly accessible.

(Pekarik, Doering, & Karns, 1999), and therefore visitor numbers and positive outcomes. So it is increasingly important to conduct robust Ke Ji Guan visitor studies in China.

In the dimension of visitors' attitudinal data, one of the most influential theories is Falk and Dierking's Interactive Experience Model, produced in 1992 and updated subsequently in 2011. They argued that both visitors' personal context and their social context have influences on visitor experience (Falk & Dierking, 1992). Personal context including visitors' interests and concerns can influence their preference and motivations. The social context is related to other people that can influence visitors' motivation or anticipation as a group member (Falk & Dierking, 1992). So both of these two contexts (personal and social) are related to visitors' experience.

Much work has built on the Interactive Experience Model in the 25 years since it was first articulated. For example, Packer and Ballantyne classified visitors' motivations to five groups: 1) learning and discovery, 2) passive enjoyment, 3) restoration, 4) social interaction, and 5) self-fulfilment (Packer & Ballantyne, 2002, p. 189). In her work to explore how families and hands-on museums interact and affect with each other, Moussouri identified five family motivations<sup>3</sup> to visit a museum: 1) education, 2) life-cycle, 3) entertainment, 4) family event and 5) place (Moussouri, 1997, p. 236). Along with Moussouri, Packer and Ballantyne's work, Falk suggested that visitors have "a finite number of" identities (or self-aspects) when choosing to visit a museum (Falk, 2006a, 2006b; Falk & Heimlich, 2009).

Falk himself developed a theoretical model relating to people's "little i" identity, meaning short-termed, unfixed identities such as an identity as a friend. This is considered as separate to "capital I" Identity, which refers to the longer-term,

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<sup>3</sup> They were also called cultural itineraries or aims by Moussouri in her thesis.

fixed identities such as identities related to gender. Falk argued that the alterable identities influence people's behaviours and motivations in different environments and conditions, which can reflect people's interaction with social, cultural and physical circumstance (Falk, 2006). Falk's "Museum Visitor Experience Model" categorised visitors into five groups: 1) Explorers, 2) Facilitators, 3) Experience seekers, 4) Professionals/Hobbyists, and 5) Rechargers (Falk, 2009, p. 158), each with their own distinct motivations for being at the museum.<sup>4</sup> As Spock argued, a better understanding of visitor identities in this regard helps museums to perfect their interpretation and evaluation work (Spock, 2006). As other researchers have commented, these models can subsequently help museums to make more strategic decisions (Trainer, Steele-Inama, & Christopher, 2012).

The Museum Visitor Experience Model was the result of extensive empirical work arising from research conducted by Falk and various colleagues, based mostly in the US. However, there is very little relevant research on visitors' identities based on Falk's model conducted under other cultural and social backgrounds, and almost none in China mainland. Sheng & Chen (2012) applied Falk's framework and conducted surveys in three institutions in Taiwan, however the result showed the visitors' motivational factors were different from Falk's (see Chapter 8). This at least suggests that Falk's theory does not transfer directly to an Eastern Asia cultural context. Furthermore, Falk's theory has previously been challenged by other researchers, such as Dawson and Jensen (2011) for lacking inclusion of visitors' demographics (see Chapter 2).

My project is thus an attempt to explore if this western science communication theory can be applied within a Chinese cultural background and then if so, how to apply it. Taking a mixed methodology approach combining a visitor questionnaire survey with a small number of face-to-face interviews with

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<sup>4</sup> These concepts and developments are explored in more depth in Chapter 2.

experts, I clarified the format and concept of Ke Ji Guan in China and explored the Chinese visitors' demographics and identity-related motivations within three case study Ke Ji Guan under the theoretical frame of Falk's Museum Visitor Experience Model. I also probed the correlations between Chinese visitors' demographics and their visit motivations (see Chapter 7). My findings contribute to Ke Ji Guan studies in China by adapting Falk's model to a more suitable Chinese context and drawing a portrait of the visitors. Also, my research may help the western science communication world to better understand the situation of China's Ke Ji Guan.

## **1.2 The concept of Ke Ji Guan**

Before progressing further with this thesis it is important to explain the choice of the term “Kexue Jishu Guan” (Ke Ji Guan in short). In Chinese, Kexue means science, Jishu refers to technology, and Guan means an institution or a building. The use of this phrasing within my thesis title (and in the previous section) is very deliberate, and draws a distinction between more westernised concepts of science museums/centres, and the similar institutions that exist within China. In brief, Ke Ji Guan is the Chinese name of a kind of Informal Science Institution and a type of science and technology popularisation infrastructure in a Chinese context. It shares some characteristics with science museums or science centres in the western sense, however is a uniquely Chinese style of institution, which will be discussed further within Chapter 2 and Chapter 8. This concept can be used in both singular and plural formats.

In my whole thesis, I will use the “Informal Science Institution” as an umbrella term to reflect all Ke Ji Guan, science museums or science centres, while I will employ their actual names when I mention some specific institutions, such as the China Science and Technology Museum (one of my case study Ke Ji Guan in Beijing, China).

### **1.3 Research questions**

As demonstrated in Section 1.1 my research involved testing Falk's theoretical identity-related motivation framework within a Chinese context. So in order to gain a better understanding of Ke Ji Guan visitors in China, I focused on the following three Research Questions:

#### **Research Question 1: What are the identity-related motivations of visitors in the case Ke Ji Guan?**

As I have written about in Section 1.1, Falk's model has been shown to not work so well in certain eastern backgrounds. There is also no other research conducted about the same topic in China. So it is worth exploring visitors' identity-related motivations on basis of the Chinese cultural and Ke Ji Guan. Furthermore, as I previously noted, Falk was challenged regarding a perceived lack of consideration of demographic factors-which results in the next Research Question:

#### **Research Question 2: What are the demographics of visitors in the case Ke Ji Guan?**

Because Chinese Ke Ji Guan visitors' demographic profiles are either non-existent nor currently publicly available, it is important to conduct contemporary demographic research in practice.

#### **Research Question 3: What are the correlations between the demographics and identity-related motivations of visitors in the case Ke Ji Guan?**

Research Question 3 takes Falk's original model a step further by probing the

relationships between visitors' demographics and identity-related motivations using statistical approaches.

#### **1.4 The structure of my thesis**

Having provided an overall context and justification for my research in the previous sections, here I provide a description of the structure of my thesis (**Figure 1**) and brief introductions to each chapter.

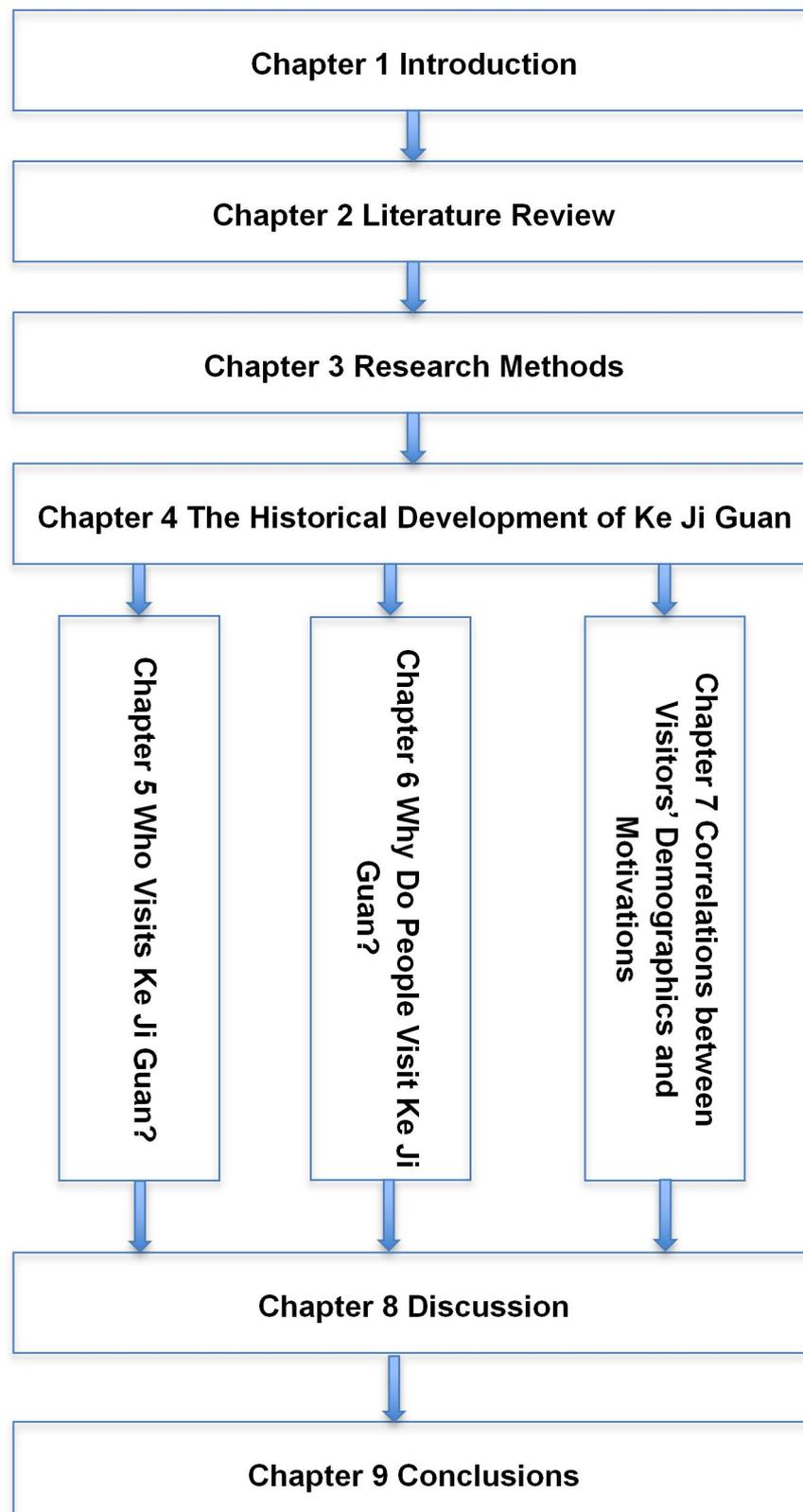
In this current chapter (Chapter 1 Introduction) I describe the research context and the potential significance of my research. I also present the thesis structure both in diagram form and textual descriptions. The research questions and the concept of Ke Ji Guan are also introduced.

In Chapter 2 (Literature Review), I review the modern concepts of science museum and science centre. Also, I reviewed the developing history of the concept of "museum" in China and the early modern science-related museums in China. Falk's work and his theoretical model are introduced, including existing criticisms against his hypothesis. Other scholars' relevant research in the field of Informal Science Institution visitor studies and the reason why I choose Falk's theoretical Museum Visitor Experience Model as my theoretical framework are also outlined. I also provide a review of Hofstede's theory of cultural dimensions in order to contextualise my analysis of my data within later chapters.

In Chapter 3 (Research Methods), I introduce my mixed research methods combining a qualitative strategy (semi-structured expert interviews), and quantitative method (visitor questionnaire survey). I outline the steps taken to ensure ethical conduct of the research, as well as the chosen research objects, sampling techniques, survey design and the recruitment process employed. The extensive piloting procedures relating to my questionnaire survey are also

described, as well as an analysis of the limitations inherent within my chosen research methods.

**Figure 1: The structure of my thesis**



Chapter 4 (The Historical Development of Ke Ji Guan) contains the results of my expert interviews and archival research. In this chapter, I present an overview of the historical development of Ke Ji Guan in China. In particular, using information drawn from the analysis of the interview data and archived internal documents, I confirm the similarities and differences between the concept of “Ke Ji Guan” and western science museum/centre.

Chapter 5 (Who Visits Ke Ji Guan?) is the first chapter presenting results from my visitor questionnaire survey conducted at three selected Ke Ji Guan in Beijing, Shanghai and Shandong. In this chapter, I explore visitors’ demographic data<sup>5</sup>, in particular gender, age, educational qualification, subject background, location of residence, previous experience of visiting that museum, and who they were accompanied by. Based on these results, I present a picture of the overall visitor profiles in my three chosen case study Ke Ji Guan.

Chapter 6 (Why Do People Visit Ke Ji Guan?) applies Falk’s Museum Visitor Experience Model within the three Ke Ji Guan. This chapter highlights visitors’ reported motivations for attending these Ke Ji Guan and their main identity-related categories based on an adapted version of Falk’s methodology. Taking this analysis further, an Exploratory Factor Analysis (EFA) indicated that there were statistically clustered factors among visitors’ motivations, which represented related but also uniquely Chinese visitor identities.

Chapter 7 (Correlations between Visitors’ Demographics and Motivations) shows the correlations between visitor demographics and their identity-related motivations at Ke Ji Guan in China. I applied the results of my EFA to examine if there were any statistical relationships between demographics and

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<sup>5</sup> It should be noted that for reasons outlined in Chapter 3, my research focused only on adult visitors, and does not include anyone below the age of 16.

motivations. The results highlighted some demographics such as gender, age, education, and previous visiting history had statistically significant relationships with specific visitor identities, which arose from the EFA results.

I provide a discussion of my results from both the expert interviews and the questionnaire survey in Chapter 8 (Discussion). Here I make comparisons between my results with both research in western Informal Science Institutions and relevant Chinese evidence. I also reflect upon the Chinese visitors' motivations arising from my data within a cultural context.

In the last chapter (Chapter 9 Conclusions), I summarise the thesis overall, in particular answering the Research Questions, outlining the original and unique aspects of my findings, and addressing what innovative about my work is. I also make suggestions for possible further work in the future based on my research both for practice and studies.

## **2 Literature Review**

In this chapter, I review the concepts of “science museum” and “science centre” in the western sense, as well as the origin of the concept of “museum” in China. The particular cases of early science-related museums’ development in China is also described. I provide a review of other scholars’ relevant research in the field of Informal Science Institution visitor studies and clarify the reasons for choosing John H Falk’s theoretical Museum Visitor Experience Model as my theoretical framework. I review Falk’s Model and its applications, as well as existing criticisms of his arguments. A deep understanding of the theoretical framing is essential to my research, including the criticisms to Falk’s theory, to help ensure my results are robust, and in particular that I avoid recognised vulnerabilities or work them out. Furthermore, studies on museum visitors in China are rare, so by reviewing what research on visitors does exist, both within China and internationally, I can get some ideas about research methods, which will be useful for choosing my own research approaches. Finally, I also review Hofstede’s theory of cultural dimensions in order that I can employ it to analyse my data from China and make comparisons between my results and other scholars’ findings.

### **2.1 Modern concepts of science museum and science centre in western sense**

The origin of western science museums could be traced from “The Cabinets of Curiosities” in the late period of Renaissance (seventeenth century). From the seventeenth century, the use of collections to help carry out education or academic communication began to occur. More museums began appearing throughout different countries in Europe, such as the first science museum: the Ashmolean Museum in Oxford in 1683, England (Gregory & Miller, 2000). Then after centuries’ development, a lot of science museums have been built all

over the world such as the Science Museum London (1909). Around the 1960s, a new type or branch of science museum-the science centre-was fast growing, particularly in the North America. For example, the New York Hall of Science opened in 1964, and the Lawrence Hall of Science opened in 1968 (Fors, 2006; McManus, 1992). These institutions are usually full of interactive facilities or hands-on exhibitions rather than the hands-off collections in traditional science museums.

Science centres are not an entirely new phenomenon and share many connections with old-fashion science museums. As noted by Durant (1992) both types of institutions are open to the general public; both of them contain exhibits for improving visitors' scientific knowledge; both of them try to at least partly help visitors to explore scientific phenomena with the support of interactive experiments and facilities (Durant, 1992). Furthermore, these two formats show extensive co-operation and mutual learning. Many traditional science museums additionally borrow innovations from science centres to supply visitors with hands-on and interactive facilities in order to better demonstrate the scientific knowledge relating to their collections (Boyle, 2010; Gregory & Miller, 1998).

In terms of the distinction between science museum and science centre, many countries make a very small distinction about what is a science museum or science centre because both of them have the key function of helping to learn science. The former director of Heureka (The Finnish Science Centre), Per-Edvin Persson, described "The difference between a science museum and a science centre is like a line drawn in water" (Ecsite-UK, 2008b, p. 2). In fact, some researchers' definitions of these institutions do reflect this blur. For example, Wagensberg defined that,

*"A museum of science is a space devoted to providing stimuli, for any citizen whatsoever, in favour of scientific knowledge, scientific method and scientific*

*opinion, which is achieved by firstly using reality (real objects and phenomena) in conversation with itself and with the visitors” (Wagensberg, 2006, pp. 26–27).*

In this narrative, there are no clearly distinguishing characteristics of a modern science museum. A science centre could also fit this definition broadly. Similarly, the mission of the Science Museum Group (London) states its mission as being to “engage people in a dialogue about the history, present and future of human ingenuity in the fields of science, technology, medicine, transport and media” (*Science Museum Group Plan 2015/16*, 2015). This is also not an exclusive description only related to a science museum environment.

In practice, modern scholars and organisations use various umbrella concepts to include both concepts. For example, Packer & Ballantyne employed the term “informal learning settings” (Packer & Ballantyne, 2002). Rowe & Nickels used the description of Informal Education Institutions (Rowe & Nickels, 2011). Additionally, the Center for the Advancement of Informal Science Education (CAISE) was built with support of the US National Science Foundation (NSF) in 2007. In the institution’s report (and its website “[Informalscience.org](http://Informalscience.org)”), the concept of Informal Science Education institutions includes “film and broadcast media, science centres and museums, zoos and aquariums, botanical gardens and nature centres, digital media and gaming, science journalism, and youth, community, and after-school programs” (CAISE, 2010, p. 2). Dawson also used the concept of Informal Science Education (ISE) institutions in her research about science museum and science centre visitors (Dawson, 2014) while Adams & Gupta used the concept of Informal Science Institutions (ISIs) to represent “science centres, natural history museums, zoos, aquaria, or arboreta” (Adams & Gupta, 2017, p. 122).

In summary, both in academia and practice, it is not necessary to separate the

concept of science museum and science centre or even consider them as distinct categories. Throughout the rest of this document I will employ the term “Informal Science Institution” as the umbrella concept to emphasise the key word “Science”.

## **2.2 Science-related museums and studies in China**

In this section I will explore science-related museums in China including their origins, how these museums developed and are defined, and an overview of existing studies on modern science-related museums in China. As yet very little scholarly work has focused on these areas, and I faced substantial challenges in trying to access relevant information. For example, many of the documents are only available to a limited group of people, and in other cases the existence of relevant documents is not even acknowledged. I therefore recognise that this review is unlikely to be exhaustive, but is instead based on whatever information was able to be accessed to provide an overall picture of the development of science museums in China. For this reason I arranged interviews with key members of the science museum community in China as part of my research. I use the data from these interviews to build a better historical picture of the development of Ke Ji Guan<sup>6</sup> in China in Chapter 4.

### **2.2.1 Origins of the concept of “museum” and early modern science-related museums in China**

In China, “museum” is an imported concept from the western world rather than arising from within its own society and culture. In ancient China, there was no concept of “museum” (Li, 2015; Wang, 2001). Even its Chinese name “Bo-Wu Guan” was also a new grouped phrase to Chinese people until the early nineteenth century. The phrase “Bo-Wu” emerged in a memorial to the emperor of the West-Han dynasty (about 202 BC-8 AD) to promote an ancient

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<sup>6</sup> I will explain this Chinese phrase later in this section.

book named *The Classic of Mountains and Seas*. The author, Xin Liu, was also the annotator of this book. He mentioned in the document: “A gentleman who is of “Bo-Wu” cannot be confused by anything.” In this original context, “Bo-Wu” means knowing all kinds of varied knowledge: a polymath. In the era of Wei-Jin and the South-North dynasty (about 220 AD-589 AD), a discipline under the name of “Bo-Wu” emerged, and famous scholars in this field were proud of distinguishing and recognising rare things including natural creatures and artefacts. But the grouped phrase “Bo-Wu Guan” (museum) did not exist before the early nineteenth century.

In the nineteenth century, the communication between China and western countries began to be more and more frequent. People in China wanted to learn western science and technology to improve their country. To build museums was considered as one of the ways to progress (Wang, 2001). In 1866, the government of the Qing dynasty (approximately 1636-1912) sent an official expedition to visit the European continent for the first time. In their travels, these officials visited museums. When they came back to China, they used more than ten different names to describe their experience at museums in Europe such as “Ji-Bao Yuan” (an institution of collecting treasures) or “Ji-Qi Guan” (a place full of amazing things) (Wang, 2001, p. 72). According to Jianming Chen’s research, the name of “Bo-Wu Guan” was first mentioned in 1844 by Yuan Wei in his book: *An Illustrated Introduction of Overseas Countries* (Chen, 2005). But the name of “Bo-Wu Guan” was not widespread until the middle and late nineteenth century. During this period, more and more Chinese people who visited other countries tended to translate “museum” to “Bo-Wu Guan”. The blossoming of newspapers, particularly the newspapers founded and supported by foreign missionaries, helped to spread the name of “Bo-Wu Guan” all over China (Chen, 2005). To consider the elements separately, the word “Guan” means a place or a functional building. The single word “Bo” means a large range of, and the word “Wu” means objects,

knowledge or disciplines. So a “Bo-Wu Guan” refers to “a place with a large range of collections” in a literal Chinese sense.

From 1868, museums began to appear in China. Compared with museums in the western world, most of the museums in China in that era were not open to the public. Foreigners, particularly the missionaries, built many museums, and most exhibitions were originally the missionaries’ personal collections (Fu, 1957). Until 1919, British, French, American, and Japanese people also established museums in China (Fu, 1957).

One example is the “Xujiahui Bo-Wu Yuan”. In 1868, Father Pierre Marie Heude (1836-1902), a Frenchman, established the Musée de Zikawei<sup>7</sup> (Hu, 2012a; Tai, 2013). This institution was mainly built based on Father Heude’s personal collections and other collections from the local church. Its Chinese name was “Xujiahui Bo-Wu Yuan” while its foreign names varied, such as Musée de Zikawei, Siccawei Museum<sup>8</sup>, Museum of Natural History, and Natural History Museum. The reason it applied the name of natural history museum was due to most of its collection being about natural history (Hu, 2012b). Heude was a zoologist and botanist. Most of his collections were samples of animals and plants from the region of the Changjiang River (known as the region of Jiang-nan) (Hu, 2012a; Tai, 2013). In its later period of 1930-1952, the museum moved to the campus of Zhendan University and changed its Chinese name to “Zhendan Bo-Wu Yuan” to reflect its new location, and applied the foreign name of “Musée Heude” in memory of its founder, Father Heude (Tai, 2013). Before 1933, this museum focused on research and paid very little attention to displaying collections or public education (Tai, 2013).

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<sup>7</sup> The main building of the museum was eventually completed in 1873.

<sup>8</sup> Both of the Zikawei and Siccawei refer to the location of the museum, in the Xujiahui district in Shanghai, China. Scholars from different regions may translate it into English names with small differences.

At around the same time, in 1874, with the support of the Shanghai Municipal Council, the North-China Branch of the Royal Asiatic Society (British) established the Shanghai Museum. British scholars John Fryer and Alexander Wylie, together with Chinese scholars Tingshu Tang, Shou Xu, and Jianyin Xu were the co-creators. This museum sometimes carried out lectures and workshops with other scholars (Fu, 1957). In the Journal of the North-China Branch of the Royal Asiatic Society, James Thomas described the collections in this museum in his Retrospect of events in China and Japan for the year 1874 as:

*“During the year the nucleus of Museum has been started, and promises very speedily to become the repository of most valuable collection of specimens of the Natural History of the North of China, and also of many objects illustrative of the arts, products and manufactures of the country; as well as of other objects of interest and worth”* (Thomas, 1875, p. ii).

From this description it can be seen that the collection of the Shanghai Museum included natural-historical exhibitions, which was similar to many museums in that time. For example, in the north China region, a French Jesuit and natural historian Emile Licent established the Musée Hoangho Paiho in 1914 based on his collections of biological specimens and geological samples (Fu, 1957; Wang, 2001).

In 1905, a Chinese scholar, Jian Zhang, established the Nan-t'ung Museum in Kiangsu province. The museum incorporated different sections such as natural history, history, and art. This was a private museum, but also the first museum open to the public, and it is regarded as the beginning of the modern museum in China (Fu, 1957; Wang, 2001). It was also the first science-related museum entirely built by Chinese people (Li, 2010). Around the 1930s, the Association of Chinese Museums argued that a museum was a cultural program, an institution for education and exploring knowledge (Wang, 2001). Then more

and more museums began to open to the public. For example, Musée Hoangho Paiho was opened to the public in 1928 (Fu, 1957; Wang, 2001), and the Zhendan Bo-Wu Yuan (Musée Heude) opened to the public in 1933 (Hu, 2012b; Tai, 2013). To change from private collection to public museum is a sublimation of Chinese museums. From private to social, and from private to public are metamorphoses of Chinese museums (Su, 1988).

In summary, from the end of the nineteenth century to the early twentieth century, by learning from the western world, certain official and personal museums were built for the purpose of improving the country. The contents of those museums included collections from the disciplines of physics, chemistry, geology, biology, botany, and geography. Some museums even had laboratories and green houses (Fu, 1957). A lot of these museums were actually what would be called in the west natural history museums, though they could be regarded as broadly science-related. But museums at that time were not open to the common public. From the 1930s, more museums began to open to the public, though many of them did not survive the upheavals associated with the world wars and Chinese civil wars. Then in a very long period until the 1980s, the museums specifically and science communication more generally in China developed very slowly.

### **2.2.2 Confusing taxonomy of science-related museums**

There are very few documents about the historical development of science-related museums in China, and the definition and taxonomy of museums are also not well developed. As noted in the previous sections, within a western context the distinctions are important for this project, especially in order to enable comparison between equivalent institutions. Similarly, in the Chinese context, it is also necessary to have distinct definitions and taxonomy of science-related museums in order to help inform research

and practice. In fact, the lack of a clear definition and taxonomy raises problems in the field of science-related museum studies in China.

After the People's Republic of China (the new China) was built in 1949, the Chinese government and scholars began from the 1980s to learn again from the western world about building modern science popularisation infrastructures. When these infrastructures were being built in China, a new phrase emerged, the "Kexue Jishu Bo-Wu Guan" (Ke Ji Guan in short). "Kexue" refers to science, "Jishu" means technology, and as noted previously "Bo-Wu Guan" refers to "a place with a large range of collections". In some cases, the phrase "Ke Ji Guan" is used to represent science museums in China, and in other cases, science centres. However, there is no official definition or taxonomy about science museums, science centres and Ke Ji Guan in Chinese academic documents.

For example, according to the Report on the Development of China's Popularisation of Science and Technology Infrastructures (PSTI) (2009), science museums (including science centres) were classified into the larger category of science-related museums (Ren, 2009). So in a similar manner to the demarcation of science centres and museums within western cultures outlined in the previous section, Chinese science centres were considered to be a sub-group within the wider science museum definition. This relationship is shown graphically in **Figure 2**.

**Figure 2: The schematic chart of the category of science-related museums in China (2009)<sup>9</sup> (adapted from Ren, 2009)**

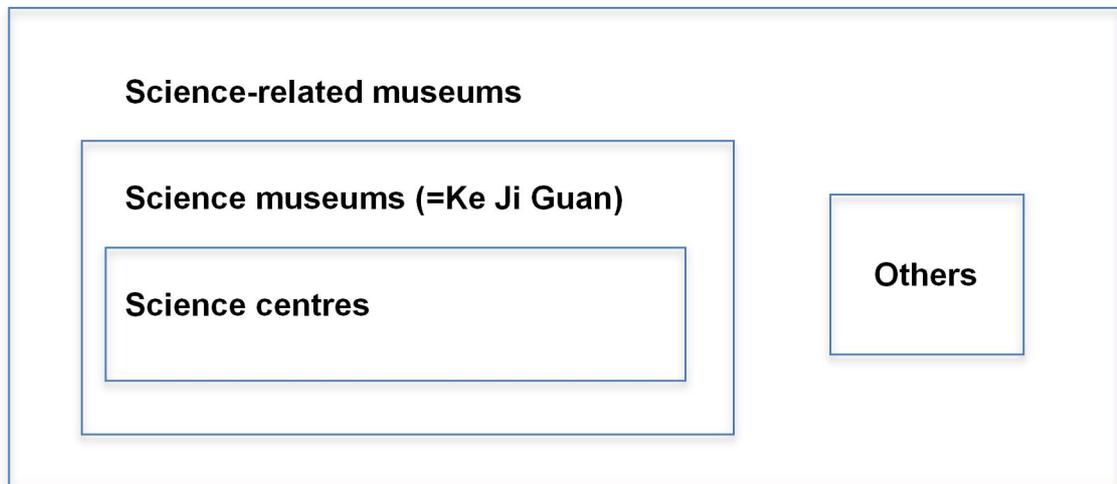


Conversely, in the report of PSTI of 2010, Ke Ji Guan were regarded as the same thing as a science centre, and science museums were not separately mentioned in the taxonomy. Their relationship can be seen in **Figure 3**.

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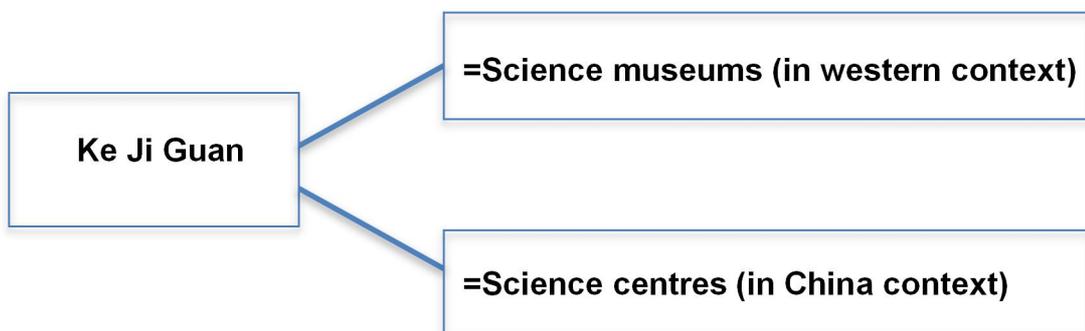
<sup>9</sup> It should be noted that, in the figures within this section, the “Others” category refers to a wide range of types of institutions, such as a natural history museum, planetarium, zoo, and nature reservation (Ren, 2009). I focus on the relationships among key concepts such as science museum, science centre and science-related museums in the figures and will not further consider the category of “Others”. So my diagrams are not the entire descriptions of the taxonomy of science-related museums in China, but this omission does no harm to my core narrative about the correlation of the key concepts.

**Figure 3: The schematic chart of the category of science-related museums in China (2010)** (adapted from Li, 2010)



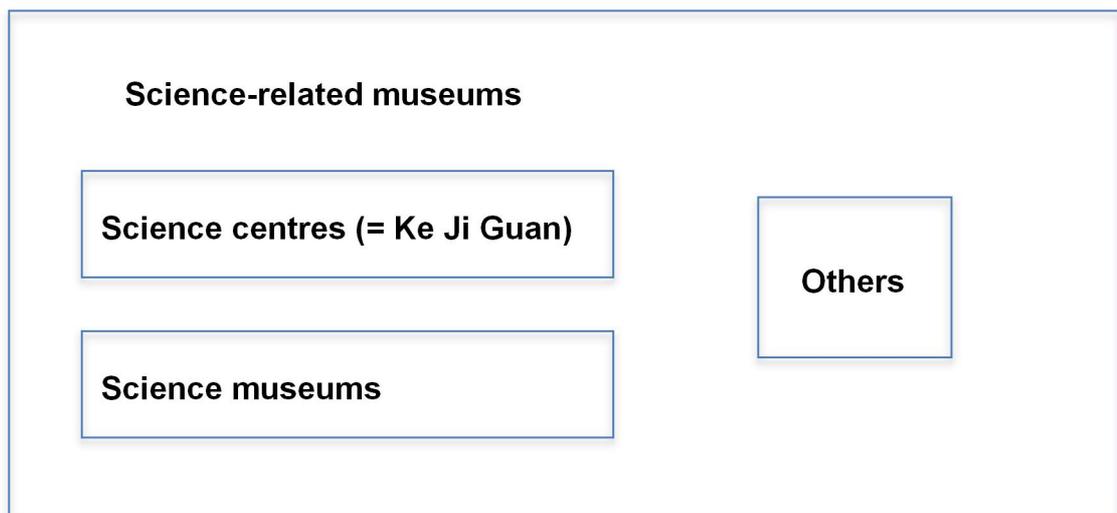
However, only one year later in 2011, the categories changed again according to the Report on the Development of China's PSTI (2011). Here Ke Ji Guan refers to science centre in the western context, while in China it refers to science centre specially (Zhu, Cai, & Zhao, 2011). Their correlation can be seen in **Figure 4**.

**Figure 4: The schematic chart of the category of science-related museums in China (2011)** (adapted from Zhu et al., 2011)



Finally, in the Report on the Development of China's PSTI (2012-2013), the relationship among science museums, science centres, and Ke Ji Guan returned to the original 2009 definition, without reference to any of the other categorisations used in the interceding years (**Figure 5**).

**Figure 5: The schematic chart of the category of science-related museums in China (2012-2013)** (adapted from Lou, 2013)



Based on the situation described by these diagrams, modern science-related museums' identities are blurry within China. For example, some Chinese institutions call themselves science museums however they actually have no historical collections, instead strongly focusing on interactive exhibits. A good example is the China Science and Technology Museum (CSTM, Beijing), which takes the name Ke Ji Guan in Chinese. Also, for many institutions their (corresponding English) phrasing is used inconsistently across different locations and even different (equivalent) reports. For example, they may use the label of science and technology museum, science centre, science palace, as well as planetarium. It is not easy to predict from their English name exactly what the contents, purpose and/or functions will be within individual "museum-like" institutions in China. For this reason I have interviewed relevant senior scholars in China regarding the purpose and function of Ke Ji Guan

institutions in order to clarify the Chinese naming conventions, the results of which are explained in Chapter 4. In my narrative within this thesis, I will apply the name of Ke Ji Guan as the concept is used in China while when I mention some particular Ke Ji Guan I will use their official English names, such as the China Science and Technology Museum.

### **2.2.3 Visitor studies in China**

There are very few accessible visitor surveys or studies in China, which makes it difficult to report accurately on what is already known about visitor experiences at Chinese science museums.

In China, only a few universities have museum-related departments. According to data from the Chinese Ministry of Education (2011), there are more than 800 government public universities in China, but only 53 of them have a department of museum studies or museology (Mei, 2011). It seems that as a discipline, museology or museum-related studies gains very little attention by educators and students in China, resulting in few academic publications on the topic.

Of course in many countries museum staff themselves conduct extensive audience research within their own institution, rather than relying on external academics and students. However the bureaucratic processes associated with getting a job at a museum in China means that very few staff members have the appropriate background or qualifications to conduct such research. This is especially true of the larger museums such as the China Science and Technology Museum because of its connection with the government. To become a member of staff in an official museum initially requires that the candidate must pass a very strict exam, which includes a lot of comprehensive questions similar with the exam of national civil servants but very rear questions about museum. Very few students with a background in museum

studies are therefore able to find a job in an official museum. Because of the lack of professional staff, there is a tendency towards repeating content and practices in place at other similar institutions, meaning that museums and science museums within China are perceived to contain similar exhibitions, offering homogeneous content without any specific appeal to visitors (Yu, 2011).

Relevant academic articles published in English or Chinese journals that describe visitor profiles are very rare, and only a few (mostly internal) reports exist that are of relevant to visitors. For example, from 1998 to 2013, the China Science and Technology Museum (CSTM, Beijing), conducted surveys of its visitors about their satisfaction with the museum. Some questions in those surveys were about visitors' background demographics, but most of the results and reports are unavailable to people outside the CSTM. For example, they published a book about their survey results and analysis titled *The Evaluation of the Permanent Exhibition in Ke Ji Guan's Science Popularisation Effects*. This book had a print run of only 1000 copies and distribution was restricted to relevant official institutions or people directly associated with the institution itself. It could not be accessed outside the circle of CSTM. Similarly, through contact with researchers at CSTM I am aware that they sometimes employed commercial companies to conduct surveys by means of questionnaires, but the data of these surveys was generally kept internal.<sup>10</sup>

Yet there are some broader indications of institutional intentions towards their visitors. Many Ke Ji Guan in China claim that their target visitors are the younger generations (Zhu et al., 2011). For instance, the Chinese Science and Technology Museum, the Guangxi Science and Technology Museum, and Xiamen Science and Technology Museum reported that they used their special resources and local materials to guide younger generations to conduct

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<sup>10</sup> Thanks to one of my interviewees, Heng Wang, I obtained a copy of the book outlining the results of the survey they conducted in 2005. But it was the only comparison data about Chinese Ke Ji Guan I had access to. My comparison can be seen in Chapter 8.

experimental studies, and foster their abilities of discovery and observation (Zhu et al., 2011). In their lists of activities they also highlight programmes such as “Teenagers Competition of Science Knowledge”, “Science Summer/Winter Camp for Teenagers”, “School Students Science Drama”, most of which are for young people (Zhu et al., 2011).

Generally, Ke Ji Guan studies in China are in their foundational stages. Most data or documents I can use come from official organisations such as the China Association for Science and Technology (CAST). Until now objective visitor studies of Ke Ji Guan in China are very rare. So my research methods (see Chapter 3) and findings in Chapter 5 and Chapter 6 make a unique contribution to the area of Ke Ji Guan studies in China.

### **2.3 Visitor studies in a modern western context**

Returning to consider developments within a Western context, from about the 1970s, both the daily operation of museums and museum studies as a field of research began to pay more attention to visitors (Bicknell & Farmelo, 1993a; Serrell, 1993). Exhibition development showed a clear trend of caring about visitors’ feelings and experience, rather than just focusing on displaying and presenting (Serrell, 1993). Meanwhile, the numbers and depth of studies involving visitors began to grow significantly (Shettel, 1993).

One of the reasons for this change has usually been deemed a reduction in public funding from government sources within many western countries. By the mid-1980s, it was the reality for both European and North American museums that it became difficult to get financial support from government or other institutions (Candlin, 2012; Pollock & Zemans, 2007). Some public museums have subsequently paid more attention to visitor benefits, frequently incorporating more commercial enterprises such as a gift shop and Café to increase funding sources, and some of them have even introduced an

admission fee (Candlin, 2012). It was necessary to be more visitor-friendly to attract more visitors (Candlin, 2012).

This situation has raised interest in whether for a museum it is necessary to play a visitor-focused role or a museum-focused role. Hood (1983) urged museum professionals to focus on the psychical characteristics of both current and potential visitors and particularly their values, attitudes, perceptions, interests, expectations, and satisfactions. In order to support visitor studies well, a single tool or method is often not enough to reflect the true social context. Multi-perspective approaches are often necessary. For example, as Housen (1987) pointed out, there are three main information-gathering perspectives relating to museum visitors: demographic, attitudinal, and developmental. Demographic measures give statistics about gender, age, occupation, education, and museum attendance. Attitudinal data show the deeper, less apparent self-reported perceptions about preferences and beliefs. Developmental data reflect thought types, encompassing what an individual comprehends, reasons about, or finds compelling and motivating in a particular domain (Housen, 1987).

Surveys have been the traditional method to obtain visitors' attitudinal information. For example, McManus conducted a survey at the Science Museum London in 1989 and found that more than one quarter of visitors went to the Science Museum for learning. Around one fifth of visitors went there for general interest. There were also some visitors who visited the museum for fun and for specific aspects of the museum. Some respondents showed they had no structured plans (McManus, 1992). McManus found that visitors' interests were wide-ranging and not limited to the learning task (McManus, 1992).

In the 1990s, Kotler and Andreason noticed that visitors were not regarded as a static general public any more (Andreasen & Kotler, 1995). They were instead segmented into particular parts of the wider population, such as local

people or travellers, families or citizens, first-time or regular visitors (Andreasen & Kotler, 1995; Loomis, 1993). The methods used to study visitor experiences also transformed from focusing on individual visitors to more emphasis on the wider social context of their visit (Uzzell, 1993).

Some scholars argued that visitor expectations are part of their personal context, and influenced by other personal factors, such as educational level, as well as social context, such as family life cycle (Sheng & Chen, 2012). Such perspectives have heavily influenced the development of visitor studies. Therefore the traditional assumptions relating to strict (factual) educational benefits were therefore insufficient, and a more sophisticated model of visitor perceptions was needed.

## **2.4 John H Falk and his theoretical model**

In this section, I will outline the main theoretical framework of my research, based on John H Falk's theory of the Museum Visitor Experience Model and the role of Identity-Related Visit Motivations. I will also reflect upon existing criticisms of his approaches, and demonstrate why this model remains the most appropriate framework for structuring my research.

### **2.4.1 Falk's theoretical model**

In 2009, Falk published his book *Identity and the Museum Visitor Experience*. In this book, he introduced the concept of the "Museum Visitor Experience Model" based on his decades of work on museum visitor studies. Within Falk's papers "museum" has been used as a very wide categorical concept, which includes a wide range of institutions, such as science museums, zoos, aquariums, art galleries and historical museums. Borrowed from identity research, Falk expressed that there are two kinds of visitor identity. One is the uppercase 'I' Identity, which means a long-term and deep identity (such as gender identity), and the other is the lowercase 'i' identity, which is relevant to

a short-term identity in a particular event or context. For example, an individual can enact his/her identity of “good family member” by sending greeting cards on another family member’s birthday (Falk, 2009).

Based on Falk’s model, an individual’s museum visiting process is also a process of communication within the museum rather than just seeing exhibitions (Falk, 2009). The model reflects the whole process of the audience’s visit, from pre-visit to post-visit. The visitors’ museum visit is an experience to build, revise and test their identities (Falk, 2009).

Before visiting, Falk argued, people have two streams of thoughts in their mind. One is that they have one or more identity-related needs to be met (*Personal Identity* in Falk’s terms) and they want to satisfy those needs through certain activities. The other thought is that they have a range of activity options to choose from, one of which is visiting a museum. These two orientations may result in the decision of visiting a museum to satisfy their identity-related needs. Falk calls the decision of choosing a museum to feed the motivation as the “Perception of Museum Affordances”. The decision-making process leads to the structure of the identity-related motivations (Falk, 2009).

Concerning museum visit motivations, there are other researchers who conducted prior exploratory work. For example, Packer and Ballantyne identified five visit motivations in 2002 as Learning and discovery, Passive enjoyment, Restoration, Social interaction, and Self-fulfilment (Packer & Ballantyne, 2002, p. 189). Based on substantial experimental work in North America, Falk then took these concepts further and categorised several identity-related motivations for visitors attending a museum. They were as follows (Falk, 2009, 2011; Falk & Dierking, 2013):

- **Explorers:** Visitors go to museums to fulfil their curiosity.

- **Facilitators:** Visitors go to museums to meet other people's needs. For example, good parents take their children to museums and let them have fun and learn something.
- **Experience seekers:** Visitors go to a museum for the museum's reputation or they want to have an experience of going to a famous museum.
- **Professional/Hobbyists:** Visitors go to a museum for professional reasons, such as for research and teaching.
- **Rechargers:** Visitors go to a museum to relax or avoid the work-a-day life. (This category was previously called a spiritual pilgrim. See (Falk et al., 2007; Falk, Heimlich, & Bronnenkant, 2008))

In 2011, Falk developed two more identity-related visitor groups as follows (Falk, 2011):

- **Respectful Pilgrims:** People visit an institution/memorial because of a sense of duty or obligation to honour the memory.
- **Affinity seekers:** Visitors attend a special museum or (more likely) exhibition for the sense of heritage and/or personhood.

In developing these last two groups Falk admitted that he did not want to change the original model, which was supported by empirical evidence for the previous five visitor categories (Falk, 2011). Indeed he has not written more papers or studies on the last two groups since they were initially suggested.

According to Falk's hypothesis, a visitor's museum experience is strongly structured by these identity-related motivations. Meanwhile, when visiting a museum, a visitor's experience is also impacted by a sub-model, the

“Contextual Model of Learning”. This model includes three contexts (Falk, 2009):

- **Personal Context:** The visitor’s prior knowledge, experience, and interest.
- **Physical Context:** The details of the exhibitions, projects, objects and labels they experience.
- **Socio-cultural Context:** The communication and interaction with others while visitors are in a museum.

These contexts work together to produce a visitor’s experience of their identity-related motivation, which is thus either satisfied or not. During and immediately after the visit, visitors will structure their own meaning of their visit. Then the identity of the visitor will be reinforced, modified or extended by this experience. This process not only influences individual’s identity-related motivations, but also impacts other people who are related to the visitor. Finally, after the visit, people’s Personal Identity and the Perception of Museum Affordances are re-built (Falk, 2009).

Although Falk talks explicitly about a “museum” experience model, this model also works well in other similar institutions. It has subsequently been applied to a wide range of visitor attractions, including science museums, science centres, zoos and common museums (Falk et al., 2008; Falk & Storksdieck, 2005). Indeed, in his book *“Identity and the Museum Visitor Experience”*, Falk applied this model within the California Science Centre (Falk, 2009, p. 160). Therefore actually, Falk uses the “museum” as an umbrella concept (Falk & Storksdieck, 2005).

In order to test the “Museum Visitor Experience Model”, Falk and his colleagues applied different methods. They employed questionnaire surveys,

(Falk et al., 2008), interviews (Falk & Gillespie, 2009; Falk & Storksdieck, 2005), and mixed methods approaches combining one or more of: questionnaires, interviews, tracking studies, and Personal Meaning Mapping (PMM) (Falk et al., 2007). Falk and his colleagues sometimes re-interviewed respondents after a period of time (Falk & Gillespie, 2009), and also carried out surveys in different locations. For example, sometimes the survey was conducted at a museum's front gate as a pretext before visitors started their visit (Falk et al., 2008). Sometimes they carried out post-surveys at the exit of a museum (Falk & Adelman, 2003). Occasionally they performed both entrance and exit surveys (Falk et al., 2007; Falk & Gillespie, 2009; Falk & Storksdieck, 2005). The results showed that all of these research methods worked well. However, these programs were carried out by researcher teams rather than one single person. According to Falk and his colleagues' papers, in order to understand visitors' identity-related motivations well, they usually used deep interviews, even re-interviewing visitors after visiting. Such approaches require high-quality teamwork and substantial financial support. For my research, I decided to adapt Falk's questionnaire approach (Falk et al., 2008), as it is easier to implement and simpler to maintain consistency when being conducted by a single researcher across multiple institutions.

Based on his decades of field experiments and surveys in the US, Falk and his colleagues strengthened their understanding of the main five identity-related visitor groups. For example, the results of some surveys showed that some visitors do not visit a museum with only one domain motivation. Sometimes they may have dual or multiple motivations (Falk et al., 2008). Several other researchers have applied Falk's model to other environments, and results have proved that Falk's model works well (See for example Falk, Heimlich, & Bronnenkant, 2008; Rowe & Nickels, 2011; Trainer, Steele-Inama, & Christopher, 2012).

### **2.4.2 Criticisms of Falk's model**

There are however some objections to Falk's model. Some researchers argued that Falk's model neglected important factors. For instance, this model did not include the influence of demographic factors on visitors' motivations, which meant he overlooked the roles that visitors' ages, ethnicities, social classes, or life experiences played in their visit. Such factors can impact people's attitudes, experiences and behaviours, so are an important omission (Dawson & Jensen, 2011). Moreover, Falk's model only focuses on the existing visitors and omits research on the people who did not visit (Dawson & Jensen, 2011). This means that when he tried to find out why people go to a museum or a science centre, he missed the question of why some people do not. This is also a question about motivations, which could provide essential insights.

To reply to these criticisms, Falk (2011) argued that within his definitions, demographic factors, such as age and gender, belong to the big "I" Identity. According to his survey in the California Science Centre, the "I" Identity did not play an important role in visitors' museum visit meaning-making (Falk, 2011). Generally, visitors tended to identify themselves in more situational and functional ways. Additionally, according to other research, visitors' motivations vary in different seasons (Black, 2005; Hood, 1989; Loomis, 1996). For example, a survey to Denver Zoo revealed that summer tourist visitors accounted for a greater percentage (63%) of those selecting to share quality time with friends and families than visitors on free days (Trainer et al., 2012). In this situation, the big "I" Identities are all the same-the same person. But the little "i" identity may change. This is not suggesting the big "I" has no influence on visitors' motivations, but it cannot reflect the main purpose of visitors. So Falk focuses on the "day-to-day", "real-time practice" rather than the coherent big "I" Identity, which related to visitors' demographics (Falk, 2011).

To explain why he did not include non-visitors as participants, Falk demonstrated that based on previous marketing research carried out for the Art Gallery of Ontario (AGO) (Northstar, 2011), both visitors and non-visitors believed that the benefits of leisure activities were spending time on the same issues, such as social relations, and visiting some institutions. This means that if the non-visitors did attend the museums, they would be likely to exhibit the same categories as the other visitors. Additionally, in Falk's model, only the visitors who really attend the AGO could regard AGO as the place to meet their needs. So he only studies the visitors who successfully make the visits (Falk, 2011).

#### **2.4.3 Justification for choosing Falk's model**

As I reviewed in Section 2.3, there were other museum experience models applied previously by other scholars, for example, McManus' survey at the Science Museum London in 1989 (McManus, 1992). However, those models and research tended to be focused in one location and with little further extension or consideration by other scholars. This meant they quickly became out-of-date and received no further testing or improvement. By contrast, Falk's model has been employed by not only his own direct colleagues but also by other scholars, particularly within western countries and cultures, and is starting to be extended elsewhere. In other words, the Falk model is "alive" and it has been tested, adjusted and applied in modern days, and it is timely for me to apply that model in my research with modern Chinese respondents. To help contextualise my work I will now review its development as well as how other scholars have employed Falk's model.

Packer and Ballantyne applied a similar model as Falk's in 2002 to conduct visitor studies at six informal education institutions in Queensland, Australia. They employed questionnaire surveys and factor analysis to explore the

visitors' motivations of visiting those six institutions and identified five motivational categories: Learning and discovery, Passive enjoyment, Restoration, Social interaction, Self-fulfilment (Packer & Ballantyne, 2002, p. 189). Although using different titles, Packer and Ballantyne's categories shared some features with Falk's identity-related motivation groups. For example, the Restoration reflected people who wanted "to relax mentally and physically, to have a change from routine and recover from stress and tension" (Packer & Ballantyne, 2002, p. 189). This description is similar to Falk's Rechargers: "Rechargers are primarily seeking to have a contemplative, spiritual and/or restorative experience; they use the science center as a refuge from the work-a-day world" (Falk & Storksdieck, 2009, p. 196). My result also shows similarities and differences with Packer and Ballantyne's motivational categories. I will discuss them in detail in Chapter 8, Section 8.5.1. Packer and Ballantyne's research also collected data regarding visitors' demographics. The researched institution types included museum, art gallery and aquarium, and the statistical analysis showed that there were significant differences among them. Packer and colleagues did further research on this model afterwards, for example (Ballantyne, Packer, & Hughes, 2008; Packer, 2004). However, it has not received further detailed investigation by other research team in other cultures. By contrast, Falk's model (which built on Packer and Ballantyne's work) has been tested not only by his own research team, but also other scholars in different institutions, even under other cultures such as Sheng and Chen's work in Taiwan (2012). From this perspective, Falk's model is therefore more suitable for my research.

A notable wider investigation of Falk's framework was conducted by Rowe and Nickels (2011). These authors applied Falk's theoretical model to studying zoos and aquariums in collaboration with the Association of Zoos and Aquariums (AZA). The studied institutions and AZA were all located in Oregon, USA. Rowe and Nickels strictly followed Falk's research methods by using the

same motivation categories, the same seven-point scale measurement for each of the statements, the same analysis technique, and even the format of the coloured card to show the options to the participants (Rowe & Nickels, 2011). Their results showed that Falk's model worked well and it could be used in a variety of Informal Science Institutions beyond only museums.

Taking Falk's work a little further, Trainer and colleagues (2012) conducted museum visitor studies under Falk's visitor-identity model in Denver, USA. They also used similar research methods to Falk's and also found his model worked well. Their data showed that different institutions had different dominant visitor motivation types. Seasonal reasons could impact visitors' motivations. They subsequently applied their motivational findings to Denver Zoo's practice to better understand their visitors. Trainer and colleagues argued that their data supplied a new perspective to understand audiences, and that Falk's model worked as an important tool to explore the portrait of visitors, which would help those case institutions make better strategies (Trainer et al., 2012).

As I reviewed in Section 2.4.1, Falk's model is the result of empirical work arising from his research, based mostly in North America, which was thus carried out under a North American cultural and social background. The majority of other work building on Falk's model has also been conducted with audiences from similar backgrounds, though there are rare exceptions. For example, a survey conducted in four Taiwan museums (Sheng & Chen, 2012) indicated that Falk's theory partly worked well there. The results supported some of Falk's arguments, for example, visitors' museum experience was related to their personal contexts such as historical experience and personal interests (Sheng & Chen, 2012). However, after statistical analysis, these researchers identified five categories of motivational factors (they were called "visitor experience expectations" in this survey) that were different to Falk's

identity-related motivations: easiness and fun, cultural entertainment, personal identification, historical reminiscence and escapism (Sheng & Chen, 2012, pp. 57-8). These results indicated that Falk's hypothesis of a Museum Visitor Experience model may be not entirely applicable to a Chinese-speaking context.

In summary, Falk's model can be regarded as an "alive" theoretical framework worthy of further testing, revision, and improvement within international and wider cultural contexts. The evidence to date is that the model itself is fit for modern research. There is relevant research and analysis using this model with modern museum visitors, which can provide comparisons with my own findings. So it is thus a robust choice as the theoretical frame for my work. Furthermore, most previous research which has employed Falk's model was conducted in institutions under the umbrella of "museum" including a wide range of informal education institutions such as an art gallery, history museum, botanical gardens and aquarium, but little published research focused specifically on science museums. So my research, as a project fully focusing on science-related institutions can contribute to this frame by providing data and analysis of these institutions. Additionally, there are still no published papers on this topic conducted under Chinese (mainland) cultural and social backgrounds. It is not certain if Falk's model will work well under Chinese societal or cultural contexts, especially for science-related institutions.

## **2.5 Hofstede's theory of cultural dimensions**

In terms of the cultural context, culture plays an important role in people's behaviours and motivation making (Matsumoto, 2007). Culture itself is defined as "the collective programming of the mind distinguishing the members of one group or category of people from another" (Hofstede, Hofstede, & Minkov, 2010). In other words, when viewed at population level, people from the same cultural background share certain cultural norms and characteristics. However,

this does not mean individuals will have absolutely the same behaviours. As Matsumoto argued, individual behaviour is the result of the interaction between culturally dependent social roles and individual identity roles (Matsumoto, 2007). Basic human nature, culture and personality have situational contribution to people's actual behaviours (Matsumoto, 2007).

From around 1968 to around 1972, Geert Hofstede conducted surveys on IBM employees in more than 50 countries about their values and related sentiments (Hofstede, 1980). Based on his research, Hofstede developed his cultural dimensions model. This model provides an overview of people's values, beliefs and behaviour in the context of national cultures. In his book *Culture's consequences: International differences in work-related values* (1980), Hofstede described his first four cultural dimensions: Power Distance, Uncertainty Avoidance, Individualism versus Collectivism, and Masculinity versus Femininity (Hofstede, 1980). In the 1980s, based on Michael Harris Bond's survey in the Far East, the fifth dimension 'Long-Term versus Short-Term Orientation' was added (Hofstede & Bond, 1988). Then in the 2000s, Michael Minkov added the sixth dimension of Indulgence versus Restraint by employing the data of his World Values Survey in 2007 (Hofstede et al., 2010). The resulting six cultural dimensions can thus be seen as follows (Hofstede, 2011):

1. *Power Distance*: related to the different solutions to the basic problem of human inequality. In a small Power Distance country, people try to make the balance of the power change to be more equitable, while under a large Power Distance culture, people tend to accept and expect that power is distributed unequally. For example, parents in a small Power Distance country treat children as equals, but parents in a large Power Distance country will teach children obedience to their seniors.

2. *Uncertainty Avoidance*: related to people's attitudes when they confront an unknown future. People from low Uncertainty Avoidance cultures tend to be more flexible and relaxed in dealing with uncertain affairs, but under a high Uncertainty Avoidance culture people may feel anxious and nervous. For instance, in order to handle uncertain situations, high Uncertainty Avoidance culture people welcome rules and laws, but people from low Uncertainty Avoidance countries dislike them.
3. *Individualism versus Collectivism*: related to what extent individual people naturally integrate into groups. Individualism culture refers to a society where people would look after themselves primarily, while in a Collectivism based society, people regard themselves as parts of the whole society. Under the latter culture, loyalty and a feeling of belonging are two of the key concerns.
4. *Masculinity versus Femininity*: related to the division of emotional roles between males and females. Masculinity culture advocates competition and achievement that is related to more typical male characteristics, while Femininity based society cares more about nurturing and modesty. There is a clear rights gap between men and women in a Masculinity based society.
5. *Long-Term versus Short-Term Orientation*: related to people's efforts towards the future or the present and past. In a Long-Term Orientation country, people tend to care about future situations so they preserve, save and plan. For example, In a Short-Term Orientation culture, people prefer to see quick results and would love to social spending and consumption, however in a Long-Term Orientation, people consider their future and have Large savings quote, money available for investment
6. *Indulgence versus Restraint*: related to the gratification versus control of basic human desires related to enjoying life. An indulgent culture focuses

more on individual happiness and well-being. Spare time and relaxing are important. On the opposite scale, people from a Restraint society do not care about their freedom and leisure so much.

According to this hypothesis, China, where I carried out my research, has clear characters of High Power Distance, Collectivism, Masculinity, Low Uncertainty Avoidance, Long-Term Orientation and High Restraint (Hofstede et al., 2010). When it comes to the US, where Falk's research mostly conducted, it shows features of Small Power Distance, Individualism, Masculinity, Low Uncertainty Avoidance, Short-Term Orientation and Indulgence (Hofstede et al., 2010). From the latest comparison on these two countries' cultural characters on the website of "Hofstede Insights", except for the Masculinity and Uncertainty Avoidance, China and the US show significant differences on other cultural characters. For example, the value ratio of China: US is 24: 68<sup>11</sup> on the dimension Indulgence (Hofstede Insights, n.d.-a). Based on this situation, it is worthy studying the visitors' identity-related motivations in different cultures from the US, such as my research in China because different cultures may cause different attending motivations.

However, some researchers have raised criticisms of this model. For example, the theory has been described as out-dated and Javidan, Taras and colleagues went on to claim it may no longer be useful. This was primarily because they felt that the cultures have changed since Hofstede's original work, and have also become much more dynamic, and that Hofstede's model could not deal with this new situation (Javidan, House, Dorfman, Hanges, & Luque, 2006; Taras, Steel, & Kirkman, 2012). As an answer to this critique, Hofstede highlighted six examples to prove that the cultural dimension theory

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<sup>11</sup> Hofstede and his colleagues applied 100 points scale to value the degree of each cultural dimension. The higher value point means the higher degree of dimension. For example, here value 68 means more features of Indulgence while 24 means lower degree of this dimension. On opposite, 24 means a higher degree of Restrain.

worked well in other international surveys, and that these surveys reinforced the relevance of his model to the modern day (Hofstede et al., 2010).

There are also other cultural models such as the Global Organisational and Behavioural Effectiveness (GLOBE) (House, Javidan, Hanges, & Dorfman, 2002) or the Cultural Dimension of Learning Framework (CDLF) (Parrish & Linder-VanBerschoot, 2010). But they are inappropriate to be applied in my analysis as tools to explore the reasons behind visitors' motivations as their areas of focus are quite different. For example the GLOBE model focuses on the culture of leadership though the study was conducted in 61 countries (House et al., 2002). So Hofstede's cultural dimension model has been chosen as the most relevant to apply in my discussion (see Chapter 8).

## **2.6 A brief introduction to Confucianism and the traditional culture of China**

China, covering an area of 9.6 million square kilometres, is located in the east of Asia with around 1.4 billion population on its land. China's main ethnical group is Han and its official language is mandarin. China is regarded as one of the great ancient civilisations with long-term and wide believed traditional cultures such as the Confucianism. These traditional cultures had guided Chinese people's life for centuries and are still having influences on modern people's life in some sense.

In this section, I will briefly introduce the Confucianism and the traditional culture of China. They are both very large and complex subject areas, with extensive histories, and it is not the purpose of this work to focus in detail on such matters. Instead, I will introduce the key elements that are particularly relevant to my research, in order to provide context for my research findings, especially for non-Chinese readers.<sup>12</sup>

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<sup>12</sup> In this section, there are some places where possibly I made reference to appropriate academic texts, but that much of these contents are commonly accepted knowledge within China, and therefore is not

As an eastern Asian country with more than 5000 years of history, China developed a unique culture. Confucianism and its derivative sub-cultures compose the main part of the Chinese traditional context. Confucianism is named after Confucius (Kong Fuzi in Chinese, around 551 BC-479 BC), a Chinese philosopher and teacher, who lived in the Spring and Autumn period (around 770 BC-453/403 BC).<sup>13</sup> In the period of the West Han Dynasty (202 BC-8 AD), Confucianism was officially promoted by the government and became the core of the Chinese system of values and cultures. His followers such as Mencius (Mengzi in Chinese, around 372 BC-289 BC) and other students built schools, taught students, wrote books and gave lectures generation by generation to complete the Confucianism approach.

Confucianism emphasises justice, sincerity, and using ethics to manage/build social relationships. In this context, some key ethical and behavioural rules became widely accepted and followed. For example, people were expected to be Ren (kind), Yi (personally loyal), Li (etiquette keeping), Zhi (wise) and Xin (faithful). This is called the “Five Consent Virtues” (Wu Chang in Chinese). However, these elements were mainly used to build individuals’ reputations or social networks, though Ren was employed by many emperors as one of the important philosophies of governing the country. Therefore, Chinese people grew a cultural habit of caring about personal morality more than social morality (Liang, 1902). This is why some people can be decent persons individually, but choosing to use the public instruments (such as public facilities in Ke Ji Guan) without any attempt to engage with the intended purpose or

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accredited to any particular source.

<sup>13</sup> Spring and Autumn Period is the first half historical stage of the Eastern Zhou Dynasty (770 BC—256 BC). At that time, the historians from Lu (one state of Eastern Zhou, Confucius’ hometown) reported important events of various states in the country and recorded them by the four seasons of spring, summer, autumn and winter. In brief, the chronicle was called “Spring and Autumn”. After Confucius’ editing work, the “Spring and Autumn” turned to be a classical and fundamental book of Confucianism. It had deep and key impacts on historical and political research in China. Therefore, the descendant historians call this period as the “Spring and Autumn Period”.

function of the institution.

Confucianism also emphasises the authority of “father” as the master of a family. Children cannot violate their fathers’ authority and must show their filial piety. This philosophy was employed by politicians and then upgraded to become faith, love and loyalty to the country. As a result, Chinese people have a long history of complying with authority. Indeed, Hofstede’s cultural dimension theory also reflects this: China is a country of Power Distance with a high rating value of 80 (Hofstede Insights, n.d.-a).

During the development of Chinese culture, women’s social status has been lower than men’s, and this situation worsened in the period of Neo- in the Ming Dynasty (1368-1644). The Neo-Confucianism is a branch of Confucianism, which was popular in the period of Song and Ming Dynasty (around 960-1644). The Neo-Confucianism enhanced those parts in Confucianism that controlling and discriminating females both in mental and physical sense. Under this context, more and more restrictions were set for females and eventually they had to stay at home. The outside world was mainly operated and ruled by males while most females could only be responsible for family issues such as house cleaning, cooking, and taking care of children. Even in modern days, this situation is recognisable within Chinese society.

In the context of Chinese traditional culture, there were four main types of occupations: officials, peasants, industrial workers and businessmen. Within this list, to be a governmental official was regarded as the top role. From the time of the Sui Dynasty (581-619), passing a national exam (Ke Ju Kao Shi in Chinese) was the main way to become a government official. So there was a long history where people spent a lot of time preparing for and attending the exams. In modern days, attending the National College Entrance Examination (NCEE) remains very popular, particularly in some countryside places. In order

to accompany their children and support their studies, a lot of parents (mainly mothers) would give up working themselves, and move to a location close to their child's school. For some localities which are close to famous schools, renting an apartment must be booked two years in advance (Bai & Wang, 2016). In order that children can achieve well in such schools, parents often introduce them to informal educational resources to raise their interest in study from a very young age. For example, parents may take their children to visit a Ke Ji Guan to stimulate their interest in science and technology.

Although in modern China Confucianism and the traditional culture do not have so obvious an influence as before, they have not yet disappeared, and still impact on Chinese people's lives. For example, such traditions may have an influence on visitors' decision making of attending a Ke Ji Guan. More discussion on this topic can be seen in Chapter 8 and Chapter 9.

## **2.7 Applying Falk's model to a Chinese context**

Falk's model, combined with an understanding of the Chinese cultural context, is useful to help understand visitors' behaviours and motivations from a holistic perspective. Once visitors' perspectives are better understood then according to his model, museums could provide a better service and improve their marketing to better meet the needs of their visitors (Falk, 2009).

There is currently no model for understanding visitors' perspectives in China. Falk's theory provides a tested model (though from a different context) and his works supply detailed research methods and analysis approaches. Using Falk's theoretical framework could help to build a suitable model for visitor studies within the Chinese context in the future. Though Falk argued that it was not necessary to pay attention to the big "I" identity (such as gender and ethnic group), for China, however, it is also meaningful to incorporate demographic research on science museum visitors, because of the rarity of

visitor studies research overall. So my research will include both visitors' big "I" identities (demographics) and little "i" identities (identity-related motivation groups). Of course it is not possible to directly apply Falk's approach within China without considering the specific needs of Chinese visitors. For this reason an initial pilot phase will be incorporated to adapt and refine my research approach prior to the main data collection. A full description of my research methodology is included within Chapter 3.

## **2.8 Chapter summary**

In this chapter I have reviewed the concepts of western Informal Science Institutions such as science museum and science centre. Then I introduced the historical development of Ke Ji Guan in China. From the review, it can be summarised that Ke Ji Guan do not originally rise from the Chinese traditional cultural context and society but are imported from the western world. That said, the definitions and taxonomy of Informal Science Institutions within China are blurry. I also reviewed key visitor studies research in the western context, particularly Falk's Museum Visitor Experience Model and the Identity-Related Visit Motivations, which I will use as the framework for my empirical analysis. Specific criticisms of Falk's theory have been acknowledged and where possible taken into account when planning my own research. Brief introductions of Hofstede's cultural dimensions theory and Chinese traditional cultures (such as Confucianism) also have been conducted in this chapter. This chapter has therefore set up both the practical and theoretical contexts within which my research will be conducted.

