A Comparison Between Chinese Construction and U.S. Construction From a Sustainability Angle

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ABSTRACT

This paper will be examining the cause of some problems in the Chinese building industry in comparison to the American construction industry from a sustainability standpoint. The differences between the Chinese and American Construction industries are affected by many factors. As a fast-growing economy, China is experiencing rapid growth in its construction industry. Growth leads to prosperity but also sometimes expose problems.
Introduction

China as a developing country is one of the fastest growing countries in the world. It “has been the largest contributor to world growth since the global financial crisis of 2008” (WorldBank, 2018). The exponential economic growth has resulted in the massive growth of the construction industries in China. The two figures below show a comparison of the GDP growth in the construction industries of the two countries. The unit for figure 1 is U.S. billion and for figure 2 is CNY HML. When converted to USD, for example, the Chinese GDP in July 2018 is about 620 billion dollars, and in January it increased to over 920 billion dollars. (WorldBank, 2018). From the graph, we can observe that, although, the Chinese construction fluctuates greatly; the general growth over the two years is very sizable. On the other hand, the growth rate for the America construction GDP is much slower than the Chinese one. From 2016 to 2018, the GDP only increased by 40 billion dollars. Urbanization became the main migration pattern, as more and more people are pouring into the cities for better job opportunities. The cities have to expand, build more buildings, and infrastructure to accommodate for the population in the cities. As of 2019, China has a population of around 1.4 billion. At this scale, construction has to be done very fast in order to meet the demand. This situation then creates problems regarding the quality of the constructions.
I went back to China in the summer of 2018 for the first time in three years. The city I grew up in is Shenyang, is located in Northeast China. The population is about 8.3 million, and the city boundary is about 5000 square miles. It is not as big as the other fast developing cities in China, but it is still very sizeable. I noticed that there are many new constructions in places I used to be
familiar. There are even newly developed areas and districts, new commercial
buildings, shopping centers, and shopping districts, most of them less than three
years old. What surprised me was that the recent constructions did not look new,
mainly because the envelope of the building looked aged from the weather. The
sites of many buildings were not well maintained. I started to think of the cities in
America and the construction qualities and buildings. I realized that the buildings
in the U.S. do not have that issue. This study will be aiming to examine the
differences between the Chinese constructions and the U.S. constructions from
the economic, environmental, and social standpoint through a variety of methods.

There are not many relevant studies on this topic. The comparison
between Chinese and U.S. constructions is not a heavily researched subject.
However, this is an important field to explore for many reasons. Based on
China’s growth rate, it soon will gain more international attention. China and the
U.S., as two major economic bodies in the world, will have more and more
connection between the two. There is still a long way for China to become a
developed country and much more things to work on. With this study, people can
have an idea on some of the factors that caused the differences in the
appearances of the buildings and provide some ideas for correction. This topic
can be a very complicated subject to study, as many factors need to be taken
into consideration. My study will only provide a glimpse of a couple of factors.
Future studies should aim to look at more factors and apply to other building
constructions sites.
Literature Review

Sustainable Developments

Sustainable developments are an important sector to consider in today’s construction practices. It is essential because of the resources and environmental crisis that people are facing today. Energy is one of the biggest concerns when considering sustainable developments because “Energy use is a central issue as energy is generally one of the most important resources used in buildings over their lifetime” (Thormark, 2002). There are many methods to achieve energy conservation. Innovative technologies can bring more saving to the buildings. A study by Dorota Chiwieduk developed the idea of three types of buildings for sustainable-energy buildings. They are energy-efficient buildings, environmental-friendly buildings, and sustainable buildings. The first step is to achieve energy efficiency so that the operating energy of the building can be low. Then the concept of the environmental-friendly building is a building that’s built with sustainable materials, in which it does not harm the environment. “In a sustainable-buildings strategy, we can find all the elements of energy efficient and environmentally-friendly buildings” (Chiwieduk, 2003). All of the features from the energy-efficient building and the environmental-friendly building are included in the sustainable building.

