Software Outsourcing Subcontracting and Its Impacts: An Exploratory Investigation

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Abstract—**China now is one of the most important places where software outsourcing businesses are flourishing. However, the subcontracting in the current software outsourcing practices has not received enough attentions. This research attempts to further the understanding on this issue. Mixed empirical research approaches were used to explore the extent and the impacts of the outsourcing subcontracting. The findings suggest the subcontracting widely exists in current China outsourcing industry. Its major enabling factors were also identified. While subcontracting provides the industry with specialized services as well as organizational and managerial flexibility in a low cost way, it also introduces some negative influences. Four future trends are also addressed in this paper.**

Keywords-software outsourcing; subcontracting; China; exploratory investigation

I. INTRODUCTION

Software outsourcing has been receiving increasing attentions both from industry and academic circle [7]. It can help organizations to reduce their costs significantly (normally over 70%). And enable them to more focus on their core businesses. It was named as "The Unspoken Revolution in Software Engineering" by Bertrand Meyer [14]. China, which is one of the potential top six outsourcing locations [2], is becoming more and more important in the global software outsourcing development industry.

In any China cities where software outsourcing is flourishing, there is a large presence of software outsourcing subcontractors. They are typically very small companies (some are even not companies, but a small group of several individuals such as university students). However, they collectively finished most of development works. They receive some packages of the whole outsourcing project from the "real" vendors, and work for them but not directly for the outsourcers. Therefore, their performances, or rather nonperformance, greatly influence the whole software outsourcing industry, and the software deliverables to the outsourcers. Besides, subcontracting phenomenon in software outsourcing does not only exist in China, but also in other countries such as India [11] The CMM® [1] level two also treats subcontract management as one of the key process areas.

Subcontracting is a double-edged sword. If well managed, subcontracting can provided low cost options for the contractors (vendors of the outsourcing projects) without lower the quality of the services, and enable the contractors more focus on the major competitive advantages. However, if the subcontracting is excessive or misused, it also can cause many negative impacts, for example, problems on software quality and security, non-payment, corruption, and so on.

Given the popularity of the subcontracting in current software outsourcing industry and its powerful influences, it is necessary to study this phenomenon empirically. However, this topic has been long ignored, few formal research pay attention to it, the empirical evidence is also not satisfying. To fill this research gap, we plan to conduct this exploratory study.

The main objectives of this investigation were to explore and analyze the extent of the subcontracting in the software outsourcing practices, along with the enabling factors of the subcontracting. The impacts of subcontracting were also analyzed. Professionals in software development organizations with managerial role were chosen as the major informants. The following three questions framed the research process:

1. What are the current status and the future trends of the subcontracting in China's software outsourcing?
2. What factors enables the subcontracting in the software outsourcing?
3. What are the impacts of the subcontracting?

The rest of this paper will be organized into following sections. Section 2 provides the research background and the related work. Section 3 describes our research methodology. Section 4 presents the results of the empirical studies. Section 5 discuses the related issues and answers the three research questions. Section 6 briefly discusses major limitations of this study. Section 7concludes the whole paper.

II. RESEARCH BACKGROUND AND RELATED WORK

As we have mentioned in introduction section, the subcontracting phenomenon in software outsourcing development is still in lack of both theoretical and empirical studies, few studies treated it as an independent research theme. Most related work just mentioned it but lack in depth analysis and empirical evidences. Generally speaking, most

prior discussions on software development subcontracting often appeared in the literatures focusing on software project risks. For example, [4] pointed out that the subcontracting might introduce risks to the software development. Some other articles such as [19] also referred this phenomenon. In some empirical studies [9, 12, and 13] on software outsourcing in China, subcontracting was also mentioned.

In many other social economic sectors (especially in construction industry), the subcontracting phenomenon has been well examined from many aspects, ranging from project management to legal or economic analysis. Gonzalez-Diaz [8] identified several major causes of the subcontracting in construction industry. Arditi [3] provided panoramic view of the issues in construction industry. Chiang [6] presents the ramifications of subcontracting and its implications for project management in Hong Kong's building market. These all brought us useful implications and analogies during we framed and conducted this research.