### **3 Research Methods**

This project is a study of identity-related motivations of Ke Ji Guan visitors in China. In this chapter, the methodology and research process will be demonstrated in detail. The reasons of selecting those methods will also be clearly outlined.

#### **3.1 Introduction: Qualitative and quantitative strategies**

The general frame for my research methods is a combination of qualitative and quantitative strategies. They worked together fluently to support approaches with each other. I conducted questionnaire survey with Ke Ji Guan visitors (valid N=1249) combined with extended semi-structured face-to-face interviews with experts in the Ke Ji Guan study field in China (N=3). Quantitative and qualitative methods were employed, and in the actual research processing, they worked together as the basis of a mixed methodology. I also carried out a qualitative piloting work to set up my questionnaire survey. Further details on these aspects are outlined within this section.

##### **3.1.1 Benefits of a mixed methodology**

A single research method or perspective cannot provide a full portrait of the research while an integrated or multiple methodology can offer a more defensive, comprehensive, and insightful understanding of the research with more credible, valuable and multiple perspectives (Greene, Kreider, & Mayer, 2004). A mixed multiple method strategy can be regarded as a specific cooperation between quantitative and qualitative approaches through

combining and integrating. The mixed methods can be conducted from the stage of design, during the data gathering, analysis and interpretation (Creswell & Clark, 2011).

A mixed methodology does not mean a double guarantee for the research but is employed to obtain specific theoretical and practical goals. In other words, it is conducted to demonstrate or answer the research questions themselves (Brannen, 2004). In this project, the main research questions are: what are the identity-related motivations of Ke Ji Guan visitors, and what is the relationship between visitors' motivations and their demographic factors. To answer these questions coherently, different concepts, elements and data have to be included. One type of information would be insufficient to answer these complex questions and one type of data source may lead to a superficial and partial understanding. Different types of data from different perspectives will help to confirm or prove the findings (Creswell & Clark, 2011).

### **3.1.2 Applying quantitative and qualitative strategies to my research**

In this research, the theoretical frame was based on Falk's hypothesis of identity-related motivations<sup>14</sup>, which categorises visitors into five identity groups. My research purpose was to test whether Ke Ji Guan visitors in China share these five groups or not, and explore their identity-related motivations more widely, especially in relation to any links to demographic factors. Falk's previous work had been conducted using both quantitative and qualitative approaches (Falk & Adelman, 2003; Falk & Gillespie, 2009; Falk, Heimlich, & Bronnenkant, 2008; Falk & Storcksdieck, 2005): due to the focus on comparing

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<sup>14</sup> As outlined in Section 2.4.1 in the Literature Review (Chapter 2), in 2009, John Falk published his book *Identity and the Museum Visitor Experience*. In this book, he categorises visitors into five groups: Explorers, Facilitators, Experience seekers, Professional/Hobbyists, and Rechargers.

visitors' identities with their demographics it was clear from the start that some form of quantitative element was going to be necessary here. However as outlined above in Section 3.1 above, a quantitative element alone would have been insufficient to fully appreciate the context. It would also not be appropriate to just apply Falk's existing (US-based) quantitative categories within China without first checking that they covered the full range of options appropriate to the local context. For these reasons it was important for me to include an additional range of qualitative strategies. This section provides a brief overview of the main quantitative and qualitative strategies that were applied, along with the key reasons for those decisions.

Quantitative methods are approaches to test hypotheses by collecting quantifiable information from representative persons within a bigger population (Bryman, 1988). As Aliaga and Gunderson argued, it employs collected numerical data to interpret phenomena, attitudes, opinions and behaviours or other defined variables (Aliaga & Gunderson, 2000). In my research, one of my purposes was to probe visitors' identity-related motivations, which was relevant to the attitudes or behaviours of samples. So the quantitative methodology was suitable for it.

One of the fundamental data collection approaches of quantitative research is the questionnaire survey (Lewin, 2005). To achieve my purpose of exploring visitors' identity-related motivations and achieve a robust result I needed to sample as many visitors as possible to Ke Ji Guan in China. The number of sampled visitors (and the number of Ke Ji Guan involved) was limited because of time and budget constraints. In this situation, a quantitative survey was the most appropriate and effective approach, as questionnaires allowed me to

obtain critical, reliable data with a large enough population at each of the selected institution to ensure validity, and carry out the statistical investigation of my empirical hypotheses (Berg, 2001).

The questionnaire survey with the Ke Ji Guan visitors specifically explored the visitor categories and relationships between visitors' identity-related motivations and their demographic factors by means of quantitative data and its analysis. The piloting and formal survey for the questionnaire used a mainly quantitative method to collect and analyse the data. The design process however relied on visitors' interviews (a qualitative approach) to build the option bank for the visitors' motivations. In this way, the quantitative and qualitative approaches were integrated and helped produce a robust overall survey. The qualitative interviews offered the questionnaire answer options, and the quantitative inquiry allowed for a broader exploration of the qualitative interview results across the museum visitor populations.

In many cases, qualitative methods within a multiple methodology can be applied more broadly to constitute the structural characters of the social research, and by using a questionnaire survey or other approaches, quantitative research can extract inner patterns and build connections among different variables (Bryman, 1988). In this research, interviews with experts in the Ke Ji Guan field in China helped me to draw a background picture of Ke Ji Guan's development, and also helped me to avoid conducting the visitor survey and data analysis out of context. Though I could have used quantitative inquiry alone to explore visitors' motivations, it could not provide any deep or unexpected information about why these results were observed rather than others. For instance, are those Ke Ji Guan built for particular kinds of visitors

and not others? What are the historical reasons behind certain observed visiting habits? As Snape & Spencer (2003) stated, a qualitative strategy can supply approaches to connect how to find the answer and what has been known about the area of research through a deep exploration of people's life stories, thoughts, histories and actual environment (Snape & Spencer, 2003). It can provide approaches to understand and analyse phenomena and trace their in-depth reasons within the wider social society (Snape & Spencer, 2003). By talking with people about their personal trajectories and experiences, researchers can collect qualitative information related to these traces (Berg, 2001). Within my research in particular, in order to understand the history of Ke Ji Guan in China, interviewing a small number of key scholars was an effective approach. Due to their age, experience and seniority, such scholars are incredibly valuable sources of information, but also extremely difficult to access. They had witnessed the full modern development of Ke Ji Guan in China, and each took part in the establishment of specific Ke Ji Guan. Through their experience, pictures, books, even newspaper reports, I discovered clues or useful information that helped me to probe and understand the in-depth reasons of Ke Ji Guan establishment in China and their target visitors historically.

It was also useful to talk with common visitors before the survey was formally conducted in order that I could prepare an appropriate selection of motivation options for participants, as well as test the format and structure of my proposed questionnaire. Furthermore, though not formally reported here, it was helpful to talk with Ke Ji Guan staff at each venue to obtain practical advice for the research.

In summary, I adopted interviews and a questionnaire survey as the main methods for this project. These methods were employed in a complementary way, which can be regarded as a set of intertwined research methods. The following sections will explore each of these methods in turn, starting with the interviews as they were designed to provide the initial wider context for the research, and to support the appropriate development of the questionnaire survey.

### **3.2 Ethical issues**

In order to protect the participants of my questionnaire survey and interviewees from harm and obtain authorisation from them, I conducted my project under appropriate ethical principles and guidelines (Piper & Simons, 2005). Prior to any data collection my research approach received ethical approval via the Department of Science and Technology Studies, University College London (UCL). It can be seen in the form of **STSETh033** (see Appendix 7: The Approval Certificate of the Ethics Application).

In order to have a robust and fluently research, I followed some ethical principles, such as informed consent, voluntary involvement, non-maleficence (do no harm), and confidentiality/anonymity.

For the informed consent, respondents should sign a written consent form giving me permission to use that data.

In terms of the voluntary involvement and confidentiality/anonymity, it should be clear from the start that the survey is optional and participants can choose not to participate. I can also offer the participants an option to select what level

of anonymity they want, such as their names be included, or if they want to be entirely anonymous.

For the requirement of non-maleficence (do no harm), I should ask nothing about contentious issues, for example, the research on illegal substances. There should also no invasive or traumatic procedures are involved including the administration of pharmacological agents. For example, if my interviewee has some uncomfortable feeling I will stop my work and call a doctor or someone can help. I will also have a good observation to visitors' mood and behaviour. For example, I will not recruit a hurry-scurry mother with a crying baby in her arms, because this will make the mother unhappy and introduce unexpected issues to my research.

In terms of my interview work, the three selected interviewees were all initially contacted by Donghong Cheng<sup>15</sup> and her colleagues to provide basic information about my interview. I then followed up with texts or phone calls about the aim and detailed research information of my project. When we met, I carefully introduced myself verbally to the participants, providing brief information about myself including who I am, where I come from, what I am doing, my projects' purpose, and how long my interview may take. Then each interviewee signed their consent form in person prior to the beginning of their interview. The consent forms included information regarding that they had right to know what they would be asked, as well as the right to withdraw from the research until a specified date (Ryen, 2004). I included my email and phone number on the consent form in order that interviewees could withdraw their

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<sup>15</sup> A senior official from the China Association for Science and Technology (CAST) with whom we already had existing connections. CAST is a key governmental organization, which is responsible for popularisation of science and technology work in China.

consent up until two months before my thesis is due. The interviews were recorded as MP3 files using digital recorders and iPhones. My participants and myself did the project in a healthy and safe environment.

As Patton suggested, in some cases it is usual to pay participants for their involvement in an in-depth interview (Patton, 2002). However, all of my interviewees did not mention nor seem to expect this, so instead I took some small presents (according to Chinese culture) to say thank you and build trust between my interviewees and me.

The interviews to visitors for piloting were entirely anonymous, and the participants could not withdraw from it. Yet, they have been told from the start that the interview was optional and they could choose not to take part in. I also asked for their permission to record their voice by a digital recorder, and this is also optional. Furthermore, I had a good design of my interview questions in order to avoid any illegal issues, sensitive questions or anything that may make the participants feel uncomfortable.

After the interviews, the recordings were transcribed into computer documents. For data protection purposes the MP3 files and written transcripts were kept in folders on my laptop requiring password access; both of their back-up files on mobile hard disk were kept in a locked room.

For the questionnaire survey, I obtained official permission from CAST in advance from each of the Ke Ji Guan to conduct the research in those locations. All respondents were kept anonymous for the reason of protecting participants' privacy and confidentiality (Piper & Simons, 2005). Each

respondent's consent was obtained via a simple statement on the very top of the first page of my questionnaire:

*“Please Note: The questionnaire survey is entirely anonymous. So if you complete the questionnaire, that means you are consenting to be part of the study, and understand that it will not be possible to remove your data once you have submitted the questionnaire back to me.”* (see Appendix 1)

I also included a question in my questionnaire to make sure if the participants would like to archive their questionnaire data for use by future researchers. Through this approach, I encouraged my participants to participate in my survey voluntarily. In order to avoid more complicated ethical issues associated with the most obvious ‘vulnerable’ group likely to be present-children-I limited my respondents to only those aged 16 and over 16 years old (Roberts-Holmes, 2014).

Following the standard ethical principles within UCL, all electronic data were stored on a computer password-protected system, and the original questionnaire sheets were kept in a locked suitcase in my room, which was also locked. The back-up files of questionnaire data were stored on a mobile hard disk, again in a locked room.

### **3.3 Interviews**

In this section, I will introduce the approach I took to conduct the interviews with the Ke Ji Guan senior scholars in China. The reason why an interview was the most appropriate approach in each case will be explained. The factors I considered to ensure that each interview was successful will also be

demonstrated step by step, for example having a well-prepared interview guide, robust sampling and effective recruitment.

### **3.3.1 Why interviews?**

As noted in the previous section, the development of modern Ke Ji Guan in China provided key background information to my research and avoided discussing the questionnaire results out of context. Visitors' motivation-related data analysis and discussion could benefit from more in-depth interpretation with help from understanding Ke Ji Guan' history and development in China. However, there are very few documents or references available about this topic, and it is even rarer for such documents to be made publicly available.

Additionally, interviews with Ke Ji Guan visitors were also important components of my research. It was necessary to have conversations with visitors in advance in order to better understand their motivations and build the options bank relating to visitor motivations within the questionnaire. During the questionnaire distribution itself I also conducted short informal conversations to confirm specific details and/or check that participants fully understood questions that had had problems during my piloting phase, thus ensuring that the questionnaire results were as valid as possible (see Section 5.5.1 for details, link to where I had to remove certain questionnaires where people were obviously lying).

All types of interviews have their own applicability and the choice of a suitable approach to the interview will depend on the features of the interviewees and the research itself (Corbetta, 2003). In my research, I had two main types of interviews. They were interviews with senior Ke Ji Guan experts and

interviews with Ke Ji Guan visitors. Though focusing on different perspectives and considering different areas of content (relating to each group's relevant experience in relation to Ke Ji Guan in China), the general approach to each interview was fairly similar, so they are considered as a single method within this section.

As a kind of conversation, the qualitative interview has some suitable features that meet the requirements of these research aims. With a cognitive goal and a plan of data gleaning, an interviewer can raise and guide a dialog to one or more interviewees in a flexible questioning style (Corbetta, 2003). Among its characteristics, being open and flexible are key points for a qualitative interview in order to probe the information behind the exterior phenomena (Patton, 2002). Thanks to such flexibility, interviews can be an effective approach to collect thoughts and information from experts (including visitors who are 'experts' in their own personal experience and motivations) (Walliman, 2006). In other words, interviews help the researcher to explore the interviewee's memory about the past or opinions about the future by probing their experiences, behaviours and thoughts (Rapley, 2004).

All of my interviews were conducted face-to-face. This kind of interview has many advantages. It can be conducted in various places, such as at home, the workplace, outdoors, even when people are moving. Face-to-face conversation is also helpful to build trust between interviewer and interviewees particularly when some sensitive questions are asked (Walliman, 2006). Face-to-face interviews can have more interactive conversation to explore more information by language, gesture, and eye contact.

With reference to the topic of Ke Ji Guan's history in China, I employed the interview method to guide senior scholars in China to present their knowledge on the development of Ke Ji Guan in China. The expert interviews' main aim was to probe how and why modern Ke Ji Guan were built, what they were built for, and what roles the interviewees themselves played in the history of science-related museum development in China. In this way, by exploring the interviewees' experiences, opinions and memories, the expert interviews performed a role of interview-data-as-resource; the gathered interview information can be regarded as representing these experts' real experience and thoughts (Rapley, 2004).

Because the interviews were aimed at probing experience, thoughts, and behaviours, it was inappropriate to follow a strict structured format with absolutely fixed questions and an invariable process. For example, they might have preferred to answer the questions in different orders. Maybe they needed time to think, or perhaps they saw connections or preferred to combine separate questions or move them to different priorities. In this kind of exploratory research, which needs to probe information regarding a little known field, or where interviewees' opinions are one of the key objectives from the conversation, the interview should be less structured, because the interviewer can ask key questions to probe more information though the probing should be more limited than the unstructured interview (Arthur & Nazroo, 2003). Completely unstructured interviews, however, also were not an appropriate method because neither questions nor their form is predetermined (Corbetta, 2003). In this condition, it would have been harder to obtain particular relevant and useful information about Ke Ji Guan's development in China or important events in its history. Additionally, because some

interviewees were seniors and none were academics they may have needed some guidance to talk or recall specific research-related matters. An appropriate way to conduct interviews in a manner that encompasses key benefits of both the structured and unstructured forms was the semi-structured interview.

A semi-structured interview approach means that the interviewer designs the questions in advance, and asks these questions in a similar manner to all interviewees (Berg, 2001; Corbetta, 2003). The interviewer can deviate or skip freely to explore more useful information beyond the pre-determined questions (Arthur & Nazroo, 2003; Berg, 2001). That is, the semi-structured interview has not only steady structure but also open questions (Walliman, 2006).

In the discussions with the senior scholars from the field of Ke Ji Guan studies in China, questions and their order were both determined in advance, and shared with the interviewees prior to the interviews being conducted. This step was a necessary part of the process in obtaining permission to conduct these interviews with such senior scholars. In the process of the actual interview, I obeyed the prepared interview guide to raise questions, but the interviewees could freely add new relevant topics or answers based on their own experience and perspectives. Also the order of the questions was flexible. This approach of using a semi-standardised interview format helped me to collect information without digression, whilst also allowing me to obtain more useful information (Arthur & Nazroo, 2003).

In order to obtain appropriate statements for the motivation options within the questionnaire it was necessary to conduct pilot interviews at the start of my data collection process in China. Yet I also had to consider whether visitors

had enough time and patience to take part in a detailed interview within a busy science museum environment, especially as they were likely giving up their leisure time to do so. It was therefore important to make sure interviewees could talk about their motivations freely without strict bounds to the conversation; complying with the form too strictly may have interrupted some interviewees (Corbetta, 2003). However, it was also necessary to keep some predetermined questions, because the main aim of those interviews was to collect as many reasons as possible within a limited time frame. A prepared interview guide with settled questions can make the interview focus on the key questions systematically (Arthur & Nazroo, 2003). So considering all the relevant factors, the semi-structured interview was also suitable for the interviews with science museum visitors.

### **3.3.2 Interview sampling**

Once the style of interview was decided, it was necessary to identify the appropriate group(s) to invite to be involved. In social science research, it is rarely possible to survey the entire relevant population; instead, samples are often selected because they have special features which lead to particular interpretation or answers to the research's core questions (Ritchie, Lewis, & Elam, 2003). In this research, interview as the qualitative method had different requirements on sample size depending on the different research purposes.

Note that because the interviews with Ke Ji Guan visitors were designed specifically to inform the development of the motivational options for the questionnaire, they shared the systematic sampling approach of the questionnaire survey. This technique will be discussed further in Section 3.4.4.

### 3.3.2.1 Purposeful Sampling

As mentioned before, there were two different interviewee groups in this research. The first group was composed of senior scholars from the Ke Ji Guan operation and field of study in China.

In order to select interviewees who were sufficiently familiar with the history of Ke Ji Guan in China, purposeful sampling was employed, which refers to choosing information-rich interviewees with this specific purpose. Both sample size and types were chosen on the basis of the research question and available resources (Patton, 2002). Two scholars were initially<sup>16</sup> selected because they have valuable experience in the operation and study of Ke Ji Guan in China. Thanks to the help of CAST officials, they were accessed successfully. Brief biographies for each interviewee are included below in order to provide context for their comments.

***Xianyi Li*** is former curator of CSTM, part-time professor of Communication and Education Centre in Beijing Normal University, and also a former official of CAST. He won the UNESCO Kalinga Prize in 2013. He is an expert on science museum theories and also witnessed and experienced the establishment of CSTM, which is regarded as the first Ke Ji Guan of China in a modern sense. As a former official of CAST, he also has experience in helping to build other Ke Ji Guan in China. He is familiar with national science policies about Ke Ji Guan, and his rich knowledge and stories supplied valuable information about the development of Ke Ji Guan.

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<sup>16</sup> A third senior scholar was also interviewed; see Section 3.3.2.2 Snowball Sampling for a discussion of how he was identified.

**Shanyan Xu** is former president of the Chinese Association of Natural Science Museums, part-time professor of Tsinghua University and Beijing University Of Posts and Telecommunications, also a former official of CAST. As the director of the expert committee of the CSTM new building construction he knows details about CSTM's development. He has published a number of papers about Ke Ji Guan in China and still gives lectures and helps to build new Ke Ji Guan all over China. His expert role ensured he talked about the Ke Ji Guan history in China from a professional perspective and this particular angle gave his stories academic grounding, which was useful to understand the background of Ke Ji Guan development within China in a critical way.

There are no exact rules for deciding sample size in qualitative inquiry. It is related to the research aim, study reason, useful information, what is reliable, and what work can be conducted within a limited research time frame and equipment (Patton, 2002). The significance, effect, and perceptions collected from a qualitative inquiry are more connected with the chosen sample's information and abundance as well as researcher's ability of analysis and observation than with sample size (Patton, 2002). In fact, sample size is often small in qualitative research projects (Ritchie et al., 2003). As demonstrated above and in the next section, all three scholars represent highly information-rich perspectives, and were directly relevant to the research. So even though the sample sizes were small (the experts were only three), the sampling and interview results remain meaningful and fruitful.

### **3.3.2.2 Snowball Sampling**

The other interview sampling approach applied in this research was snowball sampling. This sampling technique involves asking interviewees to

recommend other relevant people to interview. The identified new interviewees are expected to have similar characteristics to the original interviewee and meet the demands of sample selection (Gobo, 2004; Patton, 2002; Ritchie et al., 2003). This is a useful means of identifying relevant individuals, particularly for scattered and small populations. It can be a useful method to recruit more interviewees (Ritchie et al., 2003).

For this research, the selection of expert interviewees was not a public and open recruitment, so peer recommendation offered an effective and efficient clue to find more relevant interviewees. In fact, the sampling strategy for the expert group was a mixed method of purposeful sampling and snowball sampling. Once aware of my research aims and questions, a staff member at CSTM Beijing recommended a third expert scholar:

**Heng Wang** is a senior researcher of CSTM Beijing, and was previously the chief editor of *Ke Ji Guan*, which is the professional journal about Ke Ji Guan in China, running from 1987. His papers are collected by the official works and reports, and the journal *Ke Ji Guan* supplied valuable historical documents about the development and internal studies about Ke Ji Guan in China. More importantly, the *Ke Ji Guan* journal is able to be used as evidence to independently verify the results from all three senior scholar interviewees during certain time periods.

### **3.3.3 Recruitment and locations**

In terms of interview locations, different interviewees had different preferences regarding where the interviews should take place, centred mainly around their own convenience and (where appropriate) comfort.

In the group of experts, both Xiangyi Li and Shanyan Xu asked to have the interviews at home. Both of them were comparatively elderly at the time of the research, so interviews conducted at home helped to ensure their comfort, and that their families were available to look after them. Additionally, they had no need to travel and enjoyed their comfortable surroundings. All of these factors enhanced the possibility of successful interviews. After many rounds of discussions about the exact time by mobile phone, they finalised the meeting dates and times. Finally Xiangyi Li was interviewed for 2 hours 9 minutes 29 seconds and Shanyan Xu was 3 hours 2 minutes 19 seconds.

By contrast, Heng Wang asked to be interviewed in a meeting room of CSTM Beijing, close to the internal library of the museum. So when needed, he went to the library to find specific documents or books to support his comments. Also, due to his familiarity and on-going connections with CSTM Beijing, conducting the interview at CSTM was timesaving and comfortable for him. Heng Wang eventually was interviewed for 1 hour 57 minutes 13 seconds.

For the interviews about visitors' motivations, the location of course had to be in a Ke Ji Guan, but interviewees could choose their favourite places inside the Ke Ji Guan, such as sitting in the rest area, sitting beside the table of the water bar, or standing inside an exhibition gallery. Face-to-face interviews provided chances for me to make some quick follow-up questions to probe visitors' real reasons for visiting that particular Ke Ji Guan.

### **3.3.4 Interview guides**

When carrying out a semi-structured interview, the interviewer usually prepares a question list that contains the topics and subtopics of the research

before the interview is actually started. This outline of questions is the interview guide, also called the interview schedule (Arthur & Nazroo, 2003).

It was important to work out how to build and carry out the interview in a natural and smooth way in advance. The early deliberations should also include what questions will be asked in what order. A well ordered interview guide does a more efficient job of exploring facts and probing in-depth information. However, in the actual interview process, it is better to be flexible rather than complying strictly with the order of questions planned (Arthur & Nazroo, 2003). An interview guide helps the interviewer to arrange the use of time across the interview and set the priority for important questions. It can also help to structure a more systematic and comprehensive interview when there are different interviewees (Patton, 2002). Within my research, both the interviews with the experts and those with the visitors had printed interview guides<sup>17</sup>, but the interviews with the Ke Ji Guan staff did not because those interviews needed a more flexible format and shorter time duration. As the researcher, I had to remember the important priority questions in my mind, ready for whenever an opportunity arose to speak to such staff members.

In order to get the most comprehensive information for this complex topic from my interviews, my interview guides included the following question types:

**Throwaway Questions.** This type of question is usually put at the beginning of the interview schedule to ask interviewee's demographic information (Berg, 2001). Despite already being aware of their personal information (due to the purposeful sampling approach taken, see Section 3.3.2.1), in the interviews with the Ke Ji Guan experts, I made an expansion to include demographic data.

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<sup>17</sup> See Appendix 3: "Interview Guide for Experts" and Appendix 4: "Interview Guide for Visitors".

I also introduced my information to them because I was a stranger for them. Asking and answering some demographic questions built a feeling of trust between the interviewees and me. In the interviews with Ke Ji Guan visitors, these kinds of questions were printed on a sheet in order to act as a piloting opportunity for my questionnaire survey, though the actual data collected was not otherwise used.

**Essential Questions.** This style of question concerns the core issues of the research. They can be gathered together or scattered across the interview guide, but they should direct the interviewees to talk about the most important aspects of the research (Berg, 2001). For example, some questions in the interview guide for the experts (see Appendix 3: “Interview Guide for Experts”) were as follows:

Q3. Why were Ke Ji Guan built?

Q7. Who were the original Ke Ji Guan designed for?

In the guide for the interviews with Ke Ji Guan visitors (see Appendix 4: “Interview Guide for Visitors”), this style of question was also embodied, e.g.:

Q3. Who decided/wanted to visit the Ke Ji Guan today?

Q4. What is your reason to visit this Ke Ji Guan today?

Both of them were linked to the main aim of exploring visitors’ motivations.

**Probing Questions.** This type of question focuses on probing more useful information from some already answered questions. They lead to a more integrated story and more details (Berg, 2001). In practice, these follow-up

questions were set according to the research aim, how much can be explored and the communication balance between the respondents and interviewer (Arthur & Nazroo, 2003). Probing questions in the interview guide for experts included:

Q1. What do you consider to be the first Ke Ji Guan in China in a modern sense? Could you supply some historical documents about it? (For instance, some old pictures or newspapers about it?)

Q9. Why are they called science museum, science and technology museum and science centre in English? (What are these names' differences from each other?)

The latter questions in Q1 and Q9 (displayed in brackets above) are typical probing questions, which try to dig out more information about science museums from the interviewees.

For the interview guide for visitors, the probing questions are more complex and flexible at the same time:

Q7. Do you want to see the whole Ke Ji Guan or some particular exhibition? If some particular exhibition, then → why that particular exhibition?

From this process, I guided the interviewees to express their deeper thoughts step by step.

In summary, the interview guide performed as a useful tool to increase the conformity of information gleaning, particularly when there was more than one interviewee. It helped to make sure important questions were involved

systematically and well ordered, and it also took the need for flexibility into account at the same time (Arthur & Nazroo, 2003).

### **3.3.5 Interview data analysis approaches**

The three expert interviews were conducted jointly with Eric (Xiang Li), a visiting scholar of London School of Economics and PhD student of Tsinghua University, China. It was Eric's original suggestion to interview these experts to explore a general picture of the historical development of science-related museums in China. He needed this information for his own thesis, though we soon discovered the overlap and mutual relevance to both our research areas. It was not easy to meet these experts, and we had serious concerns that they would not agree to participate in two separate interviews. So we decided to use the chance of getting access to them jointly. We each worked out our own interview guide separately, and then combined them into a final version. Some questions were specific to one or other of us, though we did share some questions. We both contributed to arranging the interviews and asking questions during the interviews themselves. However we independently analysed the resulting data, so unless explicitly noted otherwise all work reported in the remainder of this thesis is my own.

As Ritchie argued, in practical research, transcripts have advantages over recordings because people's eyes can get information better than ears. Also, transcripts can be indexed and it is easier to conduct text searching, which are both helpful for research (Ritchie, 2003). Other researchers have also agreed that raw recordings of interviews need to be transcribed for facilitating analysis (Ritchie, Spencer, & O'Connor, 2003). But Ives pointed that transcription may require a lot of work, and as a general estimate suggested that a researcher

may spend 15 hours to transcribe a single one-hour interview voice recording (Ives, 1995). For this reason Eric and I shared this work: Eric was responsible for transcribing the interviews with Xiangyi Li and Shanyan Xu, and I transcribed the interview with Heng Wang. We both transcribed the interviews in full in order to include all information those interviewees had given. We checked the transcriptions with each other to ensure all information was written down correctly. All transcriptions were initially written in Chinese, though only a selection was separately translated into English. This was because all of these three interviews included (sometimes fairly long) discussions, which were not relevant to my research questions. So I only transcribed selected information into English that I would use directly in my thesis.

I applied Content Analysis to analyse my interview data from the three senior experts in China. Content Analysis involved analysing the interview content and the context of documents to identify specific recurring themes and how they were expressed by these data (Berelson, 1952; Robson, 2002). Here in my case, I combined the interview information and archived documents (obtained in the main from Heng Wang as context) to analyse. For the first step, I picked up some key points (such as years, events, national acts) from the interviews based on my interview guideline, and then I went to the archived documents to explore more relative detailed facts and records. Because these documents were written at the time of things happened, they kept more details. When I had produced a main structure of the historical development, I went back to the interview materials to find interviewees' personally unique memory, which were not recorded by documents but can support the facts in a

perspective of witness. Finally, I got a picture of the historical development of the science museums in China (see Chapter 4).

### **3.4 Questionnaire survey**

In this section, I will introduce the quantitative element of my research, a questionnaire survey. I will outline why the questionnaire survey was suitable and useful, how I conducted it as efficiently and effectively as possible, and the design process that was involved.

#### **3.4.1 The choice of a questionnaire survey**

As mentioned before, the key focus of this project is to explore visitors' identity-related motivations at Ke Ji Guan in China, and probe the relationship between visitors' identity-related motivations and their demographics. In order to investigate these questions, a survey is the most appropriate choice of method because of consistency, participants'-independence and repeatability. Particularly, I used a self-completion questionnaire as the best method of gleaning quantitative data for answering the research question.

Corbetta (2003) argued that asking questions is the only suitable approach to accurately seek people's motivations, opinions, awareness, anticipation, faith and feelings. A wide range of studies use questioning as an immediate means to collect information in the real social world. The primary means to collect information through asking questions is a survey. A survey can be in the format of dialogue or filling in a written questionnaire (Corbetta, 2003).

Questionnaire survey, as an information gathering approach, is an appropriate and effective tool to explore visitors' visiting motivations and their personal

information. It is cheap and quick to obtain access to a large number of participants (Sapsford, 1999; Walliman, 2006), so is especially suited to situations like mine, with limited time and budget, and only a single researcher involved. Among the various different kinds of questionnaires, the self-completion questionnaire has its own particular advantages. They are designed to be consistent, with standard criterion, and are delivered to all participants in the same manner (Sapsford, 1999). Respondents are asked to complete questionnaires by themselves. This method means that the researcher produces the questionnaire and collects information without necessarily conversing with every participant. The researcher's personal impact (and associated potential bias) is thus decreased, because this is a process of visitors answering questions by themselves (Walliman, 2006). In my research, by self-completing the questionnaire, visitors could be removed from any insinuations or even intentional suggestions, or any other conversation that may influence their answers about their motivations and personal information. Additionally, participants can have time to rethink and check their answers, and all of these help make their answers more precise (Walliman, 2006). Within my specific questionnaire, visitors could rethink their choices for their five motivations if necessary, and even re-score their options, which would make the data more accurate and closer to their in-depth thoughts.

The outcome of a study, however, should supply evidence to prove the research hypothesis validity, and this procedure should be able to be repeated by another independent researcher (Black, 1999). In Falk's surveys (2006, 2007, 2008, 2009, etc.), he employed questionnaire surveys to explore

museum<sup>18</sup> visitors' motivations and other information. There were also other researchers who used questionnaire surveys to test Falk's hypothesis on visitors' identity-related motivations (for example Rowe & Nickels, 2011; Sheng & Chen, 2012). By using the same inquiry approach I could ensure that I was building as closely as possible on Falk's original methods and hypothesis, to more robustly test whether his theories applied within Ke Ji Guan in China. It also meant that there did exist protocols and references about how the surveys were conducted, the sampling approaches used, data analysis techniques, data interpretation and other useful skills from those former research studies.

### **3.4.2 Survey design**

In this section, I will explain how the questionnaire was designed, and demonstrate my incorporation of common rules for designing effective questionnaire surveys. Copies of the final questionnaire survey (both in English and Chinese) are available in Appendix 1 and 2.<sup>19</sup>

#### **3.4.2.1 Format and design decisions**

Bradburn, Sudman, and Wansink (2004) have pointed out that the general principle of designing a questionnaire is to make it friendly (easy to understand) to respondents and look professional (Bradburn, Sudman, & Wansink, 2004). Therefore, deciding the format of the questionnaire is an important aspect, as

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<sup>18</sup> Falk's conception of 'Museum' has a wide range of institutions such as traditional museums, zoos, aquariums, science centres, and so on (Falk & Storksdieck, 2005).

<sup>19</sup> Because I designed and conducted the questionnaire survey before I interviewed Ke Ji Guan experts, I had no confirmation about the English name of Ke Ji Guan at that time. Therefore I employed the name "science museum" in my questionnaire's English version as a lot of governmental documents did. In this section and some other places that may mention specific questions in my questionnaire, the "science museum" will be used (see for example Appendix 1: Questionnaire Sample in English). But in other place, I will apply Ke Ji Guan.

it will enhance the respondents' involvement if it is readable, easy to understand, and has a professional appearance. Additionally, the questionnaire format is also important for ease of data processing after the survey is conducted (Bradburn et al., 2004).

In this research, I employed a paper questionnaire as the medium of distribution. As the research subjects are Ke Ji Guan visitors, so the survey should be conducted at a Ke Ji Guan.<sup>20</sup> A simple online questionnaire inquiry (for example distributed via email or website) could not guarantee a satisfactory result because of the uncontrollable samplings and response rate (Guest, 2016). Furthermore, despite the wide application of digital survey questionnaires (e.g. using a portable tablet), which also facilitates ease of data processing, it was unsuitable for this research because of its instrument cost and other issues related to convenience during the data collection phases. Portable tablets are relatively high value and would have required a much closer scrutiny by me for security purposes. Additionally, there were no secure locations to charge up the devices in each case study Ke Ji Guan.

The individual paper questionnaire, however, has its own particular advantages. As the survey monitor I was able to help respondents to overcome any difficulties in understanding the questions, and personal persuasion and reminders (e.g. to add in any uncompleted responses when they returned the survey to me) helped to achieve a high response rate with relatively low error frequencies. It was also easier for me to explore the reasons why some people refused to answer the questionnaire, and check on responses if any seemed unclear or incomplete (Walliman, 2006). Additionally,

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<sup>20</sup> Research with non-visitors is also a highly important facet of motivations to attend Ke Ji Guan, but outside the scope of my research reported here.

a paper questionnaire is easy to complete, and the majority of people are familiar with such processes.

The final questionnaire was a single-page sheet printed on two sides. This format was chosen due to specific advantages: it was easy for participants to turn over the page themselves, and looked professionally designed. Being printed on two sides prevented pages from being lost or accidentally mixed with other respondents'. Of course, from a transport and environmental perspective printing double sided was also positive in reducing the amount of paper involved (Bradburn et al., 2004).

In order to produce a respondent-friendly questionnaire, I made the following deliberate design decisions.

- **Typeface.** The questionnaire employed “Song” as the main font<sup>21</sup> since “Song” is the standard typeface of Chinese newspapers, and people are familiar with it. This typeface helped to make the questionnaire look as professional as a formal publication. In contrast, for some notices, such as reminding respondents to turn over the questionnaire sheet and the last ‘thank you’ acknowledgment, I applied the popular typeface “Microsoft Yahei”, which is widely used within the Windows operating system in China. It can make some computer users feel more familiar, relaxed and friendly.
- **Font shading.** The questionnaire should not look cluttered for it can be regarded as difficult to complete (Hill, Self, & Roche, 2002). The solution was shading all the questions in light grey, leaving the response options

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<sup>21</sup> For clarity all options presented within this thesis are English-language translations of the original Chinese text used during the actual data collection processes.

un-shaded. This alternately dark and bright effect made the whole page more clear, rhythmed, and easy to distinguish questions and options. The first question's option pool also had an interlaced shading design in order to distinguish between the 21 options available.

- **White space.** A neat and less crowded questionnaire with help of enough white space leads to lower error rate and higher collaboration, and it also looks easy to complete by participants (Bradburn et al., 2004). In my survey, all sentences were refined in order to avoid any unnecessary words. Additionally, using 1.3 line spacing helped make the questionnaire look less full.
- **Bold highlighting of important words.** Some key words or phrases were highlighted in bold to provide a gentle reminder to participants. For example, Question 1\_1 “**up to FIVE**” and Question 3 “**(multiple choice)**” incorporated bold text. These emphases helped respondents to notice what the questions were actually asking, thus reducing the likelihood of error and misunderstanding.
- **Question routing.** Another important aspect to consider was the question order. A well-designed question order can ensure questions are expressed in a purposive way and avoid asking the same or similar questions repeatedly, which may displease participants (Sapsford, 1999). Important questions should be put in the priority positions and less important questions about respondents' demographic information should be asked last (Taylor-Powell, 1996). In my survey, questions were clustered into three distinct sections:

### **Part 1: About the visiting reason for today**

### **Part 2: General information of your visit**

### **Part 3: Some information about yourself**

Part 1 above was the most important section about seeking visitors' identity-related motivations, and the last section was about visitors' demographic information, such as their ages, gender, education levels, residences, etc.

The above efforts were made to help the questionnaire show a friendly interface and a standard format. Furthermore, in every step of designing and conducting the survey, such details were aimed at increasing the 'Signal to Noise Ratio' in the final data collection<sup>22</sup> (Sapsford, 1999). By standing in participants' shoes, the questionnaire was designed in a readable style and easy to understand, which increased the participation rate and declined the error and refusal rate. Meanwhile, the standard format made sure all respondents were asked the same questions in the same manner and format, which lead to more robust and comparable data.

#### **3.4.2.2 Determining the visitor motivation options**

Before I decided to design my own questionnaire, Falk kindly provided a copy of his questionnaire from 2008 for exploring visitors' identity-related motivations in the US (personal communication, September 25, 2014). However, there was no evidence to confirm that I could use these options directly to conduct my survey in China. US and China are quite different

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<sup>22</sup> Here the signal can be regarded as effective data and the noise is the error or invalid data.

countries with different cultures based on Hofstede's cultural dimensions theory (see Chapter 2, Section 2.5). In this situation, I decided an initial qualitative pilot was necessary to collect options and build my own option bank of Ke Ji Guan visit motivations for Chinese participants (see Section 3.3.1). The intention was that if the resulting options for the Chinese questionnaire were similar with Falk's, then I could use his categorising standards to classify my visitor groups.

The general rules for producing a friendly and readable questionnaire outlined in Section 3.4.2.1 were employed for the motivational statements, such as using the familiar typeface "Song", shading words, maximising white space and highlighting important words in bold. There was however another additional important rule. In order to avoid introducing an unintended bias by participants choosing the first few options in order of presentation, it was necessary to create multiple versions of my questionnaire, each with a different order of presentation of the motivation options. Falk also used multiple versions of questions to prevent biases by randomly shuffling his 20 options (Falk, Heimlich, & Bronnenkant, 2008).

As described previously in Section 3.3.1, I applied the semi-structured interview as a method to seek Ke Ji Guan visitors' motivations in China and set up my own option pool. The sampling and recruitment approaches will be illustrated in Section 3.4.4 about sampling. The key work of these interviews was to talk with visitors at CSTM Beijing using probing questions in order to identify as many reasons as possible for visitors to attend the Ke Ji Guan. The interview guide design can be found in Section 3.3.4.

I interviewed 98 respondents and identified 158 raw visit motivations in total. The answers were recorded by iPhone in MP3 format. Because I did this mainly for the purpose of collecting the participants' motivations, I did not transcribe all information but only that relating to the answers about the motivations. I employed the qualitative analysis approach of Grounded Theory, which means to probe the categories, dimensions, or the identification of relationships of data (Glaser & Strauss, 1967; Strauss & Corbin, 1998). Through this approach, I discovered shared or repeated elements and key words from the collected data. As more and more data was reviewed, these elements and key words gathered into concepts, and then into categories. The process could be repeated until the categories or relationships are confirmed (Glaser & Strauss, 1967; Strauss & Corbin, 1998). This approach is appropriate for my research because I could draw on the shared elements from the raw motivational statement. Furthermore, it helped me to have a grounded checking of every respondent's answer in order that I did not omit any useful information.

In this research, I inputted all of the 158 raw motivations into an Excel table, and combined motivational statements that actually referred to the same theme using a single encompassing description. This process resulted in 20 statements, which I further tested for two more days at CSTM Beijing. The final product of this interview piloting was that I yielded a confirmed option bank with 20 motivational statements about why people visit a Ke Ji Guan in China<sup>23</sup> (see Appendix 1).

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<sup>23</sup> An extra option of 'Other' was added to allow for rare reasons not encompassed by the existing options, but the 'other' category was generally disregarded in subsequent analysis (see Chapter 6).

Once the 20 options were confirmed they were put into another Excel table and were ordered randomly to produce five variants of the questionnaire: A, B, C, D, E. Five versions was felt to be a good balance between avoiding presentation bias without creating too much more data inputting work.

In Question 1, In order to enhance the reliability of the answers, visitors were asked to rate their motivations in two distinct steps. Firstly, they were instructed to simply tick the five motivations that they felt were of most relevance:

Please **read ALL** the following statements and: “√” **up to FIVE (5) reasons best** reflecting why you are visiting here today.

Secondly, they then gave a rating to each of the five reasons they had previously selected:

Please give **your selected reasons** scores here **based on their importance** (√).

### **3.4.2.3 Deciding the demographic options**

One of the important research questions of this project is to probe the relationship between Ke Ji Guan visitors' identity-related motivations and their demographic factors, such as their ages, genders, education levels, etc. So after the first page focusing on visitor motivations it was essential to create a robust design for exploring visitors' demographic information and other important visiting facts.

The second page of my questionnaire (see Appendix 1) had two sections, the first about today's visit, and the second about visitors' personal information.

The questions themselves were designed very carefully in terms of their content and phrasing, because the questionnaire survey almost totally relies on questions to get respondents' information (Sapsford, 1999). One of the most important rules is that the words should be very accurate and not lead to any misunderstanding (Sapsford, 1999).

Under this rule, all questions within the demographic section were delivered and arranged precisely, and corresponded to styles familiar to Chinese people. For example,

3. Who are you attending this science museum with today? (If necessary, you can make a **multiple choice**)

My family member(s)  My boyfriend/girlfriend  My friend(s)

My classmate(s)/schoolmate(s)  My work colleague(s)  Client(s)  Alone

Other (Please specify) \_\_\_\_\_

In this question, participants were asked to choose who accompanied them on the day of their visit. Firstly, the question is unambiguous, and it is also clearly indicated that multiple options are possible. Secondly, the options are categorised in common Chinese traditional style. For example, in China, it was not widely accepted to describe people's living mate as "Partner"; there was not even an appropriate Chinese translation. So I did not include this option. "My boyfriend/girlfriend", however was a popular option and easy to understand. Similarly, during the survey piloting (see Section 3.6 for more details), I found that people tended to differentiate boyfriend/girlfriend, friend(s) and classmate(s)/schoolmate(s) clearly. Therefore these three groups were separately distinguished within the option pool for this question.

According to the different questions, different formats were designed. For some partly open-ended questions like Q3 above, an extra option of 'Other' was offered to collect outlier answers. In contrast, for open-ended questions such as participants' education subjects, the strategy was to ask direct questions and supply enough space to write a sufficient answer. For close-ended questions, I prepared straightforward and clear options. For instance,

7. Your gender:

Male  Female  Prefer not to say

There are only three options regarding visitors' gender. I was aware that in other questionnaire surveys, more than three options may be included in order to probe some specific information such as the gender's impact on people's lives. For example, pupils at Brighton's Blatchington Mill School were given 24 options for describing their gender in a government questionnaire survey (Nsubuga, 2016). But in order to avoid some participants marking uncommon and false options as a joke, which will introduce erroneous or invalid data, I decided to include only the traditional options: male, female and prefer not to say.

Some questions were designed to be very simple, and phrased in order to remove any bias in the final results. For instance,

6. Your age (in years):

16-25  26-35  36-45  46-55  56-65  More than 65

As can be seen from the options, all age groups share one common age frame, ten years. In contrast, in the China Science and Technology Museum's (CSTM, Beijing) surveys in 2009-2013, visitors' age options were based roughly on education levels (Yang Zhao, personal communication, March 27, 2015). For example, in 2009, 2010, and 2011, age groups were categorised as (in years):

<6  7-12  13-18  19-25  26-45  46-64  65& 65+

The earlier levels here correspond directly to education stages: less than 6 years old refers to kindergarten level, 7-12 to primary school, 13-18 to secondary school. The reason may be that in China, a Ke Ji Guan is regarded as the "secondary school" for carrying out science education with adolescents, and it is also an important place to conduct a lifelong science education with the public (Ren, 2009). "Education" here is a deliberate key word within this definition. For the other age groups, some of them indicate a much larger range of years than the above categories (where the age range are approximately 6 or 7 years) such as 26-45 (20 years) and 46-64 (19 years). If I had employed these options, a potential bias may have been introduced in the statistical data analysis, due to the different sized age categories used. So in my research, I applied standard age groups across the whole sample.

In summary, the design for the demographic data collected was intended to present the questions in a clear, precise, and effective way. At the same time, it was designed to produce a friendly and professional atmosphere for respondents in order that all questions could be answered as accurately as possible.

### 3.4.3 Selecting the questionnaire respondents

In this section, I will illustrate the sampling approach of the questionnaire survey, and demonstrate how the sampling method was conducted in practice.

First of all, it is essential to clarify who the survey respondents were. The research objects in this research were adult visitors who were over 16 years old. The main reason for this decision was that most adolescents under 16 are still in compulsory school education, and their visits are usually organised by their schools, particularly in Spring Out days in big cities such as the three cities in this research: Beijing, Shanghai, and Ji-nan. This means the decision (motivation) to visit those Ke Ji Guan was made by their teachers or headmasters rather than the students themselves. So in this research, school groups were excluded (but individual school visitors older than 16 years were included)<sup>24</sup>. Organised tourist groups were also excluded. These groups potentially represented unusual homogeneity of demographic data (such as a 'Sunset Glow Tourists Group', which consists only of seniors); their inclusion may have led to an unintentional skewing of the data findings. In addition, they have generally not self-determined to attend the Ke Ji Guan, for example their visit may have been arranged by a travel agency. So the nature of their involvement would have created a strong bias in their motivations for being there. Summarily, the target samples were independent visitors 16 years old or older. Therefore the respondents to my survey included:

a. Adults (single or unorganised group);

b. Adults with children;

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<sup>24</sup> Other reasons why visitors under 16 years old were excluded can be seen from Section 3.2.

c. Adolescents aged 16 and over (not supervised by adults).

#### **3.4.4 Sampling of the questionnaire survey**

Though the research aim is to explore the visitors' identity-related motivations as an entirety, it is important to know whether information was gathered from a sample rather than from a universal population, because samples are subject to error when we try to generalise beyond the sample (Franklin, 2008).

The required sample size of respondents was worth calculating precisely based on strict conditions in order to ensure that the final data set had statistical relevance (Corbetta, 2003). Under the usual settings of Confidence Level=95% (Zar, 1984), and Confidence Interval=5%, the minimum population sample size was calculated as 385 (Tech, 2016). That means I needed to collect at least 385 effective questionnaires from visitors in each Ke Ji Guan (excluding refusals and errors) in order that the resulting data would be eligible for statistical analysis.

For the purpose that the respondents should be recruited without bias as far as possible, it was also necessary to have a robust sampling strategy. For both the initial pilot visitor interviews and the main questionnaire survey data collection I took a systematic sampling approach (Corbetta, 2003). By inviting every  $k$ th person to participate in my research (where  $k$  was a predetermined number, for example  $k=5$ ), I was able to reduce the bias of the sampling and recruitment (Kratochvil, 1987). This approach built on previous similar work conducted by Falk & Storksdieck (Falk & Storksdieck, 2005). If the  $k$ th visitor agreed to take part in the survey, then this sampling system continued; if the

$k$ th visitor refused to complete the questionnaire, then I counted another  $k$  before issuing the next invitation to participate.

My choice of  $k$  was different depending on many factors, including each Ke Ji Guan's number of daily visitors, and the flow of visitor traffic in the area where I conducted my data collection. Initial piloting at each museum (see Section 3.6) informed my choice of  $k$  in each case, however the predetermined sample number was not fixed but flexible each day in case of unexpected factors (such as more or less visitors than anticipated). It was noticeable that all three Ke Ji Guan included in my research had in common that visitor numbers on weekdays were different from weekends. In practice,  $k$  was chosen variously from one to five. On a busy day  $k$  was larger and vice versa.

A further selection criterion was that if visitors came into a Ke Ji Guan with a group (though not an organised school group or tourist group, as those were excluded as mentioned in Section 3.4.3), then only one adult of this group was recruited randomly (Falk & Storksdieck, 2005).

### **3.5 Case selection and practicalities of participant recruitment**

In this section, I will address how I chose those three Ke Ji Guan as survey locations, as well as the process of recruiting survey respondents. This includes consideration of practical aspects such as how the systematic sampling mentioned in Section 3.4.4 was implemented. I also briefly outline specific steps I took to facilitate participant involvement and smooth running of my questionnaire survey during its implementation.

### 3.5.1 Ke Ji Guan case study selection

According to the Report on the Development of China's PSTI<sup>25</sup> (Ren & Li, 2010, 2011; Ren, 2009), there are at least three different ways to categorise Ke Ji Guan in China, which can be seen in **Table 1**:

**Table 1: Categorising Ke Ji Guan in China**

Administrative-division Region	National	Provinces/ Municipalities/ Autonomous regions level	Prefecture Cities level	County Cities level	Universities/ Enterprises level	
Scale	Small		Medium	Big		Giant
Geographic Region	Northeast & North China region	East China region	Central China region	South China region	Southwest & Northwest region	

It might seem initially that choosing at least one of these categories and identifying a representative museum within each category would give a broad representation of Ke Ji Guan within China. However, given the finances and time available, and the fact that I conducted this research on my own, it was not possible to select one case in every group, regardless of which category was selected.

<sup>25</sup> PSTI refers to Popularisation of Science and Technology Infrastructures.

So I chose the Ke Ji Guan based on the logical framework of the survey rather than representing the whole population of all Ke Ji Guan in China (Yin, 2006). In order to get as much data as I could, and to investigate variation differences, I conducted a multiple-case study approach. The rule for multiple-case selection is replication instead of sampling logic. Cases are expected to produce “similar results (a literal replication), or contrasting results but for anticipatable reasons (a theoretical replication)” (Yin, 2009, p. 54). Considering the conditions of the funding, time, and human resources I had available, as well as what museums I was able to negotiate access to<sup>26</sup>, three specific Ke Ji Guan were finalised as the locations to carry out my research:

- China Science and Technology Museum (the new building) in Beijing (CSTM Beijing)
- Shanghai Science and Technology Museum in Shanghai (SSTM Shanghai)
- Shandong Science and Technology Museum in Ji-nan<sup>27</sup> (SDSTM Shandong)

Within these three Ke Ji Guan, CSTM Beijing and SSTM Shanghai are expected to collect similar data because they are both located in the first-class cities<sup>28</sup> (Beijing and Shanghai), both are “AAAAA” level national sight-seeing locations, both are “giant” level<sup>29</sup> Ke Ji Guan, and both charge admission fees.

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<sup>26</sup> The China Association for Science and Technology (CAST) arranged for me to do the surveys in these three science museums and assisted in obtaining their permissions and support.

<sup>27</sup> Ji-nan is the capital city of the Shandong Province. In China, a province-level Ke Ji guan or other public institution is usually built in the capital city of a province.

<sup>28</sup> In China, there is a conventional classification about cities. There are only three super-big cities in the first class. They are Beijing, Shanghai, and Guangzhou.

<sup>29</sup> Based on China’s national Building Standards for Ke Ji Guan, a Ke Ji Guan in a building area of less than 8000 m<sup>2</sup> refers to the small scale, 8000 to 15000 m<sup>2</sup> refers to the medium scale, 15000 to 30000 m<sup>2</sup> refers to the big scale and more than 30000 m<sup>2</sup> refers to the giant scale (Ren & Li, 2010, 2011). Here CSTM is 102000 m<sup>2</sup>, SSTM is 98000 m<sup>2</sup> and SDSTM is only 21000 m<sup>2</sup>.

SDSTM, however, is located in a second-class city (the capital city of the Shandong Province, Ji-nan)<sup>30</sup>, not so famous sightseeing spot as Beijing and Shanghai and is free to visit. So SDSTM Shandong was anticipated to produce very different data from CSTM Beijing and SSTM Shanghai. In all cases, as outlined in Section 3.4.4, the rule of collecting at least 385 questionnaires was strictly followed in each location, and the statistical sampling approach was precisely executed in order that the data collected will be statistically meaningful.

### **3.5.2 Participant recruitment: Locations**

In each Ke Ji Guan there were three obvious general locations to recruit the participants: at the entrance, at the exit and inside the Ke Ji Guan. In making this decision I firstly considered what approaches had been taken within previous similar work.

In order to explore visitors' identity-related motivations and museum experience, Falk conducted surveys both at the entrance and the exit of museums, science centres, aquariums and zoos (Falk & Gillespie, 2009; Falk et al., 2008; Falk & Storksdieck, 2005; Falk, 2004). However, in some cases, interviews about identity-related motivations were conducted only at the exit (Falk & Adelman, 2003), and in other cases, interviews were carried out at the entrance only (Falk, 2008; Falk et al., 2007). In order to find out the similarity or difference on motivations of between pre-visits and post visits, Falk statistically compared results based on either an entry or exit interview and found that

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<sup>30</sup> Some provinces' capital cities and famous cities (in an economic sense) are in the second class, such as Ji-nan and Shenzhen. Ji-nan is a capital city but Shenzhen is not. Shenzhen is regarded as a city of second class for its high economic status in China.

there was no significant difference between these two kinds of approaches (Falk & Adelman, 2003).

In practice, however, based on the results of initial piloting in each location, I found that the choice of location did affect participation. In all three locations at the Ke Ji Guan exits the refusal rate was much higher than at the entrances. Additionally, in CSTM Beijing and SSTM Shanghai, the entrances were not ideal locations to recruit participants: due to safety and security issues, visitors were discouraged from congregating in those areas. Instead, the majority of my data collection was conducted near the rest areas in the lobbies on the exhibition floors. At CSTM Beijing I was also able to go into the galleries to recruit participants on days when visitor numbers were low, however at SSTM Shanghai the staff were worried that visitors inside the galleries would complain about being disturbed by me, so I was only allowed to recruit participants at the rest areas of floor ground, 1 and 2. By contrast, in SDSTM Shandong, there were other factors, which needed to be considered, most notably the lower overall visitor numbers, and the availability of a small lobby on the ground floor near the ticket-checking machine. This proved very useful for conducting my research, though on some days I also had to go inside the Ke Ji Guan galleries to actively recruit participants. Another factor was that SDSTM Shandong has two closed days: Mondays and Tuesdays, while CSTM Beijing and SSTM Shanghai are only closed on Mondays (except for special occasions). The situation of less available days to conduct the research also meant that more work was required to recruit sufficient participants on every survey day at SDSTM Shandong. The surveys in the three Ke Ji Guan were conducted on both weekdays and weekends in order to obtain comprehensive data.

### **3.5.3 Participant recruitment: Encouraging participation**

There were various deliberate steps that I took to encourage participation in my research. As suggested by local staff at each Ke Ji Guan, I wore a volunteer jacket at CSTM Beijing and SSTM Shanghai, and volunteer ribbon in SDSTM Shandong, to make me more recognisable to visitors. I also included a small incentive (a brightly coloured shopping bag) to increase respondents' participation rate (Dykema et al., 2012). These incentives effectively and successfully raised visitors' notice and interest.

Another area of effort was to use the most locally appropriate form of address in these three different locations. All these three cities have different historical culture systems and associated different preferences of communication with strangers. For example, 'Hello' can be translated into Chinese in two formats: "Ni-hao" and "Nin-hao". "Ni-hao" is a polite and formal manner of address, but the latter is showing respect in most cases. In Beijing, "Nin-hao" is more popular, while in Shanghai "Ni-hao" is fine. In Ji-nan, it is very popular to say hello combined with calling people "Teacher" (pronounced as "Laoshi" in Chinese). The word "Teacher" here does not necessarily refer to the job of teaching in a school, but an honorific address that means a person with some particular role or in high social statue. By using the local terminology, I was able to more quickly gain trust and ensure smoother communication with participants.

When conducting written surveys, an accompanying interviewer is necessary if the participant is weak, young, has limited literacy or cannot understand the language used in the questionnaire (Sapsford, 1999). For this reason I took a more active role for some respondents, when they could not complete the

questionnaire due to eyesight and hearing problems, even illiteracy<sup>31</sup>. For example I read the questions and options or even helped them to write their answers. Also, sometimes, some visitors were not in a position to conveniently complete the questionnaire by themselves, such as mothers having a baby in arms. All these orally answered questionnaires were marked during the data entry processes in case they required a special analysis, though in the end this did not prove necessary.

In summary, all these efforts were made to ensure a robust survey and reliable data collection. In total I collected 1258 questionnaires of which 1249 were valid (see Chapter 5).

### **3.6 Visitor pilot research stages**

After the design of a questionnaire is finished in its preliminary form, it is necessary to conduct a pre-inquiry on a small scale of participants. This process is named piloting (Arthur & Nazroo, 2003). If possible, the samples for the pilot study should be similar to the formal survey in order to identify potential problems at an early stage. This method is also useful to rehearse the process of self-introduction, project explanation, and personal persuasion. Meanwhile, other detailed issues will also be pre-tested, such as appropriate words of thanks for respondents' help at the end of the survey (Walliman, 2006).

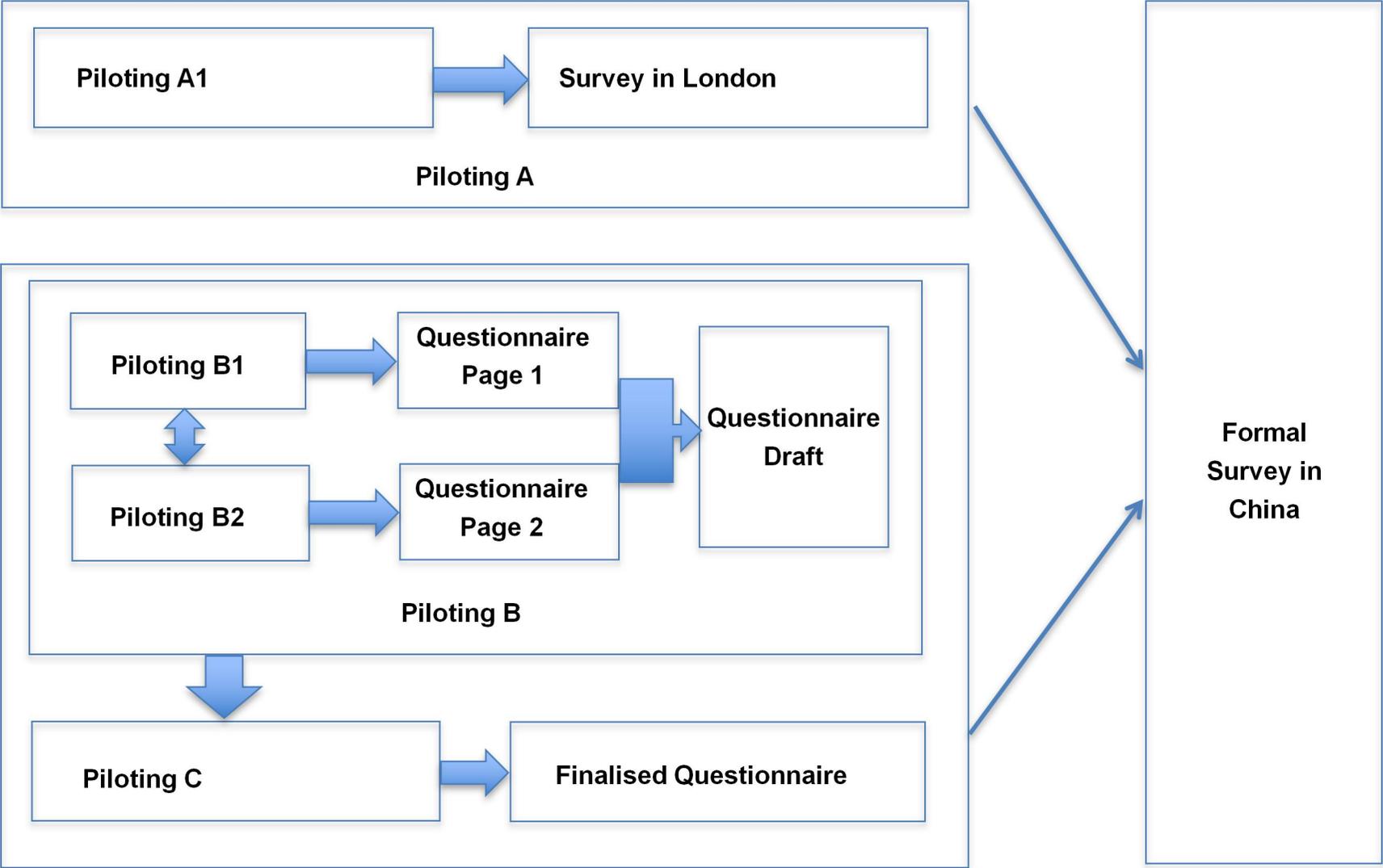
For my research, the piloting process was divided into a series of separate stages in recognition of the various different elements that were tested each time. Detailed tasks included familiarising myself with conducting this type of

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<sup>31</sup> For example, some seniors met this situation.

survey at a Ke Ji Guan, practicing the expression of questions, exploring average completion time, and so on. The relationship among these different piloting stages can be seen in **Figure 6**; the rest of this section explores each stage in turn.

Figure 6: The piloting process



### **3.6.1 Piloting at the Science Museum London**

Before I carried out the survey in China, a pilot stage (A1) was conducted in advance in the Science Museum London. This stage allowed me to become familiar with conducting visitor surveys in a similar environment where such work was comparatively commonplace, and where I had access to experts (including my supervisory team) who could advise me on my approach. This pilot stage took place in English, meaning that I could build directly on Falk's work, as well as compare and discuss my experience with local experts in museum visitor research.

Pilot stage (A1) tested the best location for conducting the survey, and determined that one questionnaire needed three to four minutes for a visitor to complete. Also, it allowed me to practice the introduction of my research and myself, and then build standard techniques and phrases to use with participants. It also offered a chance to practice the whole process of systematic sampling.

The survey itself was quite similar to the questionnaire survey conducted in China (see Section 3.4.2 for further details of its development), with the first page (about visitor motivations) following Falk's design. After three days of piloting in this stage (A1), a formal survey in the same location was conducted. In this survey, I developed a series of approaches to reduce the error rate of the collected questionnaires. Instant after-check helped me to determine whether there were any unclear or unidentified answers, in which case I used follow-up questioning to ask the respondents to rewrite or specify their answers in more detail. Some blank answers or wrong marks because of misunderstanding were also able to be refilled and corrected by this approach. All of these experiences decreased my error rate and were subsequently used in the surveys in China.

The formal survey in London obtained 498 questionnaires in total, and I developed a standardised and smooth way to carry out my questionnaire survey. The formal survey in London can also be regarded as a larger scale piloting (A) for the surveys in China. Though I did not end up using these data to make a comparison with my data in China, it proved extremely useful for my final results. In particular, as noted previously, through carrying out the survey in London, I got opportunities to frequently discuss any real or possible problems with my supervisors and other experts in a language we could all understand, and relating to an environment we were all familiar with. This training enabled me to resolve most problems in China independently without further assistance.

### **3.6.2 Mixed methods at CSTM Beijing**

In order to design the questionnaire for the surveys in China, a pilot study (B1) with mixed methods was conducted at CSTM Beijing. As mentioned in Section 3.3.1, qualitative interviews were carried out in CSTM Beijing to identify visitors' motivational statements and construct the option bank of motivations to use in the final questionnaire. Meanwhile, the demographic information on the second page of the questionnaire (see Section 3.4.2.3) also needed piloting to test its readability (piloting stage B2).

In practice, the piloting stages B1 and B2 were combined into one entire single procedure (piloting stage B): the initial interview to explore visitors' motivations to visit CSTM Beijing (piloting stage B1), followed by asking the same individual to complete the written demographic questions (piloting stage B2).

In this process, some questions were revised or deleted. For example, visitors' income levels were originally included within the demographic questions. However, through the piloting, I found that respondents tended to choose higher income groups than their actual family revenue levels. The CSTM

Beijing staff member and researcher, Yang Zhao, also indicated that in their previous surveys they were aware that this question produced a lot of false answers (personal communication, March 15, 2015). So in order to avoid collecting inaccurate data this question was deleted.

### **3.6.3 Final tests for the questionnaire in Chinese**

After the four-day piloting stage B the overall Chinese questionnaire draft was produced. This was then followed by piloting stage C that tested the whole questionnaire in written form. Over four days, I had tested the validity and clarity of the survey overall, and made some further revisions to the questionnaire. For example, some options of the motivational statements were adjusted (Some of them were combined and some of them were replaced). The demographic questions also underwent some small adjustments for more precise expression and easier understanding. Average completion times were tested and used in the introduction during participant recruitment. Different visitor sample numbers and refusal rates on weekdays and weekends were recorded to offer reference for formal sampling. Appropriate locations to recruit participants were confirmed. A standard process of recruitment was also established and practiced. At the end of piloting stage C, the Chinese questionnaire was finalised and ready for implementation.

Both piloting phases B and C were conducted at CSTM Beijing and both of them acted to test the overall Chinese survey. So piloting stage C can be considered as an overall final test of the Chinese questionnaire.

It is worth noting that the questionnaire piloting was conducted only at CSTM Beijing due to the lack of time and funds to support further extensive piloting in the other locations. The final questionnaire was then implemented across all three Ke Ji Guan. I also did some initial piloting at SSTM Shanghai and SDSTM Shandong to identify the best locations for recruiting participants,

though the actual methods and resources used were the same as those produced at the end of piloting stage C conducted at CSTM Beijing.

Through the help of multiple piloting stages, most possible problems were resolved before the formal survey, and the process of sampling and recruitment were also practiced adroitly. All of these efforts contributed to a high rate of usable data, with 1258 questionnaires collected across the three Ke Ji Guan in Beijing, Shanghai and Ji-nan in total, of which 1249 were valid.

### **3.7 Data entry and analysis processes**

As Black argued, raw data have little meaning and must be transformed into understandable information (Black, 1993). In terms of the statistical way to process my data from the questionnaire survey, I applied IBM SPSS (Mac version 24.0), which is a commonly used software for statistical analysis (Field, 2009).

