Comparing the Chinese Construction Industry with Other Developing Countries to Identify an Applicable Solution to Low Construction Performance

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The Chinese Construction Industry (CCI) has become one of the largest in the world within the last 20 years. However, due to its rapid growth it has been experiencing issues causing the industry to struggle with delivering high performing projects. Due to the differences between developed and developing countries construction industries, research from other developing countries that were similar to China (Vietnam and Kingdom of Saudi Arabia) were used to help identify solutions to improve the CCI. Previous research has identified the major risks in Vietnam and Saudi Arabia. It has also been identified the only solution that has documented evidence that it can improve construction performance is the Best Value Approach that was developed in the United States at Arizona State University. A literature research was performed identifying the major risks and issues that have been documented in the CCI. These risks were then compared to that of the Vietnam and Kingdom of Saudi Arabia’s construction industry risks. It was identified that the majority of the top risks were similar in all three countries. Identifying that developing countries have been experiencing the same issues. This also identifies that the Best Value Approach might be a solution to help improve the CCI.

Keywords: China, Construction, Performance, Risk, Developing Country, Best Value Approach, Vietnam, Saudi Arabia.

China Construction Industry Issues

In the last 20 years China’s Construction Industry (CCI) has grown to be one of the largest in the world. Each year China spends around $850 billion to support its population and business growth (Trading Economics, 2018). A study performed in 2009 identified it as the largest contributor to the international construction industry (Zhao et al. 2009). This rapid growth and the size of the CCI has caused many issues dealing with the performance and efficiency of construction projects, and the quality of the construction being built. There have been multiple studies that have been performed to verify these issues, but due to the physical size, number of people involved in the CCI, and the amount of projects that are being performed each year, it has been difficult to accurately verify how extensive and severe these issues are affecting the CCI. Few studies have been able to collect documentation on the performance of construction projects in the CCI. The research that has been performed has found the following:

1. Productivity and efficiency are poor (Shen et al. 2011, Li 2003, Zhao et al. 2009)
2. Perceived performance issues, but little documentation of actual performance and quality (Yang et al. 2010, Hu et al. 2018)
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Low Productivity and Efficiency

The CCI plays an increasingly important role in the world. But its performance is poor compared with that of its foreign counterparts, and other developed countries. Despite the significant development of the CCI, the low industry performance in various domains is frequently criticized by researchers (e.g., Deng et al. 2013; Liu et al. 2013; Liu and Deng 2009; Sha et al. 2008; Wang 2004; Wang et al. 2006; Shen et al. 2006; Wei and Lin 2004). One set of research findings stated that compared to the U.S. construction industry, the CCI employed 31 times more people and the average output per person is only 5% of U.S.’s workforce and 6% of output of the average Japanese workforce. Although CCI spends more than the U.S., it still delivers 23 times less construction services than the U.S., which shows the major issue the CCI deals with regarding their low productivity and inefficiency (Zhang et al. 2008, Xu et al. 2005). Insufficient expenditure on machinery and equipment also affects the labor productivity negatively. In the year 2005, the equipment fee accounted for less than 7% of the total project fee in China, while it accounted for 20% in the U.S. The official statistics revealed that in 2006: 1) the overall labor productivity in terms of value added is Chinese Yuan 25,741 per person; 2) the value of machines per laborer is Chinese Yuan 9,109 per person; and 3) the power of machines per laborer is 4.9 kW per person. All these figures are very low compared with western construction industries (Zhao et al. 2009).

Perceived Performance Issues

Currently, the CCI does not have a lot of information on construction performance. Failure of performance measurement in the construction industry has been criticized in literature, including a review by Yang et al. (2010). Another study also identified that there was minimal literature that simultaneously measures overall performance, efficiency, and effectiveness (Hu et al. 2018). A preliminary literature research revealed that there is no documentation on the CCI’s overall performance published. There were only a couple of studies performed that found performance information on construction projects in China. One study researched stakeholder satisfaction. It found that out of 200 construction projects in China in 2005, 24.3% had violated related regulations and only 13% could be ranked as “good quality” (Zhang et al. 2008). Similarly, one study surveyed 139 construction firms in China which one result indicate that ‘improving construction quality’ as the most common competition method, indicating the significance of quality issues for Chinese firms (Wang et al. 2006). Other research found that in 2005, only 12.85% of 515 government projects in Shenzhen and Hong-Kong completed within the scheduled completion date [of the projects delayed the average delay was 21.34% over the original schedule]. Also, in 2004, 73% of 30 government projects reported being 20.3% over the original budget (Zhang et al. 2008).