III. RESEARCH METHODOLOGY

To achieve both acceptable depth and breadth, we mixed two research approaches in the data collection process, the first one is the survey and the second one is semi-controlled interview. The details of the research process are listed as following two subsections. This study adopted exploratory approach because of the fact that, as of yet, there are no established theory or empirical analysis that addressed the subcontracting in software outsourcing. That is, we were in lack of conceptual frameworks to guide the research efforts in this field. Meanwhile, there are also no other benchmarks for us to follow and compare. For above reasons, we adopted this research methodology with a grounded theory perspective, which is a systematic, qualitative research and analysis procedure.

A. Survey Design

The survey was used to gather data from a relative large sample of the professionals in the software outsourcing industry. This was done in order to explore and characterize the extent of subcontracting in the software outsourcing industry, and to learn these practitioners' perception towards this phenomenon.

The survey populations were the practitioners who act as managerial roles (e.g. project managers, senior managers or IT managers) in the organizations or the self-employed brokers. The software and testing engineers were not included in this survey, for they do not have many chances to encounter this kind of issues. There has been many successfully applications of using managers as major informants in IT and software studies, such as [5]. All selected survey subjects were working in Shanghai. Although we selected Shanghai largely because of our own location, it is still appropriate choice because Shanghai is a city where has most developed software outsourcing industry. It is also one of the most diverse areas in China. The sample was selected from the database of registered professionals which provided by the local labor administration bureaus. We randomly selected 1000 professionals as our target informants.

The questionnaire contains three sections with 28 questions, the first section was used collect some background information, the second section was used to learn the status of the subcontracting in software outsourcing, in another word, some demographic information, the last one was the informants overall impressions and perceptions towards the subcontracting phenomenon. Several pre-test were conducted to evaluate the validity of the questionnaire.

We sent the questionnaire through email to the selected populations, because Ji et al [10] suggested the email survey is more easily accepted by Chinese people than web based survey. To encourage the participation, an attempt was made to contact every selected survey subjects. However, we can not reach everyone due to the some limitations. In the first round, we only got 81 replies. And then, we sent the questionnaire again, and got 58 extra replies. We then tested the variance using ANOVA test, and found there were no significant differences in the replies between the two questionnaire collections rounds. Finally, we received 139 valid responses (response rate: 13.9%). All the responses answers were preprocessed, and then organized according to the thematic similarity. The themes emerged in this process were not chosen beforehand

B. Interview

The interview subjects consisted of the subset of the survey respondents who indicated the willingness of sharing their thoughts and opinions in an interview. 17 survey respondents agreed to be interview, and then were emailed the interview plan and asked to schedule a face to face/telephone meeting. Finally, we arranged 10 interviews (8 were face to face, 2 were telephone). Each interview lasted around 30 minutes in Chinese. The interview process is semi-controlled. This means we had pre-prepared interview plan for each individual but we still allowed the interviewees to express what they wanted to say freely. The whole interview process lasts for 4 months, from Oct to Nov in 2008. The interviews were taken by the same interviewer with the same interview protocols for all 10 interviews. The backgrounds of the interviewees are summarized in table 1 (according to the sequence of each interview).

TABLE I. BACKGROUND INFORMATION OF THE INTERVIEWEES.

No.	Org. Type	Position	Expe. (yrs)*	Edu.
1	Contractor	Senior PM	6	Bachelor
2	Contractor	PM	3.5	Master
3	Subcontractor	General M	3	Master
4	Contractor	Architect	2	Bachelor
5	Subcontractor	PM	2.5	Master
6	Subcontractor	PM	2	Bachelor
7	Contractor	Team Leader	2.5	Bachelor
8	Contractor	Senior Consultant	7	Bachelor
9	Subcontractor	PM	4	Bachelor
10	Subcontractor	General M	4	Bachelor

*Only experiences in software outsourcing are considered

The interview transcripts were coded and analyzed by using grounded theory [18] and followed the systematic procedures suggested by Strauss et al [18] and Seaman [17]. The data was analyzed and then produced concepts and categories.