I inputted my raw data from my questionnaire surveys at the three selected Ke Ji Guan to a specially designed SPSS dataset. Before I inputted the data to my computer, I gave each questionnaire an ID as “Acronym of location + Number”. For example, the ID “SH001” refers to the number 001 questionnaire from SSTM Shanghai. These IDs helped me to check errors after I finished my inputting work by swiftly reflecting the right printed questionnaires.

When it came to the error checking, I used three approaches. The first one was to employ SPSS to examine the minimum and maximum values through frequency calculations (Pallant, 2013). For example, my maximum value of Q7 about visitors’ gender should be 3 (except for the error value of 99 which I typed manually), so any value greater than 3 referred to an inputting error. Also this approach was used to target missing cases (Pallant, 2013). The second way was to check errors using Excel. I saved my SPSS dataset as an Excel file, and used certain Excel functions to find typing problems. For example, in

order to confirm whether the two parts to the motivation scores (the tick boxes and the numerical rankings) aligned to the same options, I used the “IFS” function to check. The third way was a manually random check that I conducted separately. I stored questionnaire sheets in big envelopes according to their date of completion. I pulled out one questionnaire out of every ten randomly from each of the envelopes and checked if I had made any errors in inputting the data. For instance, I took seven questionnaires randomly from an envelope containing 70 questionnaires in total. Such errors were relatively rare, and the combination of these three approaches means that my overall data entry errors were minimised as far as possible.

In my process of data analysis using SPSS, both descriptive and inferential statistics calculations were conducted. The descriptive calculations (such as the total number of female visitors) were performed to obtain information about visitors’ demographics. The inferential statistics (e.g. Chi-square tests) were carried out to explore the identity-related motivation patterns and the correlations between visitors’ demographics and identity-related motivations. Additionally, sometimes I applied Microsoft Excel 2011 to do specific calculations and produce figures due to its better visual outputs and user interface.

### **3.8 Limitations**

As with all research, there are in hindsight areas where my research approach could potentially have been improved, as well as inherent limitations, which were unfortunately unavoidable. In this section, I reflect upon the main limitations in my project including survey methods, samplings and analysis approaches.

### **3.8.1 Limitations of the survey methods**

I applied a self-completed questionnaire as my main survey method. Despite the advantages outlined in Section 3.4.1, this method does have some inherent limitations.

For one thing, this approach limits the scope of questions. That is to say, questions must be easy to understand, and complex questions are not appropriate (Corbetta, 2003; Walliman, 2006). In my questionnaire, the first question includes 20 motivational statements, which were determined via an initial qualitative inquiry stage. In hindsight, some statements could perhaps have been further improved. For example, participants had problems on M9... I love our country and want to see our latest developments in science and technology. These respondents usually overlooked the causal correlation between "love our country" and "want to see our latest developments in science and technology". Instead, they only focused on the love to the country. Some senior and loyal participants chose this option while saying: "Love our country? Of course I do!" I am however not sure if they understood this question fully. Additionally, when using a questionnaire it is difficult to probe answers, and this limits the range of clarifications and additional data obtained (Walliman, 2006). In order to avoid my personal impact on respondents' answers, I tried my best to play a role of spectator, providing only necessary explanation relating to the questionnaire. This may have prevented me from obtaining more data and in-depth answers. Furthermore, it is difficult for me to verify the data I collected through the questionnaire (Walliman, 2006). For example, I could not find a reliable way to check if my participants lied or not. What I could do is delete some questionnaires that clearly included fake data. For example, SD393 attended the SDSTM Shandong with his girlfriend but chose most options about children, presumably as a form of joke. His

response was deleted from the overall sample, but it is difficult to know if other, subtler, similar issues arose elsewhere.

There are also other things to improve in the development process of my questionnaire, especially the motivation options. I was only able to conduct a short, single-researcher qualitative investigation to build my questionnaire options of Question 1 (see Section 3.3.1). Falk's questionnaire was developed over a much longer period of time and with many different people (both researchers and participants) involved, and also with a number of different iterations. While that's not feasible within a single PhD, it could have improved my categories (and therefore my data) substantially, had it been possible. Furthermore, I conducted Exploratory Factors Analysis to my data and obtained a set of factors (see Chapter 6, Section 6.3). Such analyses could be used to improve my questionnaire. So my survey could even be regarded as another piloting stage before an even bigger roll out. This is still possible for someone to do as future research.

However, though it has some limitations, the questionnaire survey did offer the best way to collect my data as it was cheap, quick and easy to recruit a large number of respondents, even if it was not perfect.

### **3.8.2 Limitations of the samples**

In the process of conducting my survey, I also encountered sampling limitations.

Firstly, I only had three case study selections in total, and they were not representing all categories. Though to balance this limitation, I chose them for some comparing-targeted orientation. The CSTM Beijing and the SSTM Shanghai share some characters. For instance, both of them are AAAAA level national sight seeing spots; both of them are giant level Ke Ji Guan; both of them are located in big cities of first class. But the SDSTM Shandong is not a

national level sight seeing spot, much smaller than them, and located in a smaller city. So I hope to make some comparison work between them to identify some similarities/differences.

In terms of the sampling in each Ke Ji Guan, though I applied a systematic sampling approach (see Section 3.4.4), there was still potential bias introduced due to local regulations. For example, in CSTM Beijing, I could not recruit respondents at the gates to the Science Paradise for Children or the film room because these two locations are both close to the security checking station, where it was forbidden to stay for a long time. In SSTM Shanghai, I was only allowed to recruit people who were sitting on the chairs of rest areas. Yet as I observed, young people rarely sat here. There were only a few young visitors sitting on chairs at rest areas without children. This situation may lead to a sampling bias because of participants' homogeneity. In order to overcome these limitations, I used half of every day's survey time to recruit walking visitors (still adhering to the systemic sampling methods) at gallery entrances and corridors, though as far as I observed, the refusal rates at these places were much higher than in the rest areas.

There were also some groups of visitors who were not able to participate. Some senior visitors refused to participate outright, for example saying "I am old" or "Go and find a young person." But of course there were some seniors who were happy to be recruited. As I mentioned in Section 3.5.3, I helped them to complete the questionnaires by reading questions for them or even helped them to write their answers if they could not write or be interviewed because of weak eyesight or no literacy. Additionally, people who carried a baby were also excluded because he/she would have no hand available to write and/or no time to be interviewed by me.

I also encountered some problems relating to the incentives offered. Some people were so interested in my questionnaire or my gift; they would ask their

companions to do the questionnaire too, in order to get one more gift. These people come from the same group, so they may share some demographic and/or motivational factors, such as similar locations of residence or who they accompanied on their visit. This again introduces a greater homogeneity in the data than was likely to be present in reality.

In terms of my expert interviewees (the three senior scholars in Ke Ji Guan studies in China), they all come from Beijing and worked in the CSTM, so may reflect a personal bias towards that institution. Both Xiangyi Li and Shangyan Xu also worked for CAST as senior officials. They inescapably mentioned the CSTM much more frequently than other Ke Ji Guan, and declared the “leader” status of the CSTM. As mentioned previously, the State Planning Commission and CAST stated the CSTM’s leader status and function for all Ke Ji Guan in China formally in 1997. But CAST is not the only supervising institution to all Ke Ji Guan in China. Many other Ke Ji Guan belong to other institutions. For example, the SSTM is built and supported by the Shanghai Science Commission; the Guangdong government supervises Guangdong Science Centre; and the Agriculture Museum belongs to the Agriculture Department. There are neither evidences in the journal *Ke Ji Guan* nor other my existing data sources indicating that these Ke Ji Guan would agree with CSTM’s “leader” status or not. So my exploration of the development of Ke Ji Guan in China is not an all-encompassing historical perspective, and may have some bias.

Additionally, all interviewees are old, so their memories may not be so sharp for some facts. So when I write the interview results chapter, I rely on the archived documents in priority and use the interviews as general guideline or clues as I mentioned in the Section 3.3.4 this chapter.

Furthermore, due to our respective schedules and the inappropriateness of overly imposing on their time, it was not possible to find other chances to

interview them on multiple occasions to confirm or reinforce certain details. But as I mentioned at the beginning of this chapter, they were my best choice based on availability and resources. Despite their limitations, they offer unique insights and previously unpublished perspectives as Ke Ji Guan's builders, curators, and consultants. Their experience, and familiarity with the details of Ke Ji Guan in China is irreplaceable.

Though there were the above sampling limitations, I have tried my best to overcome such problems, either within the data collection itself or when reflecting on my overall analysis and findings.

### **3.8.3 Limitations of the analysis approaches**

After I collected sufficient data, I conducted a content analysis to participants' motivational statements. I got seven identity-related visitor categories (see Chapter 6, Section 6.2). But actually this was only based on my own judgment. In order to make this result more reliable, I conducted some comparison to Falk's coding and theoretical framework to make it as sensible as possible.

I employed the Exploratory Factor Analysis (EFA) to probe the identity-related motivation patterns of my participants in a statistical manner after I got the categories from the content analysis. But the approach of choosing which factors are important within an EFA result is actually based on a pragmatic rather than theoretical standard (Tabachnick & Fidell, 2013). Different people may make different decisions regarding which factors are important. This is a normal part of EFA analysis (as highlighted by the nature of the "exploratory" approach).

For example, some researchers suggest choosing factors using the Scree Plot. Cattell argued that the cut-off point for choosing factors should be at the inflexion of the graph, which represents the point at which the lean of the curve changes remarkably (Cattell, 1966). Stevens supported Cattell's approach,

arguing that with a sample size of more than 200 respondents, the scree plot can be used to make a reliable selection of the main factors (Stevens, 2002). Using the Scree Plot suggest that I may extract less factors. Or I could also follow the K1-Kaiser's method, according to which I can keep items with eigenvalues greater than one for interpretation (Kaiser, 1960). But in my results, all extracted factors by SPSS showed eigenvalues >1. Applying this methods means I have to choose all factors I got from the original statistical calculation. In other word, there is no choice. However, in my case, it seems it worked well by finding out the most repeated clusters in multiple fix-numbered EFA calculation (see Chapter 6, Section 6.3). Finally, I selected six main factors for the combined data and acknowledged that this approach was just one way of attempting to interpret the motivations and identities behind visitors' Ke Ji Guan experiences.

Although there are limitations to the approaches taken, overall I did my best and made the survey and analysis as robust as possible.

### **3.9 Chapter summary**

In summary, in this chapter I provided a detailed description of the research methods I used. I applied a mixed methodology including qualitative and quantitative approaches. Among them, the face-to-face interview and questionnaire survey were finalised for use in my empirical research. I demonstrated the reasons for choosing these methods, the sampling approaches taken and the methods of recruitment applied.

For the interviews, Purposeful Sampling and Snowball Sampling were employed to recruit three experts in the field of Ke Ji Guan studies in China (Xiangyi Li, Shanyan Xu and Heng Wang). Content analysis, taking a grounded theory approach was used to interpret the data from the depth

expert interviews, as well as the informal qualitative pilot discussions with Ke Ji Guan visitors.

Visitor data were collected at three selected Ke Ji Guan (CSTM Beijing, SSTM Shanghai and SDSTM Shandong) for exploring some similarities or differences. In terms of the questionnaire survey, the questionnaire itself was very carefully designed in order to maximise respondent uptake and minimise errors. A systemic sampling approach was applied to recruit respondents at the three selected science museums in order to reduce the sampling bias.

Finally, three separate piloting stages (A, B, and C) were conducted to help making a skilled and smooth formal survey. Overall, three in-depth interviews were conducted and 1249 valid questionnaires were collected, the results from which are presented in Chapters 4, 5, 6 and 7.

Additionally, I analysed some limitations in survey methods, samplings and analysis approaches. I also indicated what I have done to reduce the limitations and make the research as robust as possible.

## **4 The Historical Development of Ke Ji Guan**

In this chapter, I will make a picture of the historical development of Ke Ji Guan in China. I draw on three resources to develop this theme. The first resource is the results I got from interviews to three senior scholars in the Ke Ji Guan studies field in China. The second draws on data from an interview survey to participants at the China Science and Technology Museum (CSTM Beijing) to explore visitors' recognition of the concept of Ke Ji Guan. The last source is the internal archived documents I obtained from one interviewee. Here I integrate these multiple sources to describe the development process of Ke Ji Guan in China. Furthermore, I will provide some discussion on the evolution of Ke Ji Guan's functions, names, and category in China.

In order to provide a clear narration, In this chapter, when I mention the generic concept of Informal Science Institutions (particularly the similar institutions with my research cases) in China, I will employ the concept of "Ke Ji Guan" (it can be used in both singular and plural format), while specific institutions will be referred to by their current formal English names. This will help me to make a discussion without confusion before science museum/centre in China is clearly described.

### **4.1 Data sources**

In total I interviewed three scholars as follows:

Xiangyi Li, former curator of CSTM and official of the China Association of Science and Technology (CAST), was interviewed on 19 March 2015; Shanyan Xu, director of China Association of Natural Science Museum and former director of the Expert Committee of Building the CSTM, was interviewed on 5 June 2015; Heng Wang, high engineer of the CSTM and

former chief editor of CSTM's internal journal *Ke Ji Guan* (1987-2002), was interviewed in 2 April 2015.

My main theme of the interview was about the historical development of Ke Ji Guan in China and their target visitors' evolution. All of these three experts either are very familiar with the development of Ke Ji Guan and government policies about Ke Ji Guan in China. They are all currently working as consultants for Ke Ji Guan in China. In other words, they are key people in the history of China Ke Ji Guan. All of them have written articles about Ke Ji Guan studies but none of them have published a detailed and systematic historical record about the development of Ke Ji Guan in China, so their sources and memories are important. Fujun Ren, an internationally recognised Chinese expert on science museum and science centre studies, recommended the first two experts to me. Ren comes from the China Research Institution of Science Popularisation (CRISP) and has worked in science museum/centre studies for many years. He recommended Xiangyi Li and Shanyan Xu based on his experience of research and understanding of these two experts' value on my research theme. Yang Zhao, who is a senior scholar of the CSTM, recommended Heng Wang to me. Most of the senior experts who actually attended the CSTM's establishment are too old to be interviewed, while many other experts have already passed away. Even these three interviewees are all around 70 years old. Some other experts are currently high government officials, but they could not be accessed. Taking into account the time and resource available, these three interviewees provide the best choice available, representing excellent complementary perspectives and providing unique data on the establishment of the CSTM and Ke Ji Guan more generally.

All of these three experts agreed for their interviews to be recorded using digital recorders and smart phones. Xiang Li, who originated this idea of interviewing experts, jointly conducted the two interviews with Xiangyi Li and Shanyan Xu with me while I alone conducted the interview with Heng Wang.

We worked on raising questions jointly in the interviews but performed our transcriptions and analysis separately after the interviews.

All interviews were conducted in a happy and friendly interactive atmosphere and no problems were experienced. But as senior scholars and former government officials, they tended to 'run away' from the main theme and my questions. It was not easy to 'pull them back' for they were keen to tell their own stories or things they thought I ought to know; much of these narrations were therefore not directly related to my research aims and question themes though they were very interesting. As Arthur & Nazroo (2003) argue, this situation may influence the communication between the interviewer and the interviewees, for it could obstruct the interviewer to pursue the relevant topics (Arthur & Nazroo, 2003). Furthermore, because their memories are fading, for some questions their answers were different from each other and as I mentioned before, it is hard to find other people and evidence to corroborate their answers. As a result, the level of information I obtained directly from these interviewees was limited. However, thanks to Heng Wang and Yang Zhao<sup>32</sup>, I additionally obtained access to many internal documents that contained highly useful and relevant information. Many of these documents are exclusive only to people within CSTM and CAST. Particularly, thanks to Heng Wang, access was also obtained to the CSTM's internal journal *Ke Ji Guan* from 1987 to 2010, and many other internal research reports and essay works. From these documents I was able to learn further first-hand information from people who lived in those times and could use these files to obtain other information about the development of *Ke Ji Guan* in China. It should however be noted that some of these documents, e.g. the journals of *Ke Ji Guan*, are not strictly peer-viewed academic papers. Most of them have no citation and references, and only a few of them have a very short bibliography. Authors were mainly researchers, science museum curators and staff members from all over China.

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<sup>32</sup> Yang Zhao is a researcher and officer in the CSTM.

So I prefer to apply these documents as archival primary materials. These articles are first hand sources about Ke Ji Guan because they were written contemporaneously.

I also conducted an interview survey to randomly recruited respondents at the CSTM in order to explore visitors' perception on the concept of Ke Ji Guan. I interviewed 98 participants and got 91 answers. The analysis to these data will be found in Section 4.3 this chapter.

As Creswell & Clark (2011) argued, use of only one kind of data source may be inadequate and it may lead to incomplete research results. Some problems need to be explained by other data sources. For example, qualitative results may need quantitative data to prove and enhance, and quantitative may need qualitative sources to describe what it is. Multiple materials help to build a whole and entire story (Creswell & Clark, 2011). So I have applied this integrated approach to detail the development of Ke Ji Guan in China using multiple sources of original data. In this research, I will draw on the archive documents and the visitor interview survey to help frame the interviews with experts in order that a whole picture can be made.

## **4.2 A brief historical development of Ke Ji Guan**

In this section, I will describe the development process of Ke Ji Guan in China. Ke Ji Guan's definition, functions, and target visitors have evolved along with its development. Exploring and understanding this evolution can help me to understand and analyse my questionnaire data easier. I can also use these sources to find some historical reasons for the result of my questionnaire survey to Ke Ji Guan visitors in China.

#### 4.2.1 The pre-CSTM age

Though the idea that a museum can be a place for science popularisation was mentioned by Nantong Museum (Nantong Bo Wu Yuan in Chinese) as early as 1905, the first time there was an explicit call to build a 'Ke Ji Guan' was in 1950.

In the delegates' conference of natural science workers of China in August 1950, two countrywide institutions, the China Professional Society Union of Natural Science and the China Association of Science and Technology Popularisation were set up. The sixth discipline of the latter's tenet document called on them to build science museums, Ke Ji Guan, science and technology libraries and planetariums to popularise science and technology knowledge to all people (Chen, 1990). Afterward, similar local institutions were also built in many provinces and municipalities. From then on, Ke Ji Guan "opened its first page" in China (Chen, 1990).

1958 was the first year after China completed its first 'Five-Year-plan'<sup>33</sup>. An assortment of scientific inventions and technology innovations arose along with the development of the society, while there were no corresponding approaches to conduct science and technology communication and popularisation. Scientists and science workers then planned to set up a Ke Ji Guan to implement this aim. According to Nie (1988), thanks to the China Professional Society Union of Natural Science's proposal, the premier and vice premier signed an agreement to build the China Science and Technology Museum (CSTM) and added it to the 'Ten Big Projects for Celebrating the Tenth Anniversary of the Founding of the PRC'<sup>34</sup>. The original planned function of the CSTM was to display the disciplines, functions and effects of the scientific and technological development in the 'New China'. The original plan

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<sup>33</sup> 'Five-Year-plan' was a series of domestic social and economic development initiatives in China. Its aim was to promote the country to achieve certain target developments within a period of five years.

<sup>34</sup> PRC refers to the 'People's Republic of China'.

to build the CSTM also mentioned that it was set up for science workers, cadres, formal factory workers, and adolescents with at least middle-school education (Nie, 1988). This plan emphasised a basic education and an identity of urban citizen. The science workers, cadres, formal factory workers all referred to city identities rather than farmers in the countryside at that time (Nie, 1988).

In September of 1958, the China Professional Society Union of Natural Science and China Association of Science and Technology Popularisation combined to become the China Association of Science and Technology (CAST) (Chen, 1990; Nie, 1988). From then on, CAST became the supervising department for many Ke Ji Guan and science popularisation works in China. It also was asked to be responsible for the establishment of the CSTM, so it started the building work of the CSTM then began in the same year (1958) (Nie, 1988).

However, because of a lack of building materials, the premier stopped the project of the CSTM to give way to other projects, particularly the building of the Great Hall of People. So the CSTM project ceased and all architectural works were archived by the Beijing local government in 1959<sup>35</sup> (Nie, 1988; Zhang, 1993). But in line with the idea of building Ke Ji Guan for public science enlightenment, some local associations of science and technology also began to build Ke Ji Guan in the same period such as Shandong Science and Technology Promotion Guan, Tianjin Science Palace, and Guangdong Science Centre (Chen, 1990). These were the first batch of science-related institutions in China. Though they were few in number, small in building scale, and with different functions, they really paved the way for modern Ke Ji Guan in China as early examples for their various formats of science popularisation activities (Chen, 1990). This period can be regarded as the first little flowering of Ke Ji Guan in China.

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<sup>35</sup> Shanyan Xu. (2015), Interview, 5 June 2015, transcribed by Xiang Li.

At this stage, there were no function and building regulations or definition for Ke Ji Guan. Ke Ji Guan was regarded as a name of a big category including all kinds of science and technology-related institutions such as science halls, science palaces, adolescent scientific activity palaces as well as planetariums. Local governments and local associations of science and technology built Ke Ji Guan according to their own aims and needs without reference to other science museums or science centres elsewhere in the world. In the period of the Great Leap Forward (1958-1960)<sup>36</sup> and Cultural Revolution (1966-1976)<sup>37</sup>, China's economy and society suffered a sharp decline, and people paid little concern to science and technology due to ongoing political fights and combats. Correspondingly, Ke Ji Guan developed very slowly.

#### **4.2.2 The re-building of CSTM**

1978 can be regarded as a key year for China. As both Xiangyi Li and Shanyan Xu recalled, in March that year, more than 6000 scientists and science workers attended the first Nation-wide Science Conference. In order to improve the nation's science and technology and popularise them, scientists called on the re-building of the CSTM, and afterwards CAST formally submitted its report to the State Scientific and Technological Commission. With the support of premier Xiaoping Deng and vice premier Yi Fang, the State Planning Commission signed the report and agreed to re-build the CSTM<sup>38</sup> (Zhang, 1993). In December, the Third Plenary Session of the Eleventh Central Committee of the CPC<sup>39</sup> was held in Beijing; at the conference, the president of the China Academy of Science, Moruo Guo gave a lecture, *The*

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<sup>36</sup> The Great Leap Forward was an economic and social campaign by the Communist Party of China (CPC) from 1958 to 1961. The campaign aimed to rapidly transform the country from an agrarian economy into a socialist society through rapid industrialization and collectivization. However, it is widely considered to have caused the Great Chinese Famine.

<sup>37</sup> The Cultural Revolution was a socio-political movement that took place in China from 1966 until 1976. The movement paralysed China politically and negatively affected the country's economy and society to a significant degree.

<sup>38</sup> Shanyan Xu. (2015), Interview, 5 June 2015, transcribed by Xiang Li; Xiangyi Li. (2015), Interview, 19 March 2015, transcribed by Xiang Li.

<sup>39</sup> CPC refers to the 'Communist Party of China'.

*Spring of Science*. This lecture was so encouraging that people called the conference itself as the spring of science and the milestone of the history of science and technology development (Xinhua News Agency, 2009).

After that meeting, the project of Re-building CSTM was listed in the sixth 'Five-Year-plan' of China (Chen, 1990). From then on, 1978 was regarded as the beginning of the Spring of Science and lead to a boom of science popularisation work including Ke Ji Guan.<sup>40</sup>

According to Nie (1988), CAST established the CSTM Building Committee, and Yisheng Mao was elected to be the director. Mao led a team to the US, Canada, Europe, Japan, Mexico and Hong Kong to visit 28 science museums and science centres in total so as to learn about their architectural types, exhibition contents, and operational approaches (Nie, 1988). Xiangyi Li recalled that, after their return to China, Mao and his team argued that China ought to build *science centres* (as opposed to *science museums*), because Europe has plenty of collections, instruments and old Industrial Exposition sites inherited from the Industrial Revolution, while China had no such industrial revolution and heritages. In other words, China had no conditions and historical elements to build science museums like the western world (for example the Science Museum London)<sup>41</sup> (Li, 1993). Furthermore, in the 1980s, some Chinese scholars regarded the science centre as a new trend in science museums, and they argued that China should catch the "new wave of the world"<sup>42</sup> (Li, 1993). As former CSTM curator, Xiangyi Li recalled, the premier Enlai Zhou had suggested at that time that:

*"Our science and technology should catch the new wave of the world, and we would not follow other countries' old style of science museum."*<sup>43</sup>

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<sup>40</sup> Xiangyi Li. (2015), Interview, 19 March 2015, transcribed by Xiang Li.

<sup>41</sup> Xiangyi Li. (2015), Interview, 19 March 2015, transcribed by Xiang Li.

<sup>42</sup> Xiangyi Li. (2015), Interview, 19 March 2015, transcribed by Xiang Li.

<sup>43</sup> Xiangyi Li. (2015), Interview, 19 March 2015, transcribed by Xiang Li.

So under this ideology, the CSTM was re-built as a science centre from November of 1984 (Zhang, 1993). Its main learning model was the Exploratorium (San Francisco, US).<sup>44</sup> Its target visitors were formulated as adolescents and adults with at least middle-school education in the appendix of “Plan of Project of China Science and Technology Museum” (Nie, 1988). The first part of CSTM was finished in 1988 and formally opened to the public on 22 September 1988 (Zhang, 1993).

In the process of building the first phase of the project (1984-1988), besides interactive facilitates and hands-on exhibitions reflecting specific scientific principles, the CSTM produced videos as a complementary feature to show the science and technology of ancient China (Nie, 1988). In contrast, in the second phase of the project (1988-2000), as Xiangyi Li recalled that, and the builders gave up designing and displaying exhibitions by separate subjects such as Physics, Chemistry, etc. Instead, they tended to display integrative subjects, such as Brain Science, Communication Science, Life Science, and Space Science. Compared to the practice of importing exhibitions from overseas in the first phase of building CSTM, the second phase of the CSTM showed a new era of China Ke Ji Guan through new ways of display and exhibition.<sup>45</sup>

The CSTM is regarded as the first giant-scale and national Ke Ji Guan in China (He, 1988; Zhang, 1993), and as CAST and the government’s anticipation, it worked as a leader for all Ke Ji Guan in China.<sup>46</sup> As the former chief editor of CSTM’s internal journal *Ke Ji Guan*, Heng Wang admitted in the modern sense, the CSTM could be regarded as the first science centre in China even though other Ke Ji Guan had technically opened earlier than the CSTM (such as Shanxi Science and Technology Museum). However, due to

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<sup>44</sup> Xiangyi Li. (2015), Interview, 19 March 2015, transcribed by Xiang Li; Heng Wang. (2015), Interview, 2 April 2015, transcribed by Huiping Chu.

<sup>45</sup> Xiangyi Li. (2015), Interview, 19 March 2015, transcribed by Xiang Li.

<sup>46</sup> Shanyan Xu. (2015), Interview, 5 June 2015, transcribed by Xiang Li.

their unprofessional contents and functions (particularly some functions unrelated to science and technology popularisation such as promoting industrial products in some old Ke Ji Guan), they could not be entirely regarded as Ke Ji Guan in the current sense of Ke Ji Guan in China.<sup>47</sup>

In 1980s, in terms of the CSTM's target visitors, the urban citizen identity was abandoned from the formal plan but a middle-school education was still needed. As Heng Wang explained, without this level of basic education, it was considered that visitors could not sufficiently understand and play with the interactive facilities provided in Ke Ji Guan.<sup>48</sup>

#### **4.2.3 The stage of “Lou-Tang-Guan-Suo”**

After the first part of the CSTM opened to the public, Chinese Ke Ji Guan entered their new stage. According to Xiangyi Li, local Ke Ji Guan mimicked and learned from CSTM's interactive facilities and scientific applications; even some commercial enterprises also played a part in the building work of various local Ke Ji Guan. Xiangyi Li described this as: “Ke Ji Guan mushroomed all over China.”<sup>49</sup> As Shanyan Xu recalled, many cities built their local Ke Ji Guan and there were in total more than 200 Ke Ji Guan in China between 1987 and 1988<sup>50</sup> (Chen, 1990).

Song (1991) argued that, in this stage, however, inside the CAST, there was no clear description about what a Ke Ji Guan was and what its functions were. Views differed from each other (Song, 1991). Some people argued that Ke Ji Guan was the same thing as science museum or science centre in the western sense, while some people believed that Ke Ji guan was a place to have science-related activities like a science hall (Song, 1991). Some supervising departments defined Ke Ji Guan as a ‘multi-functional, comprehensive

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<sup>47</sup> Heng Wang. (2015), Interview, 2 April 2015, transcribed by Huiping Chu.

<sup>48</sup> Heng Wang. (2015), Interview, 2 April 2015, transcribed by Huiping Chu.

<sup>49</sup> Xiangyi Li. (2015), Interview, 19 March 2015, transcribed by Xiang Li.

<sup>50</sup> Shanyan Xu. (2015), Interview, 5 June 2015, transcribed by Xiang Li.

scientific activity place' with the functions of science popularisation, academic communication, technology training, life service, staff social events, and adolescents' scientific activities (Wang & Zhu, 1998b). For example, Shandong Science and Technology Promotion Guan (now known as the Shandong Science and Technology Museum, one of my research cases) at that time had all of the above-mentioned six functions and additionally it could also edit and publish scientific literature (Wang, 1993).

This blurry definition led to a situation whereby a scientific organisation's office building, conference hall, and hotel could all be identified as 'science-related activity place'.<sup>51</sup> Wang and Zhu (1998) argued that, some departments misinterpreted the functions and tasks of Ke Ji Guan in order to achieve their own benefits and some local government officials did not know what a Ke Ji Guan actually was (Wang & Zhu, 1998b). This situation in the development of China Ke Ji Guan is informally described as stepping into an age of "Lou-Tang-Guan-Suo".<sup>52</sup> "Lou", "Tang", "Guan", and "Suo" are all Chinese building names with subtle differences. For example, "Lou" can mean a building with at least two storeys, "Tang" could be a hall or a series of houses, "Guan" is also a building and sometimes it even refers to a restaurant, and "Suo" can be understood as an institution or even be applied to police stations. So these words actually mean that the concept of Ke Ji Guan was understood very broadly and included many other places than just science and technology. Though there was no strict reference to verify when the age of "Lou-Tang-Guan-Suo" started exactly, it is widely accepted to exist as a period of the development of Ke Ji Guan.

As Heng Wang recalled, supporters of "Lou-Tang-Guan-Suo's" retorted that they did not differ from Ke Ji Guan as long as they were conducting scientific activities by saying:

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<sup>51</sup> Heng Wang. (2015), Interview, 2 April 2015, transcribed by Huiping Chu.

<sup>52</sup> Heng Wang. (2015), Interview, 2 April 2015, transcribed by Huiping Chu.

*“To have a name of Ke Ji Guan is the very reason why they can build so many ‘Lou-Tang-Guan-Suo’. Some departments’ officers argued that they are Ke Ji Guan not either science museum, so they can build them as ‘Lou-Tang-Guan-Suo’ for other aims.”*<sup>53</sup>

For instance, opening on 2 February 1988, the Shanxi Science and Technology Museum could supply free films, exhibitions, poker and Chinese chess games, parties, and ball games (Li, 1994). Neimenggu Science and Technology Museum prepared gym room for staff inside the museum building (Chen, 1994).

Chen (1990) has shown that, according to official documents, science hall, science and technology activity centre, science palace, and science and technology promotion museum all belonged to the overarching name of “Ke Ji Guan” (Chen, 1990). In the official ‘List of the First Batch of Prized Ke Ji Guan of CAST System’, Shanghai Science Hall, Jilin Science Hall, and Shandong Science and Technology Promotion Museum were awarded official prizes within this category, therefore they were all clearly regarded as Ke Ji Guan.<sup>54</sup>

Chen (1990) and Wang and Wan (1987) argued that, Ke Ji Guan as a general name in this stage could therefore be classified into three sub-groups. One sub-group is science halls, which were mainly responsible for holding national and international academic conferences; these eventually became special academic activity places. They applied the name of Ke Ji Guan, but actually they were not. The second sub-category was, what they called the actual Ke Ji Guan, which includes science centres and some professional science museums. They took science popularisation as their main task. The last sub-group was integrative Ke Ji Guan, which included both group one and group two’s functions and also had other services outside science popularisation (Chen, 1990; Wan & Wang, 1987).

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<sup>53</sup> Heng Wang. (2015), Interview, 2 April 2015, transcribed by Huiping Chu.

<sup>54</sup> The list was published on journal *Ke Ji Guan*, page 3, issue 1 of 1991.

Based on a survey in 1996, there were more than 400 Ke Ji Guan in China at that time but only about 20 of them had standing exhibitions for science popularisation (Wang & Zhu, 1998b). Among the other Ke Ji Guan, some of them carried out young people's scientific activities, farming technology training, and other science and technology popularisation works; some of them focused on supplying daily services and logistical support for local science organisations. Some Ke Ji Guan actually worked as comprehensive institutions including commercial activities such as renting their buildings to social companies (Wang & Zhu, 1998b). As Heng Wang recounted, "Some local Ke Ji Guan even worked as a milk station".<sup>55</sup>

As a result, China's Ke Ji Guan enterprise developed slowly after 1988. As Wang and Zhu (1998) described, the national government was reluctant to invest to build new Ke Ji Guan because many existing Ke Ji Guan had moved away from the government's original aim and had become "Lou-Tang-Guan-Suo". They shared the name of Ke Ji Guan but did not perform their expected duty of science popularisation (Wang & Zhu, 1998b). Furthermore, as Xiangyi Li recalled, many province-level Ke Ji Guan did not have enough building teams or design experts, so they had to rely on social enterprises to build their Ke Ji Guan. Most of these social enterprises had no familiarity with or creative abilities for scientific exhibitions, and this situation led Ke Ji Guan to mimic and learn from each other.<sup>56</sup> A lot of similar Ke Ji Guan were therefore built across China. Without creative abilities or government financial support, many Ke Ji Guan could not renew their exhibitions and instead relied on outdated or even defective facilities. Both Ke Ji Guan's development and visitors' interest in Ke Ji Guan diminished.<sup>57</sup>

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<sup>55</sup> Heng Wang. (2015), Interview, 2 April 2015, transcribed by Huiping Chu.

<sup>56</sup> Xiangyi Li. (2015), Interview, 19 March 2015, transcribed by Xiang Li.

<sup>57</sup> Shanyan Xu. (2015), Interview, 5 June 2015, transcribed by Xiang Li.

#### **4.2.4 The functions of Ke Ji Guan were defined clearly**

From the early 1990s, criticisms began to appear in journals and newspapers. For instance, articles in *Ke Ji Guan* at that time argued that it was inappropriate to call all science-related places as Ke Ji Guan (Cen, 1995; Kong, 1990; Song, 1991) because this would cause people to misunderstand about the Ke Ji Guan and harm science popularisation work (Cen, 1995; Song, 1991). Song (1991) argued that the definition of Ke Ji Guan as a communal scientific education institution was too broad. It lacked essential standards and could not reflect Ke Ji Guan's substantial features. Instead, Song argued that Ke Ji Guan should be a communal educational infrastructure of science and culture with a function of science and technology popularisation (Song, 1991).

Some people even raised attacks in the journal *Ke Ji Guan* and in newspapers. For instance, Zhao (1995) argued that most Ke Ji Guan (those within the "Lou-Tang-Guan-Suo" category) were totally unrelated to Ke Ji Guan's core features, functions and tasks. Their actual aim to build this kind of facility was to apply for the title of Ke Ji Guan. Zhao argued that this had brought negative effects, for example, the decrease in reputation of both Ke Ji Guan broadly and CAST specifically. Additionally, this phenomenon appealed worries from the government and science workers (Zhao, 1995). Shi (1996) directly titled his article "An odd phenomenon: No science in Ke Ji Guan" (Shi, 1996). There were also some people who worried that people had even forgotten the name of Ke Ji Guan (Zhao & Zhang, 1997).

But this definition was different from the popular definition of science centre or science museum in the rest of the world. Cen (1995), Wang and Zhu (1995) argued that, this should not be regarded as a 'Chinese Style' but a bias and mistake. Ke Ji Guan's definition should not underline "science-related activities" unilaterally, but emphasise its feature of 'science exhibition and education' (Cen, 1995; Wang & Zhu, 1995). The description of 'scientific activity place'

was too blurry and contained too many elements, which led many other institutions also to be identified as Ke Ji Guan such as scientific conference halls, staff pubs, office buildings and hotels (Cen, 1995). Cen (1995) further argued that by 1995, among existing Ke Ji Guan, more than 50% of them were diverted to do other things. These situations meant that Ke Ji Guan's function and tasks could not be easily identified and cause Ke Ji Guan's development into trouble (Cen, 1995). Furthermore, this gave an opportunity for some departments to divert Ke Ji Guan's facilities to benefit themselves. According to Cen (1995), in fact, they were the very departments or local governments who build Ke Ji Guan as hotels and office buildings, and then occupied and diverted Ke Ji Guan's project budget. But laws and acts to avoid this phenomenon were unavailable in China at that time, and it was also hard to guarantee sufficient financial support to Ke Ji Guan (Cen, 1995).

From 1994, the government began to admit that some 'scientific activity places' had lost the function of science popularisation and prepared to change this situation. For example, the State Scientific and Technological Commission published its *Report on enhancing the work of science and technology Popularisation* on 17 August 1994 and mentioned that,

*"Many nominal Ke Ji Guan for all kinds of reasons suffered shortages of funds and included commercial activities to different extents. Some of them even changed to pubs, ballrooms, and cabarets (Report on enhancing the work of science and technology Popularisation, 1994)."*

In the "*Science Popularisation Work and Outline in the Period of the Ninth 'Five-Year Plan' (1996-2000)*" (1996), CAST also admitted that some Ke Ji Guan had lost their function of science popularisation (*Science Popularisation Work and outline in the period of the ninth "Five-Year Plan,"* 1996).

In response to this situation, CAST began to issue guidelines to transform current Ke Ji Guan through carrying out surveys and classifying all Ke Ji Guan in China (*Work guideline for CAST in the period of the ninth "Five-Year Plan,"* 1996). In 1996, CAST confirmed that they would make a nationwide transformation of Ke Ji Guan and clarify all Ke Ji Guan's functions, categories and names in the period of the ninth 'Five-Year Plan' (1996-2000). In the discussion version of the plan, they constituted detailed standards for Ke Ji Guan. For instance, the area used within a Ke Ji Guan for science popularisation should not be less than 60% of the entire building's scale, and the institution should be open to the public at least 250 days per year. The plan also asked every Ke Ji Guan to have their own professional science popularisation staff team (*Plan of CAST system's science and technology service (version for discussion),* 1996).

In 1997, the State Planning Commission and CAST promulgated the development plan for CAST's science and technology services in the ninth 'Five-Year Plan' period. In this document, CAST confirmed that CSTM would work as the leader and example for all Ke Ji Guan in China and classified 'scientific activity places' in two categories. One category was Ke Ji Guan, which is a basic installation of science and technology popularisation and important infrastructure of public culture set up by government. Its main function is to conduct popularisation of scientific knowledge, approaches and thoughts. The other category includes scientific activity centres and science halls. Their main functions are undertaking academic communications, conferences, daily life services, enquiring services, academic related parties and logistical works (*Development plan of CAST system's science and technology service in the ninth "Five-year Plan" period,* 1997).

As previous authors pointed out, this document corrected the mistake of mixing these two different organisation types and denied that Ke Ji Guan should be defined as 'multi-functional, integrative scientific activity place'. This

definition was now regarded as a historical artefact under special conditions (Luo & Cen, 1997, 1998).

On 29 April 2000, the second part of the CSTM opened to the public formally and the enterprise of Ke Ji Guan in China stepped into a new age. Ke Ji Guan staff and researchers were now focused on exhibition design, exhibition effect analysis and other new topics. Ke Ji Guan's functions began to be performed better and better. More Ke Ji Guan began to learn from other science centres and science museums all over the world.

In terms of visitors, in the 1990s, 'the public' began to be mentioned in many articles about Ke Ji Guan, and adolescents were clearly emphasised. For example, Sun and Wu (1990) suggested in their article that Ke Ji Guan should be open to everybody, but mainly factory workers and government cadres, with a special emphasis on doing a good science popularisation job with young people (Sun & Wu, 1990). Other authors shared this argument, such as Zhang and Qian (1992), who stated that Ke Ji Guan should be open to "all human beings", particularly adolescents (Zhang & Qian, 1992). In some Ke Ji Guan's own functional descriptions, young people's scientific activities had also been clearly emphasised, showing the importance attached to this subset of the public (Wan, 1990). Some people even referred to adolescents as "Ke Ji Guan's lord" (Ai, 1993). Both Xiangyi Li and Heng Wang described Ke Ji Guan in China as being set up to benefit everyone, with adolescents being a particular (though not exclusive) target audience.<sup>58</sup>

### **4.3 The government's influence on Ke Ji Guan**

For Ke Ji Guan in China, 'function' is a key word. Unlike most science museums and science centres in the world, Ke Ji Guan are oriented, dominated, invested, and supported by the government, and their curators are

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<sup>58</sup> Xiangyi Li. (2015), Interview, 19 March 2015, transcribed by Xiang Li; Heng Wang. (2015), Interview, 2 April 2015, transcribed by Huiping Chu.

civil servants who are nominated by the government. This could be a reason why Ke Ji Guan in China show such close connections with national policies on economics and politics. The official documents' emphasis on Ke Ji Guan's functions led to some interesting results, which I will now describe.

Firstly, Ke Ji Guan in China tend to pay little attention to their taxonomy and names (both in Chinese and English). The government and official documents on Ke Ji Guan's functions perform as an indicator for all Ke Ji Guan in China. As long as a Ke Ji Guan can play its role of science popularisation well, it does not matter so much whether its name is science centre, science museum, exploration palace or others. Ke Ji Guan's name, function, and contents have been confirmed clearly by the supervising departments in Chinese. The official definition about Ke Ji Guan declares what a Ke Ji Guan is and what its functions are, but does not mention precisely what form its contents take, i.e. whether it is a science museum or a science centre. In China, people just call them "Ke Ji Guan". Additionally, Ke Ji Guan in general do not enjoy a world-wide reputation, in contrast to say the Science Museum London which has visitors from all over the world. As will be described further in Chapter 5, the vast majority visitors to Ke Ji Guan in China are Chinese people, even at two of the top three Ke Ji Guan in China, the CSTM and Shanghai Science and Technology Museum (SSTM).<sup>59</sup> It thus seems less important to Ke Ji Guan to apply the definition and names from the western world, as long as the function of science popularisation in China can be carried out.

Secondly, Ke Ji Guan in China tend not to fix their contents with their names as long as the main function has been performed. Some Ke Ji Guan introduce exhibitions from natural history and other museum-like institutions. For example, all of my surveyed Ke Ji Guan have a dinosaur skeleton exhibition inside their buildings. This does not mean they are trying to transform from Ke

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<sup>59</sup> As described in Chapter 5, I collected 832 valid questionnaires in total in these two Ke Ji Guan, but only 35 were from out of China. Of these, only five were visitors to the CSTM.

Ji Guan to natural history museums. They are still doing science popularisation but are drawing on more attractive (historical) aspects of science to recruit visitors, particularly children.<sup>60</sup> Ke Ji Guan tend to use all kinds of approaches to popularise science. For example, Guangdong Science Centre set up a themed exhibition of ‘History of Science in Lingnan<sup>61</sup>’; despite ostensibly being a place for interactive exhibits, they incorporated an exhibition focusing on historical collections. So the contents of these Ke Ji Guan are not necessarily consistent with their name, and their format or content in the future could not be anticipated to be the same as nowadays. In other words, there is no direct link between their contents and their English names, it is not easy to identify whether they are science museums or science centres in the western sense. But in Chinese, they are all still Ke Ji Guan without doubt. It is true that there are also some overlaps within similar western facilities: some traditional western science museums also introduced interactive facilities but they are still regarded as science museums rather than science centres. For example, Science Museum London developed ‘Launch Pad’ and other interactive faculties such as ‘Do Not Touch’, but they keep their traditional collections and objects.

#### **4.4 Evolution of Ke Ji Guan’s name and category**

Chinese scholars once tried to classify Ke Ji Guan using the western model of science museum and science centre. However, based on my review (Chapter 2, Section 2.1), it is unnecessary to equate the term “Ke Ji Guan” with the western concept of either science museum or science centre. It is however useful to consider where and how the name evolved, which is the focus of this section.

Some Chinese scholars declared that Ke Ji Guan was a branch of “museum”. For example, Chen (1987) suggested Ke Ji Guan belonged to the category of

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<sup>60</sup> Heng Wang. (2015), Interview, 2 April 2015, transcribed by Huiping Chu.

<sup>61</sup> Lingnan was Guangdong’s ancient name.

museum but it was different from those traditional museums and improved their offer, taking it to a new level (Chen, 1987). Some staff and curators of Ke Ji Guan also argued that Ke Ji Guan was a new international trend in the world of museums (Li, 1996; Li, 1990; Liu, 1987).

Additionally, as I discussed earlier in this chapter (Section 4.2.2), because Chinese Ke Ji Guan originally learned from western science centres, Ke Ji Guan in China was regarded as science centres, and both science centre and science museum were covered by the concept Ke Ji Guan (Xie, 1987). There were also some authors who suggested that the science centre concept was a branch of science museum and its main function was science education (Luo, 1988; Sang, 1990a, 1990b; Wang & Wang, 1990; Zhao, 1990). Xie also suggested that other places with different names also belonged to the category of what in China would be called Ke Ji Guan, such as the Discovery Palace (Palais de la Découverte in French, Paris, France), and The Exploratorium (San Francisco, US) (Xie, 1987). Others felt that Ke Ji Guan, science museum, and science centre were the same thing but were called by different names. Such authors usually used the terminology “Ke Ji Guan (also called science museum, science centre, or science palace)” (Chen, 1987). The confusing taxonomy of science centre, science museum and Ke Ji Guan in 21st century can be seen from **Figure 2** to **Figure 5** in Chapter 2, Section 2.2.2.

Therefore, there were plenty of articles within China that used science museum, science centre, museum and Ke Ji Guan in an imprecise way. For example, in the last citation of Chen’s article, he was writing about Ke Ji Guan, but mentioned that Ke Ji Guan was also a museum, and used the phrase “science museums” to replace Ke Ji Guan several times (Chen, 1987). In the articles in the journal *Ke Ji Guan*, even authors from the same Ke Ji Guan had different arguments about their own Ke Ji Guan such as (Liu, 1987; Sang, 1990a). Sometimes, even one author took inconsistent approaches, using the

term differently in different articles, for example (Wan, 1990; Wan & Wang, 1987). In the *Outline of the National Scheme for Scientific Literacy (2006-2010-2020)*, the term “science museum” is used although its Chinese name is widely used as “Ke Ji Guan”. From the internal archived materials I have received, most of the articles used these names freely and there was no article that raised criticism to this phenomenon.

Based on my interviews, both Xiangyi Li and Heng Wang acknowledged that China has no integrative science museums that contain all or most scientific subjects, and most Ke Ji Guan in China are currently similar to science centres in the western sense, with a handful of professional science museums such as the Air and Space Museum in Beijing<sup>62</sup> (Wang, 1997). Also, there are a few small-scale industrial museums such as the China Industrial Museum (Shenyang, Liaoning Province), the Chengdu Industrial Civilization Museum (Chengdu, Sichuan Province), and the Liuzhou Industrial Museum (Liuzhou, Guangxi Province). This type of industrial museum basically focuses on displaying and collecting local industrial history, old used machines, and industry-related objects. They also pay attention to science popularisation and communication of scientific knowledge.

Xiangyi Li explained that, although many of China’s Ke Ji Guan follow the name of science museum dating from the CSTM Building Committee’s international exploration in the 1980s, China never applied the name of ‘science museum’ in Chinese in any formal official documents. The official name is Kexue Jishu Guan or Ke Ji Guan in short. Only Dongguan Ke Ji Bo Wu Guan<sup>63</sup> has a name of science museum in Chinese, but the reason for that is, there had been another Dongguan Ke Ji Guan existing before it, so it had to

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<sup>62</sup> Xiangyi Li. (2015), Interview, 19 March 2015, transcribed by Xiang Li; Heng Wang. (2015), Interview, 2 April 2015, transcribed by Huiping Chu.

<sup>63</sup> Museum is translated into Chinese precisely as Bo-Wu Guan.

take another name when initially founded (Dongguan Ke Ji Bo-Wu Guan). But it is actually a science centre.<sup>64</sup>

According to Shanyan Xu's, Ke Ji Guan in China now have many different names both in Chinese and English.<sup>65</sup> For example, Guangdong Science Centre, Shanghai Science and Technology Museum, Ningbo Science Exploration Centre, and Shenyang Science Centrum. They are all science centres, and they have very similar exhibition contents, display ideas, and functions though they show different names.<sup>66</sup>

Except for researchers and Ke Ji Guan staff, my research suggests that the public also have no clear idea what is a Ke Ji Guan. For example, I interviewed 98 visitors to CSTM about one question: "What place do you think is similar with here (CSTM)?"<sup>67</sup> <sup>68</sup> I then grouped their open-response answers into common categories, as shown in the following figure.

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<sup>64</sup> Xiangyi Li. (2015), Interview, 19 March 2015, transcribed by Xiang Li.

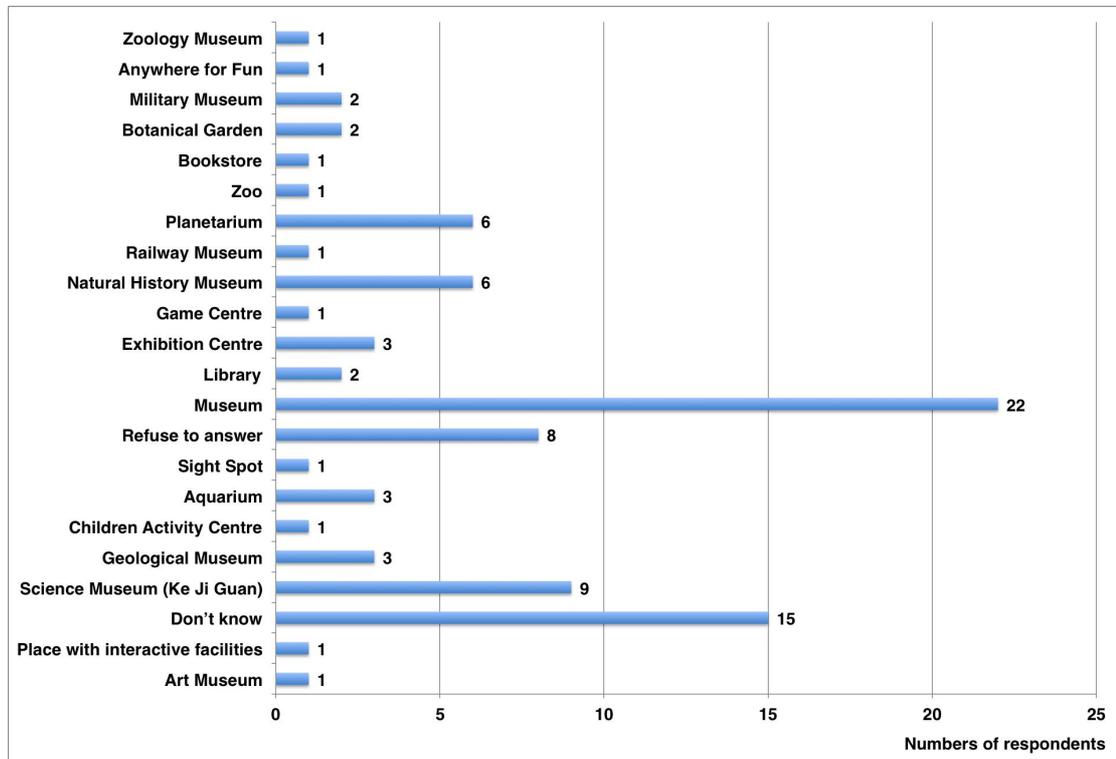
<sup>65</sup> Shanyan Xu. (2015), Interview, 5 June 2015, transcribed by Xiang Li.

<sup>66</sup> Shanyan Xu. (2015), Interview, 5 June 2015, transcribed Xiang Li.

<sup>67</sup> This was part of my piloting for the questionnaire survey in the CSTM. All interviewees agreed for their interviews to be recorded by smart phone.

<sup>68</sup> The Chinese name of the CSTM is Zhongguo (China) Ke Ji Guan.

**Figure 7: Visitors' replies to "What place do you think is similar with here (CSTM)?" (N=98)**



From the figure above, it can be seen that participants' answers are diverse and the biggest group was people who answered 'Museum' and the second was "Don't know". Some larger categories are also observed such as "Science Museum", "Natural History Museum" and "Planetarium". Visitors seemed to be confused by these places. There were a number of different taxonomies of these institutions here while the CSTM was not regarded as a prime institution of Ke Ji Guan even science museum. Furthermore, the concept of science museum and Ke Ji Guan were used in a mixed way. For example, visitors usually used them as one thing to answer me so that I had to categorise them as one option: "Science Museum (Ke Ji Guan)".

In summary, in the process of developing Ke Ji Guan in China, confusion regarding their names and categories has existed for a long time. Ke Ji Guan

staff, curators and researchers have had conflicting views about what a science museum, science centre and Ke Ji Guan are, and they have applied different names to represent Ke Ji Guan in China. However, as I noted in Section 2.1, fundamentally it is unnecessary to fit Ke Ji Guan into the model of a western science museum or science centre. Even in the western world, there is no absolute standard to distinguish them. Instead, umbrella concepts such as Informal Science Institution (ISI) are more useful concepts representing the breadth of diversity: Ke Ji Guan is also one type of ISI, specific to a Chinese context.

#### **4.5 Chapter summary**

In this chapter, I draw on three experts' interviews and archived documents to worked out a historical development of Ke Ji Guan in China. Before evolving into its modern format as a science and technology popularisation oriented institution mainly containing interactive facilities within it, Ke Ji Guan experienced three stages: the pre-CSTM age, the stage of re-building of CSTM, and the stage of "Lou-Tang-Guan-Suo". According to my interviewees, the development of the CSTM can be regarded as reflecting the development of Ke Ji Guan in China. Its improvements usually brought and led to a new age for the development of Ke Ji Guan more generally. Its developmental stages, experience, functions, orientation and evolution of definition have close connection with China's economic and political developments. So in the history of China's Ke Ji Guan, the CSTM is not only one example member of Ke Ji Guan, but is instead seen as a leader and example for all Ke Ji Guan in China.

Government has significant impact on Ke Ji Guan. Most Ke Ji Guan are built, operated and supervised by governments. The government once blurrily defined Ke Ji Guan as a place of carrying out "science-related activities", and leaded to a lot of "Lou-Tang-Guan-Suo". But it finally revised the definition based on Ke Ji Guan's main function of conducting science and technology

popularisation. Due to lacking of a confirmed taxonomy, Ke Ji Guan's name and categories remain confused to common visitors even researchers. However, as a widely accepted concept, Ke Ji Guan has no need to fit itself to the western model of science museum or science centre. It works well as a unique Chinese style of Informal Science Institution both in academia and practice.

From this overview of the development of Ke Ji Guan in China I understand my research object more deeply and clearly. It allows me to interpret and analyse my data with a historical perspective, and avoid taking my research out of context. Realising Ke Ji Guan is defined according to its functions, I can better contextualise my data from China with data from elsewhere in the world. Furthermore, it will help identify what aspects of my work are meaningful at an international level, or just for China.

## **5 Who Visits Ke Ji Guan?**

In this chapter, I will describe the results of Page 2 of my questionnaire survey to answer one of my research questions: What are the demographics of Ke Ji Guan visitors in China? The visitors' demographic factors such as age, gender, education level, residence, visiting times, subject background and who they visited with will be explored using descriptive analysis in order to help draw a portrait of who is visiting these Ke Ji Guan in China. I will employ Chi-Square tests to explore the correspondences between variables, and some cross-comparison work will also be presented to probe different variables' trends in different conditions, such as educational qualifications by gender.

### **5.1 Data background**

In this section I will address the general rules I followed to input and analyse my data to maximise the robustness and validity of my dataset. I will also explain the included and excluded data criteria for my analysis work.

#### **5.1.1 Data collection contexts**

Across the three museum case study sites I collected 1259 questionnaires in total, of which 1249 contain valid responses. A small number of questionnaires (n=10) were removed from the data sample pool due to insufficient information to use such as BJ029, BJ038, BJ174, and BJ221<sup>69</sup>, or where respondents were obviously lying about certain responses (e.g. calling their boyfriend/girlfriend a "child" and making other joke responses to the questions such as BJ179, SD002, SD006, and SD393). There are two questionnaires,

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<sup>69</sup> All of these "Letters+Numbers" are questionnaires' IDs. For example, SH175 refers to a questionnaire collected in the SSTM Shanghai.

BJ333 and SH152, which were deleted because both of these two participants are actually Chinese Americans who came from New York. They share no cultural background or experience of long-term residence in China, which are key features of my target participants.

The overall data sample was spread approximately evenly across the three museums using a systematic sampling approach. My daily questionnaire collection was between 15-70 with an average refusal rate of 33.5% across the three Ke Ji Guan. The maximum manageable number of questionnaires proved to be around 50 per day.<sup>70</sup> As outlined in the Introduction chapter, it is important to note that these three Ke Ji Guan have different characteristics, as described in **Table 2**.

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<sup>70</sup> Any more and I had no spare time to observe visitors, think over their reflections, make notes, check all the submitted questionnaires or raise further questions. So I only did a few days of 70 questionnaires per day.

**Table 2: Different natures of the three case study Ke Ji Guan**

	<b>CSTM Beijing</b>	<b>SSTM Shanghai</b>	<b>SDSTM Shandong</b>
<b>Building scale</b> <sup>71</sup>	Giant	Giant	Big
<b>City class</b> <sup>72</sup>	First class	First class	Second class
<b>Cost of visiting</b> <sup>73</sup>	Admission fees needed	Admission fees needed	Free
<b>National accredited tourist attraction</b> <sup>74</sup>	AAAAA level	AAAAA level	Not accredited

It can be seen from **Table 2** that CSTM Beijing and SSTM Shanghai are quite similar in terms of their scale and positioning, while SDSTM Shandong is smaller, located in a different type of city and with less focus as a sightseeing location. It is also the only one of the three case study museums that was free to visit at the time of my research.

Furthermore, there are some factors relating to the day-to-day data collection, which may have influenced the results, as outlined in **Table 3**.

<sup>71</sup> The explanation about Building scale can be tracked in Section 3.5.1, footnote 29.

<sup>72</sup> Visitors in different classes of cities may have different demographics and visit motivations, and this will be explored in my later sections.

<sup>73</sup> The free-visit in SDSTM Shandong was a new feature at the time of my research. Its first free-visit day was also my first data collection day in SDSTM: 2015-05-16.

<sup>74</sup> The China National Tourism Administration classifies national accredited sightseeing spots in five grades from A to AAAAA. The highest grade is the AAAAA level, which represents a sightseeing place that meets the top criterion of tourist attractions in China. The CSTM Beijing and SSTM Shanghai are both AAAAA level national tourists attractions, meaning that they are not only Ke Ji Guan but also national sightseeing spots. The National Tourism Administration also has rights to supervise them. SDSTM without this sign means that it is not accredited by the National Tourism Administration. SDSTM Shandong is supervised by the local government of the Shandong province.

**Table 3: Influencing factors of data collection**

		<b>CSTM Beijing</b>	<b>SSTM Shanghai</b>	<b>SDSTM Shandong</b>
<b>Number of valid questionnaires</b>		414	418	417
<b>Data collection dates</b>		31/03/2015 01/04/2015 04/04/2015 05/04/2015 06/04/2015 10/04/2015 11/04/2015 12/04/2015 14/04/2015 15/04/2015 16/04/2015 17/04/2015	23/04/2015 24/04/2015 25/04/2015 26/04/2015 29/04/2015 30/04/2015 01/05/2015 02/05/2015 03/05/2015 05/05/2015 06/05/2015	16/05/2015 17/05/2015 20/05/2015 21/05/2015 22/05/2015 23/05/2015 24/05/2015 27/05/2015 28/05/2015
<b>Total number of data collection days</b>		12	11	9
<b>Week days<sup>75</sup></b>	<b>Monday</b>	1	0	0
	<b>Tuesday</b>	2	1	0
	<b>Wednesday</b>	2	2	2
	<b>Thursday</b>	1	2	2
	<b>Friday</b>	2	2	1

<sup>75</sup> Both the CSTM Beijing and the SSTM Shanghai are normally closed on Mondays. But the 6 Apr 2015 (Monday) was the last day of Qingming Festival 2015, so the CSTM Beijing was specially opened for the national holiday on that day. The SDSTM Shandong is closed on both Monday and Tuesday, so there was no data collected on these days.

<b>Weekends</b>	<b>Saturday</b>	2	2	2
	<b>Sunday</b>	2	2	2
<b>National holidays<sup>76</sup></b>	<b>statutory</b>	Qingming Festival (3 days)	May Day (3 days)	No
<b>School days<sup>77</sup></b>	<b>spring outing</b>	Yes	Yes	No
<b>Average refusal rate</b>		34.1%	36.6%	29.0%

### 5.1.2 Excluded data

Some questions or variables have little academic value or ended up not being suitable for answering my research questions and have therefore been excluded from the sample. One example is the question Q8 about visitors' ethnic groups. Ethnicity is a key factor in many science museum environments, and has for example been shown to influence what benefits visitors' report experiencing, such as learning about science and enjoying science as a part of culture (Dawson, 2014). For this reason the visitors' ethnic group was included within the questionnaire. However, all of my research subjects (visitors) were Chinese people and they could be classified in one ethnic group: Chinese. They do have some Chinese-based sub ethnic groups such as Han, Hui or Menggu, but these are not very informative for the purposes of this research, so I have not presented analyses based on those classifications here.

<sup>76</sup> As introduced by Yang Zhao, a scholar of the CSTM Beijing, there are more family groups in the holidays. This may lead to slightly different proportions of responses on some visitor demographics such as "with whom", or possibly visitors' age groups and educational qualifications.

<sup>77</sup> This refers to Chinese primary and secondary schools' annual outing days in early and middle spring. When I conducted my survey in SDSTM Shandong the season of Spring Outing had already passed. Though I excluded young visitors under 16 years old (see Chapter 3 Research Methods), more school groups at CSTM Beijing and SSTM Shanghai may have raised the percentage of schoolteachers within the visitor demographics there.

Another example variable I have chosen not to include is the question Q12 about whether visitors come from the countryside or urban areas. Because literature on Ke Ji Guan visitor surveys in China is very rare, I drew on other related research when I designed the questionnaire. For example, according to the China Association for Science and Technology's surveys on Public Scientific Literacy from 2001 to 2015, there were significant differences in Scientific Literacy between people from urban areas and the countryside (CAST, 2001, 2003; Li, 2015; Wang & Fang, 2010). So I planned to explore if there would also be similar patterns in my research on Ke Ji Guan visitors. However, this question did not work well in my research. Both Beijing and Shanghai are cities with high levels of transient populations and external populations from other places, particularly the countryside, who move to work or study there (Shanghai Municipal Statistics Bureau, 2016; Beijing Municipal Bureau of Statistics, 2015). Likewise, as introduced by Zongliang Guo, head of the Department of Exhibition and Education of SDSTM, the SDSTM Shandong is located in the area of many colleges and vocational training schools with a large number of students from many other cities and the countryside. However, it can be challenging to collect consistent data for people who now live in a different part of China to where they were born. It is fairly common to request respondents' birthplaces rather than current residential locations within research surveys in China (see for example "Investigation and intervention study on interpersonal relationship of college students' dormitory," n.d.; Pan, 2012). So when they were asked about their current place of residence, my respondents were more familiar with responding with their birthplaces. This led to some clearly contradictory data, for example, the questionnaire respondent

BJ193 answered Q11<sup>78</sup> (“live in this city or not”) as “Beijing” and “Haidian” but also marked Q12 (rural/urban status) as “countryside”. Haidian is one of the boroughs of Beijing, and it is in an urban area. This is a typical self-contradictory example, which means the data provided are insufficiently reliable. Additionally, the definitions of city and countryside are blurry. It is difficult to define some places as cities or countries, such as some big towns, which have features of both city and country (Dang, 2015). For these reasons I have not included responses to Q12 (rural/urban location) within my analysis.

## **5.2 Who visits the three chosen Ke Ji Guan?**

In this section I will present an overview of the visitors’ demographics to explore who visits the Ke Ji Guan. Due to the differences between the individual museums (see **Table 2**), visitors’ demographic features are in each case presented firstly combined as an overall combined dataset, then singly for each of the three Ke Ji Guan. I will also provide a cross comparison between particularly relevant variables (e.g. the gender breakdown of education levels) for the three museums in Beijing, Shanghai and Shandong.

All my demographic data are categorical data, such as gender and age groups (Cohen, Manion, & Morrison, 2011). I will therefore use categorical data-related statistical approaches to test for statistically significant differences between different pairs of categorical variables (Cohen et al., 2011). Within this chapter therefore, after the description of visitors’ demographic factors, Chi-Square tests are applied to probe for internal connections and relationships among the demographic factors.

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<sup>78</sup> Note: That responses to Q11 about whether respondents “live in this city or not” are still reliable as it focused explicitly on whether respondents lived within the city in question, hence involved far less opportunity for mis-interpretation.

## 5.2.1 Basic results of visitors' demographics

In this section, I will express some descriptive results about visitors' demographics such as gender, age group, educational qualification, who they attended the Ke Ji Guan with, and whether it is a first-time visit, or if they have been there before. By using these results, I will draw a general portrait of visitors who attend these three Ke Ji Guan in Beijing, Shanghai and Shandong. It is important to note that, because some respondents gave "error" answers (for example, multiple answers for a single-choice required question), these data will be filtered to only include valid responses. Hence the number of valid responses per question varies.