The CCI, along with many other developing countries, often looked to more developed construction industries to find solutions to their issues (Chen, 2020). However, many developing countries have not found success in using developed countries’ solutions (Chen, 2020). This could be contributed to the fact that developing nations do not have the same issues as developed countries, thus their solutions do not address the need of the developing country. Another reason for this is because solutions created by developed nations often do not resolve the issue (Chen,
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2020). Developed nations are also trying to figure out how to improve the performance of their construction industries.

Performance recorded over the past 30 years in two of the most developed nations (United Kingdom and United States) are as follows:

- Research conducted in the U.K. has documented construction performance in showing minor improvements from 2000 to 2011 in certain areas, but continues to suffer in others (Kashiwagi, 2013, Rivera, 2016):
  - Overall customer satisfaction increased from 63% to 80%.
  - Customer satisfaction for projects over 5M Euros was at 73%.
  - Projects completing on time increased from 28% to 45%.
  - Projects completing on budget increased 50% to 63%.
  - Contractor profitability declined to 5% from 7% in 2010.

- Studies have also been conducted in the U.S. showing similar results of construction non-performance (Kashiwagi, 2013, Rivera, 2016):
  - Productivity has decreased by 0.8% annually.
  - Construction companies have the second highest failure and bankruptcy rate of 95%.
  - Over 90% of transportation construction jobs are over budget (Lepatner, 2007).
  - Almost 50% of time is wasted on the job site (Lepatner, 2007).
  - The average percent over budget amount and percent delay amount is 28% and 53% (Rivera, 2016).

Comparing Other Construction Industries to the China Construction Industry (CCI)

In a previous study conducted by the researcher (Chen, 2020), it was found that the CCI and its conditions are very similar to other developing nations (10 in total. See Table 1.1). Of the 10, only Vietnam and the Kingdom of Saudi Arabia (KSA) were identified as the two countries most similar to the CCI. The factors used to identify similarities with the CCI were the following (see Table 1.1):

1. Construction GDP %
2. Corruption Index
3. Construction GDP Increase

Table 1 shows the breakdown. Of the similar countries, the researcher was only interested in countries that were most similar to the CCI. Five countries [Bahrain, Indonesia, Mongolia, Thailand, and Turkey] were disqualified because they were not the most similar in all three factors. Of the remaining 5 that were most similar to the CCI, the Philippines and Oman were disqualified due to a lack of documentation on their construction industries. This made it impossible to do further research on them (see Table 2). India shows the lowest GDP growth with only a 14% increase. Given this, India stands out as an outlier among the five comparable countries, so it was disqualified. The only two countries remaining that had documentation were
Vietnam and KSA. These would be the countries the researcher used as the primary comparison with the CCI.

Table 1 shows that Vietnam, KSA and China’s construction industries all contributed a similar percentage to their countries overall GDP. They also had close corruption index scores showing that the environment and stability of the country’s industry is similar [all within 7 or less from each other]. Lastly, all three were found to have large growths in the last 10 years of their construction GDP.

**Table 1: Comparison of Construction Industry between Different Developed Countries**

| Country     | Corruption Index Score | Construction GDP ($) | Construction GDP (%) | Construction GDP Increase (2010 – 2017) |
|-------------|------------------------|----------------------|----------------------|----------------------------------------|
| Saudi Arabia| 46                     | $8.64B               | 4.8%                 | 38%                                    |
| Oman        | 45                     | $3.94B               | 8.9%                 | 74%                                    |
| Bahrain     | 43                     | $0.59B               | 1.8%                 | 34%                                    |
| Turkey      | 41                     | $8.08B               | 0.9%                 | 75%                                    |
| China       | 40                     | $844B                | 6.8%                 | 172%                                   |
| India       | 40                     | $35.7B               | 8.0%                 | 14%                                    |
| Mongolia    | 38                     | $0.22B               | 2.1%                 | 80%                                    |
| Indonesia   | 37                     | $19.21B              | 2.1%                 | 86%                                    |
| Philippines | 35                     | $4.3B                | 6.2%                 | 150%                                   |
| Thailand    | 35                     | $2.27B               | 2.5%                 | 36%                                    |
| Vietnam     | 33                     | $1.29B               | 4.4%                 | 40%                                    |