IV. RESULTS

A. Survey Results

1) Demographics

Table 2 presents the demographics of the survey respondents. Besides the information provided in table 2, most respondents are experienced and spent more than two years in the software outsourcing industry (Average: 3.23, Standard Deviation: 1.61). Therefore, we can safely assume that they understood the survey questions well enough to provide insightful answers. The demographic indicates the diversity of respondents, which provides a more comprehensive perspective.

2) Current status of outsourcing subcontracting

The responses to the second section of the questionnaire provided first-hand information on the current status of software outsourcing subcontracting. The informants were asked to answer the questions based on their experience from Jan/2006-Jan/2008. The informants would be suggested to stop answer the questionnaire, if they did not engaged in any subcontracting activities in this period. This aims to ensure we can receive the up-to-date information.

TABLE II. THE BASIC DEMOGRAPHICS OF THE SURVEY.

	Frequency (n=139)	Percentage %
Organization Size		
Ultra Large (>1000)	14	10.1
Large (300~1000)	17	12.2
Medium (50~300)	30	21.6
Small (<50)	78	56.1
Job Role		
Project Manager*	61	43.9
IT Consultant*	32	23.0
Other Entry Level	25	18.0
Manager	21	15.1
Manager of Manager*		
*(or equivalent role)		
Educational Level		
<Bachelor	17	12.2
Bachelor	89	64.0
Master	27	19.4
Doctor	4	2.9
Not Specify	2	1.4
Age		
<25	23	16.5
25-30	62	44.6
30-40	46	33.1
>40	8	5.8

a) Extent of software outsourcing subcontracting

We observed 92 out of 139 (66.2%) informants said that they participated in subcontracting projects in their software outsourcing experience. 38 people said they had experience as members of contractors, 66 people said they worked for the subcontractors; and 12 people had both experiences. More than 50% (49 out of 92) informants tell us that subcontracting existed in 50% or more of all projects they engaged, which proves that the software outsourcing subcontracting now is a widely existing phenomenon in China's software outsourcing practices.

b) Who are the contractors?

In some other industries such as construction, contractors and subcontractors must register themselves to the government bureaus and pass the certification process. However, there is no such kind of restrictions in software industry. Therefore, who are the contractors is an important question that needed some efforts to be clarified. In our survey, we asked the informants to specify the types of organizations/individuals which were most likely to serve a contractor role in outsourcing projects (at most three and at least one, first choice + second choice +third choice). The results are depicted by figure 1.

The top possible contractor is IT consulting/service companies, while the least possible contractor is the Individual contractors.

From the feedbacks of our informants, the individual contractors are often the project managers from the big outsourcing companies and the individuals who fully take charge of a software outsourcing development project.

c) Who are the subcontractors?

The informants' opinion on this question is similar. Most informants believe the small software companies are the main body of the subcontractors, followed by individuals and a small group of people. An interesting phenomenon pointed by some informants is that some university students are sometimes organized by university staffs or self-organized to engage in subcontracting activities.
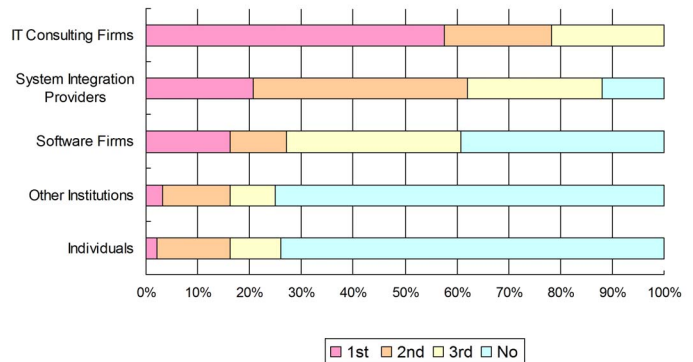

Figure 1. Possible contractor categories.