Sustainable developments are facing some challenges due to the cost of construction. The green buildings usually cost more than to other buildings because of the material and the technology it requires. The energy savings,
however, can be very attractive. Catarina Thormark did a case study on multiple
low energy buildings to evaluate their life cycle energy usage. In the low energy
buildings, embodied energy accounted for about 40% of the total energy
consumption in 50 years. “About 37–42% of the embodied energy can be
recovered through recycling. The recycling potential was about 15% of the total
energy use during an assumed lifetime of 50 years” (Thormark, 2002). This is a
considerable amount of energy that can be reused. This data shows the potential
in green buildings in energy saving. The key is to inform the decision makers of
such benefits. The benefits of green building are mostly long-term benefits; it is
hard to see at first. The problem is that the “cost consultants seriously
overestimate the capital cost of energy efficient measures and seriously
underestimate the potential for cost savings and value-added as trade-offs”
(Bartlett, 2000). The operational cost of the building and the recycle potential will
offset the extra construction cost.

**Chinese Construction**

The Chinese construction industry is very different from the U.S.
construction industry. The national economic sector controls the “production and
operation of buildings, and civil engineering works by the Chinese Standard
Industrial Classification (1993)” (Luo, 2000). All of the regulations and permits
have to go through this sector to get approved. The Construction Commission
was established in 1954, which is later than many western countries. During
these times, the government was not very stable; therefore, the construction
industry went through many changes that influenced its growth. Problems such as the value of money, construction schedule, quality of construction, and safety management are all still here today. The lack of experience and clear guidance made it hard to increase construction quality.

China now uses a tender evaluation process, which has a scoring system for bidding on a project. The lowest price does not win, but a comprehensive evaluation of “price, time, quality and construction plan and company’s reputation as well as proposed project team” (Zou, 2007). This is the same standard for the whole country to follow. It would be beneficial to “enhance and integrate its tendering practice, contract management, on-site project supervision and OHS practice into one database/system” (Zou, 2007). This will give the construction process a better-planned schedule and also provide a better work environment for the workers. The idea of project management in China has a very short history because it only started in the 1980s. Construction companies now all have a good appreciation of the importance of project management plans and are willing to implement them before the start of construction. Base on the study from Ping Chen, some of the recognized benefits for implementing project management plans, are better project control, better reputation, increased efficiency, and client satisfaction and more. However, there are still many challenges such as market competition, policy uncertainty, and lack of competent staff that influences the development of the Chinese construction industry.

U.S. Construction
The construction industry in the U.S. is more mature than the Chinese markets because it has a longer history than the Chinese one; thus, it has more experience, more guidelines, rules and programs oversee the construction process. The building materials, design, and site planning, etc. all have a stricter rule than China. The proposal for the construction of a building can be very long because there are many permits that the owner need. Each state also has different building regulation; therefore, giving an advantage to the U.S construction industry. A study by Roozbeh Kangari on the “Risk Management Perceptions and Trends of U.S. Construction” shows that the general contractors and owners in the U.S. are very aware of the risk management plans. Some of the risks are permits and ordinances, defective design, subsurface conditions, materials, and government regulations. All of those factors are considered to be very important. This shows the level of attention that the construction company gives to the building process.

**Methodology**

There are a variety of methods for research. The most appropriate design is the one that can achieve the best result in finding the answers to the proposed problem. The goal for this research is to find the differences in the construction of buildings in the U.S. and the ones in China: to find the differences from the social, economic, and environmental aspects. Therefore, this study will be conducted through a mixed method, where both qualitative and quantitative
approaches will be utilized. These two approaches can meet the different needs of this study to be successful.

There will be a questionnaire for architecture students both in China and America to answer. The questions on the questionnaire will be aiming to find how the Chinese and America students value sustainability in their design. There will also be an interview with an architecture professor in China, Lingling Zhang, who has a rich background in teaching and very knowledgeable about the Chinese construction industry. The interview will give a more in-depth discussion of the Chinese construction industry.

**Results and Discussion**

**Questionnaires**

The questionnaires were sent out to architecture students from both countries. There are 47 responses from Chinese students. In order to make the comparison easier and more clearly, only the first 47 responses from the American students will be included in this study. This study includes five of the questions on the survey, and each of these questions helps people understand the difference between the two groups.

**Question 1: How long do you think a typical construction of a 6-story office building takes?**

A. 3 month to 6 month          B. 6 month to 12 month
C. 12 month to 18 month        D. 18 month and more
From figure 3, most of the Chinese architecture students think that the typical construction time of a 6-story building is 6 to 12 month, where American students believe the construction will take longer. This question is based on the individual student’s experience and gives their best estimate. The result shows that Chinese constructions usually take a shorter period to complete than the American ones. This indicates that Chinese construction may save a lot more money on the labor cost of the project.

