

## **Improving contractor's Credit system mitigates Delayed or Late Payment issues on Chinese Construction contracts: An Academic research<sup>1, 2</sup>**

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### **ABSTRACT**

This paper comes up with a research question that from the perspective of contractors, what are the leading causes for delayed and non-payment issues? Thus, it aims at analyzing these reasons and providing feasible alternatives (Milestone payment, Commercial debt, Liens, Payment bond, Recruitment of agencies and credit system) to deal with them. Furthermore, as the process of research, the paper is verified and evaluated through Fish bone Diagrams, Pair-wise comparison method, non-comparison model, non-dimensional data technique, rank table as well as Pareto Analysis.

After these analyses, it figures out that compared with another 5 alternatives, credit system could be the most effective remedy for ensuring prompt payment. Besides, the solution of using Liens could be excluded from research as less feasible.

**Keywords:** Construction industry, delayed payment, bond, Milestone, credit, debt

### **INTRODUCTION**

As delayed and late payment issues chronically exist in domestic construction industry, Chinese companies are short of capability, competitiveness and energy in global construction market. Nowadays, the increase of payment issues attracts more attention because of the serious impact on implementation of construction programme. According to the survey, "the construction funds that have been owed by construction companies have accounted for 38.5% of the construction output value."<sup>3</sup> "Among them, "45.2% of the total arrears were within 1 year, 24.3% from 1 year

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<sup>1</sup> Editor's note: Student papers are authored by graduate or undergraduate students based on coursework at accredited universities or training programs. This paper was prepared for the course "International Contract Management" facilitated by Dr Paul D. Giammalvo of PT Mitratata Citragraha, Jakarta, Indonesia as an Adjunct Professor under contract to SKEMA Business School for the program Master of Science in Project and Programme Management and Business Development. <http://www.skema.edu/programmes/masters-of-science>. For more information on this global program (Lille and Paris in France; Belo Horizonte in Brazil), contact Dr Paul Gardiner, Global Programme Director, at [paul.gardiner@skema.edu](mailto:paul.gardiner@skema.edu).

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<sup>3</sup> Talking about the Problem of Arrears and the Countermeasures. Retrieved from:  
<https://www.cbi360.net/hyjd/20171228/110889.html>

to 2 years, 18.9% from 2 years to 3 years, and 11.6% over 3 years.”<sup>4</sup> In the arrears project, there are government projects, state-owned enterprise projects, non-governmental projects, and foreign investment projects. “The projects in arrears of construction projects generally account for more than 50% of the total number of construction and completion projects”.<sup>5</sup> Among them, real estate development projects, large-scale and extra-large projects are particularly outstanding. In conclusion, this problem probably destroys social economic principles as well as deteriorating social credit environment. “To some extent, it may increase the wages of enterprises in arrears among employees, causing decreasing employment rate.”<sup>6</sup>

“To deal with delayed and late payment issues, it’s crucial to identify and describe following 4 features”:<sup>7</sup>

1. year-on-year increase in arrears
2. particular exposure in government investment projects
3. Debt chain lengthening as well as multiple-layer debt relationship
4. decrease in construction project quality.

“Referring to these features, it shows that leading causes for delayed and late payment issues generally exist in two sides of project owner and contractor as well as the conflicts between them”.<sup>8</sup> Therefore, the solutions should consider bilateral benefits, obligation and physical truth like corporate culture and organization structure. Nowadays, contractors’ obligation and self-reflection are more likely to be ignored while dealing delayed payment issues. In the project management, supplier plays an essential role in organization theme. In the project board, senior suppliers take place to directing a project process. Through the analysis and evaluation of leading causes for delayed payment issues in Chinese construction companies, the role and obligation of contractors in delayed payment issues would be identified, discussed and verified.