Core Categories	Sub-Categories
Major enabling factors of subcontracting in software outsourcing	Low barriers to entry The power of "Guanxi" Vendors' business and technology policy Small Subcontractor's needs for survival
Software outsourcing subcontracting ramifications	*Positive Ramifications* • Low cost and competitive price • Flexibility and specialty • Opportunities for small start-up Firms • Trustable relationship *Negative Ramifications* • Software quality or the Lack of It • Corruptions • Payment delay or non-payment • Heavy work load and low
Trends of subcontracting in software outsourcing	More Invigilation and Responsibility More Considerations and Administration Long-term Cooperation Less Information Hiding

Figure 2. The core and sub categories produced through coding of interviews' transcript.

3) Practitioners Perceptions on Software Outsourcing Subcontracting

We asked the informants to provide their perceptions towards the subcontracting. In this section, we first asked the informants to provide their own evaluation to the extent of subcontracting in the whole market. Around 60% (55 in 92) people said the current subcontracting is become "excessive" in some extent.

Less than 20% people said the subcontracting should be encouraged continuously in future. And the other people held a neutral attitude and admitted it is difficult to evaluate whether the subcontracting is excessive from the whole industry level.

The more important point is that, although the most people do not think subcontracting should be continuously encouraged, over 70% informants (68 out of 92) agreed that the subcontracting would provide their organizations some kind of values. This shows most informants held a positive perception towards the software outsourcing subcontracting. This interesting contrast between overall attitude and perception needs further studies.

Among the benefits of subcontracting, lower cost is preferred by most informants. Nearly all informants selected this choice, followed by the flexibility and specialty.

B. Interview Results

This research also identifies factors that enabling factors of the subcontracting, the subcontracting impacts, and the emerging trends through the analysis to the data collected through both the survey and interviews. Figure 2 summarizes the emerging code categories and sub categories of the interested issues on subcontracting. The most important

enabling factors are the vendor's business and technical policy and the low barriers for entry, while the other two factors also receive the majority's support. For the impacts of the subcontracting, we identified four sub-categories for both positive and negative aspects. And we also summarized four current trends that may be prevalence in the future software outsourcing subcontracting activities.

Based upon our findings (from both the survey and the interviews), the next discussion section presents discussions on each identified category and sub-category in details.

V. DISCUSSIONS

In this section, we will discuss the core categories identified through the analysis of the interview results. Please note that the ramification of subcontracting are divided into two subsections: the positive aspect and the negative aspect, each contains four sub-categories as shown in table 3.

A. Major Enabling Factors of Subcontracting in Software Outsourcing

1) Low barriers of entry

Software industry is often treated as a knowledge intensive economic sector. The entry barriers are often regarded as relatively high. However, opening a small company now is really easy in China. It seems strange, but it is true. It does not need a great amount of money and there are a lot of qualified programmers needing jobs. What they need is just buying some computers, renting some offices (sometimes even no office at all), and hiring some programmers. The hardware is really cheap; one can assemble a state-of-art PC using less than $700 (around 5000 CNY). In some small companies, the software systems such as operating systems and development platforms are often not authorized.

Thanks to the expand college enrollments from the end of last century, China's universities and colleges provides a great number of computer science or software engineering graduates in recent years. Some professional training agencies also produce many workers with software design skills. These graduates compete fiercely to win in job market, which leads the decrease of salary level of the whole industry. Therefore, hiring (qualified) employee is easy and does not cost too much. Several interviewees are the mangers in the start-up firms. All of them admitted the competition in job market has been much fiercer than 5 years ago; the decrease of human resource cost is natural. But, most of our interviewees also mentioned the difficulties to hire outstanding graduates are increasing. This may result from the decrease of the education level.

2) The power of the "Guanxi"

"Guanxi" [15, 21] refers to a kind of informal social relationships and exchanges of favors that dominate business activities throughout China and East Asia. It is an ancient system based on personal relationships. The Chinese business style does not like western's which emphasize written contract and fixed procedures. Chinese typically have

high "Guanxi" orientation, which is crucial to understand business in China context.

In China, some individuals have built their superior "Guanxi" networks. "Guanxi" networks enable them can get a lot of information that can not be public accessed (for instance, who want subcontractors, who just win an outsourcing contract but do not have enough resources to finish). This makes them have capability or resource to perform as contractors. These individuals are often the project managers of the real vendors and pure brokers. A subcontractor's general manager in our interview told us his experience. He knew some individuals working in a big multinational outsourcing company; these people often gave his company some development packages, and got a sum of money as "rebate commission".