### 5.2.1.1 Genders

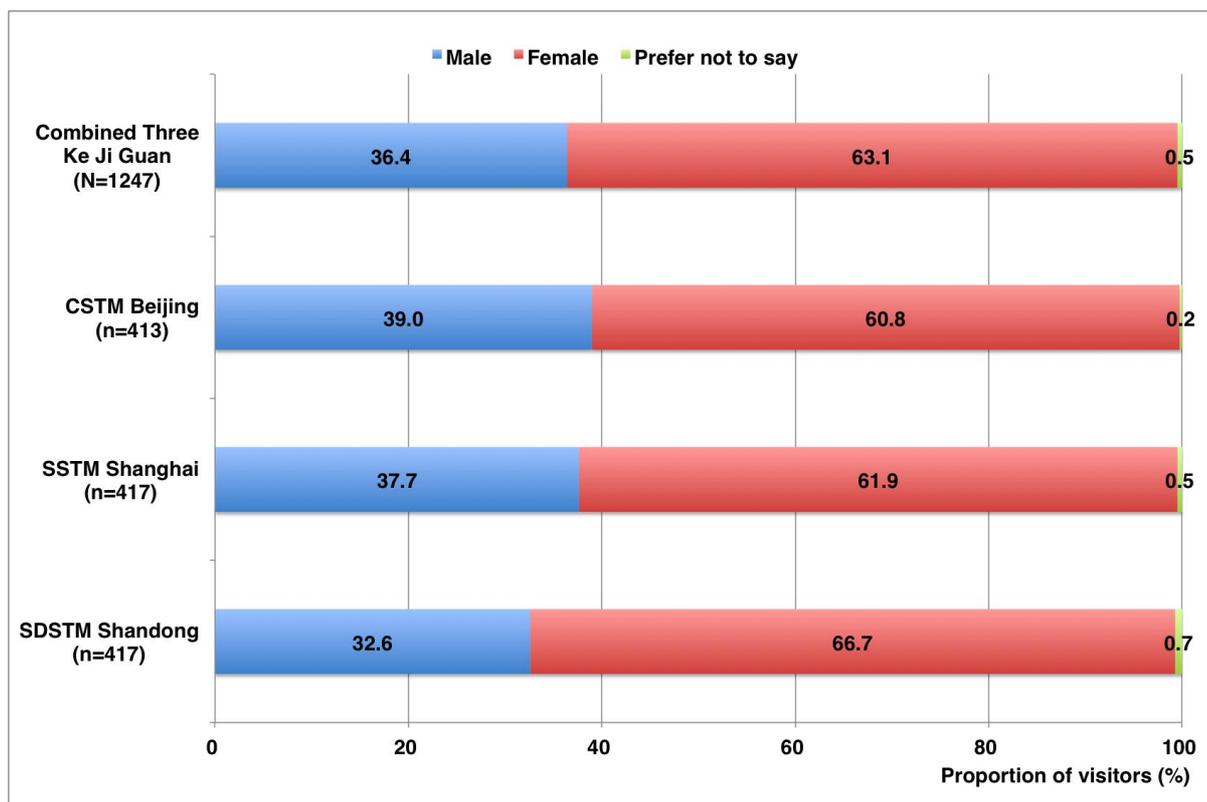
As can be seen from **Figure 8**, female visitors in these three Ke Ji Guan were much more common than males with a ratio of 63.2% female: 36.4% male = 1.7. This is very different to the overall gender distribution in China: according to *the Sixth National Population Census in 2010*, the gender composition in the whole of China in 2010 was 48.7% for females and 51.3% for males (National Bureau of Statistics of China, 2010)<sup>79</sup>. The Female: Male ratio is thus 0.9. It is clear to see that the three case studied Ke Ji Guan attracted a much higher representation of female visitors than might normally be expected within the wider Chinese population.

Exploring this further, the gender distributions for all three Ke Ji Guan, and their local whole populations are provided in **Table 4**.

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<sup>79</sup> The original data comes from the webpage of the National Bureau of Statistics of China. I did some calculations based on the data from this website.

**Figure 8: Visitors' gender**



**Table 4: Gender distribution in each Ke Ji Guan and wider locality**

	CSTM Beijing		SSTM Shanghai		SDSTM Shandong	
	Female	Male	Female	Male	Female	Male
<b>Data from My Survey</b>	60.8%	39.0%	61.9%	37.7%	66.7%	32.6%
<b>Ratio</b>	F: M <sup>80</sup> =1.6		F: M=1.6		F: M=2.0	
<b>Data from the China NBS<sup>81</sup></b>	48.4%	51.6%	48.5%	51.5%	49.4%	50.6%
<b>Ratio<sup>82</sup></b>	F: M=0.9		F: M=0.9		F: M=1.0	

<sup>80</sup> F: M refers to Female: Male.

<sup>81</sup> The original data comes from National Bureau of Statistics of China as noted, and I did some calculation based on the data from their websites.

<sup>82</sup> My participants are more than 16 years old while the China NBS' data is based on the all-age population. This may introduce some influencing factors to my comparing work. But the fact that female visitors account for a much higher percentage is reliable.

Note: the original data comes from (National Bureau of Statistics of China, 2012a, 2012b, Shanghai Municipal Statistics Bureau, 2011)

In line with the wider profiles of the three Ke Ji Guan (see Section 5.1.1), the gender ratios of visitors remain quite similar at CSTM Beijing and SSTM Shanghai, but are substantially different in SDSTM Shandong. In this later location twice as many females as males visited during the research period. Although the ratio of females to males is slightly higher within the nearby region there (F: M of 1.0 instead of 0.9 in the wider population, **Table 4**), it does not explain this large discrepancy. Compared with the wider local populations, it is clear that there are many more female visitors than male visitors in these three Ke Ji Guan.

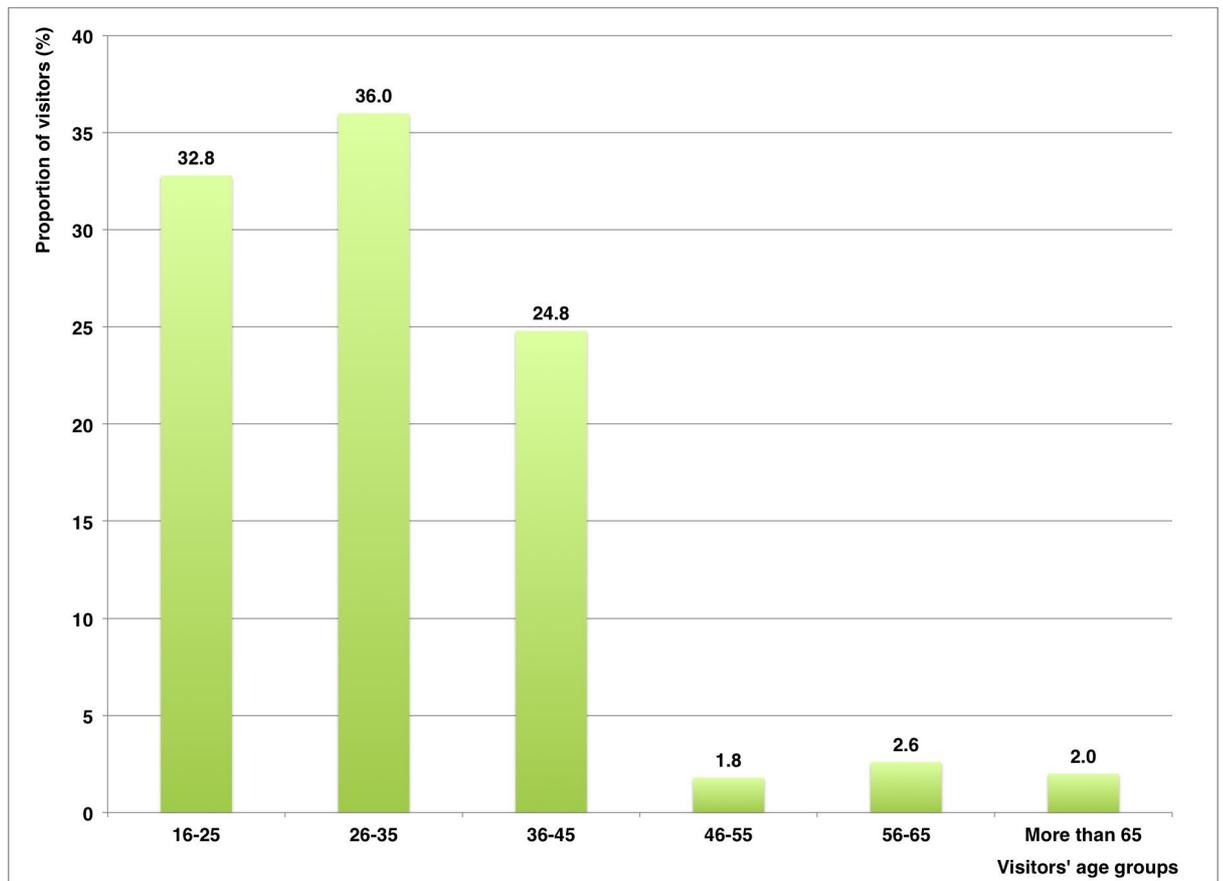
#### **5.2.1.2 Age groups**

When it comes to the age distribution, according to **Figure 9**, 26-35-year-old visitors are the largest group, with 36.0% in the combined data of the three Ke Ji Guan, followed by approximately one-third of visitors aged 16-25 and a further quarter aged 36-45.<sup>83</sup> A sharp decrease is observed in the proportions of visitors aged over 46 years, with around 2% of the overall adult population in each subsequent category.

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<sup>83</sup> Note: That under-16s were not eligible to complete this survey and so do not feature in this analysis.

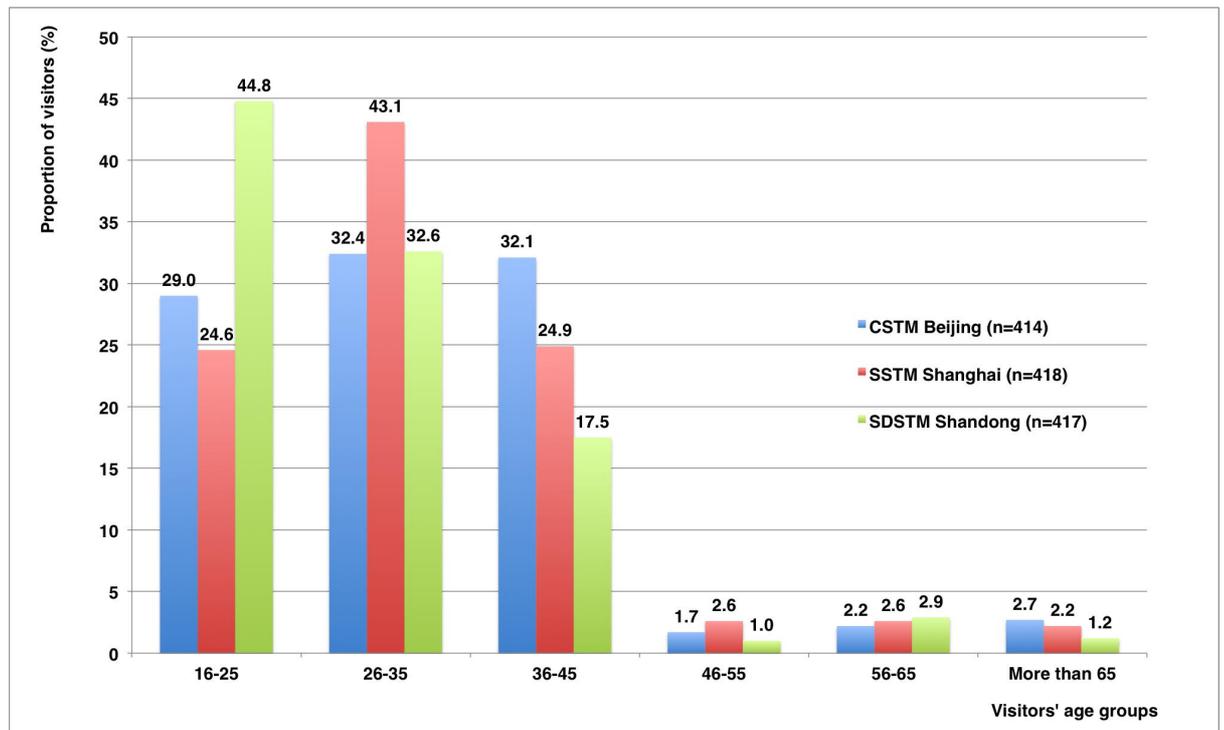
**Figure 9: Age distribution of adult visitors to all Ke Ji Guan (N=1249)**



The division of visitors' age groups across the three separate Ke Ji Guan can be seen in **Figure 10**. Though the over-46 age categories remain substantially lower than the other three age groups, the visitor age profiles are otherwise quite different across the three museums. SDSTM Shandong has many more young visitors aged 16-25 years old (almost half their adult audience profile, and their most common age category) than the other two Ke Ji Guan, with a rapid decrease to less than one in five visitors within the 36-45 years category. In contrast, SSTM Shanghai has a strong peak in the 26-35 group (43.1%), though lower percentages of both 16-25 and 36-45 years old (roughly one quarter of visitors in each case). CSTM Beijing has roughly similar proportions across the first three age groups. In all of these three Ke Ji Guan people

younger than 46 years old are the main visitors. Statistically there is however no significant correlation between visitor age and which museum they visited.

**Figure 10: Visitors' age groups in three Ke Ji Guan %**



### 5.2.1.3 Educational qualifications

In terms of “what are visitors’ highest educational qualification?”, the original survey question included nine options representing different recognised levels of education within China: Primary school, Secondary school, High school/Zhongzhuan, Vocational qualification, Associate degree, Bachelor degree or equivalent, Masters degree or equivalent, Doctorate or equivalent, and Other. According to the Compulsory Education Law of China, Chinese people are required to go to primary school from six years old (“Compulsory Education Law of the People’s Republic of China,” 1986). But primary years vary in different regions from five years to six years. So a primary school pupil

is likely to be aged from six to twelve. Then they attend secondary school for three or four years. After secondary school, students attend High school or Zhongzhuan<sup>84</sup> for three years. Then they may attend universities/colleges or vocational schools. So the approximate age (in years) for different education levels is: primary school 6-12, secondary school 13-17, High school/Zhongzhuan 18-20.

The major issue with the educational qualification question was that some respondents tended to write the degrees they were currently working to get, rather than the educational qualification they have already obtained. For example, let's consider a participant who was a university student, currently studying for a bachelor degree, but she/he has not completed his/her course yet. So his/her highest educational qualification should in fact be "high school", not "bachelor degree" as they indicated within the questionnaire. This issue was noted within the piloting phase, hence I emphasised that if the educational level they indicated was "**unfinished please mark this  using a  $\surd$** " after "Please indicate your highest educational qualification". Additionally, in order to ensure reliable data from this question, I asked every relevant participant orally "did you finish your education (degree)" after he/she completed the questionnaire. The combination of these results showed that 20.0% of respondents still wrote the degree or educational qualification they are *currently* studying rather than their finished qualification. In the data analysis I manually adjusted these types of participants' answers from "Bachelor degree" to "High school", and other education levels were processed in the same

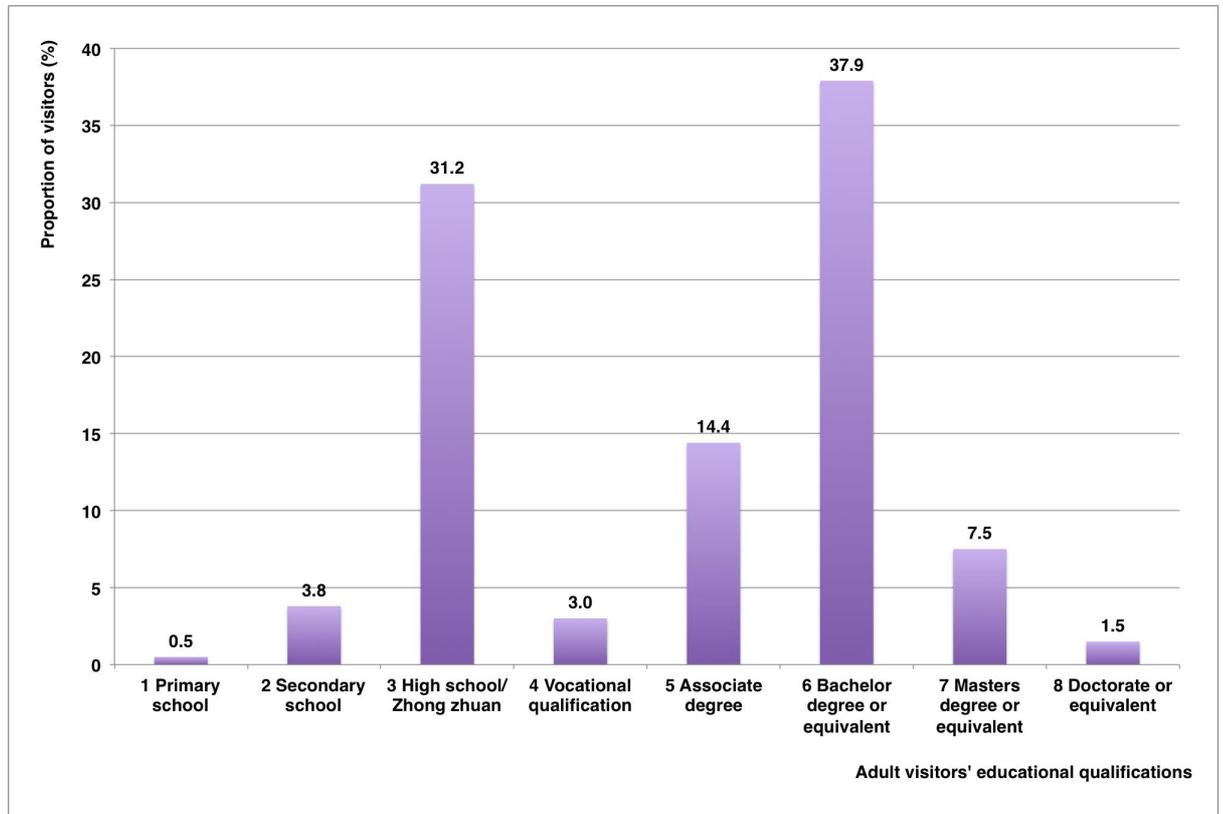
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<sup>84</sup> High school is roughly equivalent to A-Level in the UK. Zhongzhuan was one type of work-skill training school, which has now been removed from the education system in China, but there are some seniors who still hold relevant certificates so it was included within this option.

manner. The following figures show the visitors' educational qualifications based on the adjusted data.

There is a clear trend towards visitors' highest education being a bachelor degree or equivalent (**Figure 11**), representing 37.9% of visitors overall, with a further 14.4% holding an associate degree. Thus over half of the visitors have completed university education (52.3% combined total). There are also relatively high proportions of visitors who completed High school or Zhongzhuan (31.2%). It was extremely rare for visitors to have only completed Primary school (0.5%), Secondary school (3.8%) or a Vocational qualification (3.0%), suggesting that Ke Ji Guan visitors in China general have relatively high levels of education. That said, only 1.5% of visitors reported having a Doctorate or equivalent.

**Figure 11: Combined adult visitors' educational qualifications % (N=1247)**

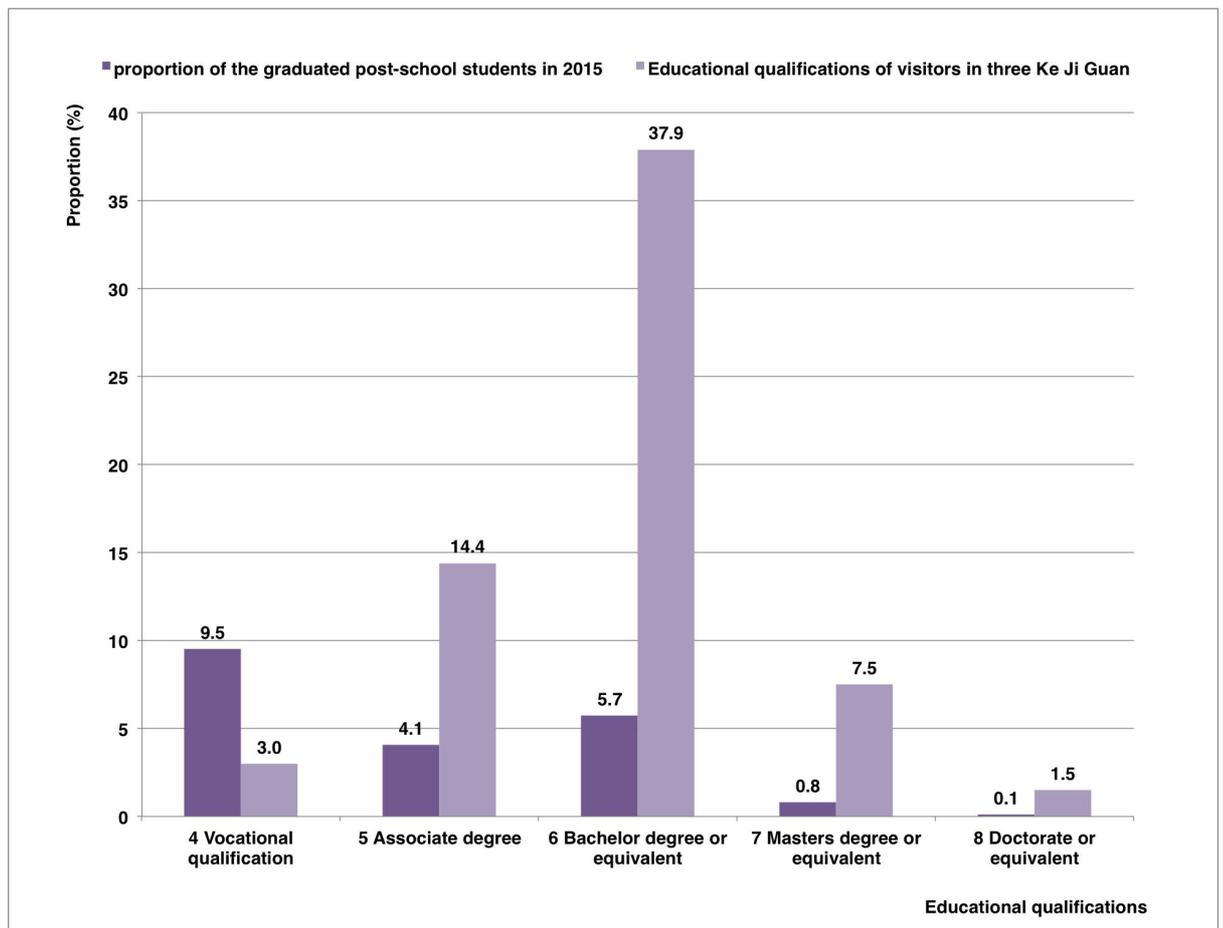


**Figure 11** shows that, there are only 0.5% visitors who report their highest educational qualification being “Primary school”. As I mentioned at the beginning of this section, the pupils’ ages in primary school is around 6-12 years old. These age groups were not covered within my research, which focused only on adults. Similarly, any currently secondary-school students at the Ke Ji Guan were also ineligible to participate in my research. So any respondents within these categories most likely represent senior people with this educational qualification.

Direct comparisons with the wider Chinese population are not easy for government data is not usually made publicly available. One option that is possible is to compare with data from the Ministry of Education of China, who

have reported the proportion of people studying various educational qualifications in 2015 (MoE, 2016).<sup>85</sup> However, its data for the lower educational levels is misleading as presumably a lot of that is compulsory schooling. So within the remainder of this section I focus on comparing post-school qualifications (categories 4 to 8), as demonstrated in **Figure 12**.

**Figure 12: A comparison of educational qualification between adult visitors in the three Ke Ji Guan and total graduated students in 2015 % (MoE, 2016)**



People with Associate, Bachelor, Master and Doctorate degrees are all over-represented within my museum visitor sample, whilst those with

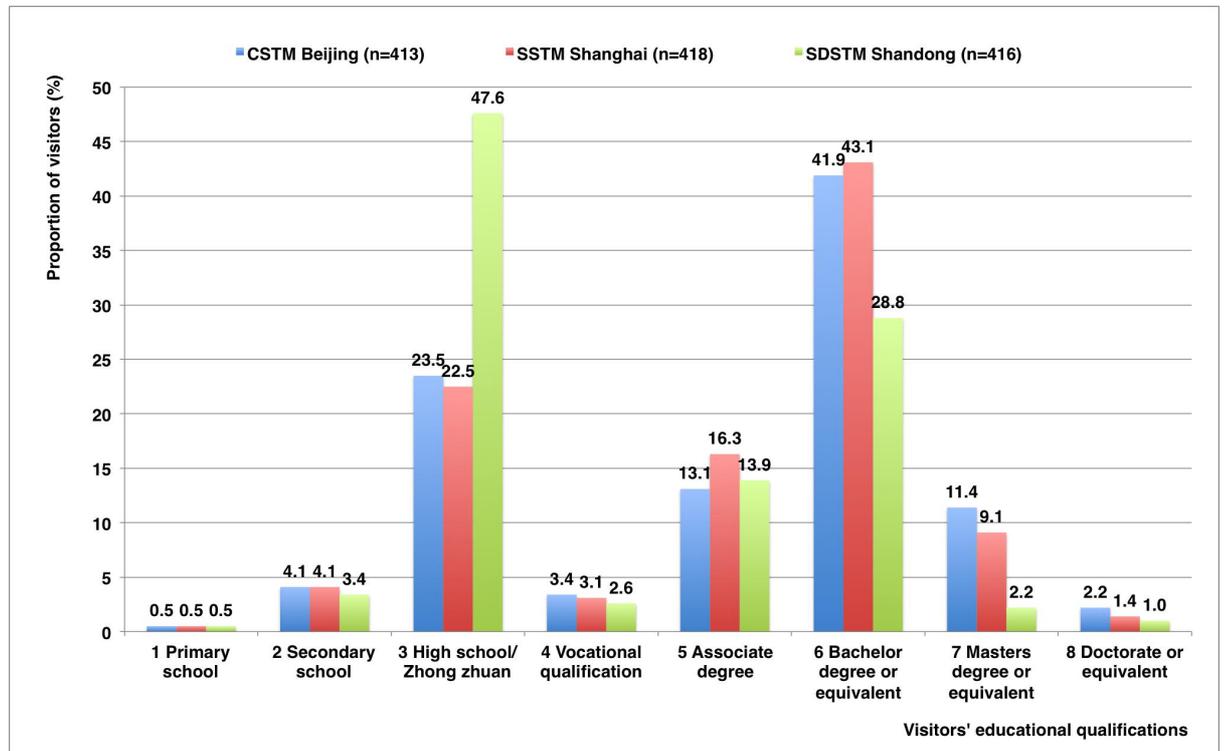
<sup>85</sup> MoE refers to the Ministry of Education of the People's Republic of China.

vocational qualifications are substantially under-represented compared to the wider population. If we consider only the degree-type qualifications (categories 5 to 8 in **Figure 12**), the visitors with a Bachelor or equivalent degree is the biggest group of both post-school graduates and these Ke Ji Guan visitors. It should however be noted that the Ministry of Education of China data only relates to people who were students in 2015. It does not reflect the exact numbers of people within the wider Chinese society with those qualifications, since such data proved impossible to obtain. Although I acknowledge that data from one single year can not represent the actual situation of China, I can still conclude that more university-based visitors (both graduated and current students) tend to visit these three Ke Ji Guan than are present within the wider Chinese populations.

In terms of the separate data for the three Ke Ji Guan, the CSTM Beijing and the SSTM Shanghai share a similar distribution of educational qualification groups with small differences. The SDSTM Shandong, however, does display some differences. As is shown by **Figure 13**, nearly half of the visitors to the SDSTM Shandong reported that their highest educational qualification was High school or Zhongzhuan level while at both Beijing and Shanghai the same figures were less than one-quarter (23.5% and 22.5% respectively). Visitors in Shandong with a Bachelor degree or equivalent (28.8%) were substantially less than Beijing (41.9%) and Shanghai (43.1%). Shandong's visitors with a Masters degree or equivalent also show a similar situation. So in both the CSTM Beijing and the SSTM Shanghai, the group of Bachelor degree or equivalent is the biggest category, while in the SDSTM Shandong, the group of High school or Zhongzhuan is instead the most populous category. Its

proportion of visitors reporting higher educational levels are much less than the other two Ke Ji Guan.

**Figure 13: Visitors' educational qualifications in the three Ke Ji Guan %**

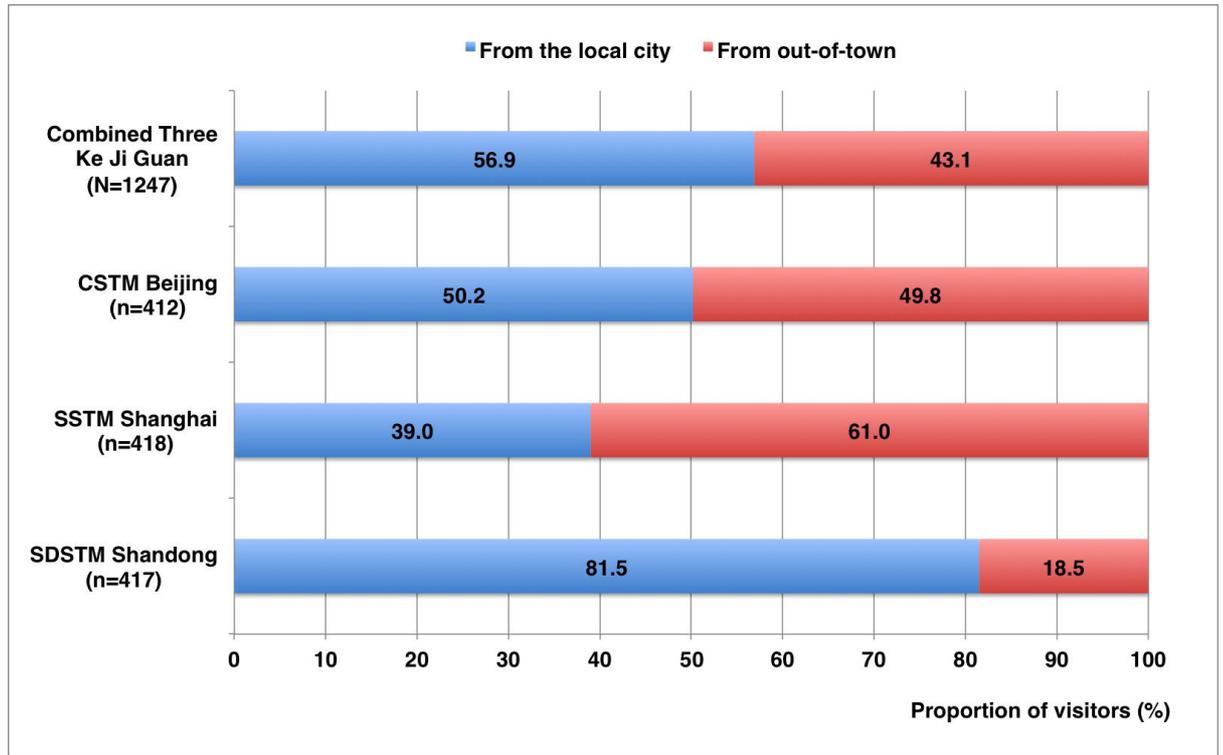


#### 5.2.1.4 Residences

For the question of visitors' residences, participants were asked "If you live in Beijing/Shanghai/Ji-nan, please write the 【 district 】 of your residence (e.g. Pudong); If you are from outside Beijing/Shanghai/Ji-nan, please specify your 【 province 】 and 【 city 】 of residence. Within the overall sample, visitors from within the local cities (Beijing/Shanghai/Ji-nan) account for 56.9% of survey respondents (Figure 14).<sup>86</sup>

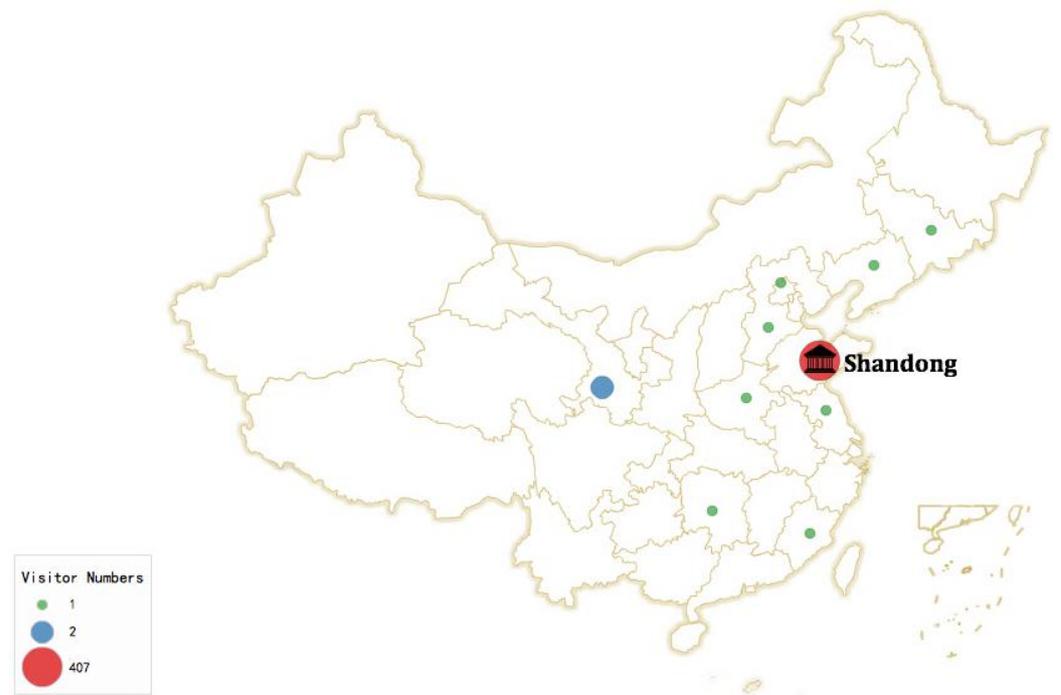
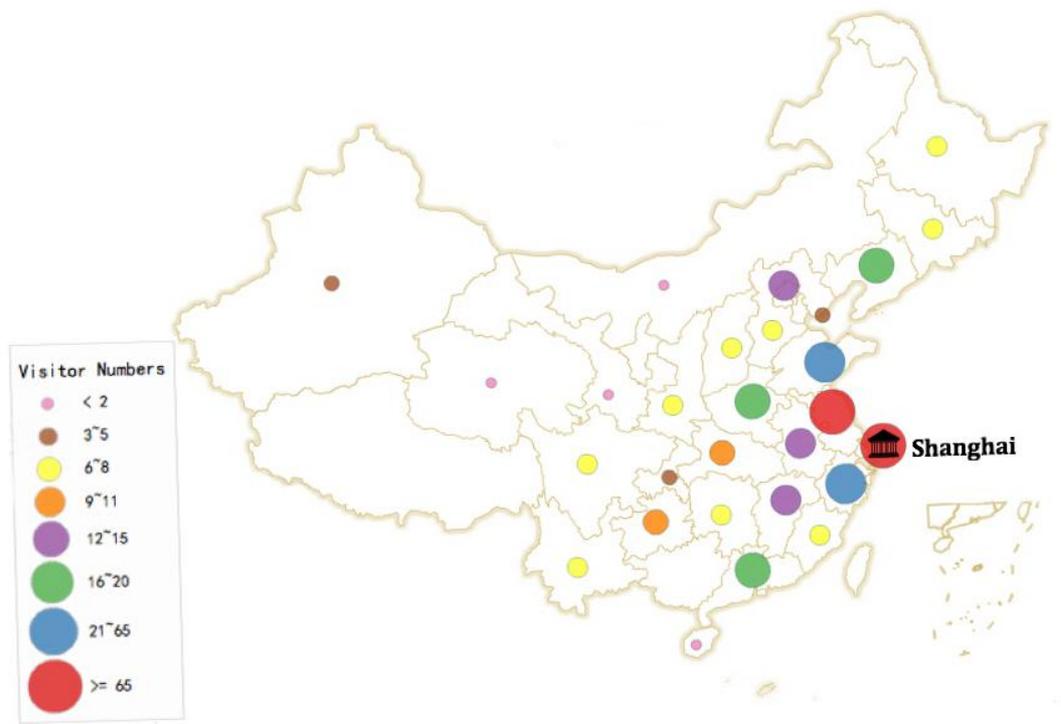
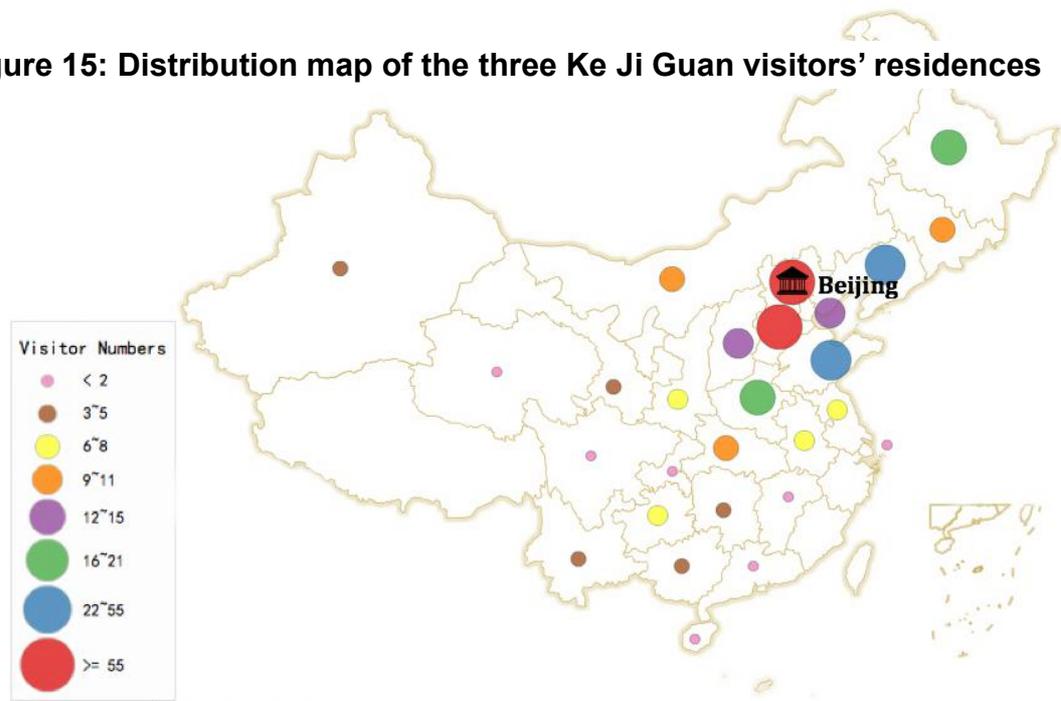
<sup>86</sup> Within my observed sample only five foreign visitors attended the CSTM Beijing in my survey period, and 35 in SSTM shanghai. SDSTM Shandong had no foreign visitors when I conducted my survey there. These figures are too small to have any statistical meaning (see the chapter of Research Methods), therefore I have not conducted any further analysis on them.

**Figure 14: Visitors' residences %**



These data represent a fairly crude breakdown based purely on the local city of residence. This is not necessarily a true indication of visitor backgrounds, for example “local” visitors of the SDSTM Shandong only include visitors who come from the very local city Ji-nan. If we break down the “out-of-town” visitor residences further the percentage of visitors who come from within the wider Shandong province is even higher. At SDSTM Shandong there were 407 visitors from within the Shandong province overall, and only ten people come from other provinces (n=417). **Figure 15** provides further geographical breakdowns for each of the three Ke Ji Guan in turn.

Figure 15: Distribution map of the three Ke Ji Guan visitors' residences



From **Figure 15**, it can be seen that the distributions are quite different for each Ke Ji Guan, though share some common features. Each Ke Ji Guan's visitors are in the main from their local city or nearby provinces. For example, most of CSTM Beijing's visitors come from the northern part of China, and SSTM Shanghai's visitors are from the region of the middle and lower reaches of the Changjiang River. The extreme example is the SDSTM Shandong, where 97.6% of the visitors come from the Shandong province itself.

#### **5.2.1.5 With whom visitors attend these Ke Ji Guan**

Another key factor previously reported relating to visitors' identity-related motivations is "with whom" they attended those Ke Ji Guan (Falk, 2009).

**Figure 16** describes visitors' different companions and their popularities.<sup>87</sup>

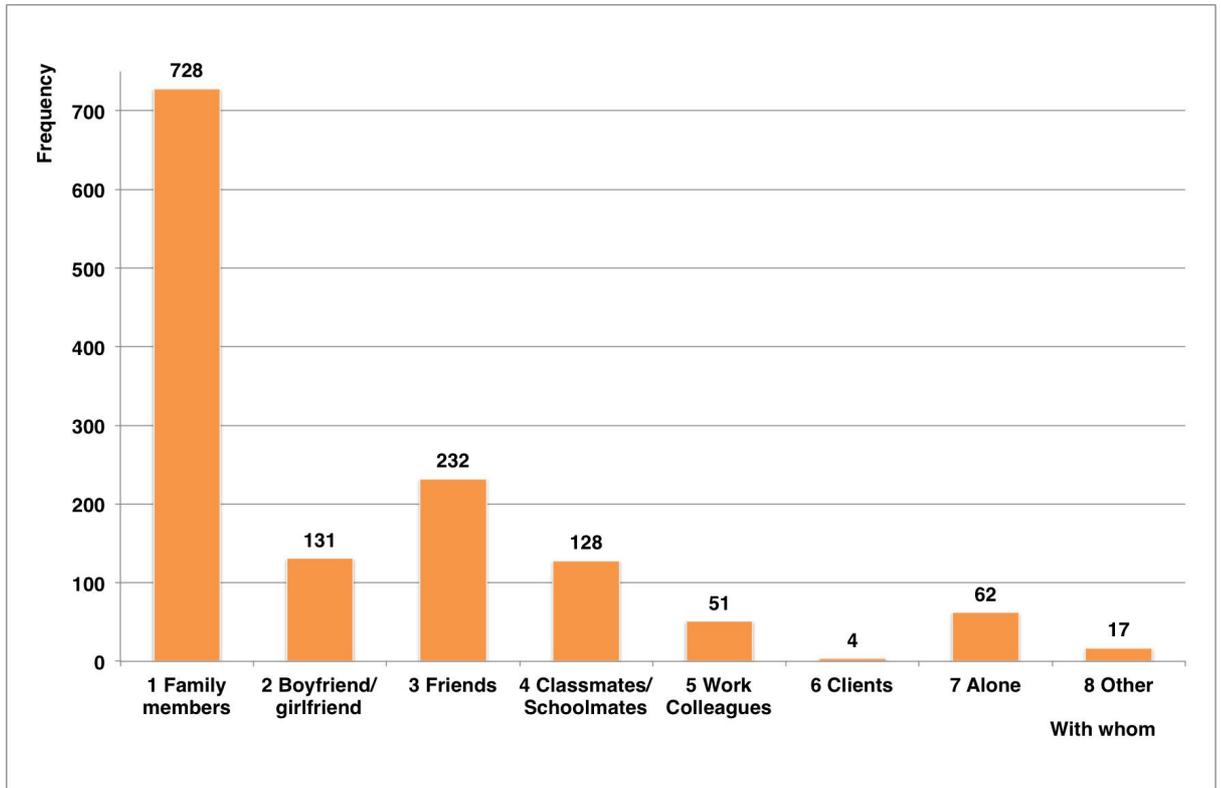
It can be seen from **Figure 16** that overall across these three Ke Ji Guan the most popular reported option was that visitors go to a Ke Ji Guan with their family members (frequency<sup>88</sup>=728). It is more than three times higher than the second most popular option: with their friends (frequency=232), which is followed closely by "boyfriend/girlfriend" (frequency=131) and "classmates/schoolmates" (frequency=128). Only a handful of visitors (frequency= 62) attended these Ke Ji Guan alone, and a similar proportion with work colleagues (frequency=51).

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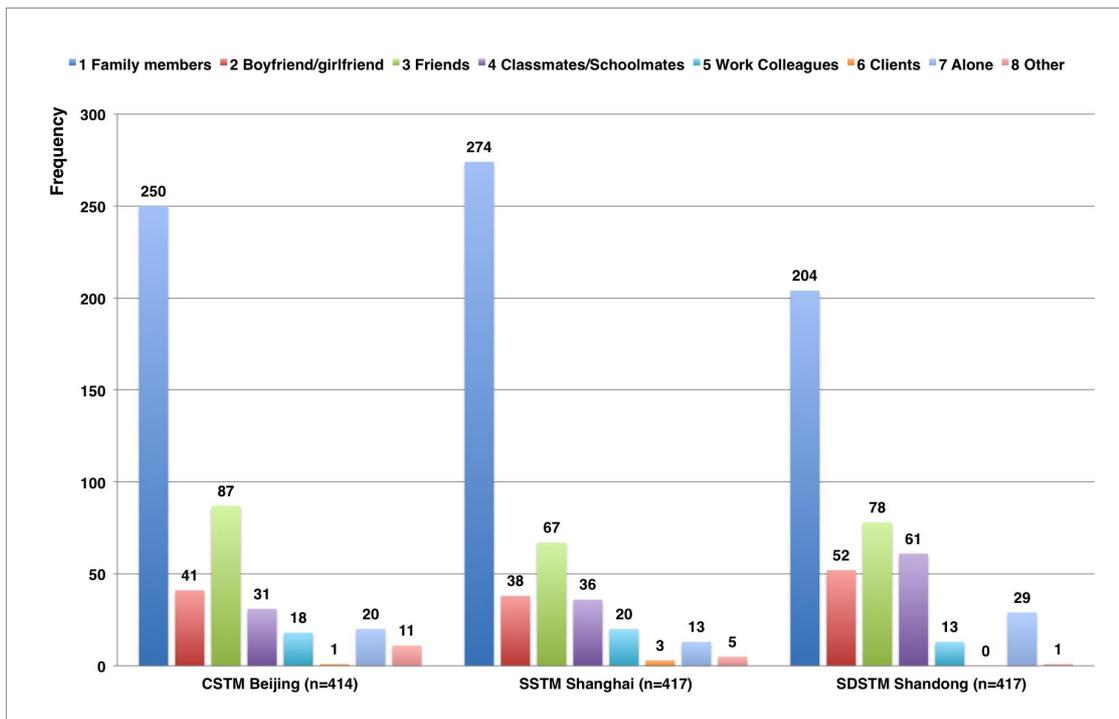
<sup>87</sup> Note: That respondents could select multiple responses to this question, so the Figure only shows the frequency of participants' answers, not a percentage.

<sup>88</sup> These numbers are just frequencies indicating how many times those options were chosen rather than how many people chose them because this question allowed multiple-choice.

**Figure 16: With whom visitors attended the Ke Ji Guan (combined, N=1248)**



**Figure 17: With whom visitors attended the three Ke Ji Guan**



When it comes to these three Ke Ji Guan's independent results, **Figure 17** shows that the profiles remain fairly consistent across the Ke Ji Guan. To attend a Ke Ji Guan with family members is by far the most popular choice in all these three Ke Ji Guan, with friends the second most popular selection. SDSTM Shandong does have slightly fewer "Family" selections, combined with increases in most of the other categories, including "Classmates/schoolmates" and "Alone". As suggested by the head of the Department of Exhibition and Education of the SDSTM, this may in part be because there are many training schools and colleges located near to the SDSTM Shandong.

#### **5.2.1.6 Subject backgrounds**

In order to understand the visitors' subject specialisms, I collected data about their subject backgrounds. For ease of completion this was asked as an open question. The resulting text responses were then classified into broad discipline areas. For example, Chemistry and Physics both belong to the group of "Natural Science" (*"China Classification and Code of Disciplines (GB/T 13745-2009)"*, 2009)<sup>89</sup>. Though not perfect for the task, this standard is the most relevant current code, and includes many subjects that are Chinese-exclusive, such as Chinese Herbology. The document *GB/T 13745-2009* classifies all disciplines into five overarching groups:

**1. Natural Science** (e.g. Physics, Psychology, Biochemistry)

**2. Agriculture** (e.g. Aquiculture, Gardening, Conservation of Water and Soil)

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<sup>89</sup> This document is the latest official standard of disciplines classifications. The alphabets "GB" refer to "National Standard" in Chinese.

**3. Medical Science** (e.g. Clinical Medicine, Pharmacology, Nursing)

**4. Technology and Engineering** (e.g. Architecture, Automatisation)

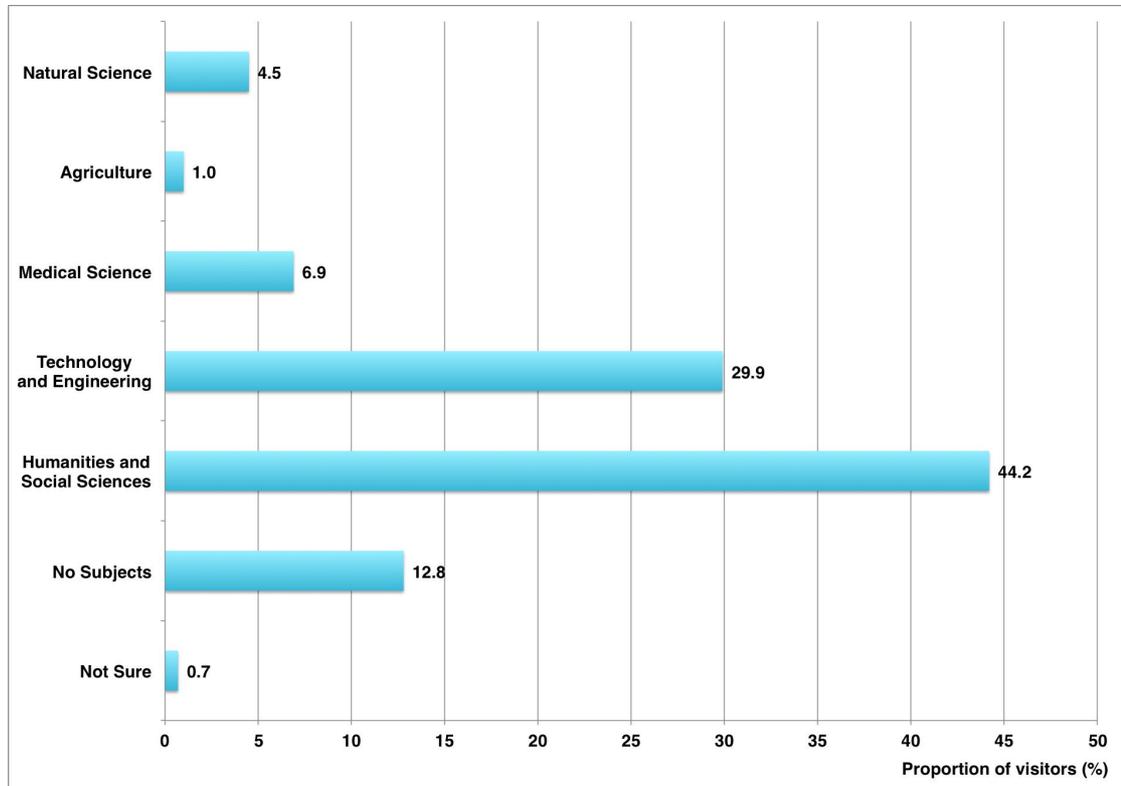
**5. Humanities and Social Sciences** (e.g. Law, Art, Economics)

Using this standard, I clustered my open response data into the above five categories.<sup>90</sup> **Figure 18** and **Figure 19** show the Ke Ji Guan visitors' subject backgrounds according to the resulting classifications, firstly for the overall group and then for each Ke Ji Guan separately.

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<sup>90</sup> This required close attention to detail as there were many ambiguities. For example some new subjects or majors that could not be found in the document are classified as "Not Sure". Additionally, some subjects have to be classified into different discipline groups though they may have similar names. For example, Economic Management belongs to the discipline of Economics, which is listed within the over-arching group of "Humanities and Social Sciences", while Business Management has to be classified as "Technology and Engineering" because it belongs to one of this group's sub-groups: "Management". Another example is Communication, which refers to a subject that uses electrical technology and engineering to make digital information communication between electric applications, so it belongs to "Technology and Engineering"; but Communication Studies is one branch of Media Studies, which belongs to "Humanities and Social Sciences". Additionally, some respondents indicated more than one subject; I took the first subject they named as their response to facilitate my analysis and avoid repeating calculations. The group of "No Subjects" refers to participants who are currently in schools; there is no specific subject in these education levels.

**Figure 18: Combined visitors' subject groups % (N=1249)**

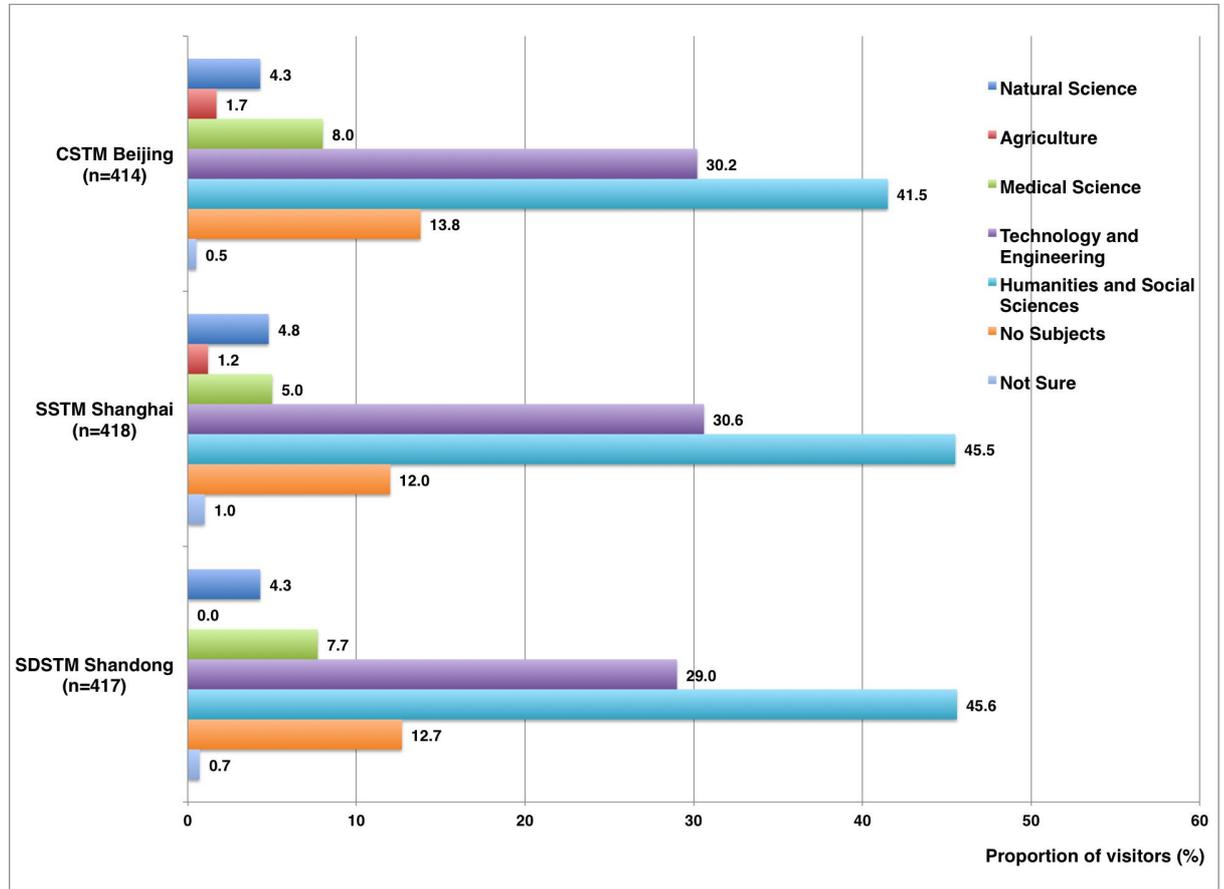


It can be seen from **Figure 18** that the group of “Humanities and Social Sciences” accounted for 44.2% out of all subjects, followed by “Technology and Engineering” (29.9%). “Natural Science” specialists represent only 4.5% of the responses, suggesting that Ke Ji Guan visitors within China do NOT naturally affiliate themselves to science more broadly.

**Figure 19** shows that these three Ke Ji Guan share very similar profiles of these five discipline categories. They all have most visitors from “Humanities and Social Sciences”(more than 40% in each case), then the group of “Technology and Engineering” (around 30%). CSTM Beijing and SDSTM Shandong have similar percentages of participants from “Medical Science” (8.0% and 7.7%), while SSTM Shanghai has only 5.0% of respondents within

this category. In terms of the “Natural Science” category, all these three Ke Ji Guan have similar percentages (just under 1 in 20 respondents).

**Figure 19: Visitors' subject groups in the three Ke Ji Guan %**

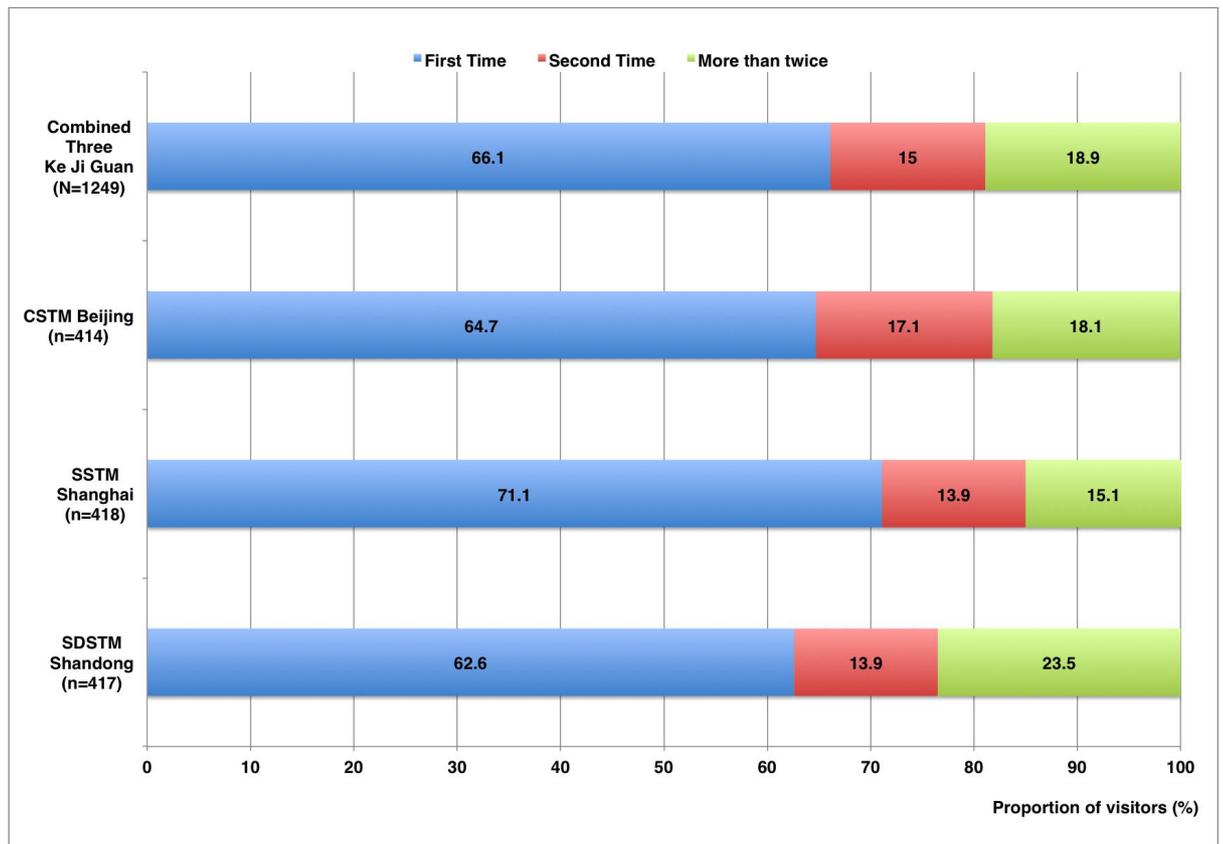


An additional interesting feature from **Figure 19** is that SDSTM Shandong has no single respondent who describes themselves as being a specialist in any category relating to “Agriculture”, despite Shandong being very famous for its agricultural products and business (Luo & Zhang, 2016). According to newspaper reports, Shandong is listed in the “Big Provinces of Agriculture”, even occasionally described as the “Biggest Province of Agriculture” (Lin, 2015). These “Agriculture” specialists are however entirely absent in the SDSTM Shandong dataset.

### 5.2.1.7 First-time or repeated visitors

Survey respondents were asked to indicate how frequently they had visited the museum (first time; second time; more than twice). From **Figure 20** it is clear that the majority of visitors (66.1% based on combined data) were first-time visitors. This differs slightly according to which Ke Ji Guan they attended: 71.1% of respondents visited SSTM Shanghai for the first time, while CSTM Beijing and SSTM Shandong separately have 64.7% and 62.6% new visitors. SDSTM Shandong has the biggest percentage of returning visitors, with approximately one quarter of respondents having attended more than twice in the past.

**Figure 20: First-time or repeated visitor status %**



### **5.2.2 Correspondences between demographic variables**

After providing a descriptive analysis of visitors' demographics separately in the above sections, I now move on to explore the relationship between demographic variables. In terms of the data type, as mentioned previously all my visitors' demographic data are categorical data. To test the difference or relationship between two or more categorical variables, I can apply the Pearson Chi-Square test (Cohen et al., 2011; Field, 2009; Pallant, 2013).

The Chi-Square test applies the null hypothesis that there is no statistically significant difference between the observed results and the expected results (Cohen et al., 2011). This hypothesis is non-directional, which means the result can express whether there is an effect, but cannot point out which direction the effect lies on (Cohen et al., 2011; Field, 2009). So by applying a non-directional hypothesis, the Chi-Square test can only show whether there is a statistically significant difference or not, and cannot specify what the difference is (Cohen et al., 2011; Field, 2009). For example, an analysis could conclude from the Chi-Square test that there is statistically significant difference between boys' and girls' examination performances, but cannot say which group performed better. My data's confidence interval is 95%, so I chose a significance level  $\alpha=.05$ , which means if the Chi-Square tests' value  $p<.05$  then the two variables in the test have a statistically significant association (Cohen et al., 2011).

In order to keep the statistical power of Chi-Square, the basic expected frequencies of cases need to be more than five. When the expected case frequencies are greater than five, the sampling distribution is good enough to conduct a reliable Chi-Square test without worrying about the sample size

(Field, 2009). For a big sample, it needs no more than 20% of expected counts less than five (Field, 2009). In order to make sure the sample meets this standard, it is necessary to check the “expected count” data from the crosstabulation table. The expected count shows the actual values of the practical analysis, and they are different according to the sample size (Field, 2009). So prior to conducting the tests I combined certain category options to produce valid sampling categories that were appropriate for Chi-Square tests. In particular, the age group categories were reduced from six categories to four: “16-25”, “26-35”, “36-45” and “>45”. The educational qualifications were combined to “School-levels”, “Associate Degree”, “Bachelor Degree” and “Postgraduates”. I did not include respondents who marked their genders as “Prefer not to say” within the comparative analysis, as that category was too small in size to be valid for Chi-Square tests. I conducted Chi-Square tests using IBM software SPSS (version 24.0) between pairs of visitor demographics; though many tests were conducted of different variable pairs, here I have chosen the most interesting results to show as follows.

- **Genders and age groups**

**Table 5: Gender \* Age Groups Chi-Square Tests**

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	8.802	3	.032
Likelihood Ratio	8.746	3	.033
Linear-by-Linear Association	3.605	1	.058
N of Valid Cases	1241		

**Table 6: Gender \* Age Groups Crosstabulation**

		16-25	26-35	36-45	>45	Total
Gender Male	Count	144	146	132	32	454
	Expected Count	148.2	163.9	113.0	28.9	454.0
Female	Count	261	302	177	47	787
	Expected Count	256.8	284.1	196.0	50.1	787.0
Total	Count	405	448	309	79	1241
	Expected Count	405.0	448.0	309.0	79.0	1241.0

The crosstabulation table can be seen as **Table 5** and **Table 6**. The smallest expected count is 28.9 for male visitors who are more than 45 years old). It exceeds five and so the assumption has been met. The Chi-Square test's result is:  $\chi^2=8.802$ ,  $df^{91}=3$ ,  $p=.032$ . (**Table 5**) This means there is a statistically significant association ( $p<.05$ ) between visitors' genders and their age groups.

- **Genders and educational groups**

**Table 7: Gender \* Education Groups Chi-Square Tests**

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	25.304	3	.000
Likelihood Ratio	24.702	3	.000
Linear-by-Linear Association	17.225	1	.000
N of Valid Cases	1239		

<sup>91</sup> The "df" refers to the "degrees of freedom", which is a mathematical concept related to the number of restrictions that have been placed on the data (Cohen et al., 2011).

**Table 8: Gender \* Education groups Crosstabulation**

			School- level	Associate Degree	Bachelor Degree	Post graduate	Total
Gender	Male	Count	154	54	183	62	453
		Expected Count	174.4	65.8	171.8	40.9	453.0
	Female	Count	323	126	287	50	786
		Expected Count	302.6	114.2	298.2	71.1	786.0
Total		Count	477	180	470	112	1239
		Expected Count	477.0	180.0	470.0	112.0	1239.0

Based on **Table 8**, the smallest expected count is 40.9 for male visitors who have the postgraduate qualification. It exceeds 5 and so the assumption has been met. The Chi-Square test's result is:  $\chi^2=25.304$ ,  $df=3$ ,  $p=.000^{92}$  (**Table 7**). This means there is a strong statistically significant difference ( $p<.05$ ) between visitors' genders and their educational qualifications.

<sup>92</sup> This does not mean that the p value is absolutely zero. It is very close to zero and the actual number needs more than three decimals to show. The p value may be very close to zero but never reaches it.

- Education groups and age groups

**Table 9: Education groups \* age groups Chi-Square Tests**

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	367.522	9	.000
Likelihood Ratio	382.032	9	.000
Linear-by-Linear Association	114.794	1	.000
N of Valid Cases	1247		

**Table 10: Education Groups \* Age Groups Crosstabulation**

			16-25	26-35	36-45	>45	Total
Education Groups	School-level	Count	302	84	53	42	481
		Expected Count	158.1	172.8	119.6	30.5	481.0
	Associate Degree	Count	23	88	54	15	180
		Expected Count	59.2	64.7	44.7	11.4	180.0
	Bachelor Degree	Count	77	221	155	20	473
		Expected Count	155.5	169.9	117.6	30.0	473.0
	Postgraduate	Count	8	55	48	2	113
		Expected Count	37.2	40.6	28.1	7.2	113.0
	Total	Count	410	448	310	79	1247
		Expected Count	410.0	448.0	310.0	79.0	1247.0

According to **Table 10**, the smallest expected count is 7.2 for postgraduate visitors who are more than 45 years old. It exceeds 5 and so the assumption has been met. The Chi-Square test's result is:  $\chi^2=367.522$ ,  $df=9$ ,  $p=.000$  (**Table 9**). This means there is a strong statistically significant difference ( $p < .05$ ) between visitors' education levels and age groups.

- **Age groups and first time or repeated visitors**

**Table 11: Age groups \* first time or repeated visitors Chi-Square Tests**

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	43.370	6	.000
Likelihood Ratio	43.011	6	.000
Linear-by-Linear Association	33.500	1	.000
N of Valid Cases	1249		

**Table 12: Age Groups \* first time or repeated visitors Crosstabulation**

			1st	2nd	More than twice	Total
Age	16-25	Count	303	62	45	410
		Expected Count	271.1	61.4	77.5	410.0
Groups	26-35	Count	302	68	80	450
		Expected Count	297.6	67.4	85.0	450.0
	36-45	Count	174	44	92	310
		Expected Count	205.0	46.4	58.6	310.0
	> 45	Count	47	13	19	79
		Expected Count	52.2	11.8	14.9	79.0
Total		Count	826	187	236	1249
		Expected Count	826.0	187.0	236.0	1249.0

It can be seen from **Table 12** that the smallest expected count is 11.8 for more than 45-year-old visitors who visited the three Ke Ji Guan more than twice. It exceeds 5 and so the assumption has been met. The Chi-Square test's result is:  $\chi^2=43.370$ ,  $df=6$ ,  $p=.000$  (**Table 11**). This means there is a strong statistically significant difference ( $p<.05$ ) between visitors' age groups and the number of times they have previously visited.