Besides, in the project management, both of project owner and contractor have obligation and

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<sup>4</sup> Default project Baidu Encyclopedia. Retrieved from:

<https://baike.baidu.com/item/%E6%8B%96%E6%AC%A0%E5%B7%A5%E7%A8%8B%E6%AC%BE/8587656?fr=aladdin>

<sup>5</sup> Default project Baidu Encyclopedia. Retrieved from:

<https://baike.baidu.com/item/%E6%8B%96%E6%AC%A0%E5%B7%A5%E7%A8%8B%E6%AC%BE/8587656?fr=aladdin>

<sup>6</sup> Jiqing. Y. Thoughts on the arrears of construction projects in the construction field. Retrieved from:

<https://wenku.baidu.com/view/9c6f6a182f3f5727a5e9856a561252d380eb20fc.html>

<sup>7</sup> Report of Causes and Countermeasures of the Arrears. Retrieved from:

<https://wenku.baidu.com/view/c14f1b98b8f3f90f76c66137ee06eff9aef849cd.html>

<sup>8</sup> Report of Causes and Countermeasures of the Arrears. Retrieved from:

<https://wenku.baidu.com/view/c14f1b98b8f3f90f76c66137ee06eff9aef849cd.html>

rights to in charge of and tackle delayed or late payment issue. According to the “**APM Competence 1: ethic, compliance and professionalism.**”<sup>9</sup> It mentions that “compliance entails understanding and abiding by relevant legal duties, rights and processes”.<sup>10</sup> To some extent, emphasis of “legal responsibilities and requirements of contractor’s certification and monitor system should be considered seriously in project management”.<sup>11</sup> Besides, for contractors, it must be focused on ensuring the enforceable of the contract, which also emphasizes that “LEGALITY- of the intent, methodology or deliverable Contracts cannot be enforced that do something which is illegal.”<sup>12</sup>

Moreover, stakeholder’s interest conflict should be considered more in conflict management and risk management in project. In the project management, any uncertainty could be exist. Therefore, this article would mention methods of contract management like punch lists to reduce the uncertainty and risk. “What this means to the project controls professional is that an activity is not 100% until the punch list has been completed OR that another activity has to be added at the end of the project called “Complete Punch list” and that activity has an appropriate duration and is cost loaded with the amount of money retained.”<sup>13</sup> In the part of conflict management, effective conflict management exploits healthy conflict to support group development and learning, and tackles negative conflict to prevent differences from becoming destructive elements in change initiatives. This competence helps contractors to avoid and secure interests in project conflicts.

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<sup>9</sup> APM. Association for project management. Retrieved from:

<https://www.apm.org.uk/resources/find-a-resource/competence-framework/>

<sup>10</sup> About Nationwide Prompt -Payment Laws in the Construction Industry. Retrieved from:

<https://www.zlien.com/prompt-payment/>

<sup>11</sup> Y.LISA COLON. Federal Prompt Payment Act – Accuracy is Critical. Retrieved from:

<https://www.smithcurrie.com/publications/common-sense-contract-law/federal-prompt-payment-act-accuracy-is-critical/>

<sup>12</sup> GUILD OF PROJECT CONTROLS COMPENDIUM and REFERENCE (CaR). Retrieved from:

<http://www.planningplanet.com/guild/gpccar/managing-contracts-managing-the-contract>

<sup>13</sup> GUILD OF PROJECT CONTROLS COMPENDIUM and REFERENCE (CaR). Retrieved from:

<http://www.planningplanet.com/guild/gpccar/managing-contracts-managing-the-contract>