Therefore, the existing of these individuals who work as "brokers" also contributes to the popularity of subcontracting. This kind of subcontracting sometimes even does not have formal agreements but relies on individuals' trust and personal relationships. This problem may threat the health development of the market.

3) Vendors' business and technology Policy

To achieve better financial performance, the outsourcing vendors tend to divide the software development works into small packages and find subcontractor to finish each package. One interviewee who is working as project manage in a big IT service company commented: *"To win the projects from the outsourcer, our quoted price is really low. In some cases, we also overstate our technical capability. Therefore, we need to find some effective ways to reduce the cost and to finish the tasks that difficult for us. No company can excel in every development domain. It is a commonsense. The subcontracting can help us to achieve above goals."*

4) Small Subcontractors' Needs for Survival

Although the entry barriers for opening a small software company are not high, most start-up small companies still face many pressures except a few ones that have sufficient operational capitals to support their long term running or novel products directly bring further opportunities. The small companies should earn enough profits for survival in this high competitive market. However, for the limitation of resources (e.g. experience, staff, or social networks), it is hard for them to win the integrated development packages.

Therefore, they have to act as the "subcontractor" role to participate in small divided packages development. The development of small packages not only brings revenues to these subcontractors, but also provides lots of experiences and domain knowledge to them; practices their project development and management skills. This mechanism also helps them to build their own social networks and credits, hence increase the possibility of winning long-term development at the price of short-term revenue loss. Based on these considerations, the system suppliers' are willing to make some economic trader-offs. Therefore, the small subcontractors' needs on survival and further development are another important enabler of subcontracting.

B. Positive Subcontracting Impacts

1) Low cost for contractors

As we mentioned before, to cut cost is one of the major motivators for the vendors choosing of subcontracting. Form the information we got from the interviewees, the subcontracting does help them reduce the cost of system development. 4 interviews reported the subcontracting make them saving over 50% cost. The left interviewees also admitted 10%-50% cost reduction.

2) Flexibility and specialty

All interviewees from the contractors agreed the subcontracting increase the flexibility of their business. The subcontracting helps them to optimize their business process, enables them to respond rapidly to the changing market, and scale quickly based on emerging opportunities. These together bring more competitive advantages to them.

3 interviewees from contractors reported their organizations chose subcontracting based on the considerations of increasing the specialty of the development. Interviewees pointed out most of the subcontractors often more focus on several special techniques while the contractors more focus on requirement acquisition and overall architecture design, if collaborate properly, the subcontracting can provide high quality service and deliverables to the outsourcers.

3) Opportunities for some start-up companies

For some small start-up software development organizations, they do not have chance to directly win the contract from the outsourcers. In order to survive in the market, they have to resort to the subcontracting. Subcontracting not only provides revenues to them, but helps them accumulate experiences and credits; it also provides them an opportunity to build their own social relationship network, which is valuable for their further development in future. Most interviewees from subcontractors agreed with this point.

4) Long term trustable relationship between contractors and subcontractors

Several contractors and subcontractors reported the mutual trustable relationships have been built between the contractor and the subcontractors. This kind of relationships is based on the satisfying former collaboration experiences. Under this kind of relationships, the contractors promise to give priority to the specific subcontractors. And the subcontractors promise to finish the assigned development package on time with high quality.

These relationships seldom base on formal agreements. Most of cases base on the oral promises among the leader of subcontractor and contractor. In this study, no interviewees report there is some formal agreements or contract to ensure the rights and responsibilities of the both parties. Therefore, this kind of relationships also contains some risks and is easy to be damaged.

C. Negative subcontracting impacts

1) Lack of Software Quality

Excessive subcontracting would unavoidably lead the decrease of the software quality [4]. While increases the flexibility, the software outsourcing subcontracting also cause the lack of the direct administrations to the development process. According to the interviewees' information, most subcontracting packages are in lack of rigorous administration from the contractor. None of our interviewees' organization chooses daily-report mechanism if the subcontracting development is not on site, the subcontractors often report the development progress once/twice a week. Even though, the contractors are still unclear about the exact situations.