**Table 2: Reference of Construction Industry from Different Developed Countries**

| Country     | Reference of Construction Industry |
|-------------|-------------------------------------|
| Saudi Arabia| 45                                  |
| Oman        | 1                                   |
| China       | 46                                  |
| Philippines | 0                                   |
| Vietnam     | 50                                  |

**Potential Solution**

As shown in Table 1 and 2, Vietnam and KSA have the most similar construction industries compared to China. Interestingly, of the publications identified for Vietnam and KSA, both have documented poor performance in their construction services. It was identified that major research studies had been performed on both the Vietnam Construction Industry (VCI) and the Kingdom of Saudi Arabia Construction Industry (KSACI) that identified the best solution to resolve their construction non-performance and minimize their risks was the Best Value Approach (BVA). Due to the similarities of VCI and KSACI with the CCI, the BVA may also be a solution for the low performance of the CCI. This next section will identify research conducted on the Best Value Approach.
The Best Value Approach

The Best Value Approach (BVA) has been the only project delivery approach that has repeated documented testing with improved project performance. It has been tested in the entire supply chain (construction and non-construction services) (Rivera, 2017).

It was derived from the industry structure model (IS) (see Figure 1). The IS model splits the industry up into two main quadrants:

1. The Best Value quadrant that has high competition and performance; and
2. The Price Based quadrant that has low competition and performance.

The model identifies that low performance is caused due to buyers trying to manage, direct, and control (MDC) vendors. The only way to move to the Best Value quadrant is to utilize the expertise of the vendor, by moving the management and control of the project to the expert vendor.

The IS model identifies the following buyer traditional activities that are used to MDC vendors (Kashiwagi, 2018; PBSRG, 2018):

- Creating technical requirements and specifications.
- Partnering and developing relationships with vendors to enable the client to be involved with the management and development of the service.
- Using the contract as leverage over the vendor.
- Using a project manager to manage a vendor after they were awarded a contract.

The IS model also identifies that the following activities will enable buyers to utilize the expertise of vendors:

- Minimize involvement in technical details of services.
• Move buyer activities to that of quality assurance (ensuring the vendor has created a plan and is measuring their performance through non-technical metrics) instead of quality control (ensuring the vendor is performing all their technical work correctly).
• Require vendors to tell the client what the technical specifications and requirements should be.
• Utilize internal buyer personnel to help and protect the vendor.

The BVA was developed to help buyers to understand and move perform the activities that enable them to utilize the expertise of vendors. The BVA splits a project up into three major phases (selection, clarification, and execution) (see Figure 2):

Selection Phase

All vendors compete based on their level of expertise instead of their technical scope of work. During this phase, the vendors are not given technical requirements or specifications, but a list of expectations and explanation of “what the client thinks they want”. They are selected upon their past performance metrics, ability to identify risk, and capability of their key personnel. The highest ranked vendor moves into the clarification phase.

Clarification Phase

This is the most important phase, as the vendor with the highest level of expertise is now required to create their scope of work and technical requirements which are required to:

• Explain how they will accomplish the work efficiently and with high customer satisfaction
• Identify their plan from beginning to end, all risks they do not control, all major milestones, how they will measure their performance, and justify their costs
• Respond to the client’s concerns and feedback about the vendor’s plan and the vendor must address those concerns in their plan

Regardless, if the concerns from the client are technical or non-technical, the vendor is required to resolve the concern using non-technical language. The contract is only signed when the client is comfortable with the vendor’s plan, otherwise, the vendor will be eliminated from clarification and the next in line vendor will be notified for clarification.