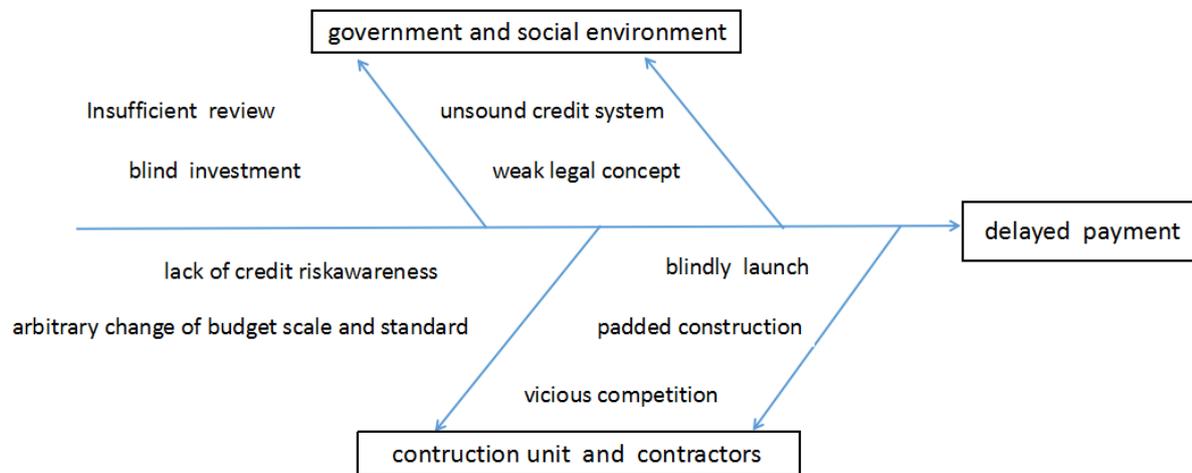


Figure 1: Root cause analysis for leading cause for delayed payment<sup>14</sup>

In conclusion, this article plans to describe, analyze and compare the leading causes for delayed and late payment issues in project owner and contractor. Moreover, it is supposed to evaluate and conclude the performance to solve different problems and reduce or avoid the conflicts in projects. After that, the main objective of this paper is to appraise the role and obligations of contractors during solving this issue.

## METHODOLOGY

### STEP 1: Problem definition

Late payment of invoices is a problem for most suppliers of goods and services. “In tough economic times the problem gets worse as cash retention becomes a greater priority. It is frequently the largest and most powerful client groups who are the worst culprits”.<sup>15</sup>

Most of the delayed payment issues could be considered as contractor's and owner's responsibilities and obligation. Here, to emphasis contractor's role for managing project and decreasing cost and lose in delayed payment problems, the alternative remedies for contractor should be discussed and identified.

<sup>14</sup> By Author

<sup>15</sup> Remedies for late payment in the construction industry. Retrieved from:  
[https://www.designingbuildings.co.uk/wiki/Remedies\\_for\\_late\\_payment\\_in\\_the\\_construction\\_industry](https://www.designingbuildings.co.uk/wiki/Remedies_for_late_payment_in_the_construction_industry)

## **STEP 2: Development of feasible alternatives**

"Issues relating to delay remain some of the most frequent legal issues to arise in relation to construction projects".<sup>16</sup> To explain the appropriate remedies for contractors, it could be separated into two parts. On the one hand, it would emphasize the legal obligation ensuring the integrity and feasibility of terms and the legal right managing the contract including credit certification and legal provision. On the other hand, it would focus on internal and external risk management for contractors.

1) **Milestone payment** is considered as a core factor for construction project and contractors are able to control and confirm timescale in terms and conditions to reduce time cost. Milestone payment is based on Activity-based management(ABM). Besides, "Activity-based costing can be considered an offshoot of activity-based management."<sup>17</sup> The definition and application of ABM and ABC are demonstrated in contract terms influencing decision-making. These are synonymous terms which often cause confusion in project control professionals particularly in determining completion dates and physical % complete. Essentially, a punch list or snag list is the work remaining AFTER "Substantial Completion". Otherwise, "the time is said to be "at large" and, under English law, a term will be implied that the contractor is to complete the works within a reasonable time".<sup>18</sup> Therefore, if delayed payment issues happen, owner could use the definition of "a reasonable time" to avoid obligation.

Moreover, it could learn from a real case that milestone payment mechanism in construction contract is still inadequate and need completion in specific situation. "There have not been many cases on this provision of the Construction Act and it is helpful to see the TCC's approach to the specific payment provisions that had been drafted into the Sub-Contract."<sup>19</sup> "In the meantime, in order to avoid costly and time consuming disputes, best practice remains to ensure that bespoke (or any) payment provisions are clear and unambiguous, leaving the parties in no doubt as to how and when payments are to be calculated and made."<sup>20</sup> Therefore, the improvement and completion of milestone management for contractors could be an effective method to

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<sup>16</sup> Remedies for delay in construction contracts. Retrieved from:  
<https://www.lexology.com/library/detail.aspx?g=7bd565a6-211f-4e51-a270-401e77fcf785>

<sup>17</sup> INVESTOPDIA, Activity-based management - ABM. Retrieved from:  
<https://www.investopedia.com/terms/a/abm.asp>

<sup>18</sup> Remedies for delay in construction contracts. Retrieved from:  
<https://www.lexology.com/library/detail.aspx?g=7bd565a6-211f-4e51-a270-401e77fcf785>

<sup>19</sup> MILESTONE PAYMENTS MAY NOT BE AN ADEQUATE PAYMENT MECHANISM IN CONSTRUCTION CONTRACTS - WHAT YOU NEED TO KNOW. Retrieved from:  
<https://gowlingwlg.com/en/insights-resources/articles/2018/milestone-payments-in-construction-contracts/>

<sup>20</sup> MILESTONE PAYMENTS MAY NOT BE AN ADEQUATE PAYMENT MECHANISM IN CONSTRUCTION CONTRACTS - WHAT YOU NEED TO KNOW. Retrieved from:  
<https://gowlingwlg.com/en/insights-resources/articles/2018/milestone-payments-in-construction-contracts/>

reduce delayed payment situation.