The established quality control policies are also ignored in many cases. The quality of software is the issue that could never be overemphasized. Therefore, the contractor should pay more attentions to the quality issues during the development process. Besides, the subcontractor should also shape the group norm or nurture a work culture so that developers have the positive attitudes on development to ensure software quality, which would make them benefit a lot both as organizations and individuals.

2) Corruption

4 interviewees reported that they encountered some kind of corruptions in the subcontracting. For example, in some cases, the subcontractors bribe to the contractors decision makers in order to get a chance to participate.

Corruption is always one of the most sensitive issues. We were not sure that all interviewees keep integrity on this. Therefore, the real situation is still ambiguous; we can not make a clear assessment on the severity degree of the corruption. However, it does exist in the industry. All interviewees admitted that there is no apparent improvement, if not worse. Corruption may also lead to some other unwanted results. For instance, the corruption will definitely cause the increase of the operation cost.

3) Payment Delay or Non-payment

The payment delay and non-payment cases in construction subcontracting have been well reported and documented. The situation is similar in software outsourcing subcontracting. In some extreme cases, there is even no formal contract between contractors and subcontractors, especially when the contractors are individuals. Consequently, the payment delay and nonpayment can not be efficiently punished and avoided through legal means.

In fact, the payment delay is more like a norm but not exceptions. Nearly all interviewees (9 out of 10) have experienced this kind of things. In cases with formal contracts, the payment delay also widely exists. In China, litigation process is time and money consuming. Many subcontractors would rather suffer the loss caused by payment delay than go to court.

4) Heavy workload and low income for subcontractors' developers

To win the chance of subcontract, the subcontractors have to lower their quoted price. The subcontractors have to watch the budget closely. Meanwhile, to finish the subcontracting package on time, the development schedule is relatively strict. These two factors both contribute to the heavy workload and low income of the developers in these organizations. Some illegal employments also exist in these organizations.

One widely existing phenomenon is the unpaid overtime working in these subcontracting organizations.

In many China's small software development organizations, unpaid overtime working is really common, [20] provides some evidences for this point. All interviewees from subcontractor agreed the presence of unpaid overtime working in their organizations. One project manager told us his team needed to work overnight during some special development periods, 2 hours overtime working is really common in many working days. The cases in the contractor is not so severe, although there are also some unpaid overtime working, the situation is much better. Compared with the average industry wages, the subcontractor's employees' salary is relatively low.

One project manager commented, "As a project manager, my monthly income is only 1/3~1/2 of the persons' who take same role in our contractor. The common developers' salary is even lower. The newly hired developer's salary is 2000CNY per month (less than 300USD according to the up-to-date currency exchange rate in Jan. 2009). This amount of money can only cover the basic survival needs in Shanghai. But we have no other choice; we can not afford to provide high offers as some foreign companies." He also added, this situation also made his company fail to retain experienced developers and hire outstanding new employees, hence threats the further development.

D. Emerging Trends of the Subcontracting in China's Software Outsourcing Industry

1) More Invigilation and Responsibility

To regulate the subcontracting market and avoid the negative impacts ask for more invigilation to the subcontracting market. In the last several years, the development subcontracting in software outsourcing was disorder and lead to some bad results. Therefore, the subcontracting market needs an interest-irrelevant agency such as related government department to take the referee role.

Besides more invigilation, the health development of this industry also needs both the contractors and subcontractors more responsible to the other party. The subcontractors should ensure they can provide services to the contractors with high quality. The contractor should also abide by their agreements, for example, payment and other supports in technology and human resource, etc. Without the sense of responsibility, the subcontracting can not achieve win-win situation and provide high add-value services and software products.

2) More Considerations and Administrations

All interviewees from the contractors admitted they would more cautious in making subcontracting decisions in future. They said some unfavorable past subcontracting

experiences made them find the selection of subcontract needs more careful evaluations. They also address the increase of direct administrations to the subcontractor's development process. It can be expectable that the rigorous administration will become more prevalence in future subcontracting.