**Question 2:** Choose three of the following that you think are the most important to consider when designing for a building.

- The budget
- The architectural design
- Occupant comfort
- Future maintenance
- Environmental impact
- Community connection
Question 2 asks the students to pick three factors that they think is the most crucial to consider for a building design. The budget of the project and the architecture design are the two most popular choices between the two groups of students. These two factors are very influential to the quality of construction. The rest of the terms are occupant comfort, future maintenance, environmental impact, and community connection. From figure 4, the American students show a greater concern for the environmental impact of the building design. This is because more students learned about the idea of sustainability and there are more students aware of this issue. The community connection is the least picked subject for this question. Many people often neglect the importance of community
involvement; however, it is important to consider this factor because the buildings are built for people to use and enjoy.

**Question 3:** Do you think that the maintenance and the endurance of the building should be considered at the design and construction phase?

Yes  No

Figure 5 for question 3 on the following page indicates that there is a significant amount of students from each group who selected different answers. We can still observe that there are a greater number of American Architecture students believe that it is necessary to consider for the maintenance and the endurance of the building at the design phase. These responses may mean that American students pay more attention to the building after the construction is done.
Question 4: Are you familiar with the concept of green building? Or familiar with LEED or any other green building standard?

Yes  No

Figure 6: graph to question 4.

This question is targeted to find out if the students are aware of the concept of green building and its standards. From the result, we can observe that there is a large difference between the two groups of students. Green building and the LEED certification, even Net-Zero, are familiar terms to most American architecture students. However, Chinese students are less educated about these ideas. This is mainly due to the interest of the educator, where in America, professors like to introduce new concepts like these.

Question 5: On a scale of 1 to 5, how important is the sustainability of a building to you?
Figure 7: graph to question 5.

Question 5 shows how students thought about sustainability. The majority of students selected option 3, which indicates that it has some level of importance, but not so important where they will make it the top of their list. From figure 7, we can still observe that American students value sustainability more than the Chinese students.

**Interview**

I have conducted an interview by phone with Lingling Zhang, who is an architecture professor at the Shenyang University of Architecture. The interview was in Chinese; therefore, the results are translated to English. Zhang feels the lack of awareness that the Chinese construction industry and the building community lack. “I have heard about the concept of green building, and I also have heard of LEED certification. However, those are not popular in China.” According to Zhang, there is only one LEED-certified project in the city of
Shenyang that she knows of, where in America, there are a lot more LEED-certified buildings. I asked what she thinks causes the difference in the construction qualities between China and America. She indicated that, “the environment is very different, in China the building code and process to get the permits I believe is not the same as America. The market and behavior are so distinct, that everyone has a different interest in mind.”

What can be sure is that the Chinese market is still driven by money and profit; the notion of sustainability is not of priority of the builders. “Once the building is complete, they think that their job is finished.” It is typical for Chinese construction companies to get their job done very fast, and then they think that is all the work they are required to do. “The most efficient way of raising awareness is through the government.” In China, the government controls the industry and oversees all rules and activities. The most effective way is for the Chinese government to push for sustainable design and change the construction industry.

Conclusion

Many factors contribute to the differences in the construction industry between China and America. From this study, I think the key factors for reducing the difference is to encourage education for sustainable design, and the government needs to support to make the changes. The three pillars of sustainability, economic, environmental, and social, aims to create an enjoyable environment for the people and nature, in which people can find a balance and live in harmony with the environment. If China adapts to this idea, it will be a big contribution to the environment.
Limitations

There are many limitations to this project. For the scale of this study, it is insufficient to address all of the issues in depth. Future studies can focus on finding the cause to questions such as, why is there a big difference in interest, how to bring the market potential of sustainable buildings to China, and what are the factors that stop the construction companies from being environmentally friendly, etc. The questionnaire results are mainly from students studying at the University of Arizona and the Shenyang University Of Architecture. The questionnaire can also be sent out to more students from different University in Both China and America to increase the diversity and the accuracy of the result. People can also interview more professionals from different regions and cities to get a better understanding of the current situation. As the Chinese market continues to grow, problems in the building industry will be worse if not corrected. This study can help to provide a different view of its construction industry and a new approach to tackle the problems.
References