- Education groups and first time or repeated visitors

**Table 13: Education groups \* first time or repeated visitors Chi-Square Tests**

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	44.631	6	.000
Likelihood Ratio	40.745	6	.000
Linear-by-Linear Association	22.262	1	.000
N of Valid Cases	1247		

**Table 14: Education groups \* first time or repeated visitors Crosstabulation**

			1st	2nd	More than twice	Total
Education Groups	School-level	Count	355	57	69	481
		Expected Count	318.2	72.1	90.6	481.0
	Associate	Count	110	29	41	180
		Expected Count	119.1	27.0	33.9	180.0
	Bachelor	Count	302	88	83	473
		Expected Count	312.9	70.9	89.1	473.0
	Postgraduate	Count	58	13	42	113
		Expected Count	74.8	16.9	21.3	113.0
	Total	Count	825	187	235	1247
		Expected Count	825.0	187.0	235.0	1247.0

According to **Table 14**, the smallest expected count is 16.9 for postgraduate visitors who had visited the three Ke Ji Guan more than twice previously. It exceeds 5 and so the assumption has been met. The Chi-Square test's result is:  $\chi^2=44.631$ ,  $df=6$ ,  $p=.000$  (**Table 13**). This means there is a strong statistically significant difference ( $p<.05$ ) between visitors' educational qualifications and previous number of visits to the Ke Ji Guan.

### **5.3 Cross comparisons**

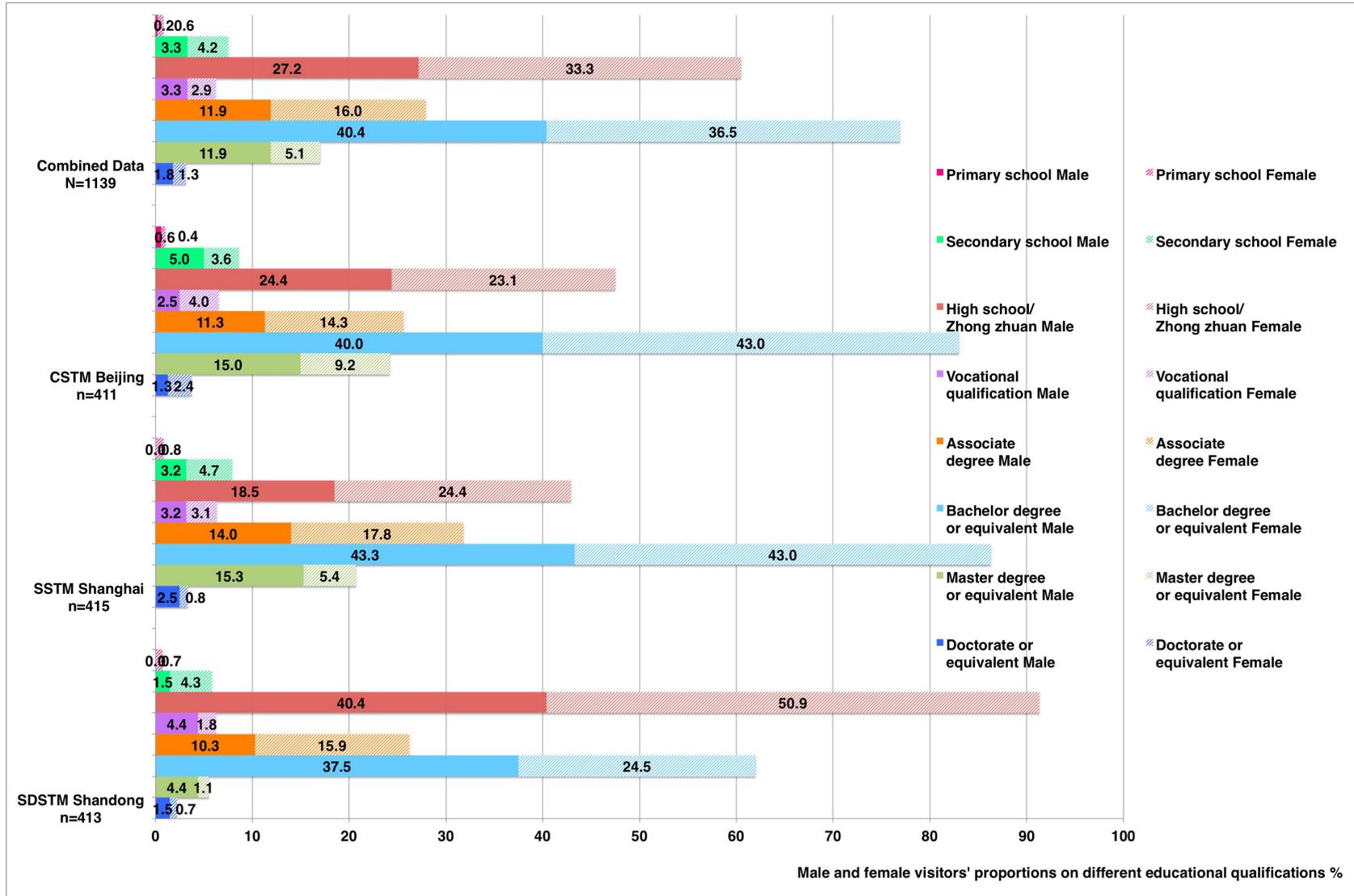
In addition to the demographic correspondences outlined above, it is also interesting to check if there are any relationships between variables according to individual Ke Ji Guan. For example, **Figure 21** shows the gender breakdown of education levels at each of the three different Ke Ji Guan.

As shown by **Figure 21**, for the overall data, males represent a higher proportion of visitors with education levels of bachelor or equivalent, master or equivalent, doctorate or equivalent, and vocational school. Given the statistical significance demonstrated in Tables 6 & 7 it seems that males who visit the three Ke Ji Guan tend to have higher educational qualifications. At the level of masters or equivalent, male visitors are more than twice the proportion of females (11.9% and 5.1% separately). However, for associate degrees, there are more females (Male: Female=10.3%: 15.9%).

The SSTM shanghai and the SDSTM Shandong share a similar pattern of gender ratios with educational qualifications. They both have comparatively more males with higher educational levels such as bachelor or equivalent, master or equivalent, doctorate or equivalent. For the level of masters or equivalent, SDSTM Shandong's male visitors are actually four times that of

females (4.4%: 1.1%). For the qualification of vocational school, male visitors also represent a bigger percentage. Except for the level of High school/Zhongzhuan, SSTM Shanghai and the SDSTM Shandong have more female visitors on the remaining education levels. The CSTM Beijing, however, shows different pattern from them. In the higher education levels, Beijing's male visitors only account for a bigger percentage of Masters degrees or equivalent. On the qualifications of bachelor or equivalent and doctorate or equivalent, more females were found. At the vocational school level, females also represent the higher proportion. It seems the CSTM Beijing's pattern of genders at different educational qualifications stands in contrast to the other two Ke Ji Guan.

Figure 21: Male and female visitors' educational qualifications in different Ke Ji Guan



## 5.4 Chapter summary

In the combined data of the three chosen Ke Ji Guan, it is clear that the three case studied Ke Ji Guan attract many more female visitors than males (around twice the proportion). When it comes to the age distribution, 26-35-year-old visitors are the largest group (36.0%) followed by approximately one-third of visitors aged 16-25 and a further quarter aged 36-45. There is a clear trend towards visitors' highest completed education level being a bachelor degree or equivalent (37.9%), while 14.4% respondents hold associate degrees. There are also high proportions of visitors who completed High school or Zhongzhuan (31.2%). It was extremely rare for visitors to have only school levels of educational qualifications, suggesting that Ke Ji Guan visitors in China are in general academically educated. Within the overall sample, visitors from within the local city (Beijing/Shanghai/Ji-nan) account for 56.9% of survey respondents. To visit a Ke Ji Guan with family members is the most popular option for most of the survey participants with a frequency of 728. It is more than three times the frequency of the second most popular option: with their friends (frequency=232), which is followed closely by "boyfriend/girlfriend" (frequency=131) and "classmates/schoolmates" (frequency=128). Only a handful of visitors attended these Ke Ji Guan alone, and a similar proportion with work colleagues. In terms of the visitors' subject specialisms, "Humanities and Social Sciences" accounted for 44.2% out of all subjects, followed by "Technology and Engineering". "Natural Science" specialists represent only 4.5% of the responses, suggesting that Ke Ji Guan visitors within China do not connect themselves with science more broadly. Additionally, 66.1% of visitors attended these three Ke Ji Guan for the first time.

Considering each Ke Ji Guan separately, there are many broadly similar patterns on some demographic factors, such as who the respondent was attending the Ke Ji Guan with, their subject specialism and the number of times they had previously visited. For some variables however, the CSTM Beijing and the SSTM shanghai share similar trends while the SDSTM Shandong demonstrates very different patterns, for example, visitors' educational qualifications. Also on some variables, these three Ke Ji Guan are different with each other, such as age groups and residences.

Chi-Square tests show that, certain demographics have statistically significant associations. They are genders and age groups, genders and educational groups, education groups and age groups, age groups and first time or repeated visitors, and education groups and first time or repeated visitors.

In summary, the demographics data I explored in this chapter do provide information about the portrait of the common or typical visitor at the three Ke Ji Guan. Further more, these data can help to explain the reasons behind visitors' identity related motivations, which I will explore in the next chapters.

## 6 Why Do People Visit Ke Ji Guan?

In this chapter I will explore the main visitor motivations as evidenced through the work conducted at three Ke Ji Guan in China (China Science and Technology Museum (Beijing), Shanghai Science and Technology Museum and Shandong Science and Technology Museum). This builds on the previous chapter, which presented an overview of the demographics of the survey respondents. Within this current chapter, the identity-related motivations of visiting a Ke Ji Guan in China and visitor categories will be used to answer one of my research questions: What are the identity-related motivations in Ke Ji Guan in China? I will compare the identity-related visitor groups within my sample with John Falk's existing scheme. After that, a statistically Exploratory Factor Analysis will be conducted to seek my own visitor groups.

### 6.1 Visitors' priority motivations

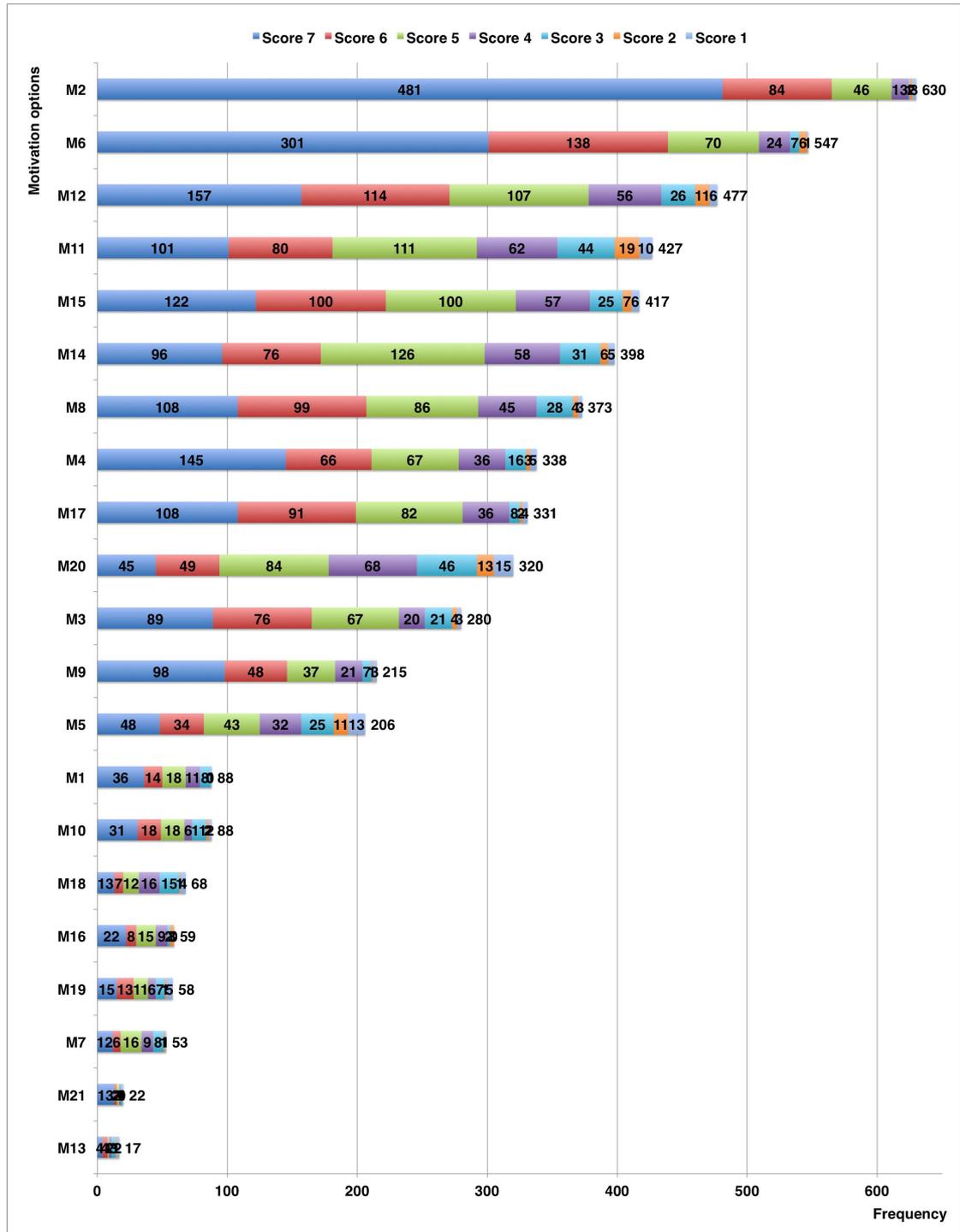
Following the approach originally taken by John Falk and colleagues (Falk, Heimlich, & Bronnenkant, 2008), within my questionnaire survey respondents were asked to choose up to five reasons regarding why they decided to visit that Ke Ji Guan, from 20 different motivation options.<sup>93</sup> For each of their five selected reasons they were asked to rank their answer with a score from one (less important) to seven (very important). An overview of respondents' motivation choices<sup>94</sup> presents in **Figure 22**.

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<sup>93</sup> The full list of the options' variable names and labels can be seen in Appendix 1: "Questionnaire Sample in English".

<sup>94</sup> Note: That since respondents could select multiple options, percentages are in general not appropriate for these data, so frequencies are used instead throughout this chapter.

**Figure 22: Frequency of visitors' chosen motivation options and scores**  
**(N=1249)<sup>95</sup>**



<sup>95</sup> There are two points to clarify within this figure: a) A score of 7 refers to “very important” and a score of 1 refers to “less important; b) For M21, there are two participants who chose this option but gave no scores. So the total frequency of M21 is 22, but the sum of scores is only 20.

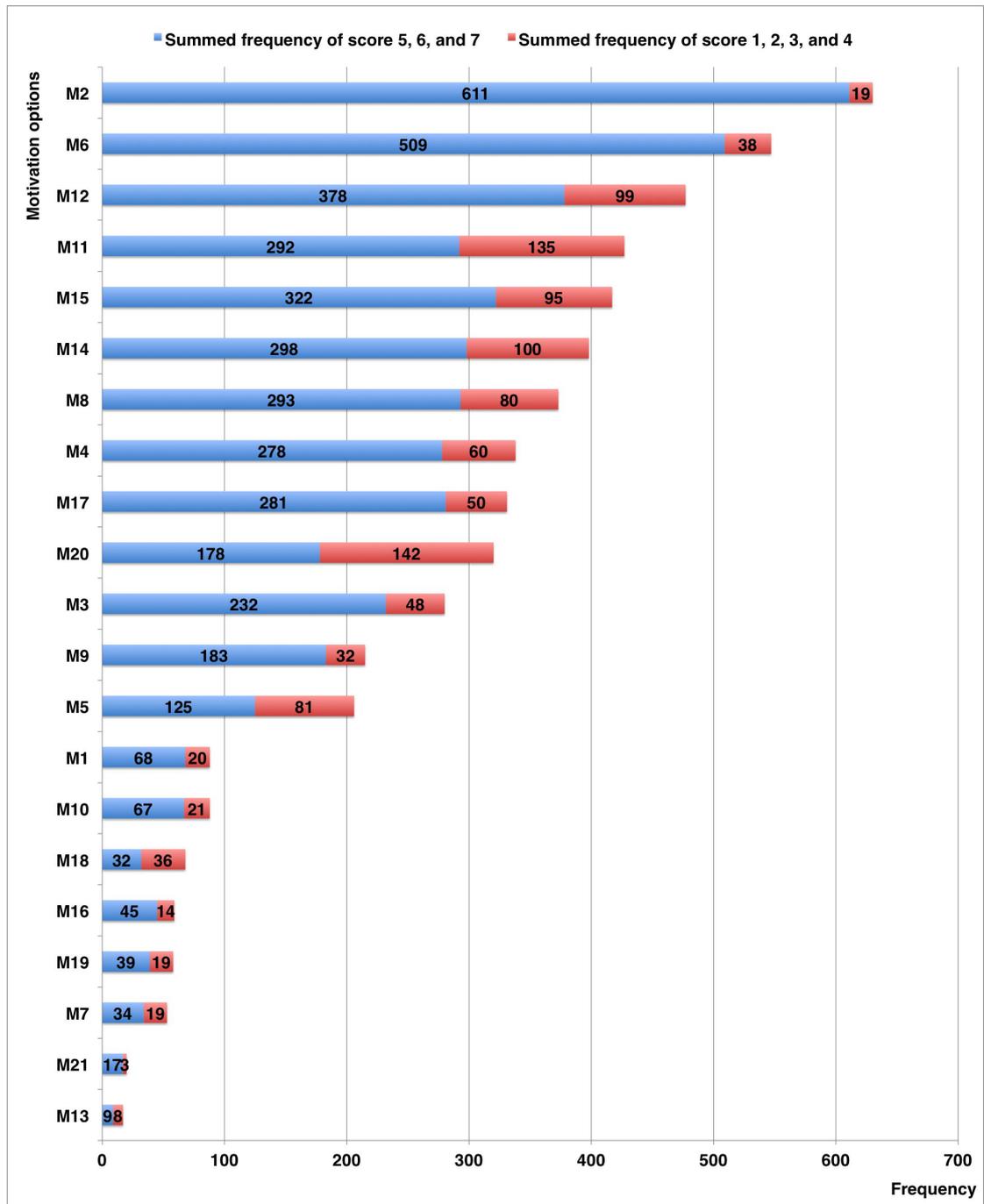
It can be seen from **Figure 22** that certain options were clearly more popular than others: although all options were selected by at least 17 respondents, only one option was selected by more than half the survey participants, M2<sup>96</sup> “I take my child to learn/expand horizon”. There is then a gradual tail-off in option popularity, with a further 9 responses being selected by at least one quarter of all respondents. The final 11 options in comparison were considered fairly minor motivations overall, ranging from two options with around 20 responses, to six options with approximately 55-90 responses, and three options in the 200-300 category. The least popular options were M13 “I come to use the facilities (e.g. climate control, seats, Wi-Fi)” and the generic M21 “Other” category.

Returning to the most popular option (M2), not only was it a popular choice, but respondents also felt strongly about its level of importance. As demonstrated in **Figure 22**, this option had the highest proportion of respondents who ranked it 7 (very important; over three quarters of people who selected this option). Furthermore, as is indicated in **Figure 22**, it was in fact common for respondents to give a score of 5, 6 or 7. Based on this situation and in order to determine the pattern of the importance rankings assigned by the respondents, I have classified the scores as “strong” values (rankings of importance of 5, 6, or 7) and “weak” values (1, 2, 3 or 4). I summed up the proportions of these two groups to explore patterns in the strength of association (**Figure 23**).

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<sup>96</sup> In order to facilitate reading and understanding the various motivation labels, I will use “M+Number” to represent the motivation options. For example, M2 refers to the second motivation in the list within the questionnaire: “...I take my child to learn/expand horizon.”

**Figure 23: Summed frequencies of visitors' strong/weak chosen motivations (N=1249)<sup>97</sup>**



<sup>97</sup> Note: The “Strong” refers to respondents’ rankings of importance of 5, 6, or 7, and “weak” refers to their rankings of importance of 1, 2, 3 or 4.

For option M2, rankings of 5, 6 and 7 account for 97% of people who selected this option in total, which shows that most of the visitors who chose this option have a strong and firm will to specify this reason (**Figure 23**). The next two most popular options (M6... This is a good way to interact with my child/share quality time with my family/friends and M12... I am interested in science) also suggest strongly felt motivations, with similarly large total proportions of “strong” rankings. As overall popularity decreased so apparently did respondents’ strength of feeling towards that option, with most of the less popular options displaying a wider range of rankings.

The frequency of visitors’ chosen motivation options within each of the three Ke Ji Guan can be seen from **Figure 24** and **Figure 25**. These two figures present the same data, but have been included separately in order to assist in comparing the patterns in the data more easily.

As can be seen from **Figure 24** and **Figure 25**, these three Ke Ji Guan showed broad similarities in terms of the order of popularity and distribution of the data within the figure overall. CSTM Beijing and the SSTM Shanghai in particular shared more similarities, whereas the SDSTM Shandong looks somewhat different to them. For example, at both the CSTM Beijing and SSTM Shanghai, M2 and M6 were the top two motivations relating to family members. (M2... I take my child to learn/expand horizon) These two options had much higher frequencies than the remaining options, and at the SSTM Shanghai, both M2 and M6’s frequencies were even over 200 (M2: 245 and M6: 215; more than half of the respondents from that museum in each case). By contrast, at the SDSTM Shandong, the M2 and M6 frequencies are obviously lower (175 and 160 respectively). Except for M2 and M6, other options in

CSTM Beijing and SSTM Shanghai both showed a clear decline. Additionally, these two Ke Ji Guan also had similar frequencies in M11, M12 and M15, though in slightly different orders. M19, M21 and M13 were the three most unpopular options for visitors in both Beijing and Shanghai, and M13 (... I come to use the facilities (e.g. climate control, seats, Wi-Fi)) showed the lowest numbers of responses in both of these two Ke Ji Guan. They also had some other options with similar frequencies, such as M11, M12 and M15. In summary, Beijing and Shanghai indicated very similar trends of motivation distribution patterns.

**Figure 24: Frequency of visitors' chosen motivation options within each of the three Ke Ji Guan**

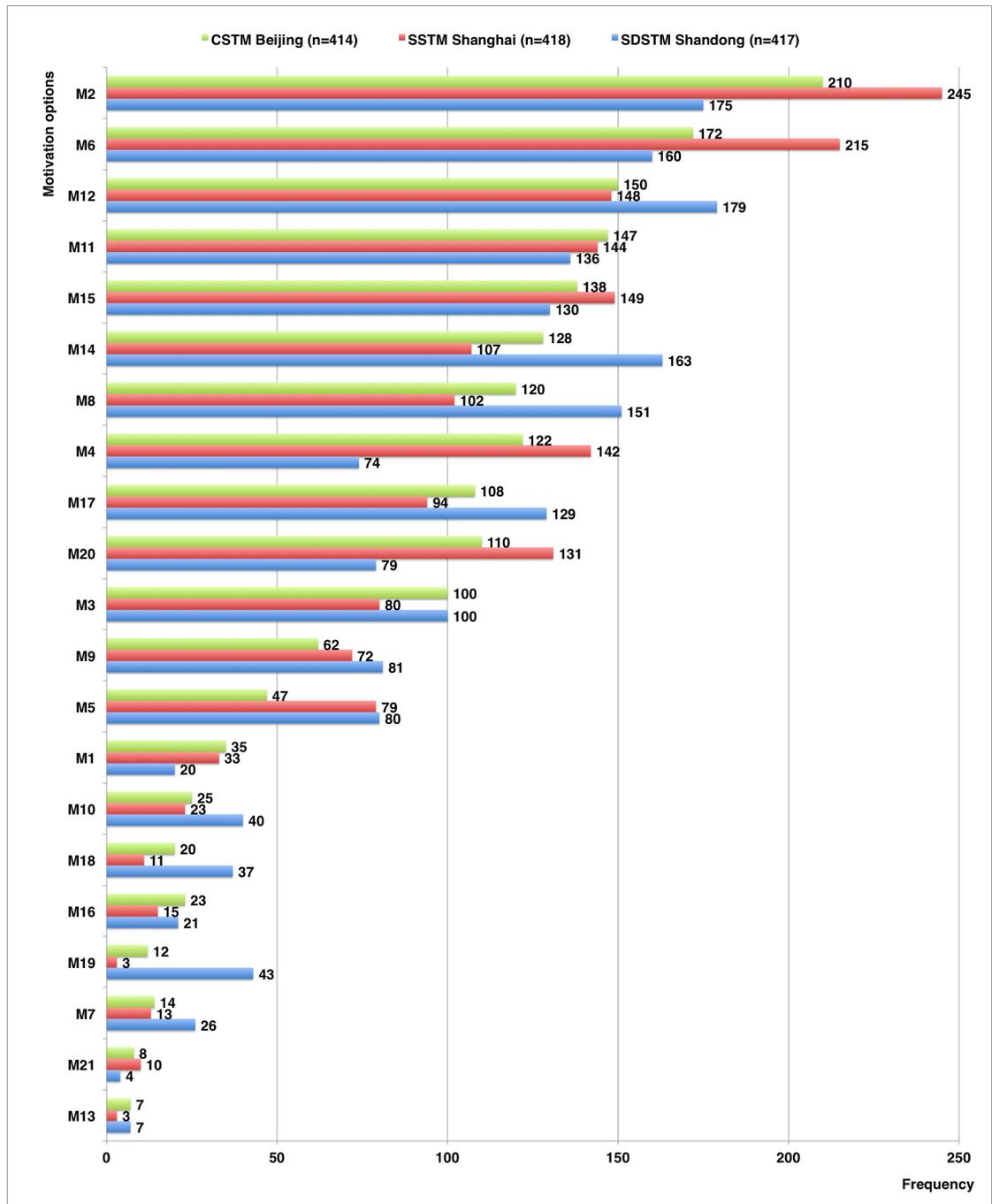
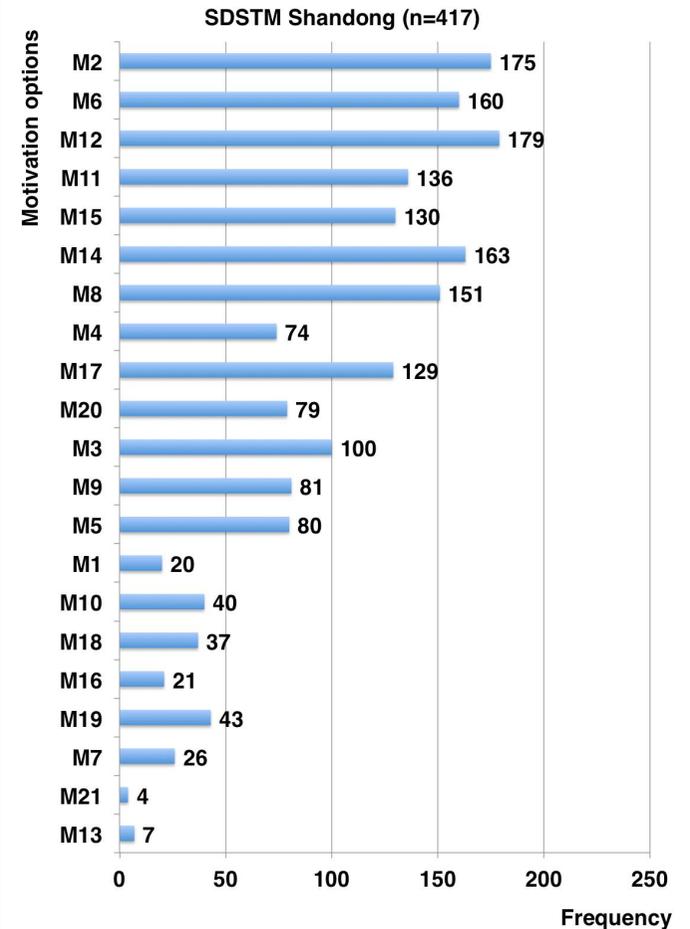
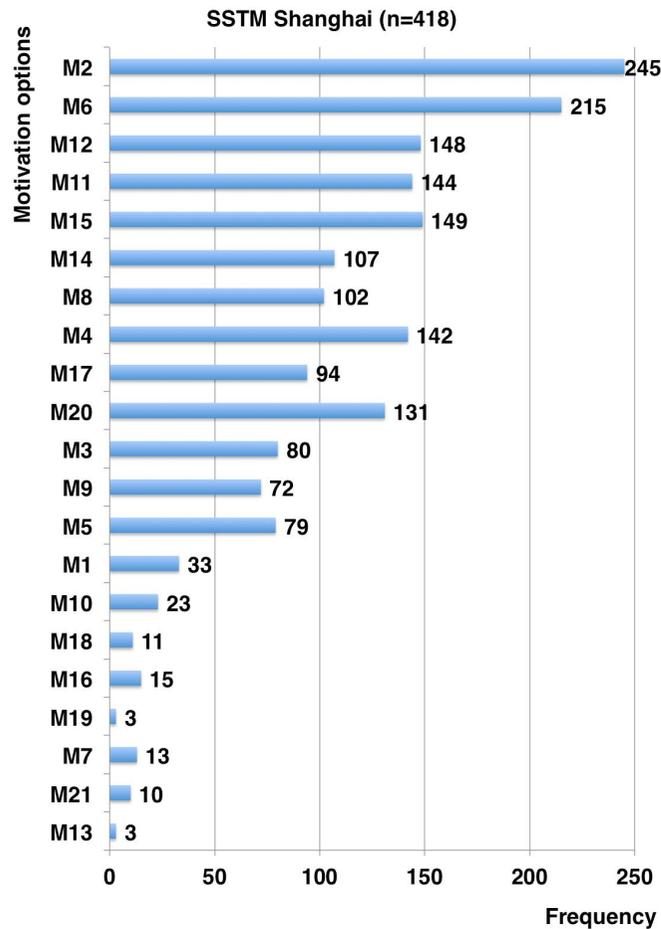
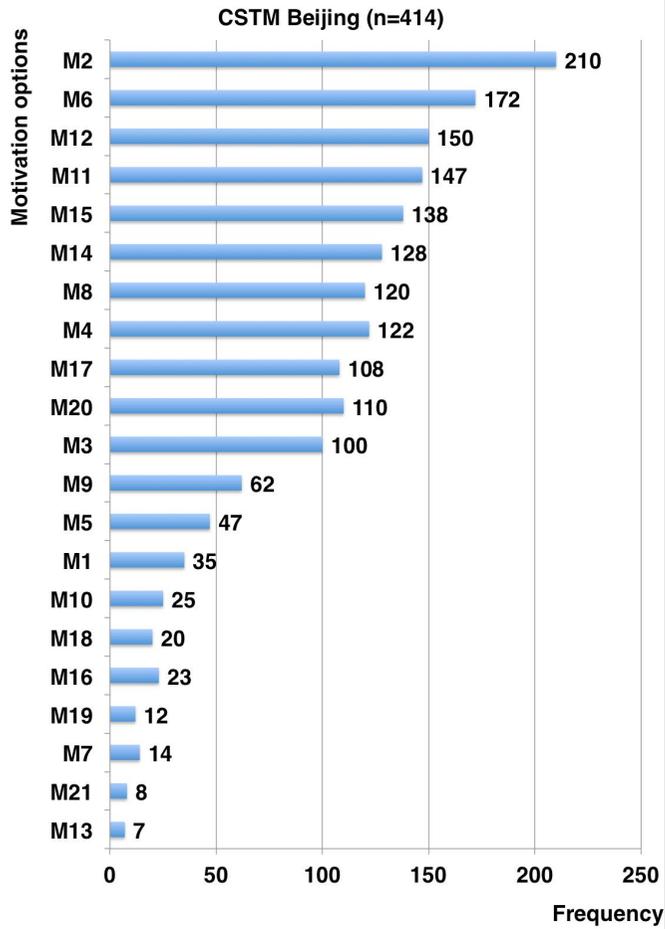


Figure 25: Frequency of visitors' chosen motivation options within each of the three Ke Ji Guan separately



However, for the SDSTM Shandong, it's most popular option was M12 (... I am interested in science) with 179 responses. M8 (... I come to enrich myself, 151 responses), M14 (... I come to satisfy my curiosity, 163 responses) and M17 (... I am interested in science museums, 129 responses) at Shandong were all more popular than in Beijing (M8: 120, M14: 128, M17: 108), and Shanghai (M8: 102, M14: 107, M17: 94). The high frequency of M12 and M17 by visitors to SDSTM Shandong suggests that this Ke Ji Guan may particularly attract people who are already fans of science-related issues. They also would additionally like to visit SDSTM Shandong to enrich themselves (M8) and satisfy their curiosity (M14). This situation suggests that the SDSTM Shandong attracts more visitors with specific interests/intentions (such as people who want to learn or explore) than common tourists or sightseers. Furthermore, fewer visitors apparently take their children to SDSTM Shandong just for fun. The SDSTM Shandong's frequency for M4 (... I take my child for fun) was only 74 while at Beijing and Shanghai it was 124 and 142 responses respectively. Approximately twice as many visitors to SSTM Shanghai chose M4 compared with visitors to SDSTM Shandong. This may suggest from the opposite perspective that Shandong visitors tend to regard the Ke Ji Guan as a place to learn rather than to have fun. Another difference at the level of individual museums is that there were more visitors who visited SDSTM Shandong because of M18 (... I live locally/pass by and come to cast a glance over). This may be because the location of the SDSTM Shandong is different to CSTM Beijing and SSTM Shanghai. The latter two Ke Ji Guan are both located far from their city centres, so it's much less likely that people would just happen to pass by. SDSTM Shandong, however, is at the centre of Ji-nan and very close to local popular venues such as Quancheng Square, Guihe Plaza and

Quancheng Hotel. So it is more than likely that some visitors went to these famous places and visited the SDSTM Shandong as they passed by.

## 6.2 The identity-related visitor groups

In John Falk's book *Identity and the Museum Visitor Experience* (2009), he categorises museum visitors into five identity-related groups: Explorers, Facilitators, Experience seekers, Professional/Hobbyists, and Rechargers.<sup>98</sup> In 2011, Falk developed two more groups of visitors: Respectful Pilgrims and Affinity Seekers (Bond & Falk, 2013; Falk, 2011). The initial first step in this analysis is to attempt to classify the identity-related visitor motivations in China according to Falk's previous methodology. Although many of my motivational statements are similar to Falk's, some of them are subtly different-and others are completely new, based on my piloting process in developing the questionnaire. The process of how the respondents' motivations map across to the main motivational statements can be found in my Chapter 3 "Research Methods" (Section 3.4.2.2). Additionally, the statements written here are the English translations of the original Chinese versions, and therefore the meanings may be slightly different, but I have allocated them according to the specific Chinese meanings, as that is the language that the respondents used to complete the questionnaires.

- **Explorers:** This group refers to visitors who go to a Ke Ji Guan to feed their curiosity or discover something. Visitors in this group tend to describe themselves as "science lovers," "learners," "discoverers," and/or

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<sup>98</sup> All of these concepts including 'identity' and these groups were explained previously in Chapter 2 Literature Review.

“curious people” (Falk, 2006). So, options about seeking and discovering will be categorised to this group, such as:

M8... I come to enrich myself.

M12... I am interested in science.

M14... I come to satisfy my curiosity.

M15... I come to see the frontiers of science and the latest technologies.

The option “... I come to enrich myself” is allocated to this group because within this context it does not mean to study some specific knowledge, but instead a general learning. Some visitors enjoy gaining all kinds of knowledge and could feel happy by learning and exploring interesting things.

- **Facilitators:** Some visitors, however, visit a Ke Ji Guan not for themselves like Explorers, but to cater to other people’s needs. Frequently these “other people” are children and in this situation, visitors are trying to perform as “good parents” (Falk, 2006). The key phrase is that visitors in this group believe that they are doing “good things” to others by taking them to visit a Ke Ji Guan. For some people, though, they go to a Ke Ji Guan alone, but their aim is to learn something for somebody else rather than himself or herself. Based on these standards, the following options from my survey can be classified to this group:

M2... I take my child to learn/expand horizon.

M3... I take my family/friends to learn/expand horizon.

M4... I take my child for fun.

M10... I want to prepare myself for a future visit with my child.

- **Experience Seekers:** This group includes visitors who visit a Ke Ji Guan in order to have an experience of “been there, done that”. A large proportion of experience seekers are tourists (Falk, 2006). Some people also visit a Ke Ji Guan for social reasons. Their actual aim is to find a cultural place to spend time with somebody, no matter whether this place is a museum or an art gallery (Falk, 2009). The following options can therefore be allocated to this category:

M5... I want to be able to tell other people that I have visited here.

M6... This is a good way to interact with my child/share quality time with my family/friends.

M16... I come to see my friend/boyfriend/girlfriend/other people.

M20... I regard here as a good spot to visit for sight seeing.

- **Professional/Hobbyists:** Some people visit a Ke Ji Guan to explore professional or particular knowledge of interest. They are not Explorers because what they seek is not general knowledge but some specific information (Falk, 2006). Some of these people may be scientists, schoolteachers, etc. There are also some Ke Ji Guan fans that would like to visit all kinds of Ke Ji Guan. Options from my survey that are relevant in this group are:

M1... I am here related to my study/work.

M17... I am interested in science museums.

In addition to Falk's original categories, during my piloting phase (see Chapter 3, Section 3.6) certain other locally relevant motivation options were introduced that were specific to my respondents in China. These options do not easily fit within those noted above, and for the purposes of the initial analysis, they have been allocated into the following NEW categories.

- **Convenience Users:** Based on my piloting interviews (see Chapter 3, Section 3.4.2.2), there are some people who visit a Ke Ji Guan just for convenience and use of the local facilities, such as resting their legs after a long walk, topping up their mobile phone charge, or enjoying free air conditioning on a hot summer day. For them it does not matter if it is a Ke Ji Guan or some other place as long as it can supply them with the facilities they seek. There are also people who may want to find a place to kill time before their train or flight. So when they find a Ke Ji Guan or some other place near by, they may step in, particularly when these places are free to visit, such as the SDSTM Shandong. Another situation is, some companies may award free tickets to cinemas, gyms, or museums. People who hold these tickets will use them because "I just don't want to waste them." It is not easy to allocate these motivations to any of the above Falk's categories, so I have created a new group for them as "Convenience Users". The motivations included in this category are as follows:

M13... I come to use the facilities (e.g. climate control, seats, Wi-Fi).

M18... I live locally/pass by and come to cast a glance over.

M19... I got a free ticket/I can get a ticket reimbursement.

- **Emotional Connection Seekers:** Within my piloting phase, some people reported visiting a Ke Ji Guan for individual emotional reasons. For example, some respondents answered that a particular Ke Ji Guan is a place, which can help, recall their memory of a certain family member. Or some people argued that they thought the Ke Ji Guan should be a place in which to find the country's science and technology development, and they come to see that because of their love of the country. These motivations are all related to seek one kind of emotional connection, and they could not fix to any of Falk's five main categories. Also, they have subtle differences from Falk's new (the sixth) category, the Respectful Pilgrims, which refers to people visit an institution/memorial because of a sense of duty or obligation to honour the memory. So the following motivations are allocated to the category of Emotional Connection Seekers.

M7... I come for an affective reason connected to my family or my childhood.

M9... I love our country and want to see our latest developments in science and technology.

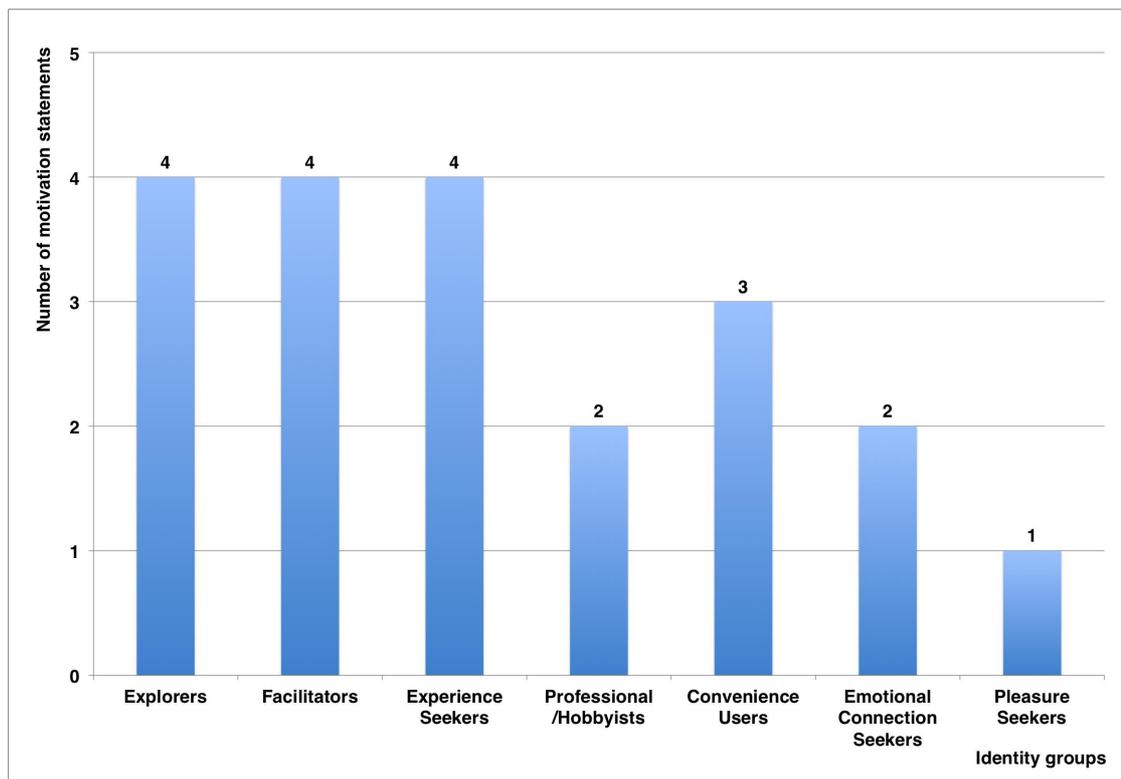
- **Pleasure Seekers:** In this group, people have no confirmed or clear aims. They just want to relax or take a rest. They may feel happy in a Ke Ji Guan or want to escape from their regular lives. In some respects this is similar to Falk's category of "Rechargers" (Falk, 2009, p. 204). But in my context, I have no such category as "Rechargers". Visitors here seem simply to want to relax, to take a mental break and have no further intentions. They may just want to find a place to please themselves, and a Ke Ji Guan can satisfy them incidentally. Sometimes they even have no

specified motivations based on my communication with them. So I describe them as pure Pleasure Seekers.

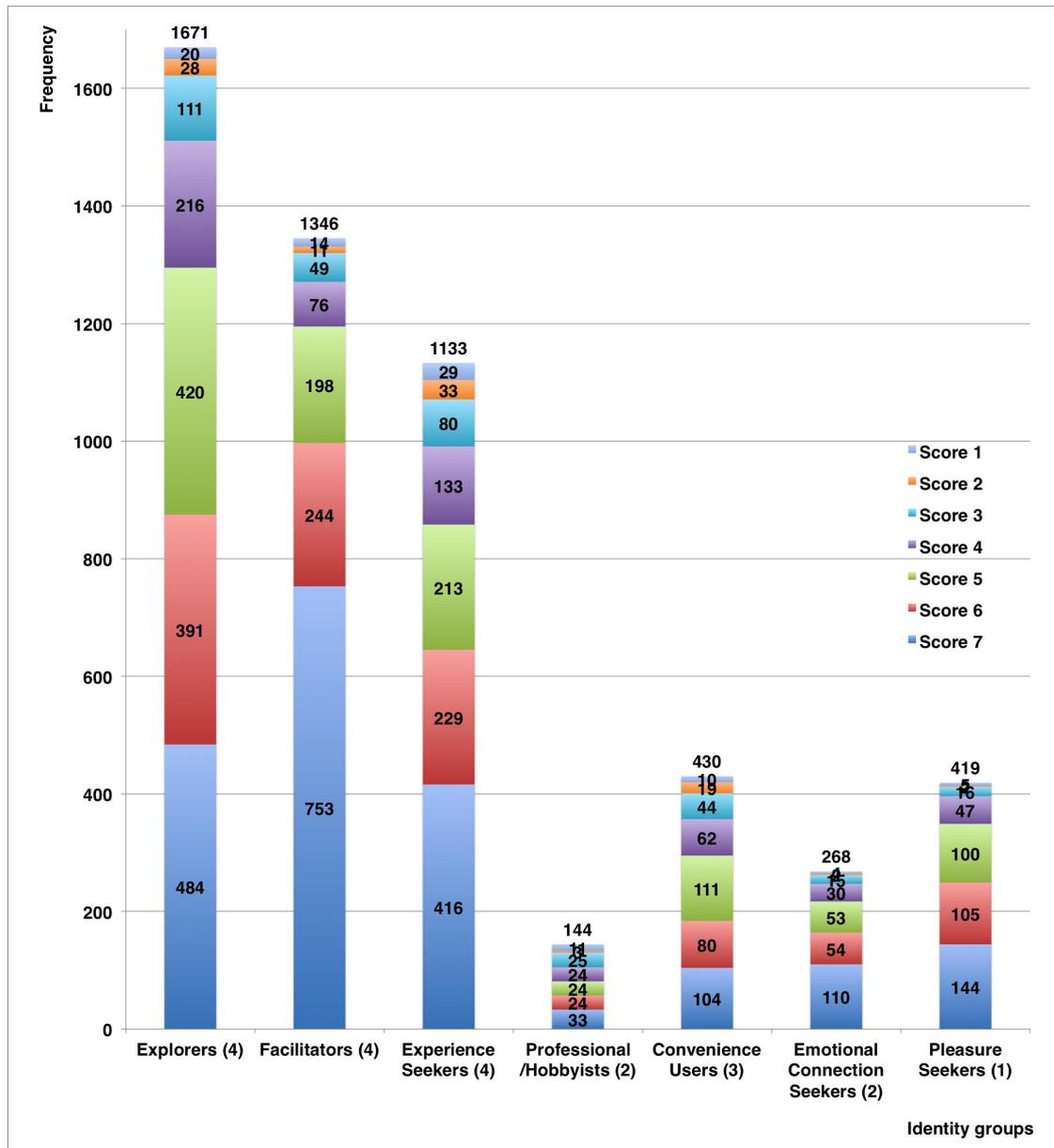
M11... I come to relax/have fun.

One important point to note before my following analysis is that the number of motivational statements within my questionnaire for each of the seven revised motivational identity groups did vary. For clarity, the number of motivational statements within each group can be seen in **Figure 26**.

**Figure 26: Number of motivational statements within each identity group**



**Figure 27: Total number of motivational statements selected from within each identity-related visitor group (N=1249)<sup>99</sup>**



<sup>99</sup> A score of 7 refers to “very important” and 1 refers to “less important”; Identity (N) shows how many motivational statements were classified within this group. For example, Explorers (4) means there are four motivational statements in my questionnaire that relate to the identity group of Explorers.

**Figure 27** presents the total number of motivational statements that were chosen from within each of the identity-related groups. It can be seen that the first three groups (all more than 1100 frequencies) show noticeably higher frequencies than the other four groups. Explorers have the highest frequency (1671) followed by Facilitators (1346) and Experience Seekers (1133). However, these are also the same identity groups that contained the most motivational statements (4 each, see **Figure 26**). This means that arguably respondents had four times as many opportunities to select a motivational statement within these categories (Explorers, Facilitators and Experience Seekers) than they did within Pleasure Seekers, and twice as many opportunities as Professional/Hobbyists or Emotional Connection Seekers. Generally, **Figure 27** shows that to be Explorers is the most popular motivation for visitors in these three Ke Ji Guan. Facilitators and Experience seekers are also popular options. Though motivation numbers inside the seven identity groups varies (**Figure 26**), this result shows some motivation groups are naturally more popular than others. But the number of motivations is not the crucial reason for the high frequency. The group of Pleasure Seekers (frequency=419) with only one motivation indicates more numbers than the Emotional Connections Seekers (frequency=268) and Professional/Hobbyists (frequency=144), which are both have two motivation options.

Both **Figure 26** and **Figure 27** indicate that based on my cases, it is less likely to have same number of motivational statements in each categories as Falk did (personal communication, September 25, 2014). It seems that simply applying an adapted version of Falk's visitor identities to my data from the case three institutions in China is inappropriate. A new approach is necessary, the Exploratory Factor Analysis, which will be presented in the next section.

### 6.3 Exploratory Factor Analysis

In the last section I classified seven visitor groups building on those previously identified within western museum contexts (particularly the US) by John Falk. But Falk's mapping is only one way to interpret and classify visitors' motivations. The option statements can at times be interpreted in different ways, and different people may arguably produce different interpretations if their judgement is only based on the text and not the wider context. For example, within Falk's groups the motivation M18 (... I live locally/pass by and come to cast a glance over) was classified as "Rechargers" (Falk, 2009, p. 204). However, according to my interviews with participants, they chose this option mostly because that particular Ke Ji Guan was near to their hotel, or on their way to another place. To visit this Ke Ji Guan seemed convenient and they had time to spare. I therefore prefer not to classify this motivation as "Rechargers" but "Convenience Users". In the previous analysis, all of the groups I have classified come from a text analysis and my understanding of visitors' motivations-so an informed choice, but still based purely on my own judgement. An alternative and arguably more objective approach for quantitative data of this nature is to apply a statistical approach, the Exploratory Factor Analysis, to categorise motivations with similar characters.

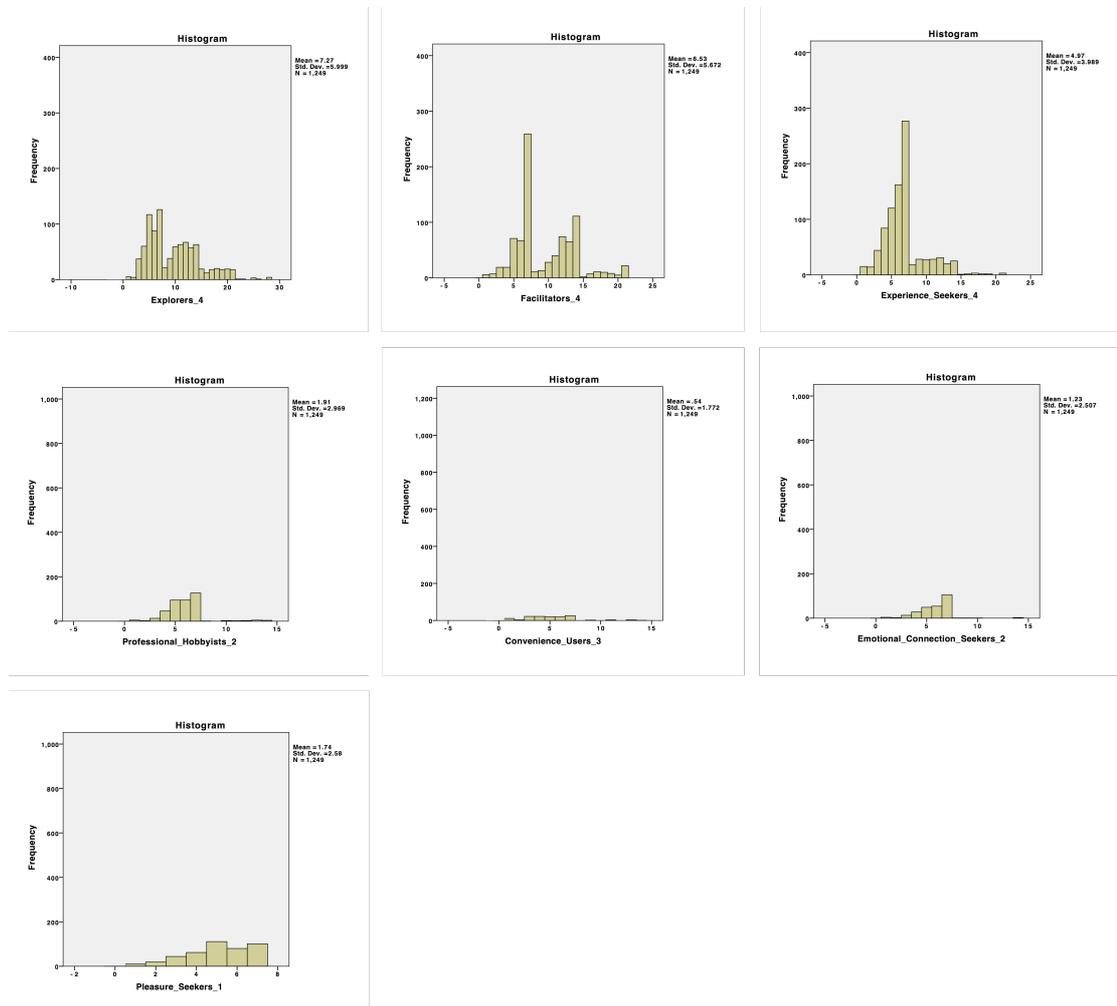
Factor analysis is an approach to statistically cluster variables, which share common features (Cohen et al., 2011). It is usually used to shrink a large number of variables to a smaller number in order to identify connections between variables or test an unconfirmed hypothesis (Cohen et al., 2011; Tabachnick & Fidell, 2013). Factor analysis has two main forms of calculation: the Exploratory Factor Analysis (EFA) and the Confirmatory Factor Analysis

(CFA). The EFA is employed to probe an unknown group and pattern of variables while CFA is usually used to test the confirmed factors or groups against a theoretical model (Cohen et al., 2011; Tabachnick & Fidell, 2013). In my project, I have no confirmed groups prior to statistical analysis. The identity groups described in Section 6.2 are based on Falk's literature and my understanding, but from the evidence above it is already doubtful that these groups are appropriate to my data collected within China. So I will use an EFA to explore possible underlying groupings of respondent motivations within my data.

### **6.3.1 Considerations of EFA validity**

For an EFA approach to be valid there are various necessary conditions that must be met. For one thing, it needs interval or ratio data (Cohen et al., 2011). I will use the respondents' scores of their chosen motivations, which were ranked from one (less important) to seven (very important). These are interval data. Another important assumption of conducting an EFA is that all variable data should be normally distributed (Cohen et al., 2011; Field, 2009; Tabachnick & Fidell, 2013). Unfortunately, as demonstrated by **Figure 28**, which shows the resulting histograms of the summed scores of the motivational statements within each identity group, my data is in non-normal distribution.

**Figure 28: Patterns of the summed scores for each of the identity groups<sup>100</sup>**



According to Field, I can transform my data if they fail to meet the normality assumption. The transformation would not change the data because the same calculating equation would be applied across the data set. Also, the relationships between data and variables will stay the same (Field, 2009). I have tried several ways (such as  $\log X$ ,  $\ln X$ ,  $\sqrt{X}$ ) to transform the data, but the results were not satisfactory. However, various respected quantitative

<sup>100</sup> These diagrams are included purely as indicative of the shape patterns produced; the individual axes and titles are not critical. The X-axes represent the possible summed score values (e.g. ranging from 0 to 28 for identity groups that contained four separate motivational statements); the Y values represent the frequencies of responses with those scores. Each diagram represents a different group, left to right and top to bottom: Explorers; Facilitators; Experience Seekers; Professional/hobbyists; Convenience Users; Emotional Connection Seekers; Pleasure Seekers.

researchers have argued that there are cases where an EFA based on non-normal data is still appropriate. For example, Tabachnick & Fidell suggested that while normally distributed data can strengthen the result of an EFA, a non-normal analysis is still worth performing (Tabachnick & Fidell, 2013). Field (2009) argued that the assumption of normality is most necessary when it is used to generalise the conclusion from the analysed samples to the whole population (Field, 2009). My plan is to conduct the EFA on my data collected at the three Ke Ji Guan in Beijing, Shanghai, and Shandong. I am not attempting to claim a conclusion for visitors in all Ke Ji Guan in China. So despite the non-normal distribution of my data an EFA is still a relevant approach to finding my participants' identity-related groups.

When it comes to the sample size, Comrey & Lee suggested that for an EFA 300 is good, 500 is very good and 1000 or more is excellent (Comrey & Lee, 1992). Other researchers suggested that the minimums for sample size include from 3 to 20 times the number of variables (Mundfrom, Shaw, & Ke, 2005). I have 20 variables (M21 "... Other" has been excluded in this analysis because it is an outlier with small numbers and no common meaning), and my sample size is N=1249. So it is more than sufficient to conduct the EFA.

Furthermore, EFA needs good values of sphericity, which means my data can be rotated well within the calculations performed by SPSS (Cohen et al., 2011). Sphericity represents the equality of variances of the differences between calculation levels (Field, 2009). The tests of sphericity related to EFA are the KMO test and the Bartlett test. The KMO test refers to the Kaiser-Mayer-Olkin test, which correlates pairs of variables and the magnitude of partial relationship between variables. A satisfactory KMO result corresponds to a

value greater than .6 (maximum is 1) (Cohen et al., 2011). Hutcheson (1999) suggested that the KMO value could vary from at least .5. He suggested that, .5-.7 is common, .7-.8 is good, .8-.9 is excellent and higher than .9 is perfect (Hutcheson, 1999, p. 244). The Bartlett's test of sphericity is used to present the statistical significance of data (Cohen et al., 2011; Tabachnick & Fidell, 2013). In my survey, I define the degree of statistical significance as .05 (as per the Chi-square test in Chapter 5). So if the result of the Bartlett's test shows  $p < .05$ , the samples are regarded as appropriate to conduct an EFA.

The remaining sections of this chapter present further details of the EFA (and associated) calculations. Given the complexity of these results, throughout this section I have shaded important numbers or values within the tables in order to facilitate readers' exploration of this work.

### 6.3.2 Whole dataset EFA

**Table 15** shows that for the EFA calculation with the whole dataset I have a Kaiser-Meyer-Olkin value of .65 and the Bartlett's test is  $< .00$ . Based on the criteria just discussed, these values both indicate that it is appropriate to conduct an EFA on my dataset as a whole.

**Table 15: KMO and Bartlett's Test (N=1249)**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.648
Bartlett's Test of Sphericity	Approx. Chi-Square	2437.316
	df	190
	Sig.	.000

When conducting EFA analysis there are various parameters that may be adjusted in order to seek the most appropriate calculation. One such parameter is whether the number of factors produced is open or fixed, and if fixed, then to what number. Adjusting the fixed number of factors allowed me to explore patterns in the resulting factors, and therefore better judge which were particularly robust. The results of calculations based on different extracted numbers of factors can be seen in **Table 16**. For clarity I have marked common motivation groupings across the calculations using different colours.

Table 16: The result of the EFA for different fixed numbers of factors (N=1249)

	F1	F2	F3	F4	F5	F6	F7	F8	F9
5 Factors	M2 M4 M6 M11 M14 M20	M12 M15 M17	M13 M18	M5 M9 M10	M1				
6 Factors	M2 M4 M6 M11 M14	M12 M15 M17 M20	M13 M18	M5 M9 M10	M1	M3 M19			
7 Factors	M2 M4 M6 M11 M14	M12 M15 M17	M13 M18	M5 M9	M16 M19	M1	M3 M7		
8 Factors	M2 M4 M6 M8 M11 M14	M9 M15 M20	M12 M17	M13 M18	M16 M19	M5	M1 M10	M3 M7	
9 Factors	M2 M4 M6 M8 M11 M14	M15	M12 M17	M13 M18	M5 M9	M16 M19	M1	M3 M20	M7 M10

As Falk and his colleagues argued, though theoretically people can have unlimited number of motivations, in practice the vast majority of visitors' express a finite number of identity-related reasons (Falk, 2011; Falk et al., 2007). It can be seen from **Table 16** that there are several clusters of motivational statements, which are common across multiple different calculations, as highlighted in the different colours. The seven fixed factors EFA calculation includes all six motivational groups common to at least three of the calculations, hence it has been chosen as the best overall representation for the final EFA calculation. Subsequent detailed results within this chapter are based on the seven-fixed factor calculation.

As Guadagnoli and Velicer found that, the most important aspects to impact the reliability of factor solutions were the absolute sample size and the absolute magnitude of factor loadings.<sup>101</sup> They argued that, factors with 10 or more loadings over 0.4 are reliable if the sample size is larger than 150 (Guadagnoli & Velicer, 1988). My sample size is 1249, so it is appropriate to suppress the smaller coefficients (those with absolute values below 0.4) in the SPSS calculation. As Field suggested, when SPSS calculates the EFA, I should employ the varimax rotation approach (Field, 2009). As Field argued, it is a way of trying to load more interpretable clusters of factors and it is a good method to facilitate the interpretation of factors (Field, 2009). Based on these approaches, I conducted the EFA using SPSS and the results are shown in **Table 17**.

---

<sup>101</sup> Factor loadings are in the format of numeric values, which refer to the relative contribution that a variable makes to a factor.

**Table 17: The clustered factors' loading scores after Exploratory Factor Analysis (N=1249)<sup>102</sup>**

	Component						
	1	2	3	4	5	6	7
M2	-.812						
M6	-.719						
M14	.576						
M4	-.563						
M11	.517						
M8							
M12		.643					
M17		.598					
M15		.412					
M20							
M13			.723				
M18			.572				
M10							
M5				.716			
M9				.651			
M19					.699		
M16					.631		
M1						.799	
M3							.651
M7							.620

<sup>102</sup> Note: The suppressed small coefficients' absolute value is below 0.4, so factor loadings less than 0.4 have not been displayed.

**Table 17** shows my original 20 motivational statements' factor loading scores on each factor, i.e. to what extent each motivational statement contributes to each factor. Statements have been clustered into seven separate factors. The first factor contains five separate motivational statements; the second factor contains three motivations; the sixth factor only has one statement, and all the remaining ones contain two motivational statements. In the table, there are some negative loading values for Factor 1, such as M2 (... I take my child to learn/expand horizon), M4 (... I take my child for fun) and M6 (... This is a good way to interact with my child/share quality time with my family/friends). According to Kline, the loadings' negative signs represent the direction of the correlation and do not impact on the interpretation of the magnitude of the factor loading or the number of factors to extract (Kline, 1994). In my case, these negative values mean that within this factor (Factor 1), these motivations have the opposite or negative correlations to the other motivations with positive values within the same factor (Field, 2009). So they can still be classified as one factor because they remain correlated with each other, however this difference needs to be taken into account when interpreting this particular factor.

Based on my EFA result (summarised in **Table 17**), 17 of my 20 motivation options can thus be classified into seven main factors. The next step is to determine how many of these factors are important and/or relevant to my research. Selecting factors is both an art and a science, and "there is debate over the criterion used to decide whether a factor is statistically important" (Field, 2009, p. 639). In my results,

**Table 16** indicates that the first six clustered factors are repeated for several different parameter settings in my EFA tests. So I have chosen the first six factors to be extracted as significant groupings within my dataset. They correspond to the following categories (note that for ease of discussion and comparison I have provided a descriptive label for each of these factors, based on common features of the motivation options contained within them):

- **F1: Benefit Seekers**

M2... I take my child to learn/expand horizon.

M4... I take my child for fun.

M6... This is a good way to interact with my child/share quality time with my family/friends.

M11... I come to relax/have fun.

M14... I come to satisfy my curiosity.

In this group, all the component motivations are about satisfying visitors' or other people's particular aims such as to learn, relax and explore. It can be seen from the **Table 17** that people who select M2, M4, M6 show an opposite correlation with those who select M11 and M14-that means people come EITHER relating to their children OR themselves, not a combination of the two.

- **F2: Science-related Fans**

M12... I am interested in science.

M15... I come to see the frontiers of science and the latest technologies.

M17... I am interested in science museums.

This category represents visitors who have a special interest in science-related contents such as that contained within science exhibitions, or even the Ke Ji Guan itself.

- **F3: Convenience Users**

M13... I come to use the facilities (e.g. climate control, seats, Wi-Fi).

M18... I live locally/pass by and come to cast a glance over.

This is a modified version of the previous similarly named category mentioned in Section 6.2. It represents people who attend a Ke Ji Guan for reasons relating to its facilities or because they happened to be in the vicinity, not for reasons associated with the Ke Ji Guan itself.

- **F4: Affirmation Seekers**

M5... I want to be able to tell other people that I have visited here.

M9... I love our country and want to see our latest developments in science and technology.

Here people who chose M5 and M9 were seeking a wider sense of worth or status, relating either to themselves or to the country as a whole.

- **F5: Opportunists**

M16... I come to see my friend/boyfriend/girlfriend/other people.

M19... I got a free ticket/I can get a ticket reimbursement.

This group is composed of respondents who visit a Ke Ji Guan to see something. Visitors within this category see their visits as an opportunity-either to get something for free that normally they would have to pay for, or to spend time with certain friends that they might not otherwise connect with.

- **F6: Professionals**

M1... I am here related to my study/work.

This group only have one statement of motivation, which is related to a professional goal, such as schoolteachers taking their students to visit a Ke Ji Guan as an out-of-class educational experience.

In summary, an Exploratory Factor Analysis was conducted on the 20 options with varimax rotation. The Kaiser–Meyer–Olkin measure verified the sampling adequacy for the analysis, KMO=.65. Bartlett’s test of sphericity  $\chi^2=2437.32$ ,  $p<.05$ , indicated that correlations between options were sufficiently large for the EFA. After rotation, six factors are kept as the final factors of the EFA. **Table 17** shows the factors’ loadings after rotation. Given the large sample numbers and the interpretation to the motivations that gather on the same groups suggests that:

- Factor 1 refers to Benefit Seekers;
- Factor 2 represents Science-related Fans;
- Factor 3 describes Convenience Users;
- Factor 4 refers to Affirmation Seekers;
- Factor 5 indicates Opportunists and

- Factor 6 describes Professionals.

Given the high sample sizes, and the theoretically diverse nature of the selected case study Ke Ji Guan (see Section 3.5.1 in Chapter 3), for each of the three Ke Ji Guan, I also conducted an EFA separately and attempted to interpret their individual factors. I applied the same methods and parameter settings as in the analysis of the combined data from the three Ke Ji Guan, and the results are shown as follows.

### 6.3.3 EFA results for CSTM Beijing

As demonstrated in **Table 18**, the Kaiser–Meyer–Olkin measure verified the sampling adequacy for the analysis,  $KMO=.62$ . Bartlett’s test of sphericity  $\chi^2=815.04$ ,  $p<.05$ , which indicated that correlations between options were sufficiently large for the EFA.