Meanwhile, the interviewees from the subcontractors also addressed this point. They admitted they also need to better evaluation their capability when receive a development package. "Do the things what we can do" is pointed out by a manager as her organization's principle. She also added that nothing can compensate the credit loss of failing to deliver high software package. The subcontractors are also welcome more direct administrations from the contractor; however, they insist the administrations should be in proper way.

3) Long-term cooperation

Some contractors and subcontractors have been built mutual trustable relationships. Both of these two parties are willing to maintain this kind of relationships and achieve the long-term win-win results. With the mature of this market, the more long-term cooperation between the contractor and subcontractor can be expected.

However, there are still some barriers for them to build such kind of relationships. The most important one is the subcontractor may be not satisfying to be a package subcontractor with its development. Subcontracting is often theirs temporal policy. The second one is that it is hard to use some kind of formal agreements to recognize this kind of relationships. The contractors also want to keep some flexibility in finding subcontractors.

4) Less information hiding

Most interviewees stated their hope of building a business atmosphere of less information hiding. The information hiding not only makes the subcontractors in lack of enough bargain capability but also increases the risk for the contractors in the subcontract selection and evaluation. An interviewee suggested the contractors and subcontractors should together build an open platform for the sake of lowering the information barriers between them. Other suggestions include building an open accessible credit system to record both parties' integrity, introducing the third party evaluation mechanisms, and so on.

VI.   LIMITATIONS

A.   Completeness

This research combines survey and interviews together to enhance the understanding towards the software outsourcing subcontracting. For the limitation of the survey sampling (n=139) and interviewees size, we can not claim that we describes the panorama of the current situation of subcontracting in China's software outsourcing industry and all possible issues on the enabling factors of this phenomenon with its impacts. With more data or experience with this topic, other related issues may be apparent. For now, we think it is more important to consider how well this research supports the future practices and researches of

software outsourcing subcontracting. In particular, does it help to:

1. Understand the subcontracting phenomenon better,
2. Explore new space and directions for research,
3. Draw both practitioners and researchers' attentions,
4. Provide useful implications to future practices.

B.   Generalizability

The second limitation is the generalizability of this research. This research was conducted in China. Conducting empirical research in China needs to pay special attentions to the unique culture backgrounds of this country, which are well documented in [10]. We can not ensure the results of this study still work well in other countries where software outsourcing is flourishing (e.g. India, Ireland, etc). However, this is also another aspect of this study's value; our research can be treated as the benchmark for other future similar research conducted under other cultural and economic contexts. More confidences will be generated if similar results can be found in other settings.

VII.   CONCLUDING REMARKS

In this paper, we describe the empirical investigation that combines survey and interviews towards the software outsourcing subcontracting in China. As far as our current knowledge, there is no published study that has been focused on the subcontracting in software outsourcing. Grounded by the empirical data, this research provides the current status, identifies the major enabling factors of this phenomenon. In addition, this research also presents the impacts of subcontracting from both positive and negative aspects. This research broadens the current understanding of the subcontracting in software outsourcing industry by offering rich practitioners' information and viewpoints.

Furthermore, it also presents many significant potential issues for researchers (ourselves included) to study in future. This research can also serves as a guide and foundations to investigate deep and more issues on the software outsourcing subcontracting. This also can be treated as the benchmark for the future researches in different contexts and settings.

CONTACT

Researchers interested in replicating this study in other settings should contact the authors: ywang1@acm.org, or eric.hhshi@gmail.com to obtain an editable/reusable copy of the survey and interview outline.

REFERENCES

[1]   Software Engineering Institute, Capability Maturity Model (CMM®): http://www.sei.cmu.edu/cmm/

[2] A.T. Kearney, Inc. Building the Optimal Global Footprint. A.T. Kearney, Inc., Chicago, IL:

[3] D. Arditi, "Issues in subcontracting practice", Journal of Construction Engineering Management, 2005, 131(8), pp. 866–76. www.atkearney.com/shared_res/pdf/GSLI-2006_S.pdf

[4] B.W. Bohem, "Software Risk Management: Priciple and Practice", IEEE Software, vol. 8, no.1, Jan., 1991, pp. 32-41.