2) **“Credit system”**<sup>21</sup> refers to corporation's credit management system. To some extent, contractors should take it into account in each progress of project's implementation. During the previous research work, contractors should specially investigate project's legality, owner's credibility and cash flow situation. It is important to prevent contractors through advance to make a tender. Besides, contractors should emphasize and insist of contract's evaluation and assessment work to decrease risk factors. “While signing in large project contract, contractors should consult lawyer or make legal certification to avoid missing and unequal clauses”.<sup>22</sup>

In conclusion, this measure aims at completing contractors' credit system to develop their legal consciousness and capability to use legal means in delayed payment issues.

3) **Commercial Debt** which is the most direct and effective solutions to prevent contractors' financial loss in delayed payment issues. It is reported that “Introduced in 2013, The Late Payment of Commercial Debts Regulations bolster the provisions of the Late Payment of Commercial Debts (Interest) Act”.<sup>23</sup> During the negotiation with project owner, contractors should grasp legal provisions and use legal means to obtain economic compensation. Such an express provision of commercial debt is essential to avoid disputes on this issue especially if it goes to unnecessary expensive arbitration or litigation proceedings.

4) **Liens** which is explained to use property as collateral security to ensure the prompt payment in construction contract. Therefore, to agree the clauses with owners in contract, according to the factual situation, contractors could use liens to constraint owners responsibility in paying on the regulated deadline. Otherwise, contractors have a legal right to handle mortgage property. Nevertheless, while contractors using lien right to get compensation, they also need to consider of the difference between the statutory lien and lien created by the indeed of trust. In other words, “where a deed of trust memorializing a lender's mortgage interest is recorded prior to the time the work on the property is begun, as is often the case where property is purchased pursuant to such a deed of trust prior to contracting for or beginning construction on the property, the deed of trust would typically have priority”.<sup>24</sup>

5) **Payment bond** which is regulated in the contract's terms, plays an important role in

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<sup>21</sup> Definition of credit system in Baidu Baike. Retrieved from:

<https://baike.baidu.com/item/%E4%BF%A1%E7%94%A8%E5%88%B6%E5%BA%A6/7899708?fr=aladdin>

<sup>22</sup> Measures to prevent arrears. Retrieved from:

<http://m.lawtime.cn/info/gongcheng/jzgcsp/201709053349899.html>

<sup>23</sup> Remedies for late payment in the construction industry. Retrieved from:

[https://www.designingbuildings.co.uk/wiki/Remedies\\_for\\_late\\_payment\\_in\\_the\\_construction\\_industry](https://www.designingbuildings.co.uk/wiki/Remedies_for_late_payment_in_the_construction_industry)

<sup>24</sup> Payment Remedies in Construction Contracts. Retrieved from:

<https://mcsmag.com/payment-remedies-construction-contracts/>

construction projects. "The payment bond forms a three-way contract between the Owner, the contractor and the surety, to make sure that all subcontractors, laborers, and material suppliers will be paid leaving the project lien free."<sup>25</sup> To some extent, the payment bond aims at protecting and enhancing contractors rights and benefits, which is the only option or tool that some suppliers and subcontractors have so they can get paid for their services and labor. From the perspective of contractor, as "project owners are now using the subcontractor default insurance in conjunction with payment and performance bonds"<sup>26</sup>, contractors could use payment bond to avoid these situations.

6) **Recruitment of agencies** is regarded as a popular and effective way for contractors to ensure prompt payment and it could be beneficial for external risk management. Using recruitment of agencies could be considered as escrow, which suggest that "instead of immediately giving the seller the purchase amount, the buyer may deposit the money into an escrow account and attach certain stipulations to the purchase agreement."<sup>27</sup> In fact, agencies are external resources to reduce risk because they either have a healthy cash balance of working capital, a bank facility or will use invoice finance to secure early payment. "This invoice finance could include factoring, when a finance company buys the agency's debt and then collects it from the client, or invoice discounting, when a finance company loans the agency money against the invoice, using it as collateral".<sup>28</sup>

Nevertheless, when contractors negotiate with agencies, they also need to insist on same period invoicing and terms as agencies and clients. Otherwise, contractors have rights to stop work even terminating contract. Once these terms been agreed, they should be concluded in the contract and use a separate schedule if required.