**Table 18: KMO and Bartlett’s Test, CSTM Beijing (n=414)**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy	.624
Bartlett's Test of Sphericity	Approx. Chi-Square
	815.036
	df
	190
	Sig.
	.000

For the second step in the calculations using just data from CSTM Beijing, I again conducted the EFA using different fixed numbers of factors (5, 6, 7, 8, and 9 factors). The results can be seen in **Table 19**. As before, commonly clustered motivations are marked in different colours.

Table 19: The results of the EFA for different fixed number of factors at the CSTM Beijing (n=414)

	F1 <sub>CSTM</sub>	F2 <sub>CSTM</sub>	F3 <sub>CSTM</sub>	F4 <sub>CSTM</sub>	F5 <sub>CSTM</sub>	F6 <sub>CSTM</sub>	F7 <sub>CSTM</sub>	F8 <sub>CSTM</sub>	F9 <sub>CSTM</sub>
5 Factors	M2 M4 M6 M8 M14	M9 M11 M16	M7 M13 M18 M20	M1 M10 M19	M3 M5 M12 M17				
6 Factors	M2 M4 M6 M11 M14	M11 M16 M19 M20	M12 M17	M7 M13 M18	M1 M10	M5 M9			
7 Factors	M2 M4 M6 M8 M14	M3 M12 M17	M7 M13 M18	M5 M9 M11	M20	M16 M19	M1 M10		
8 Factors	M2 M6 M11	M12 M17	M4 M8 M15	M7 M13 M18	M1 M10	M16 M19	M5 M9 M20	M3 M14	
9 Factors	M2 M6 M11 M20	M12 M17	M8 M15	M7 M13 M18	M1 M10	M16 M19	M4 M14	M5 M9	M3

**Table 19** indicates that in this case the EFA calculation based on eight factors is the best representation of the commonly clustered motivations across all of the calculations. So I set SPSS to extract eight factors when conducting the final EFA for CSTM Beijing. The result can be seen from **Table 20**.

**Table 20: The clustered factor loading scores after EFA, CSTM Beijing  
(n=414)<sup>103</sup>**

	Component							
	1	2	3	4	5	6	7	8
M2	-.761							
M6	-.705							
M11	.673							
M17		.738						
M12		.660						
M15			.767					
M8			.514					
M4			-.461					
M13				.658				
M7				.633				
M18				.601				
M1					.755			
M10					.509			
M19						.747		
M16						.709		
M5							.685	
M9							.615	
M20	.407						.412	
M3								.727
M14								.432

<sup>103</sup> Note: Factor loadings less than 0.4 have not been displayed.

As can be seen in **Table 20**, in the case of M20 (I regard here as a sight spot to visit for sight seeing), factor loadings appear in two separate columns (.407 and .412), indicating a case of cross loading. Yong and Pearce argue that too many cross loadings suggest the motivational statement is poorly written and had better be deleted. But the approaches to deal with the cross loadings vary according to different authors. For example some argue that choosing a different loading cut-off to make interpretation easier is also fine (Yong & Pearce, 2013). In my case, it can be seen from the **Table 20**, I only have one cross loading on M20, with factor loadings of .407 in Factor 1 and .412 in Factor 7 of the CSTM Beijing respectively. Whilst both factor loadings are comparatively small (remember the cut-off is only 0.4), the latter number is slightly larger. Furthermore, based on the statement contents, it is more conceptually sensible to classify M20 in the same group as M5 (... I want to be able to tell other people that I have visited here) and M9 (... I love our country and want to see our latest developments in science and technology), because it seems they are all related to sight seers. So M20 was finally assigned to Factor 7 of the CSTM Beijing (including M5, M9 and M20).

An EFA was computed using data only from CSTM Beijing with varimax rotation. Given the large sample numbers, and the results showed in **Table 19** and **Table 20**, the first seven factors were kept in the final analysis. **Table 20** shows the factors' loadings after rotation. Interpreting the motivations that gather on the same groups suggest the following seven factors at the CSTM Beijing. Note: It will be almost impossible to come up with factor names for every one of them, and in some cases to be honest the clusters for the individual museums don't seem all that relevant conceptually. So I Just call them **FX<sub>CSTM</sub>** instead of naming them as been done to the combined data. I will

apply the same way to carry out my analysis of the data from the SSTM Shanghai and SDSTM Shandong.

- **F1<sub>CSTM</sub>:**

M2... I take my child to learn/expand horizon.

M6... This is a good way to interact with my child/share quality time with my family/friends

M11... I come to relax/have fun.

Note: Here M2 and M6 are negative (**Table 20**), which shows opposite correlation with other motivational statements.

- **F2<sub>CSTM</sub>:**

M12... I am interested in science.

M17... I am interested in science museums.

- **F3<sub>CSTM</sub>:**

M4... I take my child for fun.

M8... I come to enrich myself.

M15... I come to see the frontiers of science and the latest technologies.

Note: M4 is negative (**Table 20**) that shows it has opposite relationship with M8 and M15 in this group.

- **F4<sub>CSTM</sub>:**

M7... I come for an affective reason connected to my family or my childhood.

M13... I come to use the facilities (e.g. climate control, seats, Wi-Fi).

M18... I live locally/pass by and come to cast a glance over.

- **F5<sub>CSTM</sub>:**

M1... I am here related to my study/work.

M10... I want to prepare myself for a future visit with my child.

- **F6<sub>CSTM</sub>:**

M16... I come to see my friend/boyfriend/girlfriend/other people.

M19... I got a free ticket/I can get a ticket reimbursement.

- **F7<sub>CSTM</sub>:**

M5... I want to be able to tell other people that I have visited here.

M9... I love our country and want to see our latest developments in science and technology.

M20... I regard here as a sight spot to visit for sight seeing.

### **6.3.4 EFA results for SSTM Shanghai**

As **Table 21** shows, the Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis with value of  $KMO=.64$ . Bartlett's test of sphericity  $\chi^2=937.76$ ,  $p<.05$ , which indicated that correlations between options were sufficiently large for the EFA.

**Table 21: KMO and Bartlett's Test, SSTM Shanghai (n=418)**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy	.643
Bartlett's Test of Sphericity Approx. Chi-Square	937.763
df	190
Sig.	.000

Then I carried out EFA by different fixed number of factors (5, 6, 7, 8, and 9 factors) using data from the SSTM Shanghai. The result of different extracted numbers of factors can be seen from. Gathered motivations are marked in different colours (**Table 22**).

Table 22: The result of the EFA for different fixed number of factors at the SSTM Shanghai (n=418)

	F1 <sub>SSTM</sub>	F2 <sub>SSTM</sub>	F3 <sub>SSTM</sub>	F4 <sub>SSTM</sub>	F5 <sub>SSTM</sub>	F6 <sub>SSTM</sub>	F7 <sub>SSTM</sub>	F8 <sub>SSTM</sub>	F9 <sub>SSTM</sub>
5 Factors	M2 M6 M11 M14 M20	M4 M12 M15 M17	M13 M16	M5 M7 M9 M10	M1 M18 M19				
6 Factors	M2 M4 M6 M11 M14	M8 M9 M15	M13 M16	M12 M17 M18	M1 M19 M20	M5 M7			
7 Factors	SPSS does not support to extract 7 factors for EFA.								
8 Factors	M2 M4 M6 M12	M11 M14	M13 M16	M9 M15 M20	M5 M7 M10	M1 M19	M8 M18	M3 M17	
9 Factors	M2 M4 M6 M12	M11 M14	M13 M16	M9 M20	M5 M10	M8 M18	M1 M17 M19	M7 M15	M3

Note: When I wanted to extract seven factors for the data of the SSTM Shanghai, the SPSS returned no results by giving: “Rotation failed to converge in 25 iterations.” Here the number 25 is an SPSS optional setting, Maximum Iterations for Convergence, which refers to the number of times that the SPSS will search for an optimal solution. 25 is a common setting (Field, 2009). The failure means under the setting of Maximum Iterations for Convergence as 25, the SPSS cannot calculate the EFA by a fixed factor number of seven or it is nonsense to extract seven factors by the same conditions with other similar calculations.

**Table 22** indicates that the EFA way of extracting eight factors can get more repeated gathering motivation groups. So I will arrange SPSS to extract eight factors when conducting the calculation as my final result of the EFA for the SSTM Shanghai. The results can be seen as **Table 23**.

**Table 23: The clustered factors' loading scores after EFA, SSTM  
Shanghai (n=418)<sup>104</sup>**

	Component							
	1	2	3	4	5	6	7	8
M6	-.742							
M2	-.732							
M4	-.731							
M12	.468							
M14		-.698						
M11		-.680						
M13			.783					
M16			.731					
M15				.674				
M9				.542				
M20				-.502				
M5					.593			
M7					-.575			
M10					.531			
M19						.620		
M1						.551		
M18							-.679	
M8							.567	
M3								-.714
M17								.598

<sup>104</sup> Note: Factor loadings less than 0.4 have not been displayed.

An EFA was computed using data only from SSTM Shanghai with varimax rotation. Given the large sample numbers, and the results showed in **Table 22** and **Table 23**, the first seven factors would be kept in the final analysis. **Table 23** shows the factors' loadings after rotation. Interpreting the motivations that gather on the same groups suggest the following seven factors at the SSTM Shanghai.

- **F1<sub>SSTM</sub>:**

M2... I take my child to learn/expand horizon.

M4... I take my child for fun.

M6... This is a good way to interact with my child/share quality time with my family/friends

M12... I am interested in science.

Note: M2, M4 and M6 shows negative values.

- **F2<sub>SSTM</sub>:**

M11... I come to relax/have fun.

M14... I come to satisfy my curiosity.

Note: M11 and M14 are negative.

- **F3<sub>SSTM</sub>:**

M13... I come to use the facilities (e.g. climate control, seats, Wi-Fi).

M16... I come to see my friend/boyfriend/girlfriend/other people.

- **F4<sub>SSTM</sub>:**

M9... I love our country and want to see our latest developments in science and technology.

M15... I come to see the frontiers of science and the latest technologies.

M20... I regard here as a sight spot to visit for sight seeing.

Note: M20 is negative.

- **F5<sub>SSTM</sub>:**

M5... I want to be able to tell other people that I have visited here.

M7... I come for an affective reason connected to my family or my childhood.

M10... I want to prepare myself for a future visit with my child.

Note: M7 is negative.

- **F6<sub>SSTM</sub>:**

M1... I am here related to my study/work.

M19... I got a free ticket/I can get a ticket reimbursement.

- **F7<sub>SSTM</sub>:**

M8... I come to enrich myself.

M18... I live locally/pass by and come to cast a glance over.

Note: M18 is negative.

### 6.3.5 EFA results for SDSTM Shandong

Firstly, the **Table 24** shows that, the Kaiser–Meyer–Olkin measure verified the sampling adequacy for the analysis, KMO=.60. Bartlett’s test of sphericity  $\chi^2=1049.02$ ,  $p<.05$ , which indicates that correlations between options were sufficiently large for the EFA.

**Table 24: KMO and Bartlett's Test, SDSTM Shandong (n=417)**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.601
Bartlett's Test of Sphericity	Approx. Chi-Square	1049.022
	df	190
	Sig.	.000

Then I conducted EFA by different fixed number of factors (5, 6, 7, 8, and 9 factors) using data from the SDSTM Shandong. The result of different extracted numbers of factors can be seen from **Table 25**. Gathered motivations are marked in different colours.

**Table 25** suggests that the EFA way of extracting eight factors can get more repeated gathering motivation groups. So I will arrange SPSS to extract eight factors when conducting the calculation as my final result of the EFA for the SDSTM Shandong. The results can be seen from **Table 26**.

Table 25: The result of the EFA in different fixed number of factors at the SDSTM Shandong (n=417)

	F1 <sub>SDSTM</sub>	F2 <sub>SDSTM</sub>	F3 <sub>SDSTM</sub>	F4 <sub>SDSTM</sub>	F5 <sub>SDSTM</sub>	F6 <sub>SDSTM</sub>	F7 <sub>SDSTM</sub>	F8 <sub>SDSTM</sub>	F9 <sub>SDSTM</sub>
5 Factors	M2 M4 M6 M8 M14	M9 M11 M15 M16	M10 M13 M18	M1 M12 M17	M5 M20				
6 Factors	M2 M4 M6 M8 M14	M9 M15 M20	M3 M16 M19	M10 M13 M18	M1 M12 M17	M5 M7			
7 Factors	M2 M4 M6 M8 M14	M9 M15 M20	M10 M11 M16	M1 M12 M17	M13 M18	M5	M3 M7 M19		
8 Factors	M2 M4 M6 M8 M14	M12 M17	M10 M11 M16	M9 M15 M20	M13 M18	M5	M3 M19	M1 M7	
9 Factors	M2 M4 M6 M8 M11 M14	M12 M17	M9 M15 M20	M13 M18	M16 M19	M5	M3	M10	M1 M7

**Table 26: The clustered factors' loading scores after EFA, SDSTM Shandong (n=417)<sup>105</sup>**

	Component							
	1	2	3	4	5	6	7	8
M2	-.843							
M6	-.752							
M4	-.644							
M14	.563							
M8	.443							
M17		-.783						
M12		-.622						
M16			.640					
M11			.525					
M10			-.459					
M9				.772				
M15				.506				
M20		.448		-.468				
M13					.705			
M18					.675			
M5						.815		
M3							-.708	
M19			.401				.476	
M1								.834
M7							-.413	-.456

It can be seen from the **Table 26** that, there are also some cross loadings in the EFA of SDSTM Shandong. Here I also follow the previous approach I

<sup>105</sup> Note: Factor loadings less than 0.4 have not been displayed.

indicated to deal with the cross loadings in **Table 20**. I will allocate the motivational statements with cross loadings according to the loading values. For example, for M19 (...I got a free ticket/I can get a ticket reimbursement) with loadings as .401 and .476, I will classify M19 to the Factor 7<sub>SDSTM</sub> rather than Factor 3<sub>SDSTM</sub> because M19 has a greater loading value (.476) on Factor 7<sub>SDSTM</sub>.

An EFA was computed using data only from SDSTM Shandong, again with varimax rotation. Given the large sample numbers, and the results showed in **Table 25** and **Table 26**, the first seven factors would be kept in the final analysis. **Table 26** shows the factors' loadings after rotation. Interpreting the motivations that gather on the same groups suggest the following seven factors at the SDSTM Shandong.

- **F1<sub>SDSTM</sub>:**

M2... I take my child to learn/expand horizon.

M4... I take my child for fun.

M6... This is a good way to interact with my child/share quality time with my family/friends.

M8... I come to enrich myself.

M14... I come to satisfy my curiosity.

Note: M2, M4 and M6 are negative.

- **F2<sub>SDSTM</sub>:**

M12... I am interested in science.

M17... I am interested in science museums.

Note: M12 and M17 are negative.

- **F3<sub>SDSTM</sub>:**

M10... I want to prepare myself for a future visit with my child.

M11... I come to relax/have fun.

M16... I come to see my friend/boyfriend/girlfriend/other people.

Note: M10 is negative.

- **F4<sub>SDSTM</sub>:**

M9... I love our country and want to see our latest developments in science and technology.

M15... I come to see the frontiers of science and the latest technologies.

M20... I regard here as a sight spot to visit for sight seeing.

Note: M20 is negative.

- **F5<sub>SDSTM</sub>:**

M13... I come to use the facilities (e.g. climate control, seats, Wi-Fi).

M18... I live locally/pass by and come to cast a glance over.

- **F6<sub>SDSTM</sub>:**

M5... I want to be able to tell other people that I have visited here.

- **F7<sub>SDSTM</sub>:**

M3... I take my family/friends to learn/expand horizon.

M19... I got a free ticket/I can get a ticket reimbursement.

Note: M3 is negative.

## 6.4 Comparison of EFA factors

On the basis of the EFA calculations for each single Ke Ji Guan (see Section 6.3.3 to 6.3.5), the three case study Ke Ji Guan demonstrate different factors to the combined data. The whole list of the component factors calculated individually for each Ke Ji Guan can be seen in **Table 27**.

**Table 27: Summary of the retrained factors at the three chosen Ke Ji Guan**

	Combined Data	CSTM Beijing	SSTM Shanghai	SDSTM Shandong
<b>Factor 1</b>	M2 M4 M6 M11 M14	M2 M6 M11	M2 M4 M6 M12	M2 M4 M6 M8 M14
<b>Factor 2</b>	M12 M15 M17	M12 M17	M11 M14	M12 M17
<b>Factor 3</b>	M13 M18	M4 M8 M15	M13 M16	M10 M11 M16
<b>Factor 4</b>	M5 M9	M7 M13 M18	M9 M15 M20	M9 M15 M20
<b>Factor 5</b>	M16 M19	M1 M10	M5 M7 M10	M13 M18
<b>Factor 6</b>	M1	M16 M19	M1 M19	M5
<b>Factor 7</b>	/	M5 M9 M20	M8 M18	M3 M19

**Table 27** shows that, there are loads of similarities in these three Ke Ji Guan and the combined data. I have marked them by different colours. It can be seen that at least four cluster of motivations are consistent, though obviously with some variations. The shared motivations that are repeated for (at least) three times are as follows:

- M2, M4 and M6;
- M12 and M17;
- M13 and M18;

- M9 and M20.

Except for these clusters, motivational categories in the three Ke Ji Guan vary obviously. So this condition suggests that the individual Ke Ji Guan calculations being potentially less robust than the overall dataset in terms of consistency of clustered motivations across different EFA parameters. So in the next sections, I will only use the combined data to explore the correlations between visitors' demographics and identity-related motivations.

## **6.5 Chapter summary**

In this chapter, I focused on the research questions of “What are the visitors' identity-related motivations of attending a Ke Ji Guan?” My analysis showed that the three Ke Ji Guan show broad similarities in the distribution patterns of visitors' reported motivations. Furthermore, CSTM Beijing and SSTM Shanghai shared more similarities whilst SDSTM Shandong demonstrated some differences to the other two locations. For example, CSTM Beijing and SSTM Shanghai both indicated M2 (... I take my child to learn/expand horizon) and M6 (... This is a good way to interact with my child/share quality time with my family/friends) were the top two motivations, both of which related to family experiences. However, for SDSTM Shandong, it's most popular option was M12 (... I am interested in science). The analysis suggested Shandong visitors tended to regard Ke Ji Guan as a place to learn rather than to have fun.

Based on my analysis and my understanding of the visitors' motivations, I manually classified the visitors' identity-related motivations into seven identity groups: Explorers, Facilitators, Experience Seekers, Professional/Hobbyists, Convenience Users, Emotional Connection Seekers, and Pleasure Seekers. Though they look similar to many of Falk's categories (such as the Explorers and Facilitators), they actually have subtle differences from Falk's groups. However, this classification was purely based on my own judgement, and

arguably lacked methodological rigour. For this reason I applied an alternative approach for quantitative data of this nature to categorise motivations with similar characteristics: Exploratory Factor Analysis (EFA).

The results of the EFA indicated that my motivational statement options could be classified into seven factors, the first six of which should be extracted as significant groups within my dataset. The selected factors were: Factor 1 Benefit Seekers, Factor 2 Science-related Fans, Factor 3 Convenience Users, Factor 4 Affirmation Seekers, Factor 5 Opportunists, and Factor 6 Professionals. When it comes to each Ke Ji Guan, their individual EFA results revealed that there are similarities in these three Ke Ji Guan and the combined data. Except for those similar clusters, motivational categories in the three Ke Ji Guan vary obviously. So this condition suggests that the individual Ke Ji Guan calculations may be less robust than the overall dataset in terms of consistency of clustered motivations across different EFA patterns. So in the next chapter, only combined data will be used to explore the correlations between visitors' demographics and identity-related motivations.

## **7 Correlations between Visitors' Demographics and Motivations**

In this chapter, Non-parametric statistical approaches, such as Mann–Whitney U test and Kruskal–Wallis test, will be employed to probe the correlation between visitors' motivational factors and their demographics. This chapter will also combine the two perspectives (visitor motivations and demographic data) to provide an overall picture of visitors' identities at the three Ke Ji Guan within China.

### **7.1 Genders vs factors**

As I mentioned in my Chapter 3, one of my research questions is to explore any correlations between visitors' motivations and their demographics. Based on an EFA conducted with the overall dataset, the main visitor groups in my project were Factor 1 Benefit Seekers, Factor 2 Science-related Fans, Factor 3 Convenience Users, Factor 4 Affirmation Seekers, Factor 5 Opportunists and Factor 6 Professionals. In this section, I will explore the correlations between these over-arching identity-related visitor groups and visitors' demographic information through the application of appropriate statistical approaches.

All my independent data such as genders, age groups and education levels are nominal and non-parametric data while the factor loading scores calculated by the EFA are continuous data (Cohen et al., 2011). If I want to find out the differences between a variable containing two categories (for example male and female) with a variable containing continuous data (for instance the factor loading scores), I can apply a particular type of non-parametric test, the Mann–Whitney U test (Cohen et al., 2011; Field, 2009; Pallant, 2013).

The Mann–Whitney U test is based on a 2-tailed analysis approach with a non-directional assumption, such as “there is no statistically significant difference between the calculated groups” (Cohen et al., 2011). The statistically significant difference level was defined as  $\alpha < .05$  as per previous tests (see Chapter 5). If the value is smaller than .05, then the compared groups are regarded to have a statistically significant difference.

Note that when I present data tables within this section, important cells (e.g. those showing statistical significance) have been shaded to facilitate readers’ exploration of this work.

Using SPSS a Mann-Whitney U test was conducted to explore differences between visitors’ gender and my six identity factors. The results of this calculation are shown in the following output, **Table 28**.

**Table 28: Results of the Mann–Whitney U tests between visitors’ genders and my six identity factors (N=1241)<sup>106</sup>**

	F1 Benefit Seekers	F2 Science-related Fans	F3 Convenience Users	F4 Affirmation Seekers	F5 Opponents	F6 Professionals
Mann-Whitney U	174665.50	166213.500	167060.500	177793.50	172319.5	177237.500
Wilcoxon W	484743.50	476291.500	477138.500	281078.50	482397.5	487315.500
Z	-.655	-2.045	-1.906	-.141	-1.041	-.232
Asymp. Sig. (2-tailed) <sup>107</sup>	.512	.041	.057	.888	.298	.816

There is only one result where  $p < .05$ , suggesting that males and females show statistically significant difference only on F2 Science-related Fans ( $p < .05$ ). This is to say there is a connection between gender and F2. In order to explore what the relationship was between them, I also calculated their median values of factor scores<sup>108</sup> calculated by EFA on F2 particularly (**Table 29**).

**Table 29: Medians of visitors’ factor scores of F2 by visitors’ genders (N=1241)**

Gender	N	Median
Male	454	-.0442052
Female	787	-.1115885
Total	1241	-.0930027

<sup>106</sup> Here I only included the participants who chose “Male” or “Female”. People who marked “Prefer not to say” were excluded because those answers have less meaning for my research, and invalidate the two-category Mann-Whitney U test approach.

<sup>107</sup> The Mann–Whitney U test applies the “Asymp. Sig. (2-tailed)” to represent the statistically significant level using the Greek character “p” to indicate the value of calculation (Field, 2009).

<sup>108</sup> Factor scores refer to each sample’s score on particular factor, and it shows the sample’s tendency on this particular factor. It is the saved result of the EFA and can be used for further analysis such as comparing their median to explore different sample groups’ preferences on some particular factors as I did in this section.

Pallant suggests that the median value of factor scores could be used to show the direction of difference (Pallant, 2013). As shown in **Table 29**, there are negative values. As I explained in Chapter 6, section 6.3, the negative sign refers to an opposite correlation. **Table 29** therefore indicates that females show less preference to be Science-related Fans due to the smaller value of their factor scores median than males (-.11<-.04).

## 7.2 Residences vs factors

I conducted Mann–Whitney U Tests on visitors’ residences and factors using the same approach and analysis settings as per section 7.1. The results of the visitors’ residences vs factors calculations are shown in **Table 30** and **Table 31**.

**Table 30: Results of the Mann–Whitney U Tests between visitors’ residences and my six identity factors (N=1247)**

	F1 Benefit Seekers	F2 Science-related Fans	F3 Convenience Users	F4 Affirmation Seekers	F5 Opportunists	F6 Professionals
Mann-Whitney U	171193.00	172922.000	188820.000	176032.000	174926.000	187969.000
Wilcoxon W	315646.000	317375.000	333273.000	428437.000	319379.000	440374.000
Z	-3.088	-2.813	-.288	-2.319	-2.495	-.423
Asymp. Sig. (2-tailed)	.002	.005	.773	.020	.013	.672

**Table 31: Medians of visitors' factor scores of F1, F2, F4 and F5 by visitors' residences (N=1247)**

Residences		F1 Benefit Seekers	F2 Science-related Fans	F4 Affirmati on Seekers	F5 Oppor tunists
Beijing/Shanghai/Ji-nan	N	710	710	710	710
	Median	.1705787	-.0477042	-.3956956	-.1257130
Outside	N	537	537	537	537
Beijing/Shanghai/Ji-nan	Median	-.3182697	-.1615632	-.3449348	-.1714780
Total	N	1247	1247	1247	1247
	Median	-.0655729	-.0925260	-.3723536	-.1435887

**Table 30** indicates that there are statistically significant differences between visitors from local cities (Beijing/Shanghai/Ji-nan) and from out-of-town (Outside Beijing/Shanghai/Ji-nan) for my identity categories of F1 Benefit Seekers, F2 Science-related Fans, F4 Affirmation Seekers and F5 Opportunists ( $p < .05$  in all these cases). This result demonstrates that the visitors' residences have obvious statistical correlation with these factors. As **Table 31** suggests, local visitors seem much less likely to visit a Ke Ji Guan as Affirmation Seekers (F4) as indicated by a larger negative median value (-.40). By contrast, though negative, the larger number (-.32) suggests that out-of-town visitors were highly unlikely to be motivated by F1. The reason for this phenomenon may be that a Ke Ji Guan is more likely to be regarded as a

sightseeing spot by visitors from other cities, who are tourists. Conceptually, it is understandable that tourists want to have an experience of visiting certain places in order that they can talk about this to other people. However, locals appear to mainly use Ke Ji Guan to seek Benefit (F1) rather than Affirmation (F4). Out-of-town people also show a bit higher negative factor scores median value on F2 Science-related Fans (-.16) and F5 Opportunists (-.17), which means they do not tend to be Science-related Fans and Opportunists. But actually, both of these data are very low in absolute values that do not indicate very strong trends.

### 7.3 Age groups vs factors

The Mann–Whitney U Test can only analyse the difference between two categories within a variable, therefore I cannot apply the same approach to the age groups, where there are at least four categories. Instead, I used another nonparametric test, the Kruskal–Wallis (K-W) Test, which can process more than two groups of samples (Cohen et al., 2011; Field, 2009; Pallant, 2013). The result of Kruskal–Wallis Test can be seen in **Table 32**.

**Table 32: Results of the Kruskal–Wallis Test between visitors’ age groups and my six identity factors (N=1249)**

	F1 Benefit Seekers	F2 Science-related Fans	F3 Convenience Users	F4 Affirmation Seekers	F5 Opportunists	F6 Professionals
Chi-Square	550.422	29.661	14.300	53.788	16.372	7.129
df	5	5	5	5	5	5
Asymp. Sig. <sup>109</sup>	.000	.000	.014	.000	.006	.211

<sup>109</sup> The “Asymp. Sig” also refers to the significant value “p”.

Strong statistically significant differences according to age categories are observed on F1, F2, F3, F4 and F5 with  $p < .05$  in each case. However, like the Chi-square test, the K-W Test can only show overall statistical differences. It does not indicate where the differences in fact lie, i.e. what trends might be predicted according to an individual respondent's age group (Field, 2009). In order to find out where the exact differences are, I conducted Mann–Whitney U Tests inside the variable of age groups following the findings of the above Kruskal–Wallis Test (Field, 2009; Pallant, 2013). Because there are in total 15 pairs of Mann–Whitney U tests, the original  $\alpha = .05$  is no longer appropriate as an indication of significance. It has to be divided into smaller subdivisions. The new  $\alpha = .05/15 = .003$  (Field, 2009; Pallant, 2013). The results of the individual Mann-Whitney U tests can be seen in **Table 33**.

**Table 33: The results of the Mann–Whitney U Test inside age groups with F1, F2, F3, F4 and F5<sup>110</sup>**

Compared pairs	$\rho$ F1 Benefit Seekers	$\rho$ F2 Science-related Fans	$\rho$ F3 Convenience Users	$\rho$ F4 Affirmation Seekers	$\rho$ F5 Opportunists
Group 1 vs Group 2	.000	.000	.017	.096	.004
Group 1 vs Group 3	.000	.007	.004	.580	.091
Group 1 vs Group 4	.000	.966	.986	.029	.092

<sup>110</sup> Note: I have six age groups (in years): Group 1: 16-25, Group 2: 26-35, Group 3: 36-45, Group 4: 46-55, Group 5: 56-65, and Group 6: >65.

Group 4					
Group 1 vs Group 5	.000	.041	.886	.000	.804
Group 1 vs Group 6	.000	.550	.277	.000	.440
Group 2 vs Group 3	.000	.186	.477	.264	.118
Group 2 vs Group 4	.160	.145	.493	.080	.357
Group 2 vs Group 5	.002	.001	.250	.000	.075
Group 2 vs Group 6	.326	.050	.029	.002	.015
Group 3 vs Group 4	.001	.354	.379	.046	.153
Group 3 vs Group 5	.000	.003 <sup>111</sup>	.156	.000	.143
Group 3 vs Group 6	.002	.127	.014	.001	.034
Group 4 vs Group 5	.673	.117	.902	.049	.073
Group 4 vs Group 6	.579	.624	.456	.639	.024
Group 5 vs Group 6	.296	.563	.479	.034	.760

<sup>111</sup> This value is actual .00327 if five decimals are allowed. So it is greater than .003.

It can be seen from **Table 33** that F1 Benefit Seekers have 10 out of 15 compared pairs of age groups showing statistically significant differences between each other ( $p < .003$ ). So age groups clearly have a strong correlation within F1. For F2 Science-related Fans, there are only two compared pairs representing statistically significant differences ( $p < .003$ ). In terms of F4 Affirmation Seekers, there are six compared pairs of age groups showing statistically significant differences between each other ( $p < .003$ ). There is no single  $p < .003$  on F3 Convenience Users or F5 Opportunists, which indicates that age doesn't really play important role on F3 and F5 or the correlation between age groups and F3 and F5 is very weak.

In order to find out the correlations between age groups on F1, F2 and F4, I calculated their medians as shown in **Table 34**.

**Table 34: Medians of visitors' factor scores of F1, F2, and F4 by visitors' age groups (N=1249)**

Age groups (in years):		F1 Benefit Seekers	F2 Science- related Fans	F4 Affirmation Seekers
16-25	N	410	410	410
	Median	.9557900	.1097880	-.4299963
26-35	N	450	450	450
	Median	-.5272785	-.2487091	-.3716034
36-45	N	310	310	310
	Median	-.8310889	-.1964079	-.4064938
46-55	N	22	22	22
	Median	-.0454400	.1353320	-.1690867
56-65	N	32	32	32
	Median	-.1009312	.8017205	1.5761569
More than 65	N	25	25	25
	Median	-.2582733	.2209737	.6480613
Total	N	1249	1249	1249
	Median	-.0655729	-.0910313	-.3723536

**Table 34** suggests that visitors aged 16-25 years old clearly tend to visit the case study Ke Ji Guan as F1 Benefit-Seekers (factor scores median=.96) while visitors aged 26-35 and 36-45 shows obvious disconnect on this factor (negative factor scores median value=-.53 and -.83 separately). The remaining groups do not show particular tendency towards or against F1. Visitors aged

56-65 show more preference on both F2 Science-related Fans and F4 Experience-Seekers with their highest factor scores median=.80 and 1.58 separately.

#### 7.4 Previous visit attendances vs factors

In order to explore the association between the number of times a visitor had been at Ke Ji Guan previously, and their motivation factors, I applied the same Kruskal–Wallis Test used in the last section (Section 7.3). I also conducted a factor scores' median value calculation to probe the internal trends on factors based on repeated visits or not. The results can be seen in **Table 35**, **Table 36**, and **Table 37**.

**Table 35: Results of the Kruskal–Wallis Test between the number of times a visitor had attended the Ke Ji Guan in the past and my six identity factors (N=1249)**

	F1 Benefit Seekers	F2 Science-related Fans	F3 Convenience Users	F4 Affirmation Seekers	F5 Opportunists	F6 Professionals
Chi-Square	51.313	3.791	10.397	19.438	8.930	1.438
df	2	2	2	2	2	2
Asymp. Sig.	.000	.150	.006	.000	.012	.487

**Table 36: The results of the Mann–Whitney U Test comparing previous visit history with F1, F3, F4 and F5<sup>112</sup>**

Compared pairs	$\rho$ F1 Benefit Seekers	$\rho$ F3 Convenience Users	$\rho$ F4 Affirmation Seekers	$\rho$ F5 Opportunists
1st time vs 2nd time	.010	.866	.000	.011
1st time vs More than twice	.000	.001	.016	.041
2nd time vs More than twice	.001	.027	.113	.554

**Table 37: Medians of visitors' factor scores in different numbers of previous visits on F1, F3, F4 and F5 (N=1249)**

Previous visit experience		F1 Benefit Seekers	F3 Convenience Users	F4 Affirmation Seekers	F5 Opportunists
1st	N	826	826	826	826
	Median	.1705787	-.1902708	-.3253334	-.1792031
2nd	N	187	187	187	187
	Median	-.0894257	-.1284281	-.4938893	-.0504555
More than twice	N	236	236	236	236
	Median	-.5453157	-.0554421	-.4300295	-.0902660
Total	N	1249	1249	1249	1249
	Median	-.0655729	-.1562879	-.3723536	-.1472321

<sup>112</sup> Note: In this case, because there are three pairs variables to compare, so the  $\alpha=.05/3=.017$ .

**Table 35** indicates that the number of previous visits to Ke Ji Guan has a significant association with F1 Benefit Seekers, F3 Convenience Users, F4 Affirmation Seekers and F5 Opportunists (all  $p < .05$ ) while both F2 Science-related Fans and F6 Professionals show no significant relationship with visitors' previous visit history. The new  $\alpha = .05/3 = .017$ . **Table 36** indicates that F1 has a stronger correlation with all groups associated with previous visit history ( $p < .017$ ) while on the other factors, the correlation seems weaker: only one cell shows  $p < .017$  (F3 and F5), and whilst two cells are correlated for F4, for one of those the  $p$ -value is very close to  $\alpha$  (.016).

Additionally, **Table 37** reveals that, fresh visitors have a bit more preference for attend Ke Ji Guan as Benefit Seekers with a small but positive median number of .17. Visitors who visit the case Ke Ji Guan for more than twice are highly unlikely to seek benefit at Ke Ji Guan with a larger negative factor scores' median value of -.55. Respondents who visit the case Ke Ji Guan for the second time and more than twice both had less likelihood of being F4 Affirmation Seekers (-.49 and -.43). Though also showed correlations in **Table 36**, all data about F3 and F5 are relatively too small to make strong pattern.

## **7.5 Educational qualifications vs factors**

In this section, I present the findings from Kruskal–Wallis Test, Mann–Whitney U Tests and factor scores' median calculations to probe the association between visitors' educational qualifications and my six identity factors. The results are shown in **Table 38**, **Table 39** and **Table 40**.

**Table 38: Results of the Kruskal–Wallis Tests between visitors’ education groups and my six identity factors (N=1247)**

	F1 Benefit Seekers	F2 Science-related Fans	F3 Convenience Users	F4 Affirmation Seekers	F5 Opportunists	F6 Professionals
Chi-Square	197.974	15.308	19.630	38.415	9.566	4.837
df	7	7	7	7	7	7
Asymp. Sig.	.000	.032	.006	.000	.215	.680

**Table 39: The results of the Mann–Whitney U Tests comparing paired educational qualification groups with F1, F2, F3 and F4<sup>113</sup>**

Compared pairs	pF1 Benefit Seekers	pF2 Science-related Fans	pF3 Convenience Users	pF4 Affirmation Seekers
Group 1 vs Group 2	.205	.956	.394	.196
Group 1 vs Group 3	.032	.325	.594	.801
Group 1 vs Group 4	.786	.619	.426	.848
Group 1 vs Group 5	.706	.850	.296	.653
Group 1 vs Group 6	.252	.899	.484	.340
Group 1 vs Group 7	.218	.538	.945	.682
Group 1 vs Group 8	.929	.697	.674	.652
Group 2 vs Group 3	.001	.022	.365	.005

<sup>113</sup> Because there are 28 pairs of variable to compare, the new  $\alpha = .05 / 28 = .002$ . Note: There are eight educational qualification groups within my data set: Group 1: Primary school, Group 2: Secondary school, Group 3: High school/Zhongzhuan, Group 4: Bachelor degree or equivalent, Group 5: Masters degree or equivalent, Group 6: Doctorate or equivalent, Group 7: Vocational qualification, and Group 8: Associate degree.

Group 2 vs Group 4	.002 <sup>114</sup>	.271	.840	.000
Group 2 vs Group 5	.036	.789	.219	.000
Group 2 vs Group 6	.000	.656	.578	.000
Group 2 vs Group 7	.503	.419	.067	.100
Group 2 vs Group 8	.000	.383	.285	.013
Group 3 vs Group 4	.000	.004	.019	.005
Group 3 vs Group 5	.000	.006	.003	.005
Group 3 vs Group 6	.000	.312	.233	.024
Group 3 vs Group 7	.082	.319	.171	.607
Group 3 vs Group 8	.000	.019	.770	.446
Group 4 vs Group 5	.569	.353	.089	.288
Group 4 vs Group 6	.008	.914	.577	.111
Group 4 vs Group 7	.005	.913	.014	.085
Group 4 vs Group 8	.378	.851	.029	.001
Group 5 vs Group 6	.006	.753	.759	.253
Group 5 vs Group 7	.020	.427	.003	.031
Group 5 vs Group 8	.270	.440	.004	.001
Group 6 vs Group 7	.002 <sup>115</sup>	.754	.071	.035
Group 6 vs Group 8	.010	.943	.187	.007
Group 7 vs Group 8	.002 <sup>116</sup>	.815	.217	.853

<sup>114</sup> This value is actually 0.0025 if four decimals can be showed.

<sup>115</sup> This value is actually 0.0015 if four decimals can be showed.

<sup>116</sup> This value is actually 0.0017 if four decimals can be showed.

**Table 40: Medians of visitors' factor scores' with different educational qualifications on (N=1247)**

Educational qualifications		F1 Benefit Seekers	F4 Affirmation Seekers
Primary school	N	6	6
	Median	-.5071471	-.4233375
Secondary school	N	48	48
	Median	.0374178	.0798764
High school/Zhong zhuan	N	389	389
	Median	.7312093	-.2874554
Bachelor degree or equivalent	N	473	473
	Median	-.4847745	-.4288084
Master degree or equivalent	N	94	94
	Median	-.4834534	-.5048464
Doctorate or equivalent	N	19	19
	Median	-1.0619895	-.6142448
Vocational qualification	N	38	38
	Median	.3265504	-.2293755
Associate degree	N	180	180
	Median	-.5960179	-.3234005
Total	N	1247	1247
	Median	-.0655729	-.3723536

The visitors' educational qualifications show significant associations with my identity factors of F1 Benefit Seekers, F2 Science-related Fans, F3 Convenience Users, and F4 Affirmation Seekers (**Table 38**). With further interpretation using **Table 39**, there are 9 out of 28 pairs of variables having a  $p$  less than .002, which means that the visitors' educational qualifications have

significant relations to F1 Benefit Seekers. With five out of 28 pairs of variables showing a  $p$  less than .002, F4 Affirmation Seekers also indicates significant correlations with visitors' educational qualifications. However, though F2 and F3 also show connections with education levels, their associations may be very weak for there is no cell less than .002 on both F2 and F3 (**Table 39**).

When it comes to the detailed comparisons, visitors with highest education of High school/Zhongzhuan indicate a strong trend to be Benefit Seekers with a factor score median value of .73 (**Table 40**). The Doctorate or equivalent visitors seems very reluctant to be Affirmation Seekers indicated by high negative factor score median value (-.61). Visitors with a Masters degree or equivalent also show higher negative factor scores (median value -.50) on F4. This means post graduate visitors have less likelihood to be F4 Affirmation Seekers than other groups.

## **7.6 Chapter summary**

In this chapter, I focused on the research questions of "What are the relationships between visitors' demographics and their identity-related motivations?" I conducted Mann–Whitney U tests, Kruskal–Wallis tests, and factor scores' median calculations to probe the correlations between visitors' demographics and their identity related motivations.

The results indicated that females show less preference to be Science-related Fans than males. Local visitors have a stronger motivation of seeking benefit, while they seem less likely to visit a Ke Ji Guan as Affirmation Seekers. By contrast, out-of-town visitors show less likelihood to be Benefit seekers. In terms of the connections between ages and identities, age groups clearly have strong correlation within F1 (Benefit Seekers) but weak with F3 (Convenience Users) and F5 (Opportunists). Visitors aged 16-25 years old clearly tend to visit Ke Ji Guan as Benefit Seekers, whilst senior visitors (aged 56-65) show

more preference as both Science-related Fans and Affirmation Seekers. Previous visit experience has significant associations with F1, F3, F4 and F5. Visitors who visit the case Ke Ji Guan for more than twice are highly unlikely to be Benefit Seekers while repeated visitors less likelihood of being F4 (Affirmation Seekers). Participants' educational qualifications show significant associations with my identity factors of F1, F2, F3 and F4. The correlation between educational qualifications and F1 is significant but weak with F2 and F3. Visitors with highest education of High school/Zhongzhuan indicate a strong trend to be Benefit Seekers, and postgraduate visitors demonstrated less likelihood to be Affirmation Seekers than other groups. It should be noticed that, F6 Professionals shows no significant correlation with any tested demographics.

## 8 Discussion

In this section, I will draw on the results from my interviews with three senior Chinese scholars as well as my questionnaire survey results conducted within three selected Ke Ji Guan in China to answer my research questions:

- Q1-What are the demographics of Ke Ji Guan visitors in China?
- Q2-What are the identity-related motivation groups in selected Ke Ji Guan?
- Q3-What are the correlations between visitors' demographics and identity-related motivations?

I will also use the results from my research to make a comparison with other similar research findings in China, Taiwan, the western world and other places (Australia).

### 8.1 Clarifying the conceptual understanding of Ke Ji Guan

As one type of Informal Science Institution, Ke Ji Guan is an imported format from the western world<sup>117</sup> to China. When Chinese people apply it in China, it has however been localised: from science centre in the western world to the related concept “Ke Ji Guan” in China. Although related, its function, contents, name and role in society have different historical developments from science centre in the western sense. Based on my interview results and archive research, within this section I clarify the differences and similarities between the concepts of Chinese Ke Ji Guan and science museums/centres in the western sense from the perspective of the functions contents, definition, and role. I will also explore the key points of Ke Ji Guan identified within my

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<sup>117</sup> Here the “western world” refers to central Europe (including the UK) and northern America according to the learning trip of Chinese scholar team conducted to the “western world” in 1980s (see Chapter 4, Section 4.2.2).

research, including the role of education, the perception of “public” visitors as a target audience and the correspondence with the government.

As an imported concept, Chinese Ke Ji Guan do inherit some features of western science centres and science museums. For example, most exhibitions in Ke Ji Guan are interactive facilities that are similar to western science centres. Ke Ji Guan also have the similar function of science education, and similar target visitors: the non-specialist public. These similarities are some of the reasons why the concept of Ke Ji Guan has been confused with science museums or science centres in China for a long time. However, Ke Ji Guan have unique characteristics that are clearly identifiable despite these approximate similarities. In other words, there are subtle differences in contents, functions and roles between Ke Ji Guan and western science museums/centres.

The origin of western science museums could be traced from the “The Cabinets of Curiosities” in the late period of Renaissance (17<sup>th</sup> century), but the function of education was not realised until the 18<sup>th</sup> century (McManus, 1992). In China, however, education was the primary aim from the beginning, and in the modern day, education or science popularisation is still the main goal and function of Ke Ji Guan. According to Friedman, from then on public education began to be listed as part of the function of science museums and centres, along with three other responsibilities: conservation, collection and research (Friedman, 2010). Some science centres have focused more on education as their only goal, but for most science museums, they still have the additional other functions (Friedman, 2010). For China, however, from the very beginning, the early Informal Science Institutions had the clear aim of education. Jian Zhang, the builder of the first science-related museum in China, Nan-t'ung Museum (founded 1905), wrote in his diary of 13 Jan 1906 that, the museum “was built as a school-like place to educate, and help people know

animals and plants” (“Events of Nan-t’ung Museum (1905-1915),” 2015). Then in the age of war, the building of science museums stopped. In the 1980s, in order to help carry out the government’s science popularisation goals, the China Association for Science and Technology (CAST) established the China Science and Technology Museum (CSTM) in 1988. After that, more and more similar institutions were built all over China. In modern days, the main aim of Ke Ji Guan is to conduct science popularisation. It is the result of a detailed governmental plan rather than a creature of natural development of the society.

Ke Ji Guan in China demonstrates a different developmental path from that of science museums/centres’ visitors in the western world. Like education, the “public” as the target visitors also experienced a gradually changing emphasis in the western world. In the ancient time of science museums, private collections (such as “The Cabinets of Curiosities”) could only be accessed by experts, nobles, and the owners’ friends or family members (Hooper-Greenhill, 1992). Then from the 18<sup>th</sup> century, target visitors evolved to some particular public groups, and eventually to a more common public. For example, the Conservatoire des Arts et Métiers regarded craftsmen and designers as their target visitors (Friedman, 2010; Orchiston & Bhathal, 1984). But in the modern day, the whole “public” or whole “society” is mentioned as the intended visitors to most science museums and centres. For example, the UK Association for Science and Discovery Centres (ASDC) works for “a society where people of all ages and backgrounds have an opportunity to enjoy and explore science” (“About us,” n.d.). In China, however, Nan-t’ung Museum from its beginning was open to all public people (from 1905) (Fu, 1957; Wang, 2001). Modern Ke Ji Guan (such as CSTM) are also all open to the public. There was no evolutionary development of the intended visitors, and mass public audiences were perceived as intended visitors in China from the beginning.

Ke Ji Guan contents also show subtle differences from western science museums/centres. Modern Ke Ji Guan in China originally learnt from the science centres of the western world (Li, 1993). For this reason, many Ke Ji Guan were built imitating western science centres from the 1980s. But in the process of developing Ke Ji Guan, other elements of western science museums (even natural history museums, such as hands-off collections and dinosaur skeletons) were added into the contents of Ke Ji Guan. Whilst seemingly disparate to many western perspectives, Ke Ji Guan therefore combined these elements within one institution. As suggested by one of my interviewees, the intention of combining such different contents within one place is to improve the effect of science popularisation and attract visitors of all ages.<sup>118</sup>

The governance and intended role of Ke Ji Guan within wider society also demonstrate some differences to similar institutions within the western world. The evolution of western science museums/centres underwent a long-term developmental process, which reflects the simultaneous evolution of culture and society. In other words, they arose from their culture and society, with many different influences (personal, intellectual, academic, institutional, governmental, even royal). However, in China, modern Ke Ji Guan is a result of government will—they did not develop from the society naturally. For one thing, all Ke Ji Guan in China are built, supervised, and operated by governments or official institutions such as CAST. A Ke Ji Guan cannot be built without the official permission of an appropriate supervising department (She, 2016). Building a Ke Ji Guan is mostly a governmental decision and process rather than a civilian activity. Achieving science popularisation is included as a responsibility of government work (*“Administrative measures for special performance evaluation of science popularisation information work (Temporary),”* 2015). The Chinese government plays the leading role in efforts

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<sup>118</sup> Heng Wang. (2015), Interview, 2 April 2015, transcribed by Huiping Chu.

to improve scientific literacy within China, whilst in other countries charities, businesses and even individuals may play a substantial role in addition to governmental initiatives (Bultitude, Cheng, Smith, Jackson, & Patairiya, 2010).

Using Ke Ji Guan to enhance the effect of science popularisation is part of the China national science policy. This can be seen from some national documents of China, such as the *Outline of the National Scheme for Scientific Literacy (2006-2010-2020)*:

*“Consolidate the science education resources outside the school, and establish an effective mechanism linking outside-school science and technology activities with school science courses. ... taking advantage of diverse education resources, including science and technology museums, research institutes, and other science and technology education bases (“Outline of the National Scheme for Scientific Literacy (2006-2010-2020),” 2006).*

It can be seen, here that Ke Ji Guan were mentioned by their English name “science and technology museums”. Not only in this document, but in all official documents I have been able to access, the English name “science and technology museums” or “science museums” was consistently applied. However, the associated Chinese name varied, such as “Ke Ji Guan”, “Ke Ji Bo-Wu Guan”, even “Ke Ji Lei Bo-Wu Guan (See **Table 41**)”. Within both academic and wider public contexts, the Chinese names of Ke Ji Guan are still used in a confused manner. To demonstrate this more clearly, **Table 41** provides various relevant institutional names in both English and Chinese:

**Table 41: Informal Science Institutions’ English names and Chinese translations**

English names	Chinese translations
Science (and Technology) museum	Kexue and Jishu Bo-Wo Guan (Ke Ji Guan in short)
Science Centre	Kexue Zhongxin/Ke Ji Guan
Science-related Museums	Ke Ji Lei Bo-Wu Guan

Here *Kexue* refers to science, *Jishu* means technology, *Bo-Wu Guan* refers to museum, *Lei* means category and *Zhongxin* refers to centre. *Guan* itself only means a place or an institution. It can thus be seen from **Table 41** that the name of *Ke Ji Guan* itself does not show direct connection with science museum or science centre directly. Instead, it focuses on the place for science and technology, which avoids the properties of science museum or science centre.

When it comes to the use of the Ke Ji Guan concept, from my research, the definition, functions and even the English names of Ke Ji Guan are not based upon societal concepts, or even academic synthesis by researchers based on many different sources. Instead they are defined by official documents. This was however not always the case. In the development process of Ke Ji Guan in China, their concepts and associated categories were intermixed. In 1997, the State Planning Commission and CAST promulgated a document to confirm the function of “Ke Ji Guan”, and this concept included what kinds of institutions this label applied to. After that point, the concept and scope relating to Ke Ji Guan began to be used more consistently in most documents. This statement of the Ke Ji Guan is a definition-like and governmental description based on its functions, rather than a precise academic definition. So in most academic papers and reports, the name is still used in a mixed way. For

example, as I outlined in Chapter 2, Section 2.2.2, it can be seen from the annual Reports on the development of China's PST Infrastructures that there has been a wide variation in terminology over different years (2009, 2010, 2011, 2012-2013). It is however worth noting that public visitors also have a mixed understanding of the concept of Ke Ji Guan (see the piloting results in Chapter 4). In my piloting with visitors at CSTM Beijing I asked them “What place do you think is similar with here (CSTM)?” Participants’ answers were highly diverse, covering more than 20 categories, with the largest responses relating to a common ‘Museum’. The second biggest group was “Don’t know”. Only a handful of respondents answered ‘science museum’ specifically. This is quite different to the definition of the State Planning Commission and CAST, which means the public does not regularly apply or possibly even recognise the official definition.

In summary, the concept of Ke Ji Guan was built out of the western “science centre” originally, but has undergone substantial localisation, with Chinese influences now clearly visible in relation to the institutional names, definitions, visitors and contents. Notably, Ke Ji Guan plays a different societal role from most western Informal Science Institutions due to their responsibility as a government-related science popularisation institution. Ke Ji Guan does not fit into a standard model of a science museum or a science centre in a Western sense, particularly when these two concepts have no confirmed academic standard as I reviewed in Section 2.1. So regarding the mixed use of various names both in Chinese and English, I suggest that “Ke Ji Guan” should be applied in both languages in preference to other options, because it is a definite Chinese term with unique Chinese features.

## **8.2 Ke Ji Guan visitor demographics: Similarities with western Informal Science Institution visitors**

In this section, I will use my combined data of selected Ke Ji Guan's visitor demographics to conduct a comparison with existing research evidence regarding western Informal Science Institutions.

I recognise that the references I have drawn on are not exhaustive, but have been chosen as the most broadly representative data available. I will draw on the references from the western research to compare specific visitor demographics such as their gender, age, education, and companions.

My data indicates that female visitors account for a large proportion of the general (adult) visitors in my three case study Ke Ji Guan, with a ratio of female 63.1%: male 36.4%. This finding is broadly similar to other major studies in western museums and science centres, though perhaps slightly more polarised than in other locations. For example, according to Ecsite-UK's extensive study of its member Science and Discovery Centres, about 56% of visitors were female (Ecsite-UK, 2008a). The Ecsite-UK study is interesting because it encompassed members of all different sizes and locations, so arguably provides a useful country-level comparison. A more recent study conducted in 2012 and 2014 among adult visitors (minimum age was 18 years old) of seven national science centres and museums in Europe<sup>119</sup> by Andrea Bandelli and Elly Konijn, showed that female visitors were in the majority in most cases. For example, both the UK and the Czech Republic had more than 60% female visitors (61.6% and 63.2% respectively), which are very similar to my data observed in China. Only Italy showed less females than males (42.3%). Here Poland had a gender ratio of approximately half to half (Female: Male = 51%: 49%) (Bandelli & Konijn, 2015). It can be seen from these data that my selected China Ke Ji Guan have roughly similar visitor gender ratios

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<sup>119</sup> The countries and cities were UK (London), Czech Republic (Pilsen), Finland (Vantaa), Italy (Milan), Netherlands (Amsterdam), Poland (Warsaw), and Portugal (Lisbon).

with key national European science centres or science museums. Furthermore, female visitors outnumber males in the majority of cases.

Based on my research, 26-35-year-old visitors were the largest visitor group, with 36.0% in the combined data of the three Ke Ji Guan, followed by approximately one-third of visitors aged 16-25 and a further quarter aged 36-45. The Copernicus Science Centre (CSC, Warsaw, Poland) also had these top three age groups with the most common age group being 15-25 (19%) followed by ages 26-35 (14.3%) and group of 36-45 (13.5%) based on the survey of the Copernicus Science Centre (CSC) in Warsaw, Poland in 2015<sup>120</sup> (Kalinowski, 2016, p. 17). When it comes to the survey conducted by Bandelli and Konijn in seven European countries, their results gave the median age as 35.23 (Bandelli & Konijn, 2015). Both my data in China and those data from Europe show that visitors less than 35 years old are the primary attendees of science museums/centres/Ke Ji Guan.

In terms of visitors' educational backgrounds, my data indicates that over half of the visitors had completed university education or higher (61.3%, combined data). There were also relatively high proportions of visitors who had completed High school or Zhongzhuan (31.2%), suggesting that science museum visitors in China generally have relatively high levels of education. Similarly, based on CSC's survey in 2015, Poland had 61.1% of visitors with "higher education" followed by the second group of "upper secondary/post-secondary education" (23.9%) (Kalinowski, 2016, p. 18). This finding is substantiated by Bandelli and Konijn's work, in which Poland had 62% of visitors who had completed tertiary education<sup>121</sup> (Bandelli & Konijn, 2015). The UK, Finland and the Netherlands had much higher visitor proportions on this level (86.7%, 74.8% and 72.3% respectively), while the

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<sup>120</sup> Note: In comparison to my work this survey was conducted with all-age participants so includes children as well as adults.

<sup>121</sup> Tertiary education refers to the third stage of education. It is usually regarded as university or college level.

Czech Republic, Italy and Portugal showed much smaller proportions of university-educated visitors (43.7%, 37.9 and 27.9% respectively) (Bandelli & Konijn, 2015). Falk argued that museum visitors have higher levels of education than more general public groups all over the world (Falk & Dierking, 2013). It seems that in the dimension of visitors' educational qualifications, science museum visitors worldwide have relatively high education levels, though individual situations do vary among different countries.

When it comes to whom visitors attend a Ke Ji Guan with, my data shows that family members are the most common (58.3%). This is in line with other findings within western science centres and museums, for example according to the Ontario Science Centres' website, over half of its visitors are from family groups ("Our visitors: Who visit the Ontario Science Centre?," n.d.). Ecsite-UK reported that its Science & Discovery Centres have a family-friendly character, which usually attracts families with young children (Ecsite-UK, 2008a). Within my cases this was also true: all of my three selected Ke Ji Guan have special areas for children. For example, the Science Paradise for children in the CSTM Beijing, the Children's Rainbow Land in the SSTM Shanghai, and the children's game centre in the SDSTM Shandong. All these places appeal to families with young children and the adults in these family groups would be among my respondents.

So the comparison of visitors' demographics reveals that, as in most western Informal Science Institutions, the typical visitor in my selected Ke Ji Guan is also female, below 35 years old, well educated and accompanied by family members.

### **8.3 Ke Ji Guan visitors: Chinese comparisons**

In this section, I will draw on my results in the context of wider research and reports to discuss the Ke Ji Guan visitor demographics from a specifically

Chinese perspective. This will firstly focus on a comparison with previous Ke Ji Guan visitor data, before exploring how well actual visitor backgrounds compare with governmental targets for popularisation of science and technology in China.

### 8.3.1 Comparison with existing Ke Ji Guan visitor demographic data

As I mentioned in my Literature Review (Chapter 2), there are few existing Ke Ji Guan visitor studies in China, and most previous research is related to satisfaction surveys and other broad topics. Some big Ke Ji Guan have conducted surveys about their visitors' demographics and brief motivations, but most of these data were only used and reported internally; even their existence is extremely difficult to confirm externally. The only data I have been able to access directly is the Evaluation of Science Popularisation Effect of the Permanent Exhibitions in Ke Ji Guan (2006)<sup>122</sup>. This evaluation was carried out by the China Research Institute for Science Popularisation (CRISP) and the China Science and Technology Museum (CSTM, Beijing). Researchers in these two institutions conducted visitor surveys at five Ke Ji Guan: the CSTM Beijing, Shenyang Science Palace, Zhengzhou Ke Ji Guan, Foshan Ke Ji Guan and Jiaxing Ke Ji Guan. Within this section I will compare my results with data from those Ke Ji Guan.

In terms of visitors' educational qualifications, **Table 42** shows that in Evaluation 2006, the "Associate degree" and "Bachelor degree or equivalent" together accounted for the biggest percentage of visitors (37.8%) followed by "Primary school" and "High school/Zhongzhuan and Vocational qualification" (20.7% and 20.5% respectively). They also had a high number of visitors with "Secondary school" qualifications (18.8%) (*Evaluation of science popularisation effect of the permanent exhibitions in Ke Ji Guan, 2006*). In my

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<sup>122</sup> Thanks to my interviewee, Heng Wang, who loaned this book to me: it could not be bought or found in any bookstore or library outside the relevant institutions. The survey was conducted in 2004-2005, and the result was published in 2006. I will refer to it as "Evaluation 2006" within this section.

research, the groups of “Associate degree” and “Bachelor degree or equivalent” also have the largest number (52.3% combined), and the second largest group is the “High school/Zhongzhuan and Vocational qualification” (34.2%). The reason my data showed a much lower percentage of visitors with primary school and secondary school qualifications only is that I did not include visitors younger than 16 years old in my survey. So if consideration of visitors <16 years old is removed from both samples, I have a broadly similar result on educational qualifications with Evaluation 2006 (see the rows of “My data-Adjusted proportion %” and “Evaluation 2006-Adjusted proportion %” in **Table 42**). Both my own research and that from Evaluation 2006 suggest that Ke Ji Guan attract more highly educated visitors, particularly those who have attended university. Falk & Dierking’s research in the US also supports this conclusion (see Section 8.2).

**Table 42: Comparison of visitors' educational qualifications in my research and Evaluation 2006**

	Primary school	Secondary school	High school /Zhongzhuan and Vocational qualification	Associate degree and Bachelor degree or equivalent	Master or equivalent and higher
My data %	0.5	3.8	34.2	52.3	9.0
My data-Adjusted proportion % <sup>123</sup>			35.8	54.8	0.1
Evaluation 2006 %	20.7	18.8	20.5	37.8	1.9
Evaluation 2006-Adjusted proportion %			34.1	62.8	0.0 <sup>124</sup>

In terms of visitors' residence locations, both my combined data and Evaluation 2006 indicate that more local visitors attend the Ke Ji Guan case studies than visitors from other cities. But when it comes to some particular Ke Ji Guan, there is a clear trend that the bigger the Ke Ji Guan, the more out-of-town visitors. For example, in Evaluation 2006, there were 44.4% out-of-town respondents at CSTM Beijing (very similar to my result of 43.1%). SSTM Shanghai was even higher within my survey, with almost half of participants from other cities (49.8%). If we look at the level of province (most Ke Ji Guan are smaller than the national level institutions just mentioned), the Ke Ji Guan at Shenayng and Zhenzhou had 20.0% and 30.7% proportions of

<sup>123</sup> Data in the raw of "My data-Adjusted proportion %" and "Evaluation 2006-Adjusted proportion %" represent the proportion of the population in the latter three categories (higher educations) if the first 2 categories (lower educations) are removed.

<sup>124</sup> The value is actually 0.03% if one more decimal is allowed.

out-of-town audiences respectively in 2006 (*Evaluation of science popularisation effect of the permanent exhibitions in Ke Ji Guan*, 2006). The equivalent within my data is SDSTM Shandong, where the number was 18.5%. In the case of the smallest Ke Ji Guan (Jiaxing and Foshan) in 2006, local visitors accounted for approximately 95% of the total audience, which means only 5% visitors came from other cities (*Evaluation of science popularisation effect of the permanent exhibitions in Ke Ji Guan*, 2006). The primary reason for these differences may be that the large Ke Ji Guan, such as CSTM Beijing and SSTM Shanghai, are nationally famous sightseeing spots, so they attract more tourists (sight seers) from all over China, while smaller Ke Ji Guan show more tight connections with local people. Maybe because of the same reason, the smaller Ke Ji Guan have more repeated visitors than first-time visitors, such as the Ke Ji Guan in Jiaxing, Foshan and Shenyang in 2006 and my case SDSTM Shandong. The large Ke Ji Guan such as CSTM Beijing and SSTM Shanghai, have many more first-time visitors who perhaps just visited for sightseeing purposes once only. So both on the visitors' residence and frequency of visits, I have similar results to Evaluation 2006, which suggests that there are different trends for the large and small Ke Ji Guan in these respects.

In terms of the question of who the respondent attended the Ke Ji Guan with, data from my respondents as well as participants of Evaluation 2006 demonstrated that "family members" was the most popular answer, followed by the option of "friends". This means the visiting model of who accompanies visitors to Ke Ji Guan remains similar in the ten years since Evaluation 2006 was conducted in 2004-2005.

Furthermore, my results show that there were many more female visitors (nearly twice that of male visitors) in my case study Ke Ji Guan. However, the Evaluation 2006 methodology was slightly different, taking a deliberate quota sampling approach to gender, in order that female and male visitors had equal

chance to show their features within the data collected (*Evaluation of science popularisation effect of the permanent exhibitions in Ke Ji Guan*, 2006). My sampling was based on a systemic sampling approach (see Chapter 3 Research Methods), a random sampling method. So it is not possible to make a direct comparison with Evaluation 2006 regarding visitors' gender. Equally, when it comes to visitors' ages, comparison with Evaluation 2006 is also not appropriate because I used different age group categories; those from Evaluation 2006 appear to be based on education levels, meaning different sized age categories, which are more difficult to explore for trends.

In summary, in terms of visitors' educational qualifications, locations of residence, frequency of visit, and who accompanied them, my results were similar to those reported within the Evaluation of science popularisation effect of the permanent exhibitions in Ke Ji Guan (2006). When it comes to gender and age groups, it is difficult to make a direct comparison due to the different methodological approaches taken. I believe my data can better reflect the actual gender ratio thanks to the systemic sampling approach taken and this means my other results may well have wider generalizability than would just be suggested by studying three specific case study museums: my data does seem broadly representative of other Chinese evidence.

### **8.3.2 Comparison with wider Chinese PST targets**

According to the annual report of *The Development of China's PST*<sup>125</sup> *Infrastructures*, Ke Ji Guan are mainly built in cities, other PST infrastructures are in counties, and the Science Wagons mainly travel in the developing areas of west China (Li, 2010; Ren, 2009). The *Outline of the National Scheme for Scientific Literacy (2006-2010-2020)* proclamation also made sub-targets for science popularisation efforts based on areas. For example,

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<sup>125</sup> PST refers to the "Popularisation of Science and Technology" in China.

*“Efforts shall be made to establish science galleries, PST activity room, and online terminals in both urban and rural communities. Enhance science education functions of minors’ outside-school activity sites. The cities and counties where conditions permit may establish special PST sites. Selected cities and counties will be equipped with Science Wagons (mobile science museums) (“Outline of the National Scheme for Scientific Literacy (2006-2010-2020),” 2006).*

As can be seen from the above quote, besides Ke Ji Guan, there are other PST (popularisation of science and technology) infrastructures in China. The *Outline* states that it is necessary to build PST infrastructures not only in different areas but also population selection:

*“Promote the enhancement of all Chinese citizens’ **scientific literacy**, led by the improvement of scientific literacy of selected populations in the first place. Raise minors’ interests and enthusiasm in science, and enhance their innovation awareness and associated practice capability. Meanwhile, efforts shall be made to raise the scientific literacy of farmers and urban workforce in a noticeable manner, gradually narrowing down the gaps between the urban and rural residents in scientific literacy. Leading cadres and public servants shall have a top level of scientific literacy among professionals” (“Outline of the National Scheme for Scientific Literacy (2006-2010-2020),” 2006) (My emphasis added) .*

Here “scientific literacy” is a key phrase. All PST infrastructures and efforts should work towards the target of improving people’s scientific literacy. Different infrastructures/activities are of course built for different audience groups. For example, the “Market of Science and Technology Popularisation” and “Science and Technology 110” are particularly directed towards the farmers in the rural countryside. The Ke Ji Guan are mostly based in cities and big towns (“*Outline of the National Scheme for Scientific Literacy*

(2006-2010-2020),” 2006). However, according to my studies in selected Ke Ji Guan, the actual situation shows a gap from the government’s stated target. A large proportion of Ke Ji Guan visitors are already well educated. That is to say, Ke Ji Guan as a city-based infrastructure for improving people’s scientific literacy mainly attracts people who are already likely to have a good scientific literacy. Furthermore, in terms of the visitors’ subject specialisms, “Humanities and Social Sciences” accounted for 44.2% out of all subjects, followed by “Technology and Engineering” (29.9%). “Natural Science” specialists represented only 4.5% of the responses, suggesting that Ke Ji Guan visitors do not connect themselves with science more broadly. It’s not scientific parents who are bringing their kids to Ke Ji Guan-although they’re educated, they’re not from science backgrounds themselves.