[5] P. Y. K. Chau, and K. Y. Tam, "Factors Affecting the Adoption of Open Aystems: An Exploratory Study". MIS Quarterly: Management Information Systems, 21(1), 1997, pp1-20.

[6] Yat-Hung Chiang, "Subcontracting and its ramifications: A survey of the building industry in Hong Kong", to be appeared in International Journal of Project Management, 27, 2009, pp. 80–88

[7] J. Dibbern, T. Goles, R. Hirschheim, and B. Jayatilaka , "Information Systems Outsourcing: A Survey and Analysis of the Literature," ACM SIGMIS Database, 2004, 35 (4), pp. 6-102.

[8] M. Gonzalez-Diaz, B. Arrunada, and A. Fernandez, "Causes of Subcontracting: Evidence from Panel Data on Construction firms". Journal of Economic Behavioral Organiztion, 2000, 42(2), pp. 167–87.

[9] Wanjin Hu, Luchuan Liu, and Yu Chen., "Software Outsourcing in Beijing: Basics, Trends and Implications", in Proc. 2007 IEEE International Conference on Systems, Man, and Cybernetics (SMC 2007), Montreal, Quebec, Canada, 2007, pp.3235-3239.

[10] Junzhong Ji, Jingyue Li, Reidar Conradi, Chunnian Liu, Jianqiang Ma, and Weibing Chen, "Some Lessons Learned in Cconducting Software Engineering Surveys in China", In Proceedings of the Second ACM-IEEE International Symposium on Empirical Software Engineering and Measurement (ESEM 2008), Kaiserslautern, Germany, pp. 168-177.

[11] W. Kobitzsch, D. Rombach, and R.L. Feldmann, "Outsourcing in India [Software Development]", IEEE Software, vol. 18, no.2, Feb., 2001, pp. 78-86.

[12] T. Le, W. Huang, and Zhang, J., "China as a Software Outsourcing Outlet: Status, Enabling Factors, International Impact, and Growth Determinants", Proc. of The 3rd IEEE International Conference on Wireless Communications, Networking and Mobile Computing (WiCom 2007), Shanghai, China, 2007, pp.6115-6121.

[13] Jingyue Li, Jianqiang Ma, Reidar Conradi, Weibing Chen, Junzhong Ji and Chunnian Liu. "A Survey on the Business Relationship between Chinese Outsourcing Software Suppliers and Their Outsourcers", in Proc. 14th Asia-Pacific Software Engineering Conference (APSEC 2007), Nagoya, Japan, 2007, pp. 470-477.

[14] B. Meyer , "The Unspoken Revolution in Software Engineering", IEEE Computer, vol. 39, no. 1, Jan., 2006, pp. 121-123, 124.

[15] S. H. Park, and Yadong Luo. "Guanxi and Organisational Dynamics: Organisational Networking in Chinese Firms." Strategic Management Journal, Vol. 22, 2001, pp. 455-477.

[16] Sahay, Sundeep, Brian Nicholson, S. Krishna, Global IT Outsourcing, Cambridge University Press, 2003.

[17] C. B. Seaman, "Qualitative Methods in Empirical Studies of Software Engineering", IEEE Transactions on Software Engineering, 25(4):557-572, July/August 1999.

[18] A. L. Strauss, and J. M. Corbin, Basics of qualitative research : techniques and procedures for developing grounded theory (2nd edition), Thousand Oaks: Sage Publications, 1998.

[19] D. Turk, R. France, and B. Rumpe, "Limitations of Agile Software Processes", In Proceedings of the 3rd International Conference on Agile Processes and eXtreme Programming in Software Engineering (XP 2002), pp. 43--46, Alghero, Italy, May 2002.

[20] Y. Wang, and H. Shi, "An Exploratory Study on China's Software Engineers' Unpaid Overtime Working", In Proceedings of the ACM SIGMIS CPR Conference 2009, pp. 209-214.

[21] B. Zuo, "The Chinese relation orientation: Concept and its measurement", Journal of Central China Normal University (Humanities and Social Sciences), 41(1), 2002, pp. 74–80, (in Chinese).