Execution Phase

Upon signing the contract, the contractor can proceed to work according to their plan. Since the vendor was the entity that developed the plan and the metrics, it has now put them in full control of the project. Performance will be tracked and posted online for each contractor through Weekly Risk Reports (WRR) which the contractor will turn in on every Friday. If ever another stakeholder tries to control the expert, that is also reported on the WRR and the vendor identifies what the impact that control will have on the project’s performance.
Many of these ideas are different from the traditional delivery models. However, BVA system has documented the following performance (Rivera, 2017; PBSRG.com, 2018):

- 2,000+ projects and services delivered (construction and non-construction).
- $6.6B of projects and services delivered with a 98% customer satisfaction and 9.0/10 client rating of process.
- Services delivered: construction, facility maintenance, IT, professional (design), redesign of systems and organizations and supply chain applications.
- $18M in research funding generated, due to the effectiveness of decreasing buyer cost of services on average by 31% (57% of the time, the highest performing expert was selected and was the lowest cost).
- Contractors/experts could offer the client/owner 38% more value and decreased client efforts by up to 79%.
- 90% of all project cost and schedule deviation is caused by the owner’s non-expert stakeholders.
- Change order rates were reduced to as low as -0.6% (Rivera, 2017).
- CIB W117 has worked with over 123 unique clients (both government and private sector) and received 12 National/International Awards.
- 5 to 30 percent cost savings are achieved on the projects.
- The BVA is the most licensed technology to come out of Arizona State University licenses (63).
- It is internationally recognized through repeated testing (Canada, Netherlands, Sweden, Norway, Finland, Botswana, Malaysia, Australia, Democratic Republic of Congo, France). Education efforts are in Poland, Saudi Arabia, India, Vietnam and China.
- Been audited four times: The State of Hawaii Audit [Kashiwagi et al. 2002; State of Hawaii Report 2002 (DISD)]; The Dutch Study on the Impact of PIPS (Duren & Doree, 2008); The Corps of Engineers (COE) PARC, 2008 (Kashiwagi, 2018); The Western States Contracting Alliance (WSCA) Agreement, 2011 (PBSRG, 2018).
Proposal

Due to the China Construction Industry (CCI) environment and conditions being similar to Vietnam and the Kingdom of Saudi Arabia (KSA), the researcher asserts the following proposals:

1. The CCI will have similar risks and issues as Vietnam and KSA.
2. If the CCI risks are similar to Vietnam and KSA, the Best Value Approach may also be a potential solution to help it overcome its low construction performance.

Methodology

The following research proposes to investigate whether the China Construction Industry (CCI) has similar risks to Vietnam and the Kingdom of Saudi Arabia (KSA), and if the Best Value Approach (BVA) is a potential solution to help it improve its performance. To investigate this proposal, a literature research will be performed as follows:

1. Perform a literature research in the CCI and compile a list of top risks.
2. Analyze and prioritize the risks in terms of most to least frequently documented.
3. Repeat steps 1 and 2 for the VCI and KSACI.
4. Compare and analyze the CCI risks to those of VCI and KSACI.
5. Research which risks BVA seeks to address in Vietnam and KSA to investigate if BVA can mitigate the same risks in the CCI.

Literature Research on the Risks in China’s Construction Industry (CCI)

To identify the major risks in the CCI, a literature search was performed through 5 databases with more than 6891 journals. The five databases included:

1. Emerald Journals
2. ABI/Inform
3. Google Scholar
4. ASCE Library
5. EI Compendix

These databases combined had the following characteristics:

1. Updated weekly with articles from 55 different countries (EI Compendex).
2. Has over 10 million papers and more than 650,000 are added annually (EI Compendex).
3. Maintains a database of articles from multiple construction related areas (Emerald Journals).
4. Publications from the entire world on topics that include facility management, engineering, construction, and project management (ABI/Inform).
5. Contains all articles and papers that can be found on the internet (Scholar Google).
Six search terms were used to look for articles in each database (See Table 3). These terms were derived from looking at other research efforts that performed literature research on construction risks and the terms that they used. For each search term for each database the following information was tracked:

1. The number of articles that the search term brought up.
2. The number of articles that were relevant to the research topic.
3. The year the article was published.

The researchers read each abstract from articles published since 2003. Each abstract that was relevant to the research, the full paper was downloaded and read for information regarding risks in the CCI. Table 3 identifies the number of relevant papers that were identified from each database.