#### **8.4 Visitor motivations are related to cultural backgrounds**

In this section, I will discuss my new identity-related motivation groups and compare with Falk’s original framework. I will also analyse my motivational statements under the theory of Hofstede’s cultural dimensions. The factors from my Exploratory Factor Analysis and the correlations between visitors’ demographics and identity factors will also be explored.

##### **8.4.1 Similarities with Falk’s framework**

As outlined in Chapter 6, based on my initial pilot results, I created a conceptual map of identity-related visitor groups based on Falk’s theoretical framework but taking into account the local Chinese cultural context. Taking this further, I also conducted a statistical analysis of my combined survey results using Exploratory Factor Analysis to obtain specific statistical factors. The similarities and differences between these two sets of categories with Falk’s work can be seen from **Table 43**.

**Table 43: Comparison of visitors' identity-related categories**

<b>Falk's Categories</b>	<b>My conceptual mapping based on Falk's theoretical framework</b>	<b>Factors from Exploratory Factor Analysis (EFA)</b>
Explorers	Explorers	Benefit Seekers
Facilitators	Facilitators	Science-related Fans
Experience Seekers	Experience Seekers	Convenience Users
Professional/Hobbyists	Professional/Hobbyists	Affirmation Seekers
Rechargers	Convenience Users	Opportunists
	Emotional Connection Seekers	Professionals
	Pleasure Seekers	

**Table 43** shows that there are four categories shared by my conceptual mapping and Falk's theoretical framework (coloured in red): Explorers, Facilitators, Experience Seekers and Professional/Hobbyists. Though there are different numbers of motivational statements in each category between my conceptual mapping and Falk's categories, they do share similar statement meanings (see Chapter 6, Section 6.2). For example, the motivation of "I went because it satisfies my curiosity" in Falk's Explorers (personal communication, September 25, 2014) and the statement "I come to satisfy my curiosity" which I used within my own survey, and attributed to Explorers. This fact indicates that there is some consistence across China and the western (particularly the US) contexts.

#### **8.4.2 My new identity-related motivation categories**

Within my conceptual mapping I have four identity-related visitor groups that exhibit substantial similarities with Falk's framework (see Section 8.4.1).

However, I also have three brand new categories, and other identities identified by Falk did not appear within my data.

Firstly, I have no group of “Rechargers”, and instead a related-though conceptually different-category of “**Pleasure Seekers**”. In Falk’s context, mainly based on his work in the US, “Rechargers” visit a museum to escape from the rush-a-day life. In Falk’s “Rechargers” there were four motivational statements:

*I find going helps me get away from normal rush of life.*

*The museum is more inspiring than going to the mall or a movie.*

*I don’t get to be in spaces like this every day.*

*I feel at peace in these surroundings.*

According to Hofstede’s cultural dimensions, the US is one member of the “High Indulgence” countries, which refers to enjoying life and having fun. In the society of indulgence, leisure time is regarded as very important as well as freedom and self-control (Hofstede et al., 2010). In China, which is instead culturally located in the domain of “High Restraint”, freedom and leisure are not emphasised to the same extent (Hofstede et al., 2010). Though there was one motivation about personally “having fun” within my final motivation categories (*M11... I come to relax/have fun*), based on my piloting and interview experience, Chinese visitors who chose this option seemed simply to want to relax, to take a mental break and had no further intentions. In other words, they did not show an obviously uninfluenced motivation to **recharge** themselves or escape from their daily life in order to seek “freedom” like US visitors (for example, “get away from normal rush of life”). They may just want to find a place to enjoy themselves, and a Ke Ji Guan can satisfy them

incidentally. So I prefer to describe them as a new group: **Pleasure Seekers** rather than “Rechargers” as Falk did.

The second new category is the “**Emotional Connection Seekers**”. In the category of “**Emotional Connection Seekers**”, I have a motivation M9 (... *I love our country and want to see our latest developments in science and technology*). There is no similar motivation like this in Falk’s option list (personal communication, September 25, 2014), and this can be regarded as a Chinese-specific motivation, which shows the character of Chinese culture. According to Hofstede’s cultural dimensions, China is located in a high position for collectivism (Hofstede et al., 2010). In the culture of collectivism, people are regarded as one segment of the whole society, and in that society, they are expected to care for others. Loyalty is seen as the main principal of collectivism. In China, one format of loyalty to the nation is patriotism. People show their love to the country by some particular behaviour, such as caring about the development of the country’s science and technology.

Another new category is the “**Convenience Users**”. For example, some visitors at SDSTM Shandong attended the Ke Ji Guan because they wanted to rest after visiting the nearby Quancheng Guangchang and Guihe Plaza, which are both very close to the Ke Ji Guan. Likewise, motivation M19 (... *I got a free ticket/I can get a ticket reimbursement*) is also unrelated to the institution itself. Staff or members of certain big national enterprises or government-related institutions usually get free tickets to Ke Ji Guan. This is one kind of promotional activity to conduct science popularisation in China: using free tickets to encourage people to visit Ke Ji Guan. This activity is related to the national science policy to “Promote the enhancement of all Chinese citizens’ scientific literacy” (“*Outline of the National Scheme for Scientific Literacy (2006-2010-2020)*,” 2006). The intention is that through this offer, more people will attend a Ke Ji Guan because of the free tickets though they may have no confirmed or self-decided motivation. These kinds of reasons are actually

indirectly related to the Ke Ji Guan itself and are difficult to be classified to other categories. So I have gathered them in the distinct group of “**Convenience Users**”.

#### **8.4.3 Cultural associations with specific motivational statements**

My research findings suggest that there are deep cultural reasons behind some specific visitor motivations. For example, I have found that national characteristics, such as the findings of Hofstede and the Chinese traditional culture play important roles in building visitors’ motivations.

For the specific motivational statements, there are some statements that demonstrate clear Chinese characteristics, though they can still be classified within Falk’s existing categories. For example, this is true for the group of “Facilitators”, within which M10... *I want to prepare myself for a future visit with my child* occurs. Based on Hofstede’s cultural dimensions, China shows an obvious trend of Long-Term Orientation. This dimension suggests that people care about future situations, and tend to have strong wills to perseverance, saving and planning (Hofstede, 2011; Hofstede et al., 2010). Also, this character suggests an attitude that people tend to believe most important things will happen in the future (Hofstede, 2011). As Nomikou, Archer and King argued, Informal Science Institutions (such as science museums) work as one way to build Science Capital, a concept referring to people’s science-related resources and tendencies (Nomikou, Archer, & King, 2017). Archer and other colleagues have pointed out that learning science through Informal Science Institutions may build young people’s positive attitudes to science and impact their science learning in schools, potentially influencing their future careers (Archer et al., 2012; Archer, Dawson, DeWitt, Seakins, & Wong, 2015; Archer, DeWitt, & Wong, 2014; Nomikou et al., 2017). It can be deduced that in order to support children’s future learning and careers, Chinese parents with M10

were preparing for future attendance with children by visiting Ke Ji Guan in advance. According to my interviews to visitors (see my Piloting B1 for collecting motivational options in Section 3.6.2), participants with this motivation specified that they wanted to visit the Ke Ji Guan in advance to check if the Ke Ji Guan has appropriate contents to their children and what kind of knowledge they would need for explaining these exhibitions to their children. This is what the word “prepare” meant in this motivation. This motivation shows visitors who chose this option regarded their children’s learning very seriously.

The reason why Chinese people treat their children’s learning so seriously can be tracked by the Chinese traditional culture. For example, there are very famous verses as “Learning is more valuable for your career than anything else”, and “young people should study hard because the study achievement will build your reputation”.<sup>126</sup> Some famous Confucianism quotes on education and learning even point the aim of learning directly for instance by saying: “He who excels in study can follow an official career” (Confucius, About 551 BC-479 BC). In modern days, based on the national policy of “Strong our country by improving science and technology”, students’ science points/scores in exams are very important for their future study and career. So actually, those respondents who selected M10 were preparing for their children’s career by preparing their visiting to a Ke Ji Guan.

Although M10 does not appear within Falk’s original statements, this can be regarded as a typical Chinese motivation of the Long-Term Orientation. Also, this motivation is related to the child, not the parent themselves. This is very particular in my group of “Facilitators”, with no similar motivation in Falk’s equivalent category.

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<sup>126</sup> These verses come from a long poem written by Zhu Wang who was regarded as a Child Prodigy by people living in the North Song dynasty (960 - 1127). But the exact year of this poem written is unavailable.

The second finding about visitors' motivations within my dataset is that some motivations reflect the importance of children and females' identities in family and society in China. There are three motivations in total that are only about children in my research: M2... *I take my child to learn/expand horizon*; M4... *I take my child for fun*; and M10 as discussed immediately above. But in Falk's motivation pool, there was only one reason relating to children: "...I like to support the learning of my children/significant other" (personal communication, September 25, 2014).

There is another motivation, which reflects Chinese people's concern to children although it is neither exclusive to children nor particular for Chinese people. That is M6 ... *This is a good way to interact with my child/share quality time with my family/friends*. In Falk's questionnaire sample, there was also a similar motivational option as "...this is a good way for my family/friends to share quality time". According to my result, at both CSTM Beijing and SSTM Shanghai, M2 and M6 were the top two motivations. One possible explanation for this could relate to parental concerns about their offspring, and feeling a need to support and encourage their child's education. On 12 May 2017, the Internet-based Chinese survey company "UC Big Data" released its Report on the Anxiety of Chinese Mothers (Shi, 2017). This report indicates that Shanghai is the city with the highest proportion of anxious mothers, followed by Beijing. The top two reasons for their anxiety were children's health (including mental health) and education (Shi, 2017). Since M2 and M6 both relate to parents deciding to help their children, it is perhaps unsurprising that such motivations are high in cities with high reported levels of anxiety related to supporting their children's education (Shanghai and Beijing). By contrast, Ji-nan (Shandong province's capital city, the location of SDSTM) is only tenth place on the issue of mothers' anxiety (Shi, 2017), and the M2 and M6 frequencies were subsequently lower (though still high compared to other motivations). This situation could also be explained by Hofstede's Long-Term

Orientation because the parents who chose M2 and M6 were actually worrying about their children's future education and health, even their social status and careers related to their educational qualifications. In Chinese traditional culture, parents' function on children's education is emphasised. For example, in a widely used traditional enlightenment book, the *Three-Character Canon*, there are some parts about parents such as the story of Mencius<sup>127</sup> mother. The mother selected neighbours in order that Mencius could study in good surroundings. There is also sentences as "What's a father? A good teacher." So in traditional culture of China, parents are directly responsible for children's education by accompanying, teaching and guiding children through their own behaviours. This can also explain why some respondents would choose "share" a quality time with children (M6). They need to show they are also interested in science.

Moving on from considering children, there are also gender-related issues that are noticeable within my dataset, most prominently the traditional role of females within China. Based on Hofstede's theory, China is a country of high Masculinity, which means that in this type of country, amongst other related factors, traditional gender roles are more rigid. A woman's role is expected to be more about caring for family, nursing and other traditional duties (Hofstede, 2011; Hofstede et al., 2010). This kind of characteristic can also be found within traditional Chinese culture. For example, there are some widely known sayings, such as "Men are responsible for outside affairs and women should be responsible for family matters", or "A woman's main work is to support her husband and teach the children."<sup>128</sup> In the context of Confucianism (see Chapter 2, Section 2.6), females are traditionally given compulsory duties. For example, women's Four Virtues are perceived as: "conjugal fidelity, proper speech, proper demeanour, and proper work" (Tang, 1995, p. 280). Here the

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<sup>127</sup> Mencius (around 372 BC-289 BC) was a Chinese philosopher who is believed to represent the "Second Sage" of Confucianism and the successor of Confucius.

<sup>128</sup> Both of these two sentences are very famous and common sayings in Chinese society, so no citation has been included.

“work” includes supporting children for their future careers. These reasons could explain why the survey mentioned “anxious mothers” rather than “anxious fathers”. For mothers, their children’s successful future could be regarded as their own work achievement and one of their personal goals.

Thirdly, as a life philosophy and value system in China (Tang, 1995), Confucianism has direct influences on visitors’ motivations to attend a Ke Ji Guan. For example, as Wang argued, under Confucianism there is an isomorphism between the notions of nation and family. People should love the country just as children love their fathers (Wang, 2010). The new developmental notion of this philosophy in modern China is patriotism. This is reflected by M9... *I love our country and want to see our latest developments in science and technology*. From the piloting stage in my data collection it was clear that M9’s meaning has a clear causality linking “I want to see the latest developments” *because* “I love my country”. This is different from M15... *I come to see the frontiers of science and the latest technologies*, which suggests a pure interest in science and technology. M9 represents a sense of national pride and concern about the future of the country. This is unique compared to Falk’s existing work because some visitors within my research appear to have connected the behaviour of visiting a Ke Ji Guan with their love of the country. Another obvious influence of Confucianism is its philosophy of “...a public and common spirit ruled all under the sky” (“Tian Xia Wei Gong” in Chinese) (Dai, 202 BC-8 AD; translated by James Legge, 1885). This philosophy emphasises that “The world is equally shared by all”. In this context, Chinese people may tend to use PUBLIC infrastructures by their own motivation according to their needs of convenience. For example, the motivations of M13... *I come to use the facilities (e.g. climate control, seats, Wi-Fi)* and M19... *I got a free ticket/I can get a ticket reimbursement* may reflect this philosophy. Visitors who have these two motivations may choose to visit a museum to access the free facilities without interest in the institution.

## 8.5 EFA results and their connections with visitors' demographics

In this section, I will discuss the key results of the EFA, as well as the correlations between visitors' demographics such as gender, age, previous history and educational qualifications with the factors I obtained from the EFA.

### 8.5.1 Ke Ji Guan visitor motivations from the EFA clusters

The Exploratory Factor Analysis (EFA) allowed me to obtain statistically clustered visitor groups, which are different to those obtained from my own conceptual mapping of the motivational statements (mentioned above in Sections 8.4.1 & 8.4.2 and described originally in Chapter 6, Section 6.3). I have six motivational factors: Factor 1 **Benefit Seekers**; Factor 2 **Science-related Fans**; Factor 3 **Convenience Users**; Factor 4 **Affirmation Seekers**; Factor 5 **Opportunists**; Factor 6 **Professionals**. The factors I extracted from the combined dataset clearly showed shared characteristics within each group, which suggests that my EFA is conceptually robust.

For instance, the first factor I obtained from the EFA of the combined dataset was the **Benefit Seekers**, which encompassed:

M2... *I take my child to learn/expand horizon.*

M4... *I take my child for fun.*

M6... *This is a good way to interact with my child/share quality time with my family/friends.*

M11... *I come to relax/have fun.*

M14... *I come to satisfy my curiosity.*

It should be noted that, "Facilitator"-related options (M2 and M4) and family-related M6 were negatively loaded here (see Chapter 6, Section 6.3.1),

indicating that although linked, the five statements represented opposite perspectives, ie people came EITHER for themselves OR others, not usually a combination of the two. Here “Facilitator” (under Falk’s frame work) seems a sub-category of **Benefit Seekers** but it can only reflect one part of the group. The reason why the options related to visitor self and others gathered in one category may be that Chinese people have the culture of “Collectivism”, which means people would regard them as part of the society and related to others (Hofstede et al., 2010). So the statistical classification of the motivational statements of **Benefit Seekers** may suggest that there are underlying cultural relations between these options.

Besides, the Factor 3 **Convenience Users**<sup>129</sup> is also similar with the conceptual mapping of motivational group of Convenience Users that are only one more motivational statement: M19 (*... I got a free ticket/I can get a ticket reimbursement*). However, M19 is classified into the Factor 5 **Opportunists**<sup>130</sup> by EFA. Also, Factor 6 **Professionals** and my mapping based category Professional/Hobbyists<sup>131</sup> share the motivation of M1 (*... I am here related to my study/work*).

So it can be seen that, when compared with the content analysis based categories, the EFA factors do have some similarities, which show that the EFA result is not only robust on basis of the statistics but also the conceptual mapping in some sense.

Although not so many, there are other researchers who conducted factor analysis to the museum visitors’ motivation. For example, Packer and

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<sup>129</sup> The Factor 3 Convenience Users is composed of two motivational statements: M13... I come to use the facilities (e.g. climate control, seats, Wi-Fi); M18... I live locally/pass by and come to cast a glance over.

<sup>130</sup> The Factor 5 Opportunists is composed by M16... I come to see my friend/boyfriend/girlfriend/other people and M19... I got a free ticket/I can get a ticket reimbursement.

<sup>131</sup> The category of Professional/Hobbyists has one more motivational statement: M17... I am interested in science museums.

Ballantyne categorised visitors' reasons for attendance within the following five categories (Packer & Ballantyne, 2002, p. 189):

- **Learning and discovery** (*the desire to discover new things, expand knowledge, be better informed and experience something new or unusual*);
- **Passive enjoyment** (*the desire to enjoy oneself, to be pleasantly occupied and to feel happy and satisfied*);
- **Restoration** (*the desire to relax mentally and physically, to have a change from routine and recover from stress and tension*);
- **Social interaction** (*the desire to spend time with friends or family, interact with others and build relationships*); and
- **Self-fulfilment** (*the desire to make things more meaningful, challenge abilities, feel a sense of achievement and develop self-knowledge and self-worth*).

From the explanation of each group, it can be seen that visitors categorised by this taxonomy have many similar stated reasons with my participants in China. For instance, “the desire to spend time with friends or family” is similar to my M2, M4, M6 and M16; “the desire to relax mentally and physically” is similar to my M11 and “develop self-knowledge and self-worth” to my M8 (... *I come to enrich myself*). It is however noticeable that all their reasons (motivations) clustered into different groups to those within my dataset, though they have very similar single motivations within my reason bank. There were perhaps two explanations responsible for this difference. One was the different cultural background (Australia VS China), and the other was a difference in the institutions involved. In Packer and Ballantyne’s research, the data came from three different institutions: a museum, an art gallery, and an aquarium (Packer & Ballantyne, 2002). The researchers called all of them “educational leisure

settings” (Packer & Ballantyne, 2002) but they do not mainly focus on science content. By contrast, my research objects were three Ke Ji Guan in China (all Informal Science Institutions). As other researchers have previously argued, motivations might not only represent the characters of visitors but potentially also reflect the features of the institution (Pekarik et al., 1999). So although broad motivations may be similar, the different characters of the institution involved may lead to different final factors.

There was also some visitor motivation research conducted under a similar cultural perspective: Taiwan<sup>132</sup>. Sheng and Chen carried out survey at three Taiwanese institutions: a museum of artistic works, a museum of historical relics and a museum of science and technology (Sheng & Chen, 2012). Their EFA results showed there were five “experience expectation” factors: Factor 1 easiness and fun; Factor 2 cultural entertainment; Factor 3 personal identification; Factor 4 historical reminiscences; and Factor 5 escapism (Sheng & Chen, 2012, p. 57). These factors also look somewhat different to my factors. For example, the culture and historical reasons were specified here while in my factors, there is no such emphasisation. Again, their research involved different museum types to my Ke Ji Guan, which may partly explain the differences. Additionally, although Taiwan may initially appear culturally similar to the Chinese mainland, there are some key differences. For example, according to Hofstede’s more recent work involving Taiwan, published on his webpage, Taiwan and China show significant differences on dimensions of Power Distance, Masculinity, Uncertainty Avoidance and Indulgence (Hofstede Insights, n.d.-b). For example, China: Taiwan’s values on these four dimensions are 80: 58, 66: 45, 30: 69 and 24: 49 (Hofstede Insights, n.d.-a).

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<sup>132</sup> Taiwan is a state in East Asia. From the middle of 17th century, Han immigrants from the mainland of China became to be the biggest ethnic group in Taiwan islands. Therefore, they share very similar traditional cultures with people in Mainland China. The political and legal statuses of Taiwan are long-term issues. The People’s Republic of China (PRC) claims sovereignty over Taiwan and the government of Taiwan, the Republic of China (ROC) is illegal. But ROC does not confess it. Now Taiwan is internationally used at the name of this region in most cases rather than ROC.

These two reasons may lead to the differences between my factors and visitor motivations in Taiwan.

So in summary, my motivational factors also reflect the particularly Chinese cultural characters. Museum type and visitors' cultural background both have obvious influences on visitor motivation factors. When it comes to the data process approach, EFA result is robust both on basis of the statistics and the conceptual mapping partly. As other scholars' research for instance Packer & Ballantyne in Australia and Shen & Chen in Taiwan, my result also suggests that museum type (features) can be reflected by visitors' motivational factors. For example, historical museum visitors would show different motivational factors from Ke Ji Guan visitors. Additionally, country (cultural) characters would also play roles in visitors' motivational factors.

### **8.5.2 Individual Ke Ji Guan clusters are conceptually weak**

Further investigation of the EFA analyses suggests that although relevant at the level of the combined dataset, at the level of the individual Ke Ji Guan case studies the clusters are conceptually weak.

There are some commonalities, for example for the **Benefit Seekers** cluster; M2, M4 and M6 are also (mostly) included in the factors calculated for the three Ke Ji Guan separately. All of these reflect a family-based bond. In the context of wider science museum evidence this is unsurprising: as Ecsite-UK argued, Science & Discovery Centres build "bonding social capital"<sup>133</sup>, especially in family groups (Ecsite-UK, 2008a). Other researchers have suggested that within a western context, spending time with families and friends is a key motivation for visiting a museum, and the same does seem to be true within my case study Ke Ji Guan (Beaumont & Sterry, 2005; Macdonald, 2002; Sterry, 2004). However, when I conducted the separate EFA

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<sup>133</sup> This concept refers to the strengthening of bonds within groups and communities.

analyses for each Ke Ji Guan individually, the wider results appear conceptually weaker. They all contain clustered motivational statements, which are difficult to intellectually reconcile based on existing evidence and understanding of museums and their visitors (whether within China or wider western contexts). For example, there was a factor for SSTM Shanghai, which combined M8 (... *I come to enrich myself*) and M18 (... *I live locally/pass by and come to cast a glance over*). M8 shows an obvious strong self-decided personally oriented motivation while M18 seems more optional, even representing no confirmed or deliberate motivation.

Additionally, as I described in Chapter 6 (Section 6.4), there are only a few clusters that are consistent in all EFA calculations, such as M2, M4 and M6; M12 and M17; M13 and M18; M9 and M20. Apart from those, most categories of the three Ke Ji Guan are different. This situation suggests that my EFA results for each individual Ke Ji Guan are weaker, maybe due to a combination of smaller sample size and non-normal distributional data. For this reason, only the combined dataset was considered for the investigation of connections between demographic and motivational data outlined in the next section.

### **8.5.3 Demographics showed strong correlations with visitors' motivational factors**

As outlined in my Literature Review (Chapter 2), Falk asserted that the long-term traditional research on demographics did not help to understand respondents' visits but actually obscured them, and gave the example that one person can visit a museum on two different days for completely different purposes (Falk, 2006). However, my results in Chapter 7 suggest that visitors' demographics such as gender, age, and educational qualification do have connections with their statistically-determined identity-related motivations.

As Chapter 7 (**Table 28**) showed, gender was only showing statistically

significant differences on Factor 2 Science-related Fans (Mann–Whitney U test,  $p < .05$ ). Factor 2 includes three motivational statements: M12... *I am interested in science*; M15... *I come to see the frontiers of science and the latest technologies*; and M17... *I am interested in science museums*. This result suggests that female visitors at my case study institutions may have lower levels of interest in science or science museums (Ke Ji Guan) than male visitors. Based on the data that female visitors were roughly twice as common as male visitors (Females: Males is 63.1%: 36.4%, based on **Figure 8** in Section 5.2.1.1), and the top motivations were about children, it could be concluded that a large percentage of female visitors attended a Ke Ji Guan mainly for their children rather than for their own curiosity of science or Ke Ji Guan.

**Table 29** indicates that females show less preference to be Science-related Fans because of the smaller value of their factor scores median than males ( $-.11 < -.04$ ) (see Chapter 7, Section 7.1). This result is also consistent with the gender division in university students' subject selection. There are more males attending science-related subjects in universities. For example, in five surveyed Chinese universities of science and technology, there were four universities that had a male to female student ratio of 6:4 and in the remaining one the ratio was 7:3 (Zhang & Cai, 2012). There is a similar situation internationally, especially for physics and engineering related subjects-boys demonstrating a higher interest in science is a recognised phenomenon (Colley & Comber, 2003). Going back to the Chinese situation, more recently there are some surveys, which suggest that female representation has undergone some changes. For example, in some universities of science and technology in China, the students' gender ratio of male to female was once as high as 7:1 but in 2012 the ratio decreased to 2:1 (Wang & Lei, 2012). So there could be a potential trend that the visitors' gender-associated preference for motivations associated with Science-related Fans may change in the future.

In terms of visitors' residences, my results showed that local visitors tended to visit the selected Ke Ji Guan as **Benefit Seekers** (Factor 1). Inside the F1, three motivational statements (M2... *I take my child to learn/expand horizon*, M4... *I take my child for fun* and M6... *This is a good way to interact with my child/share quality time with my family/friends*) shared negative factor loadings within the EFA, they could be classified as a sub-group of Factor 1, a family-related sub group. Two of them (M2 and M4) also belong to the group of "Facilitators" in my original conceptual analysis of identity-related motivation categories based on Falk's theoretical framework. My result indicated that local visitors preferred to regard Ke Ji Guan as a place to have engagement with their families rather than attending those Ke Ji Guan as **Science-related Fans (F2)** or **Opportunists (F5)**<sup>134</sup>.

From my data in Chapter 5, CSTM Beijing and SSTM Shanghai experienced proportionally higher percentages of out-of-town participants, at 49.8% and 61.0% respectively, while SDSTM Shandong only had 18.5% visitors from other cities (see Chapter 5, Section 5.2.1.4). Given that both CSTM Beijing and SSTM Shanghai are AAAAA level national sightseeing spots and very famous in China, the reason why out-of-town visitors loved to attend them may be that they hoped to see these famous and interesting places.

Local people were more reluctant (less likely) to visit them for M5... *I want to be able to tell other people that I have visited here* and M9... *I love our country and want to see our latest developments in science and technology* (Factor 4 **Affirmation Seekers**). The reason may be they were very familiar with these places, so did their friends and local relatives (the "other people"). In other words, the experience of visiting these places for local people is not so worthy talking to "other people" as they may also be familiar with there. So summarily, visitors from the local city or out-of-town used the selected Ke Ji Guan in subtly

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<sup>134</sup> F5 Opportunists includes two motivational statements: M16... *I come to see my friend/boyfriend/girlfriend/other people*; M19... *I got a free ticket/I can get a ticket reimbursement*.

different ways that aligned well to those demographic properties.

Visitor's ages also generally show strong statistically significant correlations with some factors (F1, F2, F3, F4 and F5). Visitors aged 16-25 years old showed a clear trend to visit the Ke Ji Guan for M11...*I come to relax/have fun* and M14... *I come to satisfy my curiosity*, while visitors aged 26-35 and 36-45 showed more preference to attend the Ke Ji Guan for M2, M4 and M6. There is evidence that current younger generations become more and more focused on the personality and are perceived as self-centred (Luo, 2011), though they remain within a collectivistic society based on Hofstede's cultural theory (Hofstede et al., 2010). So M11 and M14 do reflect this trend by specifying their motivations of self-relaxation and self-satisfaction. According to the Sixth National Population Census in 2010, the average childbearing age of Chinese women is just over 28 years old (Zhang, & Li, 2013). So it can be deduced that many of the people selecting M2, M4 and M6 were likely to be parents, whilst those in the younger category were independent adults. The visitors of the group aged 56-65 show more preference on both F2 **Science-related Fans** and F4 **Affirmation Seekers**. The F4 includes M5 and M9. For people aged 56-65, most of them were in their retirement life, because China's average retirement age is about 54 years old (Li, 2017). This group of visitors had more spare time to enjoy their own life, such as satisfying their curiosity for science (F2-M12 and M15). They are also more likely to have enough time and money to travel and visit sightseeing spots. So the motivation of M5 has a typical feature of retirement-age tourists, which shows some similarities with Falk's "Experience Seekers" (see Chapter 2, Section 2.4.1). On the other hand, from their ages, it can be seen that they were roughly born at the very start (1<sup>st</sup> Oct 1949) of the new country, the People's Republic of China. It is possible that they have strong feelings of pride in the country because they actually witnessed the country being built from the old society and wars. More importantly, they also took part in and witnessed the fast development of the

country. This may help explain why senior visitors were more likely to choose M9.

It can thus be observed that different age groups have relatively unique motivations to visit a Ke Ji Guan, and that there were three clear layers of identity-related motivation groups. Adult visitors under 26 years old tended to satisfy themselves by having fun and exploring interesting things in Ke Ji Guan (M11 and M14). Visitors aged 26-45 showed a clear trend to visit a Ke Ji Guan for others, especially for their family members (M2, M4 and M6). The last group, visitors aged 56-65 seemed mainly focused on exploring science-related attractions and affirmation reasons such as hoping to talk with somebody about their Ke Ji Guan experience (M5) or seeing the country's development (M9). Unlike the other age groups the group aged 46-55 years old did not show strong correlations with any factors. This could perhaps be because they are a mixed demographic: some might possibly still be parents of young children, whilst others might be almost grandparents. Further studies on sub-groups (such as groups with smaller age scales) may help reveal the reasons. Although the Kruskal–Wallis Test between visitors' age groups and identity factors shows F5 Opportunists also demonstrated a correlation with age (**Table 32**), the further statistical analysis indicated that the correlation is very weak because no value was less than .003 based on their Mann-Whitney U tests (**Table 33**, see Chapter 7, Section 7.3). This indicates that, although showing some relationship, age does not play an important role on motivations of F5.

When it comes to visitors' previous visiting history, my results indicated that visitors who had previously attended the Ke Ji Guan more than twice tended to select motivations such as M2, M4 and M6, all of which formed part of Factor 1 **Benefit Seekers** and related to different perceived benefits for their child(ren). In contrast, first-time visitors showed more preference for M11 and M14 of Factor 1 **Benefit Seekers**, which as noted in Chapter 7 (Section 7.4) were

more related to benefits for themselves. It seems that visitors who are already keen to take their families to visit Ke Ji Guan may find the experience beneficial (particularly for their child(ren)), and thus be more inclined to attend more than once.

The data analysis also showed that the first-time visitors were less likely to visit Ke Ji Guan for reasons associated with F3 Convenience Users and F5 Opportunists. This is unsurprising since both F3 and F5 are factors that do not show very close connections with the main characters of Ke Ji Guan (such as science and technology popularisation). That is to say, a new visitor tended not to choose a Ke Ji Guan for some indirect reasons such as using Wi-Fi or meeting somebody. Instead, they tended to demonstrate explicit or specific aims to visit those Ke Ji Guan. It is less likely that out-of-town visitors would visit a Ke Ji Guan regularly because of the distance involved. By contrast, local visitors have more chance and convenience to visit those Ke Ji Guan repeatedly, particularly people who live nearby, who would have more opportunity to attend a Ke Ji Guan to use its facilities (F3-M13... *I come to use the facilities (e.g. climate control, seats, Wi-Fi)*). Also, the free tickets were usually offered to local people season by season, so it is possible that local people would attend those Ke Ji Guan regularly for this reason (F5-M19... *I got a free ticket/I can get a ticket reimbursement*). For some people who use Ke Ji Guan as a meeting place, it is more likely that they would visit the Ke Ji Guan repeatedly if they were satisfied with the environment or facilities (F5-M16... *I come to see my friend/boyfriend/girlfriend/other people*).

From my data analysis of Chapter 7 (Section 7.5), visitors with high levels of education (Associate degree, Masters degree or equivalent, Bachelor degree or equivalent, and Doctorate or equivalent) all show strong tendencies to visit Ke Ji Guan for reasons associated with M2, M4 and M6 of the F1 **Benefit Seekers**, and among them, the group of Doctorate or equivalent visitors

displayed the strongest trend. It can be seen from the results that parents with a higher education level took their children to visit the three case study Ke Ji Guan, so these children could have more opportunities to learn or be inspired by science than other children with lower educated parents. This may cause a circular pattern in that well educated people support and encourage their offspring to have high (even higher) education through trips like visits to Ke Ji Guan, and vice versa for people from lower educated backgrounds. As some researchers have previously suggested, China is currently facing a crisis of “class solidification”, where people get locked into the social class into which they are born (Ma & Zhu, 2012; Yang, 2014). This situation within the Ke Ji Guan may intensify the extent of class solidification and expand the gap of science learning between well-educated people and others. Furthermore, this goes expressly against the stated intentions of the Chinese government and CAST, which hope to improve less educated people’s science literacy through initiatives such as Ke Ji Guan.

In summary, visitors’ demographics and their motivational factors had clear correlations, and the F1 **Benefit Seekers** seems to be the most important factor, which showed connections with all demographic variables I tested. Falk and his colleagues argued that visitors’ demographics are poor predictors of how and why people learn in museums (Falk & Adelman, 2003; Falk & Storcksdieck, 2005). As my research has demonstrated, the function of demographics is not to predict but instead to help to interpret or explain the underlying reasons for visitor motivations or behaviours. My analysis suggests that visitors’ motivations (factors) do have some connections with their demographics, even relating to recognised social issues such as class solidification. Though of course people may visit a Ke Ji Guan with different motivations on different days, there was suggestion within my data that demographics do in fact play a role in determining their motivations, especially for those people who visit a museum for reasons relating to seeking

identifiable benefits, either for themselves or their families.

Finally, as mentioned in Section 8.5.1, I chose six main factors from my EFA analysis as my identity-related motivation groups. However, my statistical analysis found that no tested demographics showed correlations with the sixth factor: Professionals. This may suggest that this last factor has very weak associations with the main data patterns and may in fact be better removed from the overall EFA identity groupings.

## **8.6 Chapter summary**

In summary, in this chapter I initially clarified the concept of Ke Ji Guan. Ke Ji Guan is an imported concept from the western world, and has been localised during its development in China. Its contents and functions have subtle differences from science museums and science centres in a western sense. Due to a lack of sufficient academic research, and instead relying mainly on governmental guidance, Ke Ji Guan's academic definition and taxonomy are both still in confusion. I suggested that "Ke Ji Guan" is the most appropriate term to apply within the Chinese environment, rather than using science museum, science centre, or science-related museum as its English name because the name "Ke Ji Guan" can not only perfectly avoid the debate of science museum/centre but also reflect the unique character of such institutions in China.

Regarding visitors' demographics, I drew on comparisons between my results and various evidences from wide-ranging western research. I found that my data were roughly similar with western data, with a typical visitor from my selected Ke Ji Guan being female, below 35 years old, well educated and accompanied by family members.

When I compared my data with the similar previous Chinese research that was accessible, I discovered that the findings were broadly comparable to existing

evidence, suggesting that although my research was focused only within three case study Ke Ji Guan, my results remain robust, and likely relevant more widely within China. Additionally, there was clear evidence of a gap between the performance of Ke Ji Guan and the government's expectations regarding their stated task of science and technology popularisation.

In terms of visitors' identity-related motivations, I concluded that it is inappropriate to simply apply western motivational statements directly in my research. According to Hofstede's theory of cultural dimensions, there were some unique Chinese style motivations. For example, M10... *I want to prepare myself for a future visit with my child* reflects the Chinese people's cultural characteristic of Long-Term Orientation. Furthermore, certain visitor demographics demonstrated clear correlations with the identified motivational factors. Contrary to previous suggestions, demographics do help to interpret and explain the underlying reasons for visitor motivations or behaviours, perhaps even suggesting that Ke Ji Guan are contributing to rather than overcoming the problem of class solidification in China.

## **9 Conclusions**

Within my project I applied a visitor questionnaire survey and face-to-face expert interviews to conduct research in three selected Ke Ji Guan in China. Based on my results from 1249 valid questionnaires and interviews with three experts, I explored visitor motivations, the wider strategy and context relating to CSTM Beijing, SSTM Shanghai and SDSTM Shandong. In this final chapter I will draw together findings from all of my results and analysis to highlight the key original findings of my research and answer my three core research questions.

### **9.1 Clarification of the concept of Ke Ji Guan**

Ke Ji Guan can be regarded as the result of the Chinese government's efforts in supporting the country's science and technology development, building on learning from Informal Science Institutions in the western world. In the process of localisation, the concepts of science museum/centre transformed to a specific Chinese type of institution: Ke Ji Guan. Ke Ji Guan shares some features with western Informal Science Institutions, such as target visitors and some contents, but they show clear Chinese characteristics. All formal Ke Ji Guan are supported, operated and supervised by governmental departments of different levels. Playing an important role as part of the infrastructure of science and technology popularisation in China, Ke Ji Guan's dominant mission is to conduct science education for the public, especially younger generations.

This function-driven definition was made by government through official documents rather than academic circles or professional associations, though of course experts were involved in creating that definition. However, the name (both in Chinese and English) and the taxonomy of Ke Ji Guan remain

confusing. Because of some unique features (such as close connection to governments), and differences from Informal Science Institutions in the western sense, I suggest using the name of Ke Ji Guan rather than science museum or science centre as some documents currently do.

## **9.2 Answers to the Research Questions**

Through my research in the three case study Ke Ji Guan in China, I identified the answers to the research questions as follows:

### **9.2.1 Answer to RQ1: Visitors' identity-related motivations at three case study Ke Ji Guan in China**

According to my analysis based on Falk's framework and methodology, the identity-related motivational groups in the three Ke Ji Guan were Explorers, Facilitators, Experience Seekers, Professional/Hobbyists, Convenience Users, Emotional Connection Seekers, and Pleasure Seekers. It can be seen that my data share some categories with Falk's model (for example, the first four categories listed above). At the same time, some categories showed specific Chinese-based characteristics on the basis of their motivational statements (for example, the M9... *I love our country and want to see our latest developments in science and technology* in the category of Emotional Connection Seekers).

Extending Falk's methodology using a statistical analysis approach, the Exploratory Factor Analysis (EFA), I obtained an alternative set of identities (factors) based on the motivational statements used within my questionnaire. The EFA helped me to cluster variables sharing common features (Cohen et al., 2011). The extracted identity-related factors were:

- **F1 Benefit Seekers:** people who wish to satisfy their own or other people's particular aims such as to learn, relax and explore.
- **F2 Science-related Fans:** Visitors who have a special interest in science-related contents such as that contained within science exhibitions, or even the Ke Ji Guan itself.
- **F3 Convenience Users:** People who attend a Ke Ji Guan for reasons relating to its facilities or because they happened to be in the vicinity, not for reasons associated with the Ke Ji Guan itself.
- **F4 Affirmation Seekers:** People who seek a wider sense of worth or status, relating either to themselves or to the country as a whole.
- **F5 Opportunists:** Visitors within this category see their visits as an opportunity-either to get something for free that normally they would have to pay for, or to spend time with certain friends that they might not otherwise connect with.
- **F6 Professionals:** People in this group have professional goals, such as schoolteachers taking their students to visit a Ke Ji Guan as an out-of-class educational experience.

Based on Hofstede's cultural dimensions theory, some single motivational statements showed clear Chinese cultural features, for example "Long-Term Orientation" and "Collectivism". These results indicated that though my factors shared some identity-related motivational groups with Falk's original work, some single motivations still have subtle differences. Further discussion can be seen in Section 6.2 and Section 8.4.2.

### **9.2.2 Answer to RQ2: Visitors' demographics at three case study Ke Ji Guan in China**

The visitors' demographics demonstrate certain patterns, aligned roughly with similar previous results both within China and in various western contexts. In the combined data from the adult visitors (aged 16 years or more) of the three chosen Ke Ji Guan, it is clear that they attract many more female visitors than males (around twice the proportion). When it comes to the age distribution, 26-35 year old visitors are the largest group (36.0%) followed by approximately one-third of visitors aged 16-25 and a further quarter aged 36-45. There is a clear trend towards visitors' highest completed education level being a bachelor degree or equivalent (37.9%), while 14.4% respondents hold associate degrees, suggesting that Ke Ji Guan visitors in China are well educated. Visitors from the local cities (Beijing/Shanghai/Ji-nan) account for 56.9% of survey respondents. Family members are the most common people to accompany visitors to Ke Ji Guan. In terms of the visitors' subject specialisms, "Humanities and Social Sciences" accounted for 44.2% out of all subjects, followed by "Technology and Engineering". "Natural Science" specialists represented only 4.5% of the responses, suggesting that Ke Ji Guan visitors do not connect themselves with science more broadly. Additionally, 66.1% of visitors attended the three Ke Ji Guan for the first time during my research data collection period.

My research showed similar results with other previous Chinese research in Ke Ji Guan for certain demographic variables, such as visitors' educational qualifications, locations of residence, frequency of visit, and who accompanied them (see Section 8.3.1). This suggests that my data are robust. When I compared my data with existing relevant western data, the results showed Chinese visitors have roughly similar typical visitor profiles with visitors of European Informal Science Institutions. However, the data also revealed that

the selected Ke Ji Guan do not completely meet their mission of popularising science and technology to the target visitors (the public, particularly young people who need to improve their science literacy) perfectly (see Section 8.3.2, and further recommendations can be seen in Section 9.3.1 and Section 9.3.2).

### **9.2.3 Answer to RQ3: Correlations between visitors' demographics and their identity-related motivations at three case study Ke Ji Guan in China**

According to my analysis (see Chapter 7 and Section 8.5.3 of Chapter 8) there were clear correlations between certain visitor demographics and their motivational factors. In particular F1 Benefit Seekers seems to be the most important factor, which showed connections with all demographic variables I tested.

The results indicated that females show less preference to be Science-related Fans than males. Visitors from the local city or out-of-town used the selected Ke Ji Guan in subtly different ways. Local visitors displayed a stronger motivation of seeking benefits, while out-of-town visitors showed more preference as Affirmation Seekers. Visitors aged 16-25 years old clearly tended to visit Ke Ji Guan as Benefit Seekers, whilst senior visitors (aged 56-65) showed more preference as both Science-related Fans and Experience Seekers. Visitors aged 26-45 showed a clear trend to visit a Ke Ji Guan for the benefit of others, especially their family members. Visitors aged more than 65 years seemed mainly focused on exploring science-related attractions and some opportunistic reasons. Visitors who attended the case study Ke Ji Guan for the first time showed a slight preference to be Benefit Seekers, whilst second-time visitors were on the contrary. Repeated visitors also had less likelihood of being F4 Affirmation Seekers. The correlation between visitors' educational qualifications and my factor F1 is significant. Visitors whose highest education was High school/Zhongzhuan indicated a strong trend to be

Benefit Seekers. Comparing parents with lower educational qualifications, parents with higher education levels showed a preference to take their children to visit the Ke Ji Guan.

My results above showed that demographics do help to interpret and explain the underlying reasons for visitor motivations or behaviours, and they should not be neglected. Further discussion and suggestions is in Section 9.3.1 and Section 9.3.2.

### **9.3. Implications for practice and policy**

Based on my research, I identified various aspects whereby Ke Ji Guan in China can improve their service, which I will outline here. Additionally, within this section some suggestions will be made for improving Ke Ji Guan policy.

#### **9.3.1. Impacts on practice in China**

In this section, I will outline practical suggestions for Ke Ji Guan's work and policy in order that their science communication work can be done in a more effective way. Though focused on Ke Ji Guan, it is likely that other Chinese Informal Science Institutions may also benefit from these recommendations.

##### **9.3.1.1. Recommendations for individual institutions**

Whilst conducting visitor surveys in the three Ke Ji Guan in Beijing, Shanghai and Shandong I also undertook some observational work to familiarise myself with the context and visitor behaviours in those locations. I observed that there were some delivery and/or facility aspects relating specifically to visitor motivations that could be further developed, although all of them have supplied good service to visitors to date.

As I discussed in Chapter 8 (Section 8.3.2), based on my research, Ke Ji

Guan's practice does not fully meet the government's intended target. The largest group of Ke Ji Guan visitors were not people who needed to improve their science literacy. As part of the governmental Popularisation of Science and Technology Infrastructure (PSTI), Ke Ji Guan need to develop their practice to attract more of their target visitors. One way to achieve this goal is to improve their service strategically and better meet visitors' needs according to the most common motivations for attendance. By meeting visitors' needs well and providing good service, Ke Ji Guan can improve their reputation and then attract more visitors. Displaying an attitude of caring about their visitors may also help Ke Ji Guan to appeal to more diverse audiences.

The visitor motivations identified within my research can thus be used strategically by Ke Ji Guan to improve their offer to visitors, thereby better meeting their needs. For this reason, I have identified the following recommendations for Ke Ji Guan's practice. Where appropriate, existing good practice within one or more of my case study Ke Ji Guan is highlighted as examples that other similar institutions can learn from.

The recommendations according to my researched visitor motivations are as follows:

1. For M6... *This is a good way to interact with my child/share quality time with my family/friends.* M6 was a very popular motivation of visitors attending those three Ke Ji Guan with 547 visitors out of 1249 choosing it (see **Figure 22**, Section 6.1). Therefore for Ke Ji Guan it is worthy paying more attention to people with this motivation. It would be advisable to **include facilities that need visitors' combined cooperation to play**. For example, there is a long-distance sound wave communication facility in the CSTM Beijing, which needs at least two people to play: one is the sound wave maker and the other is the receiver. This type of facility could help families or groups of friends to

share their quality time more effectively and believe this is a worthy place to interact and spend their time.

2. For M2... *I take my child to learn/expand horizon*; M4... *I take my child for fun*; M6... *This is a good way to interact with my child/share quality time with my family/friends*. It can be seen here that “child” is the key word, meaning that it is important to **include children-focused exhibitions and children-friendly facilities** such as the “Free Fall”<sup>135</sup> instrument in SDSTM Shandong. The 3D Printing World<sup>136</sup> in SSTM Shanghai is also a good place for children to learn 3D technology and try the printing machine.

Furthermore, in order to maintain children’s interest in the exhibitions/facilities and ensure their safety, **update and maintenance of the exhibitions needs to be done more frequently**. For example, I observed that some facilities that were broken at the start of my research at CSTM Beijing remained “out of order” for the entirety of my 12-day survey. The SDSTM Shandong contained many examples of old-fashioned exhibitions from the last century. Broken facilities should be repaired as soon as possible and for some popular facilities, it would be helpful to use better quality materials and protective measures in order that they can be operated safely and smoothly. According to my survey, first-time visitors accounted for 66.1% in the three Ke Ji Guan (see **Figure 20**, Section 5.2.1.7). This data suggests that more work could be done to raise the repeated visitors because they accounted less than one half of the total numbers. It is worthy thinking about how to appeal them to visit the Ke Ji Guan again. Therefore new modern facilities are also needed to attract repeated visitors (not only children) as they can play and see different things when they visit the Ke Ji Guan next time.

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<sup>135</sup> The free fall is a facility with balls and iron tracks. Visitors can put balls with different weights at the top of the tracks and let the balls drop freely to discover the different tracks that the balls fall along with. The tracks’ shapes are actually different parabolas. Visitors can learn the mathematical discipline of parabola through playing with this facility.

<sup>136</sup> The 3D Printing World is a room to let visitors experience the whole process of 3D printing such as 3D scanning, 3D model building, and 3D printing.

3. For M11... *I come to relax/have fun*; M13... *I come to use the facilities (e.g. climate control, seats, Wi-Fi)*; M16... *I come to see my friend/boyfriend/girlfriend/other people*. It would be helpful to **improve the internal services such as Wi-Fi connection, food provision and souvenir shops** in order that visitors can have a good time at Ke Ji Guan with good service. Visitors with M11, M13 and M16 may regard Ke Ji Guan as a place to provide good service and let them feel convenient and relaxing. So it could be helpful for Ke Ji Guan to develop all relevant services to meet these needs.

Smartphone penetration in China in 2016 was 58% (EChinacities.com, 2016) and 82% of young people (16-24 years old) were using smartphones (Go-Globe, 2014). The number continues to grow rapidly. For the most popular social media app, WeChat, its users in China reached 8.89 hundred million in 2017 (Sohu, 2017). Most people prefer to use free Wi-Fi to save money, particularly for video chat, which needs a lot of data to support. Moreover, nowadays it is a common phenomenon that most Chinese public places (such as Cafés, restaurants and cinemas) provide free Wi-Fi service. Furthermore, a good connection to the Internet would help visitors share their pictures and experiences with friends, which will act as an informal marketing mechanism for the Ke Ji Guan. In other words, good Wi-Fi is useful not only to help attract visitors interested in such convenient amenities, but also to encourage free endorsements on social media. Based on my experience at the three case study Ke Ji Guan however, all of their Wi-Fi services need to be updated. The CSTM did have Wi-Fi service, but the signal was very poor and occasionally unavailable altogether. Moreover, visitors had to register their national ID cards at the reception desk to obtain a password. The password was changed daily, so even repeated visitors had to queue to register their ID cards for each visit. The process to use Wi-Fi was too complex and too strict compared to other similar public amenities. The SSTM Shanghai also supported Wi-Fi service,

but only for a limited time period, and some visitors complained that the signal was poor. There was no Wi-Fi service at all at the SDSTM Shandong.

It would also be helpful to improve the food supply services including the Café, canteen and water bar in order to encourage visitors to stay longer (especially those with young children), or attract repeated visitors due to the amenities. For my three chosen Ke Ji Guan, their practices on this topic need to be improved. Both the CSTM Beijing and SSTM Shanghai are located far from the central city, so people have to spend a long time travelling to reach those Ke Ji Guan. Additionally, both of them are giant level Ke Ji Guan (see Section 3.5.1), which means that visitors need a lot of time to see most of the exhibitions. If suitable facilities are provided then visitors would more likely to choose to have their lunch inside the Ke Ji Guan, particularly as there are very few restaurants nearby. However, the visitor canteen of the CSTM Beijing was located in one corner of the underground floor. There were only a few expensive dishes to choose from. The lights of the canteen were comparatively dim. There was a water bar on the first floor but it was surrounded by messy tables and ashbins. These expensive food, dim lighting and mess may cause unhappy experience of visitors and then decline visitors' interests in visiting the Ke Ji Guan again. The canteen of SSTM Shanghai was better than the CSTM because it had bright windows, a tidy environment and clean space. But the food's price was also high comparing with regular restaurants outside. There was no canteen for visitors at the SDSTM Shandong but they did provide a counter for drinks. In all these three Ke Ji Guan, there were no Cafés or high quality tea bars for visitors. Improving the food service can thus raise the satisfaction rate of visitors because high quality eating or drinking places such as canteen, Café or tea bars could provide comfortable environments for people who want to use Ke Ji Guan as a place to meet friends or relax (For example, for the visitors with the motivational statements M11 or M16).

Finally, the items on offer at the souvenir shop should be more related to the specific Ke Ji Guan. A souvenir shop is also a good channel to encourage visitors to appreciate the specific local science and exhibitions at that Ke Ji Guan with specially designed products. For example, the Science Museum London and the National Palace Museum (Beijing) both contain good examples of effective souvenir shops, and have the added bonus of acting as an additional source of income for those institutions. Indeed, the National Palace Museum's famous collection replicas are highly popular and the turnover relating to them in 2016 was 1 billion RMB<sup>137</sup> (Ebrun, 2016). However, the CSTM Beijing's souvenir shop was full of expensive toys, but most of them were common toys rather than having been designed for CSTM Beijing specially. The same products could be bought from other places for much lower prices. For the SDSTM Shandong, when I finished my study there, its souvenir shop had only just been built and contained only a few common toys in it. It looked nearly empty. SSTM Shanghai had a better souvenir shop, which contained some specially designed products related to the exhibitions in the SSTM. It also had a coin press machine on the third floor. Visitors could choose from a variety of models to make special metal commemorative coins as souvenirs of their visit to the SSTM. This machine was very popular with children and I observed there were always a lot of children around the machine. So summarily, SSTM did a better job on meeting visitors' motivations M11 and M16 with better eating places, bright space and good souvenir shop. CSTM and SDSTM should also at least improve their service on these aspects.

Alongside my motivational findings, I also collected data about visitors' demographics, which are relevant to each of the individual case study Ke Ji Guan. As Trainer and colleagues argued, knowing the portrait of visitors can help institutions make better strategies (Trainer et al., 2012). My demographic

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<sup>137</sup> RMB is the Chinese currency (also as known as CNY), and based on the exchange rate of November 2017, 1 billion RMB=114.8 million GBP.

findings can help to broaden each Ke Ji Guan's audience by letting Ke Ji Guan know their existing visitors better, and informing future strategies to improve their practice. The following recommendations are made to the case study Ke Je Guan according to my demographic findings:

1. There were 63.1% female visitors who attended the three case study Ke Ji Guan, meaning roughly twice as many females as the number of male visitors (see Section 5.2.1.1). However, I observed that there was usually a long queue outside the female toilets at the CSTM Beijing. Given the strong gender imbalance in visitor numbers it would be helpful to add more female toilets. Additionally, a baby change room is also needed in order to support mothers who bring infants to the Ke Ji Guan. **Good service to the main visitor demographic group** (mothers) could help encourage the number of repeat audience visits and attract more visitors with young children, including perhaps those from less educated families. It is maybe difficult to reference this but it is true that many big Informal Science Institutions have baby care facilities, such as the Science Museum London and the Natural History Museum London.

2. The top two groups of visitors were family groups and friends (see Section 5.2.1.5). A **good broadcasting system** for announcements would be helpful for parents or groups in order that they can find their children/friends as soon as possible when they become separated from each other.

3. My survey also collected visitors' ages groups at my three case Ke Ji Guan, for example, that young people (visitors less than 36 years old, accounting for 68.8% of total visitors) were the main body of visitors (see Section 5.2.1.2). I suggest that **all three Ke Ji Guan provide suggested services that are divided according to visitors' ages**. For instance, SSTM Shanghai has a visitor guide that is broken down according to the visitors' age groups. On both

the visitor guide brochure and website<sup>138</sup>, there are four recommended routes for adolescents, adults, seniors, and families with children under ten years old. These routes showed that the SSTM Shanghai considered visitors' likely interests, health conditions and mode of visit based on their age categories. The four routes did share some common recommended exhibitions, but also some differences. For example, there was a Spider Exhibition particularly suggested for adolescents, which was related to their biology course in school and daily observation/exploring work. In the route suggestion for adults, there was an exhibition about Designers, which may be better related to adults' work, interest or knowledge backgrounds. The route for seniors only included nine recommended exhibitions while routes for the other three groups all had 12 exhibitions. The reason may be that seniors choose to visit fewer exhibitions in more depth due to a mixture of being interested in more detailed information, as well as potentially less energy and health than other visitor groups. Also, for senior people, the guide suggested the IMAX cinema, while for younger people (adults and adolescents), the 4D cinema was suggested. The difference may be in order to avoid the potential risks caused by 4D visual effect and cinema chairs for senior visitors, such as dizziness and possible heart problems. Neither CSTM Beijing nor SDSTM Shandong had visiting route guides based on age groups. Shanghai's practice can be seen as an exploration about providing more specific service according to visitors' demographics and extend the existing good practice in line with wider government priorities to target audiences. Such visitor guides are not compulsory-visitors can still choose whatever route takes their individual fancy-but they would provide more structure and clarity for those visitors who are interested in such information. It might also help the Ke Ji Guan staff to think clearly about who they are trying to attract, and what content/facilities they are providing to each of the target demographic audiences.

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<sup>138</sup> Recommended visiting routes of SSTM Shanghai: <http://www.sstm.org.cn/course/2>, accessed on 2018-02-02.

4. Although visitors with lower levels of education only accounted for a small proportion within my research (4.3% of my participants in total had educational qualifications lower than “High School/Zhongzhuan”), they were actually the official target visitors of Ke Ji Guan because they have lower scientific literacy. **The instructions of the facilities (or exhibitions) need to be easier to understand and avoid using obscure jargon** to better cater for visitors from lower education backgrounds. Furthermore, there would be more things can be done to attract these visitors. For instance, running specific exhibitions/facilities that are likely to be of more interest to such visitors such as exhibitions about science related to daily life or facilities with video guidance. Offering free tickets to representatives from such communities could also be an effective way to catch more this type of visitors.

Through supplying better service to these visitors, Ke Ji Guan can better meet their needs, hopefully attracting more of them to visit, and thus better fulfil their official role of science and technology popularisation. This would greatly help to reduce the gap between the actual practice and the governmental requirements. Further recommendations about policy making can be seen in Section 9.3.2.

#### **9.3.1.2. Recommendations for field-wide practice across Ke Ji Guan in China**

There are hundreds of Ke Ji Guan in China currently and I only studied three of them. I cannot therefore claim that my data are representative, yet there are still some general lessons that can be applied across the field-wide practice within Ke Ji Guan throughout the country.

1. In order to better equip staff employed in Ke Ji Guan with the relevant skills,

it would be helpful to **enhance the training and accreditation provision**. In particular, this could be achieved through cooperation between Ke Ji Guan and universities by setting joint subjects about Ke Ji Guan management, or even vocational training (e.g. through staff professional development workshops) of Ke Ji Guan service techniques such as exhibition interpretation/explanation. As I mentioned in Section 2.2.3, only a few universities have museum-related departments in China. According to data from the Chinese Ministry of Education (2011), only 53 out of more than 800 government public universities have a department of museum studies or museology (Mei, 2011), which limits the likelihood of Ke Ji Guan staff having such skills. Such joint education would raise the number of Ke Ji Guan experts and trained staff within Ke Ji Guan, thereby enabling such institutions to better manage their strategic direction and incorporate known international best practice at a local level. For those university students, the cooperation with Ke Ji Guan could give them chances to attend internship at Ke Ji Guan to practice their skills and knowledge about Ke Ji Guan. Universities could build their reputation of developing high quality students in the field of Ke Ji Guan and then recruit more students who are interested in Ke Ji Guan work. Additionally, Ke Ji Guan can provide opportunities for current students to attend workshops or internships at Ke Ji Guan in order that they can learn practical techniques about Ke Ji Guan operation. Through hiring professional staff and experts, Ke Ji Guan can supply higher quality services and thereby be likely to attract more visitors. Additionally, professional knowledge would help Ke Ji Guan staff do a better job on Science and Technology Popularisation and shrink the gap between the governmental target and Ke Ji Guan's intended work.

**2. It would also be sensible to design exhibitions or facilities that reflect the local culture or the local history of science.** According to my own observations as well as the studies of Zhu and colleagues (2011), many Ke Ji Guan still display old exhibitions from the last century. It would be helpful to

cooperate with Ke Ji Guan experts to design exhibits that are unique for each Ke Ji Guan in order to reflect the local scientific, historical and cultural specialities. More importantly, by designing exhibitions at a local level they can better take into account the scientific literacy levels of the local people, as well as their likely Ke Ji Guan visiting needs. For example, although there were some similarities, each Ke Ji Guan's visitors did have their own particular visiting motivations (factors), which reflected differences in their visitors' needs from other case study Ke Ji Guan (see **Table 27**). Specially designed facilities and exhibitions reflecting local cultures could also attract out-of-town visitors because these locally designed exhibitions would avoid visitors seeing similar exhibitions (or even the same) at different Ke Ji Guan. In other words, every Ke Ji Guan should be (at least partly) unique and interesting.

**3. Overall visitor evaluation can be an effective way to connect the Ke Ji Guan with their visitors**, particularly in letting the Ke Ji Guan better understand their audiences. Besides the national survey of people's scientific literacy, Ke Ji Guan could also carry out similar surveys with specially designed questions related to the local people and that Ke Ji Guan, in order to find out the potential scientific needs of local people, test their understandings and anticipations of the exhibitions at the Ke Ji Guan, and collect feedback on its service. Additionally, observing visitors at specific exhibits or near relevant facilities such as a souvenir shop or Café, can be useful to better understand their interactions and experiences and help to explore their actual needs and feedback. Through better understanding visitors' information, behaviours and feedback, Ke Ji Guan can provide better services and improve the strategic design of their exhibitions, facilities and activities, thereby improving their reach and ability to meet their official targets.

### 9.3.2. The direction of wider policy-making in China

According to my research findings, Chinese policies on Ke Ji Guan are very prescriptive. For example, in the project “Village Science Popularisation (‘Ke Pu Cun Cun Tong’ in Chinese)”, they instruct the local science popularisation departments to display an information board containing specific agricultural knowledge. Very detailed standards regarding the display are proscribed, for example the set location, the size of the board and the materials to use (Du, 2006). These sort of guidelines overlook the differences between regional areas, and of course do not take into consideration the audience’s motivations for viewing such information. To avoid such scenarios in the future, based on my research and findings I have the following suggestions for Chinese science policy regarding Ke Ji Guan.

1. I would suggest the government **seek a looser system of guidance for Ke Ji Guan**, instead encouraging science popularisation according to the actual needs of the relevant audiences and regional features, rather than making detailed homogenous standards. Each city has its own specific culture and science institution visitors. It may be helpful to give these institutions more freedom to build their own localised exhibition policy in order that they can do a better job of science and technology popularisation within their specific setting.

2. **More alternative public PSTI should be built in rural places without Ke Ji Guan.** As I mentioned in Section 8.3.2, I found that there is a gap between the national science policy and the reality of the Ke Ji Guan’s delivery of science and technology popularisation. One of the important official missions of Ke Ji Guan is to popularise science to people who have little scientific literacy, but in reality, my findings suggest that the main visitors of those case study Ke Ji Guan were people who already have a comparatively good scientific literacy (well educated). Based on the fact that the Ke Ji Guan are

mostly built in cities and urban areas where people usually have higher education levels, more alternative public science engagements should be conducted in rural places without Ke Ji Guan. For example, mobile Ke Ji Guan, science and technology vans, community science and technology popularisation boards, and online Ke Ji Guan. News reports have previously shown that some of these infrastructures have helped successfully achieve science and technology popularisation in rural areas (See for example Li, 2015; Li, 2011; Yang, Fang, & Lan, 2015; Zhou, 2011).

**3.** It would also be helpful if the Chinese government was to **require each Ke Ji Guan to have a regional presence outside the cities in which they are based.** Currently there is a relevant policy titled “Three Works Go to Countryside”. The “Three Works” refer to culture, science (and technology), and medical treatment. The aim of this policy is to improve the levels of these three issues in countryside by letting people know more knowledge and skills about culture, science and medical care. Within the efforts of “Science (and technology) Goes to Countryside”, there have been some previous activities conducted by Ke Ji Guan which achieved satisfactory effects. For example, the Ke Ji Guan of Guizhou province took their 4D cinema instruments and other facilities to popularise science and technology in the countryside (Chen, 2013). Another Ke Ji Guan in Shixing city (Guangdong province) visited minority villages to give science lectures to isolated children whose parents were working in larger cities (Li, 2015). There is evidence that those activities were helpful in popularising science in rural places. However, there is currently no governmental policy specifying or even encouraging Ke Ji Guan to be part of such initiatives. So it may be helpful to develop dedicated policy initiatives to encourage Ke Ji Guan to use their facilities to popularise science and technology in rural places in order that Ke Ji Guan can better reach the target audiences stated in the *Outline of the National Scheme for Scientific Literacy (2006-2010-2020)*.

4. Even within urban locations, it is also **necessary for Ke Ji Guan to consider how to better appeal to people with lower scientific literacy**. For example, using the popular social media WeChat to advertise the Ke Ji Guan and popularise scientific knowledge.

In summary, Chinese science policy on Ke Ji Guan and other Informal Science Institutions appears to be relatively strict and detailed. My findings and observations showed that some Ke Ji Guan services need to improve to meet the standards of that policy, and that there was an especial gap between Ke Ji Guan practice and governmental policy in terms of the target visitors reached.

### **9.3.3. Comparison with practices in Informal Science Institutions in similar cultures**

In this section, I will consider how China's Ke Ji Guan practice compares with the practises of Informal Science Institutions under similar cultures, such as Taiwan and Japan.

#### **9.3.3.1. Practices in Informal Science Institutions in cultures that may share traits with Chinese values**

There are some countries and regions in eastern Asia, where people share similar cultural characteristics with China, such as Taiwan and Japan. In this section, I will explore their practice and policies regarding Informal Science Institutions and identify recommendations based on my research findings.

Taiwan shares large language and cultural associations with China. For one thing, they speak the same language: Chinese. As some researchers have argued, there is a very tight connection between language and culture (Jiang, 2000; Kim, 2003). So the same language may suggest at least an element of a

shared culture. Secondly, Han is the biggest ethnic group both in China and Taiwan so that it is very likely that China and Taiwan share traits within social values and cultures. According to Hofstede's cultural dimension theory, China and Taiwan both display traits of Collectivism, Long-Term Orientation, and Restraint, though with different rating values (Hofstede Insights, n.d.-a).

Returning to my own findings, these shared cultural dimensions may be related to certain motivations displayed by visitors attending Informal Science Institutions (such as Ke Ji Guan). For example, the cultural feature of Long-Term Orientation may lead to a motivation of M10... *I want to prepare myself for a future visit with my child* (see Section 8.4.3). Likewise, according to Fetzer and Soper, Confucianism remains a powerful ideology in Taiwan (Fetzer & Soper, 2013). So it could be possible that Taiwanese visitors also have similar motivations to Chinese visitors such as M2 (... *I take my child to learn/expand their horizon*), M4 (... *I take my child for fun*) and M6 (... *This is a good way to interact with my child/share quality time with my family/friends*), which reflect Confucianism's influence on children and parents' (particularly mothers') social identities or status (see Section 8.4.3).

Based on these comparisons, it is also sensible to suggest that Informal Science Institutions in Taiwan reflect on the quality and effectiveness of their services to ensure they fully meet the needs of visitors with these motivations. For example, it may be helpful to improve the services of food supply and baby-care facilities (see Section 9.3.1). Indeed, in terms of these aspects, there is evidence that some Taiwanese Informal Science Institutions deliver better practice than my three case study Ke Ji Guan in China. For example, the National Museum of Natural Science (NMNS, Taiwan) apparently has a much higher level of provision and service. According to its website<sup>139</sup>, the NMNS Taiwan supplies pasta, cakes, coffee and other foods within a bright

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<sup>139</sup> <http://www.nmns.edu.tw/>, accessed on 2018-02-01.

and clean environment. It even has snack bar, Café and a McDonald's inside. These services could particularly meet the need of people who just want to relax or meet somebody here (motivations like my M11... *I come to relax/have fun* and M16... *I come to see my friend/boyfriend/girlfriend/other people*). Such facilities go well above and beyond anything on offer at the three case study Ke Ji Guan that I studied, despite two of them (CSTM Beijing and SSTM Shanghai) being AAAAA national sightseeing spots. The NMNS Taiwan also houses four separate souvenir shops where visitors can buy a variety of products including specially designed dinosaur models, NMNS Taiwan T-shirts, and other goods that are of particular interest to the NMNS Taiwan's content and exhibitions. The NMNS Taiwan additionally contains a service centre, which provides wheelchairs, baby prams, hot water, a hair dryer and sofas for those who wish to rest between viewing exhibits. All of these facilities offer the possibility to enhance the experiences of visitors from key demographic groups, e.g. mothers with children.