Table 3: The Number of Identified Relevant Papers from Each Database

| Search Term          | EI Compendex Relevant Papers | Year touched | Emerald Journals Relevant Papers | Year touched | ABI/Inform Relevant Papers | Year touched | Google Scholar Relevant Papers | Year touched | ASCE Library Relevant Papers | Year touched | ASCE Library Relevant Papers | Year touched | Other Search Term Relevant Papers | Year touched |
|----------------------|------------------------------|--------------|---------------------------------|--------------|-----------------------------|--------------|---------------------------------|--------------|------------------------------|--------------|------------------------------|--------------|---------------------------------|--------------|
| CCI                  | 3356                         | 3            | 2003                            | 12412        | 4                           | 2001         | 34000                           | 1            | 41400                        | 2003         | 4911                         | 2004         | CCI Risks                       | 5000          | 4000                          | 2001         |
| CCI Risks            | 5000                         | 4            | 2003                            | 9440         | 2001                        | 11000        | 2003                            | 347000       | 2003                        | 4635         | 1                            | 2004         | CCI Issues                      | 11897         | 2000                         | 2003         |
| CCI Issues           | 11897                        | 2            | 2003                            | 14706        | 2001                        | 19455        | 2003                            | 179          | 2003                        | 6625         | 2004                         | 4000         | CCI Performance                 | 2199          | 2000                         | 2003         |
| CCI Performance      | 2199                         | 4            | 2003                            | 14366        | 2001                        | 16522        | 2003                            | 174000       | 2003                        | 10197        | 7                            | 2004         | CCI Risk Management             | 3855          | 2000                         | 2003         |
| CCI Risk Management  | 3855                         | 1            | 2003                            | 8707         | 2001                        | 13135        | 2003                            | 72300        | 2003                        | 4274         | 2                            | 2004         | CCI Inefficiency                | 805           | 2000                         | 2003         |
| CCI Inefficiency     | 805                          | 0            | 2003                            | 2042         | 2001                        | 845          | 2003                            | 34900        | 2003                        | 622          | 2004                         | 4000         | Total Hits                      | 27112         | 2000                         | 2003         |

The literature search identified 46 relevant publications on construction risks in the CCI. Those 46 publications identified 72 risks. Each risk was prioritized based upon the frequency in which they appeared in the studies. Table 4 identifies the risks that appeared most frequently in the studies and gives an example of how documentation was kept on each risk appearing in the different publications. Of the 72 risks identified, 42% were only found in one publication and 15% were found in only two publications. Only 43% of the risks were found in more than three of the publications.
Table 4: Identified CCI Risks in the Literature Research

| Major Categories | Unforeseen risks | Infrastructure support | Management Skills | Outdated Technology | Relationships and Guanxi | Legal and Contract Issues | Project Financing | Skill level of labor | Government Control | Bureaucracy in organizations | Government Instability and Politics | Infrastructure support | Government Control | Procurement Model | Communication between stakeholders | Ownership control and decision making | Experience and Buildability of Design | Time | Uncertainty in political economy | Uncertainty in economic and social environment | Management of Uncertainties and Consequential Costs for Construction Projects | Management of Uncertainties and Consequential Costs for Construction Projects | Management of Uncertainties and Consequential Costs for Construction Projects | Management of Uncertainties and Consequential Costs for Construction Projects | Management of Uncertainties and Consequential Costs for Construction Projects | Management of Uncertainties and 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| Categories                                 | Definition                                                                 | Risks                                                                 | % of Risks |
|--------------------------------------------|---------------------------------------------------------------------------|----------------------------------------------------------------------|------------|
| Bureaucracy in organizations               |                                                                           |                                                                      | 6          |
| Government Instability and Politics         |                                                                           |                                                                      | 6          |
| Owner control and decision making           |                                                                           |                                                                      | 6          |
| Quality and Buildability of Design Drawings |                                                                           |                                                                      | 6          |
| Corruption                                 |                                                                           |                                                                      | 5          |
| Infrastructure support                      |                                                                           |                                                                      | 5          |
| Lack of Government Regulation and Standards |                                                                           |                                                                      | 5          |

In further analyzing the 72 CCI risks, the researcher grouped the risks into different categories to identify any patterns. The researcher identified seven main categories that encompassed all the risks. Table 6 identifies the seven main categories, the definition of each category and the percent of risks that were associated with that category.