Although there are some similarities between the cultures of Taiwan and China, they do have some differences. For instance, although both are examples of societies displaying Restraint characteristics, Taiwan's rating value of Indulgence is about twice that of China's (49: 24) according to Hofstede Insight research. This means that Taiwanese visitors may have more tendencies to relax at Informal Science Institutions or use them as appointment places (M11... *I come to relax/have fun* and M16... *I come to see my friend/boyfriend/girlfriend/other people*). As I have previously shown, visitors' motivations are related to cultural backgrounds (see Section 8.4). Therefore it is not appropriate to necessarily assume that Taiwanese visitors will directly match those I observed in China. For this reason I suggest that it is sensible to conduct detailed visitor surveys to identify each Informal Science Institution's own particular visitor groups (and their associated motivations). Such information can then be used to update their service in order that visitors'

needs can be better met and lead to further visitor uptake.

Another country with a comparable eastern culture is Japan. Based on Hofstede's theory, Japan shares the following cultural dimensions with China: Power Distance, Collectivism, Masculinity, Long-Term Orientation and Restraint (Hofstede Insights, n.d.-a). So it can be deduced that Japan's Informal Science Institution visitors may share more similarities to Chinese visitors in their visiting motivations than Taiwan. It is therefore likely that my suggestions to Chinese Ke Ji Guan for their practice may be also useful for Japan's Informal Science Institutions, such as the food supply and baby care facilities.

Again, there is some evidence that there are Japanese Informal Science Institutions who do better than my three case Ke Ji Guan. For example, according to its website<sup>140</sup>, the National Museum of Nature and Science (NMNS, Tokyo) has five places to eat, including various kinds of food, drinks, and snacks. This includes two eating-places located on the roof of the museum surrounded by plants. They provide very detailed information about these facilities including menus and opening times. The NMNS Tokyo also has many other facilities to make visitors' attendance easier, such as baby-feeding/changing rooms, baby-carriages, wheelchairs, and audio guides. The audio guides can support multiple languages including Japanese, Japanese for children, Chinese, English, and Korean. It can be seen that these services can meet visitors' needs of M11 and M16 in my case. In addition to all kinds of exhibitions and interactive facilities designed to popularise science and technology, the NMNS Tokyo also offers a range of science lectures to children, school students, university students and general adults. They also provide rooms such as laboratories, libraries, and seminar rooms to let visitors carry out experiments, research and seminars. They have close connections

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<sup>140</sup> <http://www.kahaku.go.jp/index.php>, accessed on 2018-02-02.

with schools and lend exhibits/facilities to schools for science education purposes. As an Informal Science Institution, all of these practices of the NMNS Tokyo provide good support to formal science education. Based on their websites, the Science Museum Tokyo<sup>141</sup> and other major Informal Science Institutions in Japan also appear to have similar practices to the NMNS Tokyo.

My case study Ke Ji Guan and other Informal Science Institutions can learn from this successful visitor focus to improve their own services, especially the support to formal science education in schools. There is also a clear focus within Japanese Informal Science Institutions on providing facilities and activities specifically for children. Therefore I would also make similar suggestions to Japanese Informal Science Institutions as I did in Section 9.3.1.1 to Chinese Ke Ji Guan regarding enhancing child-focused exhibitions and children-friendly facilities. Also, frequent repair work is helpful to make sure all the facilities work well for children.

In summary, some eastern Asia countries, such as Taiwan and Japan, share cultures and value traits with China. Their Informal Science Institution visitors may have similar motivations for attending with the Chinese visitors that were part of my study. Therefore my research findings may also be meaningful for them (at least partly). I have been able to make some suggestions to their practice and service based on my findings, primarily relating to ensuring that they provide high quality visitor services to ensure visitors' needs are met. Also, surveys are helpful to understand visitors and better meet visitors' needs by implementing changes based on the survey evidence. Countries with similar cultures may learn from each other to improve their Informal Science Institutions' practices, but this needs to be supported by individually targeted work based on evidence of their own features and visitors.

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<sup>141</sup> <http://www.jsf.or.jp/>, accessed on 2018-02-02.

### 9.3.3.2. Informal Science Institutions' settings across the world

In this section, I will introduce the Informal Science Institutions' setting across the world and try to make some recommendations to their practice particularly for the situation of culture mixing under the globalisation and the rising of minority visitors. For the first step, I will make a brief review about the policy situation related to Informal Science Institutions around the world in order to provide context for the subsequent discussion.

As I outlined in Section 4.2 and Section 4.3, China has strict policies on Ke Ji Guan, such as defining their functions, appointing their target visitors and setting building standards. As a country sharing cultural traits with China, Japan's science policies on museums (including Informal Science Institutions) are even stricter. For example, according to the report of the "Present Status of Museums in Japan (2008)" written by the Japanese Association of Museums (JAM) and the Japan Ministry of Education, Culture, Sports, Science and Technology, the "Museum Act" defines and classifies museums in Japan. Informal Science Institutions of various types, such as science museums, natural history museums and science centres, are all included in this Act. The Act classifies museums in Japan into three categories: registered museums, museum-equivalent facilities, and museum-like facilities (JAM, 2008). Registered museums are particularly restricted in terms of their funding source, with only four organisation types allowed. Among them, "local governments" is the first one (JAM, 2008).<sup>142</sup> Based on the strict rule of financial supporters, the registered museums have a strict list of requirements, for example they "Must be open at least 150 days a year" (JAM, 2008, p. 4). The Act also clearly defines the 11 Museum Businesses, including supporting formal education in schools (JAM, 2008).

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<sup>142</sup> The other three types of funding organizations are general incorporated associations or general incorporated foundations, religious corporations, juridical persons stipulated by Cabinet Order (Japanese Red Cross Society, NHK).

In the western world, however, the government policies on Informal Science Institutions' practices are looser than in China and Japan. They do not have so many "must do" aspects as China and Japan. For example, in the UK, the government does not make rules about the museum practice but provides more remote support. According to the government policy paper of *2015 to 2020 government policy: Museums and galleries*, the UK government states that "We sponsor these institutions at 'arm's length' (indirectly): the government is not involved in their day-to-day business operations (UK Government, 2016, p. 4)". Throughout this paper, it can be seen that words like "help, maintain, fund, guide, provide" are the main language used (UK Government, 2016). The UK government does not define nor classify the museums.

In other parts of the world, informal science-related associations take similar strategies to guide Informal Science Institutions' practical activities. For instance, the European Network of Science & Discovery Centres and Museums (Ecsite) holds conferences, publishes reports and books to help the communication between Informal Science Institutions in order to improve their science education practices. Additionally, it produces "The Creative Museum Toolkit" to help museum professionals conduct innovative and creative practices for science education (Ecsite, 2017).

The Association of Science-Technology Centers (ASTC) is a similar global organisation of science centres and museums as Ecsite, which encourages innovative practices in informal science learning by serving and linking its members all over the world. Although ASTC have also created descriptions of Informal Science Institutions, such as the concept of science centre (ASTC, 2017a), this is more like a shared understanding about this concept, or a philosophy of this organisation, rather than an official or governmental

definition with legal force. Based on this understanding or philosophy, ASTC brings together its members and provides practical guides and supports. For example, its webpage publishes “Best Practices” of its members worldwide.<sup>143</sup> These good practice experiences are shared within the network, for example to improve member science institutions’ services for people with disabilities. The practical suggestions include services such as an information desk, facilities for disabilities, media facilities, accessibility guide, printed materials and a variety of other relevant services (ASTC, 2017b). This situation suggests that connections between member institutions also play an important role in their informal science practices, unlike the situation in China where the governmental guidelines play the most essential role. In China, the communications between Ke Ji Guan are also very popular, but the priority is always that they should follow the governmental policy first, and complete the specified governmental tasks.

From the above comparison of international policies and governance of Informal Science Institutions’ practice, it can be seen that the various cultural influences haven’t been reflected very well. As I reviewed in Section 2.4.1, Falk’s theory that visitors have distinct motivational categories has been shown to be broadly true, and has been tested in both US and other countries. But according to my findings, the motivational visitor categories show key differences in a Chinese context, which appears to be related to cultural aspects of Chinese society such as Confucianism (see Section 8.4.3). Therefore I suggest that western Informal Science Institutions shouldn’t assume that any existing findings relate specifically to their own cultural environment. Instead, international Informal Science Institutions should more directly investigate their own visitors’ motivations; as such knowledge will be useful from both a practical and strategic sense (such as improving their food supply service or female/child-friendly facilities (see Section 9.3.1.1), and

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<sup>143</sup> <http://www.astc.org/resource/access/best.htm>, accessed on 2018-02-05.

designing exhibitions or facilities that reflect the local culture or the local history of science (see Section 9.3.1.2)).

It is also worth considering the specific context in which an Informal Science Institution operates. For example, some very large Informal Science Institutions, such as the famous Science Museum London, attract a large proportion of overseas visitors. In fact 31.3%<sup>144</sup> of total visitors were from overseas in 2015/2016 (Science Museum Group, 2016). For visitors who attended as part of an education group, the percentage rose to 46% (Science Museum Group, 2016). For the Natural History Museum London, there were nearly 60% of visitors who came from other countries in the reporting year 2015/2016 (UK Department for Digital, Culture, Media & Sport, 2016). These overseas visitors are likely to come from different cultural backgrounds, and therefore may have different motivations to attend an Informal Science Institution. Although perhaps not an immediately obvious consideration, it is therefore helpful to set policies and improve practice by taking into account visitors' international cultural backgrounds. My findings about Chinese visitors' motivations to attend Ke Ji Guan could be useful to improve western Informal Science Institutions' service to people from similar Confucian cultures. For example, some Chinese visitors may visit a Ke Ji Guan for seeking convenience or meeting with somebody (M13 and M16). For these visitors, they may ask for good Wi-Fi connection, food provision and souvenir shops as I suggested in Section 9.3.

Additionally, in terms of the local population, living in the same city does not necessarily mean that visitors will have the same cultural background, particular in some big cities. Returning again to the example of London (UK), more than 300 languages are spoken, and there are at least 50 non-indigenous communities within the city (Wood, Landry, & Bloomfield,

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<sup>144</sup> I calculated the number myself according to the data provided in the referenced paper.

2006). According to the government of New York City<sup>145</sup>, its inhabitants show a clear cultural diversity with about 200 languages spoken by residents. The city has the largest Puerto Rican population of any city in the world and the biggest West Indian ancestry community outside of the West Indies. It also contains the largest Chinese population of any city outside of Asia. So in these types of large cities like London and New York, a single “cultural background” is inappropriate. Understanding the various cultural contributions, and their respective needs and motivations, will provide a much more accurate picture. To achieve this, more research is needed with visitors to explore their cultures, in order that Informal Science Institutions can improve their practice in science communication and attract more local visitors. For those cities with large communities of Chinese people, my findings about visitors’ motivational categories may be helpful to let the Informal Science Institutions build their own science education strategies such as adding more exhibition/facilities, which are useful for children’s achievements in schools. This may support children’s future careers as one effective way of building children’s Science Capital as I discussed in Section 8.4.3.

Even in highly cultural diverse communities, minority groups can in fact be very important visitor categories. For example, according to the survey of the American Association of Museums (AAM), in 2006 34.1% of science/technology museum visitors in the US were Asian Americans (Farrell & Medvedeva, 2010). Data from the Scottish Government also shows that the proportion of Scottish science centre visitors from minority groups rose during 2008-2010 (Scottish Government, 2011). However, some researchers have also argued that minority visitors feel that Informal Science Institutions are “not designed for us”. This could be for a various of reasons, such as they could not read the English instructions and there were no other languages available

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<sup>145</sup> <https://www1.nyc.gov/site/planning/data-maps/nyc-population/population-facts.page>, accessed on 2018-02-05.

(Dawson, 2014). Therefore it may also be sensible for international Informal Science Institutions to consider updating their instruments and facilities to meet minority visitors' needs and recruit more minorities, particularly for some minorities with typically lower scientific qualifications. Here the New York Hall of Science's successful practice of programme "Science Career Ladder" can be a good example. This programme was targeted to women and minorities (Gupta & Siegel, 2008; National Science Foundation, 1991). The Hall recruited junior and senior high school women and minorities as explainers aiming to motivate them to be precollege science teachers after graduation (Gupta & Siegel, 2008; National Science Foundation, 1991). These minority explainers could be very useful for raising minorities' interests in science and the minority visitors' experience of attending the Hall.

In summary, western countries or associations apply looser policies and governance structures regarding museums than either China or Japan. Although their Informal Science Institutions' practices are often well developed, there are still areas that can be improved. For example, in some big cities, visitors' multi-cultural backgrounds should be considered. Also, services for minority groups should be improved. My Chinese findings can therefore contribute partly to understanding Chinese visitors' actions at international Informal Science Institutions, but more and further visitor studies as well as practice strategies are needed for visitors from multiple cultures.

#### **9.4 My original contribution to the field of science communication research**

Through my research at the three selected Ke Ji Guan in China, as well as the wider expert interviews, I produced the following original contributions to the field of science communication studies.

- 1. I clarified the relationship between Ke Ji Guan and the western concepts of Informal Science Institutions such as science museum and science centre, and described for the first time the historical development process of Ke Ji Guan. These elements then acted as key contextual information for my subsequent visitor studies.
- 2. I used two separate methods — a conceptual mapping and a statistical EFA approach — to clarify the identity-related motivation groups of Ke Ji Guan visitors. These groupings were compared with John Falk’s original motivation categories determined within the USA, concluding that there are some similarities, but also that some adaptations are necessary when Falk’s theoretical framework is applied in other cultural contexts.
- 3. I statistically explored correlations between visitors’ demographics and their identified motivational factors. The result did show that there were obvious connections between visitors’ demographics and identified motivational factors. In contrast to some previous arguments (for example (Falk, 2011)), the impacts of visitor demographics on identified motivational factors should not be overlooked.

In conclusion, Ke Ji Guan, though built on imported ideas relating to science centres and museums from the west, do seem to have developed clear Chinese characteristics. Although Ke Ji Guan have a roughly similar typical visitor to many similar western institutions (female, less than 35 years old, well educated and accompanied by family members), the visitors’ motivations to attend a Ke Ji Guan do show some specific Chinese characteristics. For example the motivation “I want to prepare myself for a future visit with my child” reflects a Chinese cultural feature of Long-Term Orientation based on Hofstede’s cultural dimension theory. This is the first time such findings have been identified within visitor motivation studies, suggesting such perspectives are unique to China (and possibly similar cultural backgrounds) and demonstrate the importance of locally adapted theoretical frameworks for

understanding visitors' motivations. This work has provided a solid initial understanding of visitor experiences within Ke Ji Guan in China, preparing the way for deeper studies on visitors' perceptions.

Overall, this work has applied key concepts from western visitor studies within a new cultural context — China. By doing so I have emphasised both the importance of widening the context of existing theoretical frameworks, as well as provided key baseline information about Ke Ji Guan visitors. It is insufficient for either Western or Chinese research to ignore each other from a theoretical perspective, or make assumptions about what concepts from western science museums transfer to other locations. As recalled by Heng Wang when describing these unique Chinese institutions as part of this research: “We are not science museums, but Ke Ji Guan”.

## **9.5 Recommendations for further studies**

When I carried out my research and analysed my results, I found it is impossible to include all relevant research possibilities within the scope of a single PhD, and therefore I have identified some specific learning coming out of my work that I would recommend being considered for future studies.

### **9.5.1. Recommendations for further studies of Ke Ji Guan in China**

As part of my piloting work, I explored visitors' opinions about “What place do you think is similar with here (CSTM Beijing)?” As discussed in Chapter 4, the results suggest Ke Ji Guan visitors in China are still confused about the concept and purpose of out-of-school educational places, including Ke Ji Guan (Chapter 4, Section 4.4). It is worth doing more in-depth work and recruiting a wider range of participants to explore the gap between visitors' understandings and Ke Ji Guan's self and official-identities (Chapter 4, Section 8.1 and 8.3.2). Visitors' understandings of a Ke Ji Guan's identity may be one of the key factors of motivation making. There would also be likely benefits related to Ke

Ji Guan being able to improve their offer and better meet the needs and expectations of visitors or satisfy the government intentions if they better understand their visitors' perspectives in this regard.

Another area for future work I would suggest in China is to explore the correlation between visitors' visiting frequency (first time or repeated visitors) and their motivations. In Chapter 7, Section 7.4 showed that visitors who attended the case study Ke Ji Guan for the first time tended to be Benefit Seekers (M11 and M14) while respondents who visited the case study Ke Ji Guan for twice had less likelihood of just seeking experience. They have had that initial experience so Benefit Seekers tended to then move on somewhere else to see something new. This suggests that the experiences of previous visits have some influence on visitors' motivations for their next visit. It maybe therefore be helpful to conduct initial audience research with visitors from less educated backgrounds (the target groups mentioned within the government strategy), and find out what "benefits" they might be interested in seeking, or expectations they have about the Ke Ji Guan. This information can then be used to enhance the Ke Ji Guan service or adjust their practice to meet such visitors' expectations in order to further attract such target visitors to attend Ke Ji Guan.

It would be interesting to explore whether there is any possibility that the Ke Ji Guan itself is playing an important role in building or changing visitors' motivations. Is the motivational decision-making a two-way process rather than a one-way process determined by visitors themselves? If this two-way pattern exists, what kind of motivations will be (or even can be) influenced by the Ke Ji Guan? Is this two-way process a one-off pattern or a circulatory one? What can the Ke Ji Guan do to foster target visitors' motivations consciously? These questions have not been focused on in my current research, but I suggest in the future that it would be highly beneficial to conduct long-term surveys in both pre- and post- visit formats to explore these questions. Before

that, it is sensible to understand the visitors and improve the science communication practice according to the motivational results for the first step.

In terms of the categories from my Exploratory Factor Analysis (EFA, see Section 6.3), as the name suggests, it is an *exploratory* factor analysis. It is worth conducting more surveys and collecting more data in China, which build upon and extend my methodology and current statistical results, and then try to carry out a Confirmatory Factor Analysis (CFA) to determine the confirmed categories. Taking an iterative process to apply the EFA results to inform the questionnaire design will allow the identification of the final confirmed factors, which will allow the creation of a framework similar to Falk's for use in China, which has both conceptual and statistical validity.

#### **9.5.2. Comparison with other international studies based on Falk's framework**

My results achieved similar results regarding the impact of culture on visitors' identity-related motivations. So in this section, I will use my findings and other similar comparable international work in to make some comments and suggestions to Falk's theory of visitors' identity-related motivations.

As discussed in my Literature Review (Chapter 2), there were some researchers who used Falk's model to study visitors' motivations in museums under western culture (the US) and eastern culture (Taiwan). Their results showed that culture did have an influence on visitors' decisions to attend museums.

Rowe and Nickels applied Falk's theoretical model on studying zoos and aquariums of the Association of Zoos and Aquariums (AZA). They followed Falk's research methods strictly. For example, they used pre-set motivational options from AZA toolkit, and categorised the 20 motivational options into five

groups (explorer, experience seeker, facilitator, professional hobbyist, and recharger (Falk, 2006, 2009)) with four motivations in each group (Rowe & Nickels, 2011). Also, they employed Falk's way of 7-point scale measurement for each of the selected five statements and the breakpoint setting in data analysis (Rowe & Nickels, 2011).

This research resulted that Falk's identity-related visitor motivation model worked very well and could be used in a wide variety of informal science educational institutions both in understanding the existing audience and developing new visitors (Rowe & Nickels, 2011).

Laureen Trainer with colleagues (2012) conducted citywide utilisation of the Falk visitor-identity model in Denver, USA. They also used similar research methods as Falk used, and had a pre-set five categories following Falk's five identity groups (Trainer et al., 2012). Trainer and colleagues discovered that different institutions have different domain-motivated visitors (Trainer et al., 2012).

Both studies to AZA and institutes in Denver observed that other elements such as seasonal reason also influences the identity-related motivations (Trainer et al., 2012). I also got similar results in my research. Although not a big percentage, some people did visit the CSTM Beijing for seasonal reasons. For example, some visitors wrote for "Other"<sup>146</sup> reason as "My school organises us to visit here for Summer Out" and "It is big wind today and unsuitable for outdoor activities, but to visit a science museum is good to enjoy our family time". These motivations reflected the seasonal reasons such as attending summer activities and escaping from the bad spring sandy weather in Beijing.

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<sup>146</sup> In my questionnaire, "Other" is the 21th option of my motivational banks for the first question of why do people visit this Ke Ji Guan.

In Taiwan, Sheng & Chen (2012) carried out visitor survey at four informal educational institutes. In their research, Sheng & Chen used different option collecting way for the question about visitors' motivations. They combined experts' experience and visitors' answers (Sheng & Chen, 2012). By coding of these answers, they eventually produced the option bank, which was more representative of Taiwan culture. This approach was different with Falk's setting as it included visitors' actual motivations and those raw motivations were coded by experts after piloting. Sheng & Chen applied Exploratory Factor Analysis to explore the inner connection of motivations and got five groups, which were different from Falk's. The results indicated that Falk's hypothesis of the visitor-identity model might be not entirely applicable to the Taiwan culture. The element of culture had influence on the result of visitors' identity.

So based on the comparison work between my study and other international research on museum visitors' identity-related motivations, I have identified the following recommendations to international studies related to this topic.

**1. More studies under multiple or mixed cultures would be helpful to understand modern visitors.** My research shared certain traits with Falk's US-based results, both on single motivations and the categorical factor groups. For example, they shared the conceptual mapping identity-related motivational groups of Explorers and Experience Seekers, and one sub-group from my EFA results, the Facilitators (which was contained within the factor F1 Benefit Seekers (see Section 8.4.1 and 8.5.1)). Also, my findings have similarities with Packer and Ballantyne's work based in Australia. For example, their motivation of "develop self-knowledge and self-worth" is similar with my M8... *I come to enrich myself* (more similarities can be found in Section 8.5.1).

This situation suggests that in modern days, different cultural formats do not

necessarily mean absolutely different visitor motivations to attend Informal Science Institutions. Global communications encourage intermixing of different cultural perspectives (Kraidy, 2002). Therefore, deeper visitor studies may be helpful to understand complex modern visitors, especially under multiple or mixed cultures, such as in large cities as I suggested in Section 9.3.3.2.

**2. Apply the research findings in a cyclical manner directly within Informal Science Institutions: improving their practice and then updating the research as part of assessing the visitors' experience of the amended practice.** For example, Trainer and colleagues (2012) used their findings to better understand Denver Zoo visitors. From their experience of applying those experiences in practice they collected more visitor information, such as the seasonal influence on visitors' attending motivations. The Denver Zoo also made changes to their strategies, for example training their staff according to visitors' identity-related motivations and adjusting marketing strategies to facilitators (Trainer et al., 2012). This sort of approach should lead to a win-win situation where the research can be updated simultaneously with the improvement of the institutions' practice.

**3. More additional elements that impact the visitors' identities or behaviours should be explored.** For example, there is some preliminary evidence from my own research, as well as published studies in other settings (see for example Rowe & Nickels, 2011; Trainer et al., 2012), that seasonal reasons may have a strong influence. My results showed that some people visited the Ke Ji Guan for reasons relating to the weather (see earlier in this section). These results reflect that an audience's visiting behaviour seems to be influenced by multiple factors. Furthermore, visitors' decision-making tends to be a complex process. So it is sensible to explore more relevant factors, which will add to Falk's visitor-identity model (see Section 9.5.3).

### **9.5.3. Recommendations relating to the application of Falk's theory of visitors' identity-related motivations**

In practice, my research found that Falk's model worked in part within a Chinese context. Based on my own experience as well as comparisons of research conducted within different cultures, I propose the following amendments to Falk's model.

**1. It is necessary to include an understanding of visitors' demographics to fully comprehend the whole picture of the visitor-identity model.** My findings showed that there were statistically significant correlations between some of the visitors' demographics and their identity-related motivations, in particular the demographics of gender, age, educational qualification and previous visit attendances. Through comprehensive application of visitors' demographics and motivations, Informal Science Institutions can understand their current visitors more precisely, as well as find ways to reach new visitors. Furthermore, data relating to both visitors' demographics and motivations can help the museums to improve their visitor services.

**2. Statistical analysis approaches provide a robust interpretation of respondents' motivational preferences and should be used where possible.** Though I did attempt an initial conceptual mapping of the findings, in line with Falk's original work (Section 6.2 and 6.3), the findings proved less robust and more prone to individual researcher bias during analysis. Alternatively, when applied with sense and discretion, Exploratory Factor Analysis (EFA) can supply data-based evidence for the identities (factors) produced. Within my work this statistical analysis approach helped to decrease any potential bias from my own individual preferences, previous research experience or background.

**3. It is useful to study the theory of visitors' identity-related motivations within particular cultures, and to analyse the impacts of cultures on visitor identities.** In Falk's Museum Experience Model, the social context is regarded as an important visiting context or condition, but in his actual research on visitor identities, social factors such as culture have not been well considered. It is not appropriate to assume that the categories developed based on research primarily conducted in the US will be relevant in other contexts. My research, as well as that from other cultural contexts building on Falk's methodology (see for example Sheng & Chen (2012)) emphasises the influence of culture on visitors' motivations. The impact of cultural context on the model should not be overlooked. One clear recommendation for the international studies is that more research under different cultures is needed. Falk's model needs to be tested, revised and developed in different cultures in order to find out the specific pattern for each specific culture.

**4. It is essential to conduct brief qualitative pilot interviews to build up the initial option bank of motivations within a new cultural context.** Pre-assuming the relevant options through consultation only with researchers or experts may not reflect the full spectrum of visitors' motivations. As I discussed in Section 6.2, visitors naturally prefer to attend an Informal Science Institution (such as a Ke Ji Guan) for some specific reasons. It is therefore essential when conducting research within a new cultural context to conduct piloting surveys to collect a broader range of options, which can then be synthesised to produce the final option bank. In terms of the specific steps required, the best approach to building the option bank could be: collect the motivations via short open-response interviews → extract themes → code themes → produce primary options → re-pilot → get feedback → modify the options. The last three steps could be repeated in order to finalise the formal version of the motivation options for subsequent survey distribution. In this process, professional thematic coding and qualitative text analysis skills are

needed.

**5. Visitor studies with particular types of Informal Science Institutions could be enhanced.** Falk's current broad generalisation of the institutional category of "museums" should be more specific, which would then enhance the importance of the framework within specific contexts. The theory should be improved, tested and applied to different types of institutions in turn, rather than applied as an overall result for the wide concept of "museum", which is used by Falk to include a very diverse array of informal educational institutions. Various research studies (including my own) have demonstrated that different institution types, such as aquariums and science centres, attract different domain visiting motivators. For example, one of Sheng and Chen's motivational factors is "historical reminiscences" (Sheng & Chen, 2012). It cannot be denied that this result correlates with the two museums of historical relics (Taiwan Museum and the National Museum of History) that they included within their four case study museums. Likewise, one of my motivational factors is "Science-related Fan", which reflects a key feature of Ke Ji Guan in China (links to scientific concepts). However, such results would of course be less likely to occur for an institution of a different type, such as an art museum. Therefore, more motivation-related research based on multiple examples of one particular *type* of museum (such as an art gallery, aquarium, Informal Science Institution or history museum) could be worth doing. Falk's model is a sensible framework but could not reflect all visitors' identity-related motivations in different types of institutions. More specific research could supply more precise suggestions to the institutions, and make the findings more specifically relevant within that field. As I argued in Section 9.3.1.2, there are aspects of my own results, for example, that can be considered applicable to Ke Ji Guan within China more generally, though I would hesitate to claim that they would apply to other types of museums, art galleries and the like.

**6. It is worth conducting more exploratory work to determine other essential factors to improve the model**, such as the duration and/or time of entry could also conceivably affect visitors' experience and motivations. Therefore aspects relating to the chronology (timing) of a visit may be an important aspect to explore further. Identifying such influences could further reinforce the model and make it more precise and pragmatic, thus greatly improving its application within wider Informal Science Institution settings.

## **9.6 Chapter summary**

In this chapter, I demonstrated all the key findings of my research. I clarified the concept of Ke Ji Guan, which does share some features with western Informal Science Institutions, but it is unnecessary to fit it into any particular western concepts. "Ke Ji Guan" can be used as its English name to reflect its unique Chinese features.

This chapter also provided answers to all my Research Questions. Firstly, according to my research there were six types of identity-related motivations in my three case Ke Ji Guan. They were Benefit Seekers, Science-related Fans, Convenience Users, Affirmation Seekers, Opportunists and Professionals. The second research question involved exploring the demographics of Chinese visitors. There were more female visitors and the largest age group was 26-35 years old. More than one third of visitors had an educational qualification of bachelor degree or equivalent and the biggest subject group was "Humanities and Social Sciences". Visitors are mainly from local cities with their families, and 66.1% of visitors attended the three Ke Ji Guan for the first time. Finally, in my response to the third research question I explored the correlations between certain visitor demographics and most of their motivational factors. In particular Benefit Seekers seems to be the most important factor, which showed connections with all demographic variables such as gender, age,

education, subject, who they were accompanied by, and any previous visits.

According to my findings of the visitors' motivations and demographics, I developed recommendations for the use of Ke Ji Guan in China, such as improving their food service, building more female-friendly facilities, conducting more child-focused activities and installing more exhibitions and instruments for children. I also made comparisons of Informal Science Institution practice between China and countries that share cultural traits with China, such as Taiwan and Japan. I identified certain recommendations for their practice using my findings, which can be applied in their institutions.

For the international Informal Science Institutions, they do not work under such strict policies and governance conditions as are found in China. My main recommendation was to pay more attention to existing studies of visitors with multiple/mixed cultures, and recruit more minorities. Based on my findings I also made some suggestions to Falk's theory of identity-related motivations. Primarily this should involve conducting more tests on different cultural backgrounds, and exploring other factors that influence visitors' motivations. It would also be useful to apply the research findings to Informal Science Institution practices, and carry out visitor studies in various types of institutions in order to make specific and practical suggestions to particular institutions rather than giving some general results under the umbrella concept of "museum".

In modern days, along with the development of science, technology and culture, people's requirements for Informal Science Institutions become diversified. Understanding visitors well would be helpful for Informal Science Institutions to practice and meet visitors' needs better. Given there were very rare papers about visitor studies at Chinese Informal Science Institutions, my research on Ke Ji Guan visitors' identity-related motivations opens a window to

the international science communication world. In the context of globalisation, more and more cultures began to connect and mix with each other. My findings about the correlations between visitors' identity-related motivations and cultures could be an addition to the research on international Informal Science Institutions' visitor studies under different cultural backgrounds.

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## **Appendices**

### **Appendix 1: Questionnaire Sample in English**



Please mark the relevant options using a “√”.

2. Is this your first visit to this science museum?

First Second Third or more

3. Who are you attending this science museum with today? (If necessary, you can make a **multiple choice**)

My family member(s) My boyfriend/girlfriend My friend(s)  
My classmate(s)/schoolmate(s) My work colleague(s) Client(s) Alone  
Other(Please specify) \_\_\_\_\_

4. Are you going to see the whole science museum or some particular places here?

The whole science museum Some particular exhibitions The Special Effect Cinema Canteen  
Shop of licensed products Other (Please specify) \_\_\_\_\_

5. Why do you choose **【today】** to visit the CSTM?

No special reason Because \_\_\_\_\_

### Part 3: Some information about yourself

Please mark the relevant options using a “√”.

6. Your age (in years):

16-25 26-35 36-45 46-55 56-65 More than 65

7. Your gender:

Male Female Prefer not to say

8. You ethnic group in China:

Please write here \_\_\_\_\_ Prefer not to say

9. Please indicate your **highest** educational qualification (**unfinished please mark this**  **using a “√”**):

Primary school Secondary school High school/Zhong zhuan Vocational qualification Associate degree  
Bachelor degree or equivalent Masters degree or equivalent Doctorate or equivalent  
Other (please specify) \_\_\_\_\_

10. Your major (if applicable):

Please write here: \_\_\_\_\_

11. If you **live in Beijing**, please write the **【district】** of your residence (e.g. Shijingshan): \_\_\_\_\_

If you are from **outside Beijing**, please specify your **【province】** \_\_\_\_\_ and **【city】** \_\_\_\_\_ of residence.

12. Would you mind letting us know you are from urban area or countryside?

Urban area Countryside Prefer not to say

13. If you do not want your data to be archived for future use (for example for comparison with similar anonymous data collected at other museums outside this specific research project), please mark this  using a “√”.

**Thank you very much for your help! Enjoy your time!**

## **Appendix 2: Questionnaire Sample in Chinese**



**第二部分：参观科技馆的基本信息**

请用“√”标记您的答案。

2. 今天您是第几次来中国科技馆？

第一次 第二次 第三次和以上

3. 今天您和谁一起来的？（可以多选）

家人 男/女朋友 朋友 同学 同事 客户 独自一人 其他（请写明）\_\_\_\_\_

4. 今天您来中国科技馆是准备参观/去什么地方？

参观整个中国科技馆主展厅 参观某个展览 特效影院 餐厅 特许商品店

其他（请写明）\_\_\_\_\_

5. 您为什么选择【今天】来参观中国科技馆？

没有特殊原因 因为：\_\_\_\_\_

**第三部分：您的基本信息**

请用“√”标记您的答案。

6. 您的年龄（周岁）：

16-25 26-35 36-45 46-55 56-65 65 周岁以上

7. 您的性别：

男 女 不愿意透露

8. 您的民族：

请填写\_\_\_\_\_ 不愿意透露

9. 您的学历【在读请在此处打√】：

小学 初中 高中/中专 高职或者职业技术学院 专科或者同等学力 本科或者同等学力

硕士或者同等学力 博士或者同等学力 其他（请写明）\_\_\_\_\_

10. 您的专业：

请填写：\_\_\_\_\_

11. 如果您住在北京，请写明您居住在【哪个区】？（如：石景山区）：\_\_\_\_\_

如果您不住在北京，请写明您居住的【省份】：\_\_\_\_\_和【城市】：\_\_\_\_\_

12. 方便透露您居住在城市还是农村吗？

城市 农村 不愿意透露

如果您不希望您的问卷数据被储存并应用于后续研究（比如被用来与其他课题中其他科技馆的数据相比较）请在此处打√。

**非常感谢您的热心参与！祝您愉快！**

## **Appendix 3: Interview Guide for Experts**

**Project: Interview for the Development of Ke Ji Guan in China**

**Interviewer: Huiping Chu (University College London)**

**Interviewee: Xiangyi Li/ Shanyan Xu/Heng Wang**

### **Question List:**

#### **Section A. Origin and History**

- 1. What do you consider to be the first Ke Ji Guan of China in a modern sense? Could you supply some historical documents about it? (For instance, some old pictures or newspapers about it?)**
- 2. How was it built?**
- 3. Why was it built?**
- 4. Where did the contents come from?**
- 5. Are there any other institutions you consider particular important in the development of modern Ke Ji Guan in China?**
- 6. How have Ke Ji Guan developed in China?**
- 7. Who were the original Ke Ji Guan designed for?**
- 8. What is the future of Chinese Ke Ji Guan in your opinion?**

#### **Section B. Content**

- 9. Why are they called science museum, science and technology museum and science centre in English? (What are these names' differences from each other?)**
- 10. What are the typical contents within a standard Chinese Ke Ji Guan? (Former and contemporary)**
- 11. Why are those contents, rather than other elements, displayed in**

### **Chinese Ke Ji Guan?**

**12. On the topic of displaying, what are the differences between the modern Ke Ji Guan and the old ones within China?**

### **Section C. Science Politics**

**13. Are there some key conferences or acts of Chinese science policies related to the development of Ke Ji Guan?**

**14. What are these conferences'/acts' importance and what are their impacts on the development of Chinese Ke Ji Guan?**

**15. What are the regulatory departments of the Ke Ji Guan?**

### **Section D. Documents and further interview**

**16. What historical documentation, pictures and/or information are you aware of that would assist in mapping the development of Ke Ji Guan within China?**

**17. Are there any other people that you think would be particularly worth being interviewed on these topics?**

## **Appendix 4: Interview Guide for Visitors**

### **Step 1: Introduction**

*Hello! I am a PhD Student<sup>147</sup> of University College London, and doing a piloting survey about people's visit<sup>148</sup> to a Ke Ji Guan. Would you please talk with me for a few minutes?*

### **Step 2: Ask respondents questions about motivations**

*Now I am going to ask you some questions around your motivations to visit this Ke Ji Guan. Here are the questions:*

1. How long do you take to arrive here?<sup>149</sup>

2. Is this your first time to visit this Ke Ji Guan?

If NO, then → how often do you visit here? Are you a regular visitor?

3. Who decided/wanted to visit the Ke Ji Guan today?

4. What is your reason to visit this Ke Ji Guan today?

5. What are you hoping to see in the Ke Ji Guan today?

If "because I got a free ticket", then → if you didn't have a free ticket, would you still have visited today? → How did you get your free ticket? → Would you visit again without a free ticket? → Then Q6.

---

<sup>147</sup> I found that, in the UK, it is very common that interviewer introduce his/her name when he/she invites a respondent. But in China, people tend to do not care of interviewer's name but their identity. If somebody tells his/her name when recruiting a participant, he/she may be regarded as a salesman. But if visitors ask, I will tell my name. Also, I will wear a badge with my name on it.

<sup>148</sup> In China, the word "Motivation" may lead to some negative meanings. Also, I will ask some questions that seems not about visitors' motivations and other questions to help them relax. So in order to avoid asking an abrupt "Why" and make visitors happy to talk, I will not mentioned the "identity-related motivation" in case they will be confused or frightened.

<sup>149</sup> In Beijing, this is a common question for chat. People will be happy to talk about this because the traffic is too crowded and it is a good question to make people relax.

6. Is there anything in particular you hope to gain from your visit? (I may provide a range of examples, such as some particular exhibitions or facilities.)

If the answer is like, "Nothing, just cast a glance over" then → what is the stimulus to let you visit today?

7. Do you want to see the whole Ke Ji Guan or some particular exhibition?

If some particular exhibition, then → why that particular exhibition?

8. Did you browse this Ke Ji Guan's official website before you come here? Do you have anything particular to see (or to check) before you browse those websites?

9. Have you ever visited any other places, which you consider to be similar to this Ke Ji Guan?

### **Step 3: Ask participants to see my questionnaire draft**

*OK, thank you so much for this great talk! Actually, I have a questionnaire draft. Could you spend a little more time to fill this questionnaire?*

### **Step 4: Ask participants to give some comments**

*Thanks a lot! We almost finish! At last, do you think my questionnaire have any problems? You can use this pen<sup>150</sup> to mark or write anywhere.*

### **Step 5: Say thank you again**

*Thank you very much again for your time and excellent participation! Enjoy your visit! Good Bye!*

---

<sup>150</sup> Another pen with different colour with the pen used to choose the five reasons.

## **Appendix 5: Application for Inclusion of A Research Project**

## Application for inclusion of a research project

All sections must be completed before submitting this form to the data protection team.

All research projects using personal data must be registered with the UCL Data Protection Officer **before the data is collected**. This includes projects approved by the Joint Research Office.

It is rarely necessary to store electronic personal data on portable devices such as laptops, USB flash drives, portable hard drives, CDs, DVDs, or any computer not owned by UCL. Similarly, manual personal data should not be regularly removed from UCL premises. In the case of electronic data, to minimise the risk of loss or disclosure, a secure remote connection to UCL should be used wherever possible.

The UCL Computer Security Team has published guidance on the storage of sensitive data on portable devices and media which is available at <http://www.ucl.ac.uk/informationsecurity/itsecurity/knowledgebase/securitybaselines/encryption/GuidanceStorageSensitiveData>

If storing sensitive data on portable devices or media all data must be strongly encrypted. ADS general encryption guidance is available at <http://www.ucl.ac.uk/isd/staff/ads/help/guides/encryption> .

Manual personal data and portable electronic devices should be stored in locked units, and they should not be left on desks overnight or in view of third parties.

**Anonymised data** Projects using anonymised data do not have to be registered with the Data Protection Team and you do not have to worry about compliance with the Act.

Data is only truly anonymised if it is impossible to identify subjects from that information and, if relevant, any other information that UCL holds. For example, if you have a list of research subjects and anonymise it by giving each one a number, but keep a list of the numbers with the names of the subjects, the information has not been anonymised. In this case, it is personal data, and the project must be registered with the Data Protection Team.

**Approval** We may have some questions about the information you provide, but you will normally be provided with a registration number within a week of submitting the form. However, the period leading up to meetings of the Ethics Committee is always very busy, and you should allow more time for your application to be processed. It is therefore very important to check in good time whether you need to register your project.

Please note that Data Protection Registration numbers will **NOT** be issued when you submit an application form in person to the Data Protection Team.

Please submit this form electronically and send to [data-protection@ucl.ac.uk](mailto:data-protection@ucl.ac.uk) with copies of any information sheets and consent forms that you are using.

UCL Data Protection website

[http://www.ucl.ac.uk/finance/legal\\_services/data\\_protection/data\\_protection.php](http://www.ucl.ac.uk/finance/legal_services/data_protection/data_protection.php)

Any queries regarding this form please contact 020 3108 3128 (internal extension 53128)

**This form will be returned to you with the appropriate registration number, which you may quote on your Ethics Application Form, or any other related forms.**

## Application for inclusion of a research project Form 2

### A. APPLICATION DETAILS

A1	<b>Project Title:</b> A study investigating visitors' identity-related motivations in science museums in China and the UK	
	Date of Submission: 8 Dec 2015	Proposed Start Date: in the UK: 20 Oct 2014 and in China: 12 Mar 2015
	UCL Ethics Project ID Number: STSETh033	Proposed End Date: in the UK: 10 Dec 2014 and in China: 5 Jun 2015

A2	<b>Principal Researcher</b> <i>(Please note that a student – undergraduate, postgraduate or research postgraduate cannot be the Principal Researcher for Ethics purposes).</i>	
	Full Name: Karen Bultitude (dissertation supervisor)	
	Position Held: Senior Lecturer in Science Communication	
	Address: Department of Science and Technology Studies, UCL	
		Email: karen.bultitude@ucl.ac.uk
		Telephone: 020 7679 4431

A3	<b>Data Collector(s) Details</b> <i>(if Applicant is not the Principal Researcher e.g. student details):</i>	
	Full Name: Huiping Chu	
	Position Held: PhD student	
	Address:	
	Department of Science and Technology Studies, UCL,	Email: huiping.chu.12@ucl.ac.uk
	22 Gordon Square, London, WC1E 6BT	Telephone: 075 9898 4020

### B. DETAILS OF THE PROJECT

B1	Please provide a brief summary of the project
	<p>My project is a study investigating visitors' identity-related motivations in science museums in China and the UK. The main Research Questions are:</p> <p>What are the identity-related motivations of science museum visitors in China? What are the relationship between visitors' identity-related motivations and their demographic factors? How have Chinese science museums developed historically? Why are they called science museum, science and technology museum and science centre in China? (What are their differences from each other?) Who were the original science museums built for?</p> <p>Questionnaire survey and Interview will be the methods I will employ to carry out my project. I plan to carry out an anonymised questionnaire survey at the Science Museum London and three Chinese science and technology museums. In addition, I will conduct interviews with senior Chinese scholars who were closely involved in the development of science museums within China. The interviews will be conducted face-to-face<sup>1</sup> after obtaining their permissions. I will apply a 'snowball sampling' approach,</p>

<sup>1</sup> Some people may be interviewed by phone, and this depends on their locations and arranging a mutually convenient time for the interview.

which means that these scholars will recommend other relevant scholars to talk to, whom I will then follow up with. Further more, In order to design my Chinese questionnaire, I have to conduct piloting interviews to science museum visitors and some science museums' staff.

Since the questionnaires will be entirely anonymous (no personal identifiable data will be collected) they do not require data protection; the part I am applying for in this registration is the interview component.

## C. DETAILS OF PARTICIPANTS

<b>C1</b>	<p><b>Data subjects</b> Who will the personal data be collected from?</p> <ol style="list-style-type: none"> <li>1. Shanyan Xu, former director of the Chinese Association of Natural Science Museum.</li> <li>2. Xiangyi Li, former Curator of the Chinese Science and Technology Museum (CSTM) and the Head of the Department of Publication Work, Chinese Association of Science and Technology.</li> <li>3. Heng Wang, former editor of the CSTM's internal journal "<i>Science and Technology Museum</i>" and scholar on the development of China's science museums.</li> <li>4. Some anonymised science museum visitors</li> </ol>
<b>C2</b>	<p><b>What data will be collected</b> Please provide details of the type of personal data to be collected</p> <p>Depends on interviewees' permissions, the following information will be collected:</p> <ol style="list-style-type: none"> <li>1. Interviewees' names</li> <li>2. Interviewees' job positions (Past and Now)</li> <li>3. Interviewees' research fields (Past and Now)</li> <li>4. Interviewees' Addresses (Alternative)</li> <li>5. Interviewees' contact details</li> </ol> <p>Of course the interviews will also contain details of their personal recollections and perspectives on the development of science museums within China. For the anonymised science museum visitors, their motivations to visit the science museum will be recorded.</p>
<b>C3</b>	<p><b>Disclosure</b> Who will the results of your project be disclosed to?</p> <p>The broader results will be disclosed to the following groups, though personal details such as contact information etc. will remain confidential at all times. With permission only the interviewees' names and job positions (both past and current) will be mentioned in any reporting.</p> <ol style="list-style-type: none"> <li>1. Karen Bultitude, my PhD supervisor at UCL</li> <li>2. The experts who will be responsible for my thesis examination</li> <li>3. The people who make contributions to my research</li> <li>4. The editor, reviewers and readers of the journals which I submit my paper to</li> </ol>

## D. CONSENT

<b>D1</b>	<p><b>Consent</b> Please include the information sheet and consent forms you will be using for this project, and or protocol</p> <p>If you are not including an information sheet and consent form, please explain why:</p>
	<p>Please see appendixes. But I could not submit these consent forms in advance before I go back to China because all my interviewees are in China and I could only submit these forms when I am back in London.</p>

## E. INTERNATIONAL TRANSFER

<b>E1</b>	<p><b>International Transfer</b></p> <p>The eighth principle of the Data Protection Act 1998 prohibits the transfer of personal data to countries or territories outside the European Economic Area (which consists of the 27 EU member states, Iceland, Liechtenstein and Norway).</p> <p>At the time of writing the following countries have also been deemed adequate for the purposes of the 8th principle Argentina, Canada, Guernsey, Isle of Man, Jersey and Switzerland.</p> <p>If you intend to transfer data to a country not mentioned above, please supply details of adequate safeguards below:</p> <p>The interviews etc. will be conducted in China, and the personal contact details will be necessary to have available locally in order to be able to conduct the interviews. However such information will only be kept on the students' personal computer and will not be transferred elsewhere. No further data will be transferred externally as part of this project.</p>
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## F. PUBLICATION

Will the results of your research be published in an academic journal or other publication? **YES**

***Please note that published results must not contain data by which an individual can be identified.***

## G. NOTIFICATION

<b>G1</b>	<p><b>Notification</b> (Please note that notification is a prerequisite for registration)</p> <p>Have you informed your department's Data Protection Coordinator about your project? <b>YES</b></p>
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<b>G2</b>	<b>Notification</b> (Please note that notification is a prerequisite for registration)
	Have you informed your department's computer representative about your project? <b>YES</b>

**H. ETHICS**

<b>H1</b>	Are you applying to the UCL Research Ethics Committee? <b>YES</b>
Date of Ethics meeting: Due to its low-risk nature this work has been considered at Departmental level and has satisfied the appropriate ethical approvals (ref STSETh033). 10/09/2014	

**I. REGISTRATION**

<b>I1</b>	<b>Registration: Office use only:</b>	
	UCL Data Protection Registration Number:	Data issued:

**Further information**

For more information and guidance on the UCL Research Committee, please visit <http://ethics.grad.ucl.ac.uk/>

When all essential documents are ready to archive, contact the UCL Records Office by email at [records.office@ucl.ac.uk](mailto:records.office@ucl.ac.uk) to arrange ongoing secure storage of your research records unless you have made specific alternative arrangements with your department, or funder.

For information on the UCL Records Management Service, please visit <http://www.ucl.ac.uk/efd/recordsoffice/policy/records-transfer>

**Appendix A: Huiping Chu's Interview Information Sheet**

**Information Sheet – The Development History of Chinese Science Museums**

**Interview Information**

Thank you for agreeing to participate in an interview on the history of Chinese science museums.

The interview will explore how modern Chinese science museums developed, for example investigating their original source, contents, main route(s) of development, key people involved, and relationship to broader science politics. Additionally, we hope you can offer some clues regarding the whereabouts of relevant historical pictures, documents and other important people to interview. Please be as open and honest as possible within the interviews.

Two PhD students will conduct these interviews, Huiping Chu from University College London and Xiang Li from Tsinghua University. With your permission the interviews will be audio recorded in order to allow the researchers to

concentrate on their conversation with you, rather than taking written notes. The two PhD students will independently analyse the data provided – this information sheet relates only to the work conducted by Huiping Chu. The information collected from your interview will be used towards her PhD thesis and future study on science museums. The findings may be published in academic journals and with your permission your name will be mentioned as an interviewee in any resulting academic papers. If you prefer to be quoted anonymously, please let me know prior to the interview and I will revise my approach according to your requirements.

We would like to conduct the interview at some point between 12 March and 6 June. Within this period the date and time of the interview can be flexible and we are keen to accommodate any preferences you may have. For example you can choose whether to conduct the interview on a single occasion or over multiple visits. You may stop the interview at anytime. Only the two researchers conducting the interview will hear the recordings, which will be stored securely in password protected files. With your permission the transcript (which will be only in digital format) will also be archived in UCL Drop Box for potential future use.

### **Withdrawal**

If, following the interview, you decide you would prefer not to participate in the interview, or would like to remove specific comments from the data, please contact me at the address below by 31 June 2015 and your data will be withdrawn from the study.

Huiping Chu  
Email: [huiping.chu.12@ucl.ac.uk](mailto:huiping.chu.12@ucl.ac.uk)

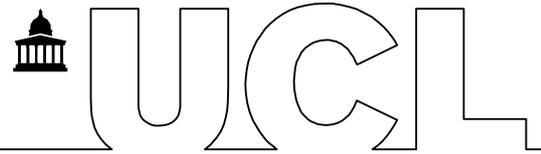
If you have any queries or comments about the interview please don't hesitate to get in touch. Many thanks once again for agreeing to be involved.

Best Wishes,

Huiping Chu

## **Appendix B: Interviewees' signed Consent Form**

## **Appendix 6: Ethics Application Form**



## STS Ethical Procedures Overview

21 March 2018

### Who needs to complete ethical review?

Anyone working with 'live human participants' as part of their research. In our department this usually means conducting interviews but could also involve distributing questionnaires, running focus groups, conducting observations, taking audio / video / photographic recordings of people for research purposes etc.

'Anyone' applies right across the department – from dissertation students to graduate students, staff, visiting fellows etc. whose work is associated with the department. Undergraduate students conducting data collection with members of the public as part of their studies also fall under this category. **Supervisors / tutors are responsible** for ensuring that their students or post-docs or research fellows complete these processes well in advance of any data collection.

### Why should I bother / force my students to do this?

- It's good research practice.
- Many journals are now expecting a statement noting institutional ethical approval for any relevant data within submitted articles.
- You can get sued if something goes wrong – whether it's your own research or that of someone you are supervising / managing. Saying "I didn't know" is NOT an accepted excuse!
- It's neither difficult nor time-consuming – and in many cases actually assists in formulating an effective methodology / research process, thus improving the data collection in the end.

### What's involved?

1. Complete the 'STS Ethical Review' form (overleaf) and submit it to Alasdair Tatam.
2. The contents will be reviewed by the STS Director of Research (or a suitable nominee.).
3. If the project is 'minimal risk':
  - a. Any queries will be discussed between the researcher and the DoR (or their nominee). If necessary further detail may be sought.
  - b. Once approved, the application will be put on file and the research may commence.
4. If the project is NOT 'minimal risk' a more detailed application will be required, in line with UCL's central ethical procedures: <http://ethics.grad.ucl.ac.uk/procedures.php>.

***Note that you cannot start your research until you have received ethical approval. This can take some time – you should allow a minimum of 1 week for processing.***

### Don't forget!

These elements are especially important for STS work:

- Make sure you include information about the processes you will follow to obtain informed consent (preferably in writing but it should be commensurate with the data collected), as well as (where appropriate) how participants can withdraw their data from your research at a later date. It's also advisable to include a deadline for withdrawal (e.g. a month before a dissertation is due or similar).
- Keep in mind how you store your data: personal information must be kept separate to the raw data, plus everything must be 'secured' i.e. on password-protected systems / in locked drawers / filing cabinets etc. Further information on data protection is included in Appendix B here.
- Make sure you get consent to archive any data (raw audio files if possible/appropriate or anonymised transcripts where necessary) for potential use by future researchers. Don't worry, you don't have to predict how they'll use it – the other researcher will need to complete a separate ethics application when the time comes to use the data for their own purposes.

## STS Ethical Review Application Form

Please complete this form electronically, then either print and sign it or provide an electronic signature for submission. The boxes should expand automatically to contain your responses to each question.

**Name(s):** Huiping Chu

**Project title:** A study investigating visitors' identity-related motivations in the science museums in China and the UK

**Proposed dates for the research** (*please estimate if not exactly known*):

Start date: **in the UK:** 23/10/2014 and **in China:** 12/03/2015

End date: **in the UK:** 10/12/2014 and **in China:** 05/06/2015

### Research question:

What are the identity-related motivations of science museum visitors in China? What are the relationship between visitors' identity-related motivations and their demographic factors? How have Chinese science museums developed historically? Why are they called science museum, science and technology museum and science centre in China? (What are their differences from each other?) Who were the original science museums built for?

Please provide a brief description of your data collection processes. *Include your intended methods and how participants will be both identified (what do they have in common?) and recruited:*

### Intended Methods:

Questionnaire survey and Interview

### How to identify participants:

For the questionnaire survey, I will recruit visitors to the Science Museum London and three science museums in China. I am in the process of obtaining permissions from all four science museums, and no data collection will begin without explicit permissions in writing from those institutions.

For the interviews, I will interview senior Chinese scholars who are familiar with the development of the Chinese science museums.

When I carry out my survey in Chinese science museums, I need to conduct a piloting about people's motivations to visit science museums. However, I cannot make some options in advance by imagination. What I would do is to interview visitors and find their real reasons for visiting a science museum. And then, I extract and purify their answers to produce my reason list.

Further more, I will also talk with some staff of science museums to get some useful information.

### How to recruit participants:

For the questionnaire survey, I will stand at the entrance/exit (or inside) of the science museums with some questionnaires in my hand. An actual or imaginary line will be set in advance. Then I will approach every Xth<sup>1</sup> visitor and invite him/her to do my questionnaire after a brief introduction of myself and what I am doing and how much time the questionnaire will take approximately. For the interviews, I will be introduced via email or telephone to the relevant scholars by existing colleagues

<sup>1</sup> X is a key element of Systematic Sampling, which is a number set to make the participants be selected randomly at a given interval.

(via my supervisor) from the field of science communication or Chinese officers of the China Association for Science and Technology (CAST).

The interviews to scholars will be conducted face-to-face<sup>2</sup> after obtaining their permissions. I will apply a 'snowball sampling' approach, which means that these scholars will recommend other relevant scholars to talk to, whom I will then follow up with. For the interviews of piloting, I will stand inside a Chinese science museum and randomly choose visitors to talk with. For the interview to some science museum staff, I may talk with them face-to-face in their office or somewhere inside science museums with appointments in advance.

UCL defines a number of 'minimal risk' categories (*see Appendix A for further information here*).

Do you consider this research to be 'minimal risk' **Yes**

If **YES** please briefly describe why you feel your project is 'minimal risk', outlining the steps that you plan to take to ensure that your project operates in an ethical manner. *See Appendix A for areas you should cover within this section.*

**The reason of why my project is 'minimal risk':**

- There are nothing about contentious issues, for example, the genetic research or research on illegal substances.
- There are no invasive or traumatic procedures are involved including the administration of pharmacological agents.
- My participants are adult science museum visitors and scholars, and there are no people aged less than 16 years old included in the research.

**My plan to ensure that my project will be operated in an ethical manner:**

- Firstly, I will carefully introduce myself (verbally and in writing as appropriate) to the participants, providing brief information about my project and myself including who I am, where I come from, what I am doing, my projects' purpose, and how long my questionnaire or interview may take.

For the questionnaire part, I will wear a badge or logo of the relevant museum to emphasise the credibility of my presence. The questionnaire survey is entirely anonymous, so the participants can't withdraw from it. However, it will be clear from the start that the questionnaire is optional and they can choose not to participate. I will put a statement at the top of the questionnaire saying that completion of the questionnaire indicates that they are consenting to be part of the study, and understand that it will not be possible to remove their data once they have submitted the questionnaire back to me. I will also include a question in my questionnaire to make sure if the participants would like to archive their questionnaire data for use by future researchers.

For the part of interview, some scholars or officers from China will introduce me to the two initial interviewees, who will be provided with a clear information sheet outlining the purpose of the interview and how the data will be used. They will sign a written consent form giving me permission to use that data. I can also offer the interviewees an option to select what level of anonymity they want, such as their names be included, or their job title / role, or their institution, or if they want to be entirely anonymous. I will give them my email and phone number in order that they can withdraw their consent up until two months before my thesis is due. The interviews to science

<sup>2</sup> Some people may be interviewed by phone, and this depends on their locations and arranging a mutually convenient time for the interview.

museum staff will employ the same rules as above. The interviews to visitors for piloting will be also entirely anonymous, and the participants can't withdraw from it. Yet, they will be told from the start that the interview is optional and they can choose not to take part in. I will also ask for their permission to record their voice by a digital recorder, and this is also optional.

I will keep all of the information very carefully and safely, for example I will put all electronic information in a password-protected folder in my laptop. Any hardcopy materials will be stored securely, for example locked away once obtained.

- Secondly, I will have a good design of my questionnaire and interview questions in order to avoid any illegal issues or sensitive questions and anything that may make the participants feel uncomfortable. I will also try my best to make the questionnaire as short as possible so that it requires as little time as possible to complete.
- Thirdly, I will make sure that my participants and myself do the project in a healthy and safe environment. For example, if my interviewee has some uncomfortable feeling I will stop my work and call a doctor or someone can help (eg my point of contact within the local institution). I will also have a good observation to visitors' mood and behaviour. For example, I will not recruit a hurry-scurry mother with a crying baby in her arms, because this will make the mother unhappy and introduce unexpected issues to my research.
- Fourthly, I will arrange in advance a point of contact in every museum to help familiarise me with each location and to deal with any queries or emergencies. I have good friends in the Chinese cities where I will carry out my research, they will know my locations, approximate expected time to return and be able to contact me at all times via my mobile phone.

Please indicate what level of Data Protection your project requires and why. See Appendix B for details; if 'light touch' or deeper please also complete the table below for your project:

**Level of Data Protection my project requires and why:**

My questionnaire data is completely anonymised, because there will be no record of any personal information e.g. names, contact details etc. The data format will be paper questionnaire and they will be stored in a locked filing cabinet.

But the data of my interviews will be at the level of "deeper touch", because I have to note the Chinese scholars' names, work position and research fields during the consent process (and possibly within the research data, depending on the level of anonymity they select. Furthermore I will have a deep interview with them. I will therefore apply to central UCL separately for data protection approval for the oral history interviews.

Person(s) Responsible for Data	Personal Data to be Registered	Type of Data Subjects	Data Format	Method of Securing Data
Huiping Chu	Oral history interviews and transcripts	Huiping Chu and relevant Chinese scholars, science museum visitors, science museum staff	Mp3 files of voice recordings and written transcripts of them	Mp3 files and written transcripts will be kept on folders requiring password access in my laptop

				requiring password access; both of their back-up files on mobile hard disk in a locked room.
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Applicant Signature:	Huiping Chu	Date: 08/09/2014
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Supervisor Comments (*please provide reasons why you feel this proposed research will operate in an ethically appropriate manner*):

We have discussed the ethical implications of Huiping's project in depth. I am confident that she is aware of the necessary processes, and is implementing appropriate procedures and documentation to ensure that her research operates in an ethical manner.

Supervisor Name:	Signature:	Date:
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Director of Research Comments:

DoR Signature:	Date:
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Please return this form to Alasdair Tatam (a.tatam@ucl.ac.uk) for processing. If you have any questions at any stage please contact the STS Director of Research for an informal chat.

## Appendix A: Is my project ethically sensitive?

The bulk of activities within STS meet the criteria for '**minimal risk**':

- Applications where there are NO contentious issues such as genetic research or research on illegal substances.
- Applications where NO invasive or traumatic procedures are involved including the administration of pharmacological agents.
- Applications where participants are NOT children or other vulnerable subjects (e.g. participant suffering from mental disorder, prisoners).
- Applications that potentially DO NOT put the investigators at risk.

The following research would normally be considered as **involving MORE than minimal risk**:

- Research involving vulnerable groups as defined above.
- Research involving sensitive topics – for example participants' sexual behaviour, their illegal or political behaviour, their experience of violence, their abuse or exploitation, their mental health, or their gender or ethnic status.
- Research involving groups where permission of a "gatekeeper" is normally required for initial access to members – for example, ethnic or cultural groups, native peoples or indigenous communities.
- Research involving deception or which is conducted without participants' full and informed consent at the time the study is carried out.
- Research involving access to records of personal or confidential information, including genetic or other biological information, concerning identifiable individuals.
- Research which could induce psychological stress, anxiety or humiliation or cause more than

minimal pain.

- Research involving intrusive interventions – for example, the administration of drugs or other substances, vigorous physical exercise, or techniques such as hypnotherapy. Participants should not encounter such interventions, which may cause them to reveal information which causes concern, in the course of their everyday lives.

***If you are not sure which category your work fits under please arrange an informal chat with the STS Director of Research.***

Points you should cover within your explanation of why your project is 'minimal risk':

- Managing participant consent (be especially specific about how you will ensure you obtain evidence of informed consent commensurate with the data you are collecting) & withdrawal processes
- Health and safety (both for you and for your participants)
- Maintaining participants' anonymity (if appropriate)
- How any confidentiality issues will be handled
- Obtaining permission for archiving data for use by future researchers

## Appendix B: Data protection – STS internal procedures for Research purposes

This document summarises the appropriate processes involving data protection for **research** purposes within the STS Department at UCL. It's been designed to be as 'light touch' as possible whilst still ensuring that we comply with the appropriate legal requirements. If you have any questions about these matters please speak to the STS Director of Research.

### Background

Data protection is a legal requirement at both institutional and individual staff levels – heavy fines as well as legal proceedings can be imposed for non-compliance. UCL has various procedures in place to ensure that we comply with the Data Protection Act – see [http://www.ucl.ac.uk/finance/legal\\_services/data\\_protection/index.php](http://www.ucl.ac.uk/finance/legal_services/data_protection/index.php) for details.

### What's involved

This depends on what kind of data you're talking about:

- **Completely anonymised data** (where there is no record of any personal information e.g. names, contact details etc.) doesn't have to be registered for data protection purposes.
- **Light-touch research data** (e.g. emails containing basic contact details of interview participants, but no further personal data relating to them) are incorporated into the department's existing annual data holdings review. *Note that this is only true so long as such 'basic information' is not a material part of the research – otherwise see below.* Within the department's internal 'ethics approval' application form you will need to provide (brief!) details of your 'data holdings' (see the table over the page for some examples), and once a year (usually around Easter) you will be asked to confirm whether they are still appropriate.
- Any **research containing a deeper degree of personal information about individuals** should be registered centrally with UCL for data protection purposes using the relevant forms at [http://www.ucl.ac.uk/finance/legal\\_services/data\\_protection/index.php](http://www.ucl.ac.uk/finance/legal_services/data_protection/index.php). *Note that such information still needs to be included in the department's annual data holdings review mentioned above.*

### Want more advice?

**Encryption:** UCL policy advises that all portable machines and/or devices should be encrypted. Encryption is the most effective way to achieve security of your personal data. The Computer Security Team have produced guidance on the use of encryption with Windows which is available from [http://www.ucl.ac.uk/isd/common/cst/good\\_practice/encrypt/FullDiskEncryption](http://www.ucl.ac.uk/isd/common/cst/good_practice/encrypt/FullDiskEncryption). They also provide more general guidance via their website at [http://www.ucl.ac.uk/isd/common/cst/good\\_practice/encrypt](http://www.ucl.ac.uk/isd/common/cst/good_practice/encrypt). For anyone using a Mac it's also very straightforward to implement – see <http://support.apple.com/kb/PH11123> for example.

**Data handling & protection more generally:** There is plenty of information on the central UCL data protection site [http://www.ucl.ac.uk/finance/legal\\_services/data\\_protection/index.php](http://www.ucl.ac.uk/finance/legal_services/data_protection/index.php), plus the department has also produced a policy document entitled 'Data Protection and Research'.

The annual data holdings review includes summary of the following elements. Three examples have also been included in order to give you an idea of what is appropriate for different sorts of information.

<b>Person(s) Responsible for Data</b>	<b>Personal Data to be Registered</b>	<b>Type of Data Subjects</b>	<b>Data Format</b>	<b>Method of Securing Data</b>
This might be the student / researcher or the supervisor, depending on the data involved.	State what type of personal data is held, for what purpose, and in what system.	(ie: Staff, Student, Patient, Researcher, Research participant, Former UCL staff, Former UCL student, External Workers Contract Workers, External attendees, Pensioner)	(ie: paper/microfilm, electronic files & databases, video, voice recordings, web pages, X-Rays, photographs)	(ie: locked filing cabinet, safe, locked room, password protected on PC, password protected on laptop, removable disk/memory stick detailing how data secured, data encrypted, archive records stored at Belnor House)
<<Your Name>>	Oral history interviews*	Research participants	Mp3 and wav files voice recordings	Electronic documents kept on encrypted laptop requiring password access; back-up files on cd-rom in locked cabinet in locked office.
<<Your Name>>	Oral history interviews; transcripts*	Research participants	Paper; electronic files	Paper kept in locked filing cabinets in locked office. Electronic documents kept on encrypted laptop requiring password access.
<<Your Name>>	Contact details and records of email correspondence with oral history interview participants	Research participants	Electronic files	Held within password-protected email files on a password protected and encrypted computer.

\* As noted on the previous page, if these elements contain any personal information then they would also need to be registered with the central UCL data protection processes – see [http://www.ucl.ac.uk/finance/legal\\_services/data\\_protection/index.php](http://www.ucl.ac.uk/finance/legal_services/data_protection/index.php) for the relevant forms and procedures.

## Appendix 7: The Approval Certificate of the Ethics Application

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DEPARTMENT OF  
SCIENCE AND TECHNOLOGY STUDIES



This document certifies that

**Huiping Chu**

has received ethical approval for their project entitled

**A Study Investigating Visitors' Identity-Related  
Motivations in the Science Museums in China and the  
UK**

in accordance with the UCL Department of Science and Technology  
Ethical Research policies and procedures.

Application reference number: STSETh033

*pp A. Tutum,*

Signed: Dr Simon Werrett

Director of Research

Date of Approval: 10/09/2014