**Table 6: Risks Categories and Definition**

| Categories                                 | Definition                                                                 | Risks                                                                 | % of Risks |
|--------------------------------------------|---------------------------------------------------------------------------|----------------------------------------------------------------------|------------|
| Management, Direction, and Control (MDC)   | Risks involving the buyer or government managing, directing or controlling the contractor in any way. | Legal and contract issues, change of scope due to a stakeholder of a project, decision making of the buyer, requirements and approvals, and government regulations. | 23.7%      |
| Non-Transparency                           | Risks being caused due to issues in communication, misunderstandings, complexity, relationships, lack of accountability or support from management. | Guanxi, organizational bureaucracy, government politics, corruption, and risk sharing. | 16.6%      |
| Finance                                    | Risks caused due to financial aspects of a project or financial conditions of the country. | Market and currency instability, delay in payment to the contractor, contractor mismanagement of project funds, rapid growth of skilled labor cost and contractor lending issues. | 11.4%      |
| Vendor Capability                          | Risks being caused due to the contractor/vendor not being capable of delivering high performing projects. | Lack of expertise and management skills, Inability to create quality design drawings, inability to manage labor supply, high worker turnover rate, no insurance, insufficient safety measures, and a lack of understanding of lean and efficiency principles. | 10.4%      |
| Material and Technology                    | Risks caused due to not having access or a knowledge of the latest technology and materials. | Outdated technology, outdated construction methods, materials required to be replaced during construction, and unknown capability of materials. | 10.4%      |
| Procurement                                | Risks caused due to how buyers select the contractor.                      | Type of procurement model, buyer low bidding projects, not hiring the right contractor, and the administration of procuring a construction service. | 5.2%       |
| Lack of Information                        | Risks caused due to a lack of information of both the buyer and contractor. | Unforeseen risks and inadequate site information.                      | 1.9%       |
After prioritizing the categories, the first two categories (MDC and Non-transparency) included more than 40% of all the risks. Interestingly, despite many different reasons for non-performance in the CCI, it was identified that the biggest issues did not deal with the Chinese contractors’ ability to deliver high quality construction. It was identified that it dealt more with the interaction between the buyer and the contractor. This would also match up with the analysis on the individual risks (see Table 4), as Legal and Contract Issues and Relationships and Guanxi were the two most frequently occurring risks in the 46 publications that were documented.

It was also identified that although vendor capability only included 10.4% of all the risks, 3 out of the top 15 risks involved the vendor’s lack of capability. For the categories of Financing and Materials and Technology, it was also found that each one of these had one risk in the top 15 most frequent risks.

**Risk Research Performed on the Vietnam and Kingdom of Saudi Arabia (KSA) Construction Industries**

In the last five years, two research studies at Arizona State University were performed by PhD candidates from the Kingdom of Saudi Arabia (KSA) and Vietnam on the major risks that KSA and Vietnam have documented and are currently facing. Both research efforts performed in-depth literature research compiling all information on previous studies performed, on the KSACI and the VCI, identifying and prioritizing construction risks and issues. These research efforts also surveyed construction professionals in their countries to validate previous research and identify any risks the industries are currently facing.

*Saudi Arabia Risk Research (Algahtany, 2018)*

In 2017, Mohammed Algahtany, PhD candidate researcher, performed research identifying risks and issues construction organizations were facing in the Kingdom of Saudi Arabia (KSA). Mohammed performed both a literature research and conducted a survey questionnaire to collect the information. The literature research performed, reviewed all previous research performed identifying major risks that had occurred on KSA construction projects from 1977 to 2017. The research found 24 publications [18 of which were published in refereed journals]. From these 24 publications, 32 risks were identified and prioritized by the frequency in which they occurred. Dr. Mohammed then surveyed construction organizations that were certified by the Ministry of Municipal and Rural Affairs, a KSA government organization in charge of delivering all KSA government construction. The survey asked the construction organizations to evaluate each of the 35 risks (3 risks were added due to consultation with a KSA construction expert) on a 5-point scale for both severity and frequency. The risks were then prioritized using the Importance Index, which considers both the severity and the frequency rating. Table 7 is an example of some of the top risks prioritized. To see the full list, please refer to the original study (Algahtany, 2018).
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Table 7: The Overall Importance of Risks in the Saudi Construction Industry

| Risk Factor                                          | HI  | Rank | SI  | Rank | II  | Rank |
|------------------------------------------------------|-----|------|-----|------|-----|------|
| 1- Owner’s related risks                             |     |      |     |      |     |      |
| Delay in progress payments by owner                 | 90.740 | 2 | 98.559 | 1 | 87.618 | 1 |
| Owners’ practice of assigning contracts to lowest bidder | 91.111 | 1 | 86.956 | 3 | 79.227 | 2 |
| Slow decision making by the owner                    | 79.629 | 5 | 82.888 | 6 | 66.004 | 3 |
| Change orders by owner during construction           | 81.481 | 3 | 79.354 | 18 | 64.659 | 4 |
| Excessive bureaucracy in the owner’s administration  | 81.481 | 3 | 79.318 | 19 | 64.629 | 5 |
| Delay in approving shop drawings and sample materials | 77.037 | 7 | 82.173 | 7 | 63.304 | 8 |
| Owner’s team lack of experience                      | 77.037 | 7 | 79.775 | 15 | 61.456 | 10 |
| Owner’s poor coordination with the construction parties and government authorities | 75.555 | 10 | 80 | 12 | 60.444 | 11 |
| Changes in specifications during construction         | 71.851 | 16 | 80 | 12 | 57.481 | 14 |
| Unrealistic contract duration                         | 72.222 | 13 | 79.565 | 16 | 57.463 | 15 |
| Interference by owner in the construction operations | 75.849 | 9 | 73.333 | 30 | 55.622 | 18 |
| Additional work due to changes in the scope of the project | 71.111 | 18 | 76 | 27 | 54.044 | 21 |
| Difficulties in obtaining work permits                | 69.629 | 22 | 76.179 | 25 | 53.043 | 24 |

Vietnam Risk Research (Le; et.al, 2019)

In 2018, Nguyen Le, PhD candidate researcher, performed research investigating the Vietnam construction industry and the risks that were most impactful to their construction performance. As with Mohammed’s KSA construction research, Dr. Le performed both a literature research and survey research of the construction professionals in Vietnam. The literature research looked for any studies performed within the last 15 years that identified non-performance causes in Vietnamese construction projects. Dr. Le reviewed more than 100 published papers and identified only 11 studies related to non-performance construction causes in Vietnam. These studies identified 23 risks that Vietnam currently faces in their construction industry. These risks were prioritized based upon frequency. Table 8 is an example of some of the top risks prioritized. To see the full list, please refer to the original study (Le; et.al, 2019).

Table 8: Top Risk in Vietnam Construction Industry from Literature Research

| No. | Top Risk in Vietnamese Construction Industry | Agreed Frequency |
|-----|--------------------------------------------|------------------|
| 1   | Poor design capacity and the frequent design changes | 73%              |
| 2   | Incompetent contractors                      | 64%              |
| 3   | Incompetence of project management           | 64%              |
| 4   | Financial difficulties of owner              | 64%              |
| 5   | Financial difficulties of contractor         | 55%              |
| 6   | Poor site management and supervision         | 55%              |
| 7   | Corruption                                  | 45%              |
| 8   | Lack of experience in complex projects       | 36%              |
| 9   | Slow payment of completed works              | 36%              |
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Using the research from PhD Candidates Nguyen Le and Mohammed Algahtany, the researcher created an adjusted list of top risks by combining the risks seen in Vietnam and KSA. A comparison analysis identified that 80% of the top risks of the Vietnam Construction Industry (VCA) matched the top risks of the Kingdom of Saudi Arabia (KSACI). Both studies suggest that the Best Value Approach (BVA) is a potential solution to address risks in the VCA and KSACI.

Risk Comparison of the China Construction Industry (CCI) with the Construction Industries of Vietnam (VCI) and the Kingdom of Saudi Arabia (KSACI)

According to the data found in the literature search, 100% of the VCI and KSACI risks are found in the CCI (see Table 9).

Table 9: CCI Risk Comparison with KSACI and VCI Risks

| Top VCI and KSACI Risks                          | CCI Risks |
|-------------------------------------------------|-----------|
| Approval delay by the client or government      | x         |
| Bureaucracy in organizations                    | x         |
| Changes to the initial design                    | x         |
| Communication between stakeholders               | x         |
| Corruption                                       | x         |
| Delay in Payment                                 | x         |
| Government Instability and Politics             | x         |
| Inadequate Site Information                      | x         |
| Infrastructure support                           | x         |
| Instability of currency value                    | x         |
| Lack of expertise in construction services       | x         |
| Management Skills                                | x         |
| Market Instability                               | x         |
| Owner control and decision making                | x         |
| Project Financing                                | x         |
| Quality and Buildability of Design Drawings     | x         |
| Skill level of labor                             | x         |
| Type of procurement model                        | x         |

On the other hand, each country has a different prioritization of each list of risks. Table 10 below shows a list of the top 10 risks in CCI. The table marks whether each of these top risks were also top risks in the VCI and KSACI. The data shows that 5 of the top 10 risks in CCI were also top risks in KSACI and VCI. Of the 5 risks that were not top risks of the VCI and KSACI, 4 of them are government related issues (Legal and Contract Issues, Relationships and Guanxi,
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Government Control and Government Instability and Politics) that fall into the management, direction and control (MDC) and non-transparency categories.

Table 10: Top CCI Risks Vs. VCI and KSACI

| No. | Top 10 Risks in CCI | Top VCI and KSACI Risks |
|-----|---------------------|-------------------------|
| 1.  | Legal and Contract Issues |                     |
| 2.  | Relationships and Guanxi |                     |
| 3.  | Outdated Technology |                     |
| 4.  | Lack of expertise in construction services | x |
| 5.  | Management Skills | x |
| 6.  | Project Financing | x |
| 7.  | Skill level of labor | x |
| 8.  | Government Control |                     |
| 9.  | Bureaucracy in organizations | x |
| 10. | Government Instability and Politics |                     |

Applicability of the Best Value Approach (BVA) with China’s Construction Industry (CCI)

From the risk analysis of the VCI and KSACI, it was identified that the CCI is experiencing all the same risks in their top risks. However, 5 of the top 10 CCI risks (50%) were not risks found in the VCI and KSACI. Due to past research suggesting that the BVA effectively addresses issues created by all of the VCI and KSACI risks identified and 50% of the CCI’s top 10 list, the researcher proposes that the BVA can also help the CCI’s low construction performance (Algahtany, 2018; Le; et.al, 2019).

Conclusion

Due to the rapid growth of China’s Construction Industry (CCI), it has been difficult to maintain a high level of performance on its construction projects. Compared to other similar developing countries (Vietnam and the Kingdom of Saudi Arabia (KSA)) that have also seen a large growth in their construction industries in a short amount of time, they are also experiencing the same issue.

Literature research found that both Vietnam and the KSA have both had research performed to identify the major risks they are facing and the solution that could best help them overcome their issue of construction non-performance. Both research results identified that there has been only one delivery approach that has documented evidence showing that it can minimize the risks these countries are facing and improve their construction performance. This delivery approach is the Best Value Approach (BVA).

A literature research was performed to identify the major risks the CCI is facing and compare them to the Vietnam Construction Industry (VCI) and the Kingdom of Saudi Arabia Construction Industry (KSACI). The results of this research identified that the CCI is facing all of the top risks identified by the VCI and KSACI. However, the VCI and KSACI differ from the CCI because only 50% of the CCI’s top 10 risks are also found in the VCI and KSACI’s top
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The remaining 50% of the CCI’s top risks are unique to the CCI, four of which are Chinese government related issues (Legal and Contract Issues, Relationships and Guanxi, Government Control and Government Instability and Politics). This could be due to several factors. One of the major factors could be due to the socialist government of China, in which, the government becomes both the buyer and the contractor in most construction projects (Zou et al. 2007; Zou 2007; Liu et al. 2013; Zhang et al. 2008; Xu et al. 2005). It has been concluded that due to the CCI having most risks similar to the VCI and KSACI, it is a candidate to utilize the Best Value Approach to help its low construction performance.

**Recommendations**

While this research suggests that China’s Construction Industry (CCI) faces similar risks compared to the Vietnam Construction Industry (VCI) and the Kingdom of Saudi Arabia Construction Industry (KSACI), China is unique in its issues with government involvement. The researchers recommend additional research to investigate the Best Value Approach (BVA) as a potential solution for the CCI’s non-performance issues. The researchers recommend surveying CCI stakeholders to investigate whether the BVA concepts can improve the CCI and the potential of the BVA being able to be implemented in the CCI.

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