We will have a look at specific attributes that will allow us to assess each of the alternative resolution for delayed payment in order to analyse them quantitatively. The said attributes are the following.

**"Financial feasibility"**<sup>29</sup> this attribute aims at analyze and evaluate financial investment for each remedies and their relationship with decision-thinking.

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<sup>25</sup> How Payment Bonds Work on Construction Projects. Retrieved from:  
<https://www.thebalancesmb.com/how-payment-bonds-work-on-construction-projects-844794>

<sup>26</sup> How Payment Bonds Work on Construction Projects. Retrieved from:  
<https://www.thebalancesmb.com/how-payment-bonds-work-on-construction-projects-844794>

<sup>27</sup> Investing Answers, Escrow. Retrieved from:  
<https://investinganswers.com/financial-dictionary/real-estate/escrow-65>

<sup>28</sup> Ensure you get paid when contracting. Retrieved from:  
[https://www.contractorcalculator.co.uk/ensuring\\_payment\\_contracting.aspx](https://www.contractorcalculator.co.uk/ensuring_payment_contracting.aspx)

<sup>29</sup> Anna Regína Björnsdóttir. (2010). Financial feasibility assessments. Retrieved from  
[https://skemman.is/bitstream/1946/4452/1/Assessments\\_fixed.pdf](https://skemman.is/bitstream/1946/4452/1/Assessments_fixed.pdf)

**“Uncertainty”**<sup>30</sup> this attribute expounds and assesses the uncertainty in applying these solutions. To some extent, Application of the suggested risk and uncertainty extenuating techniques in practise was shown as analysis of precision and bias dependence with available information at different stages of appraisal phase<sup>31</sup>.

**Partnership** is the core relationship management of contractor and stakeholders. In addition, “delay in payment is directly related to cash flow which is critical to each stakeholder”.<sup>32</sup> Here, it would evaluate the partnership factor’s influence in handling payment issue.

**Lawsuits/Litigation records** is considered as the most significant feature of legal provisions and regulations, which is effective and crucial for contract completion. “Without some largely specialist contractors, the only redress would be a legal one involving specialists and lawyers seeking formal redress through the courts or adjudication”.<sup>33</sup>

**“Accuracy”**<sup>34</sup> this attribute describes the accuracy requirement for contractors in practicing these remedies. To some extent, it would explain the accuracy of completion of terms and application of feasible legal rights as well as assessment data from risk management in factual project environment.

**“Surety bonding”**<sup>35</sup> is defined as a surety bond or surety is a promise by a surety or guarantor to pay one party (the obligee) a certain amount if a second party (the principal) fails to meet some obligation, such as fulfilling the terms of a contract. The surety bond protects the obligee against losses resulting from the principal's failure to meet the obligation. Following analysis would like to relate the surety bonding with feasible solutions to contractors to assess its importance.

**“Credit score”**<sup>36</sup> this attribute describe the credit scores for contractors in practicing these remedies as credit is regarded as the foundation of project cooperation. To some extent, it also determines and evaluates the potential risk while implement these alternatives.

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<sup>30</sup> L. Ustinovičius and D. Migilinskas and J. Tamošaitienė and E.K. Zavadskas. UNCERTAINTY ANALYSIS IN CONSTRUCTION , PROJECT’S APPRAISAL PHASE. Retrieved from: <https://pdfs.semanticscholar.org/0265/7c64c84c4d6ddb7e81f4edbb3fac674daf22.pdf>

<sup>31</sup> L. Ustinovičius et al. UNCERTAINTY ANALYSIS IN CONSTRUCTION PROJECT’S APPRAISAL PHASE. Retrieved from: <https://pdfs.semanticscholar.org/0265/7c64c84c4d6ddb7e81f4edbb3fac674daf22.pdf>

<sup>32</sup> Yun.C and Zhigen.H and Quan.L and Maoyang.Z. Risk Propagation of Delayed Payment in Stakeholder Network of Large Hydropower Project Construction considering Risk Resistance and Mitigation. Retrieved from: <https://www.hindawi.com/journals/mpe/2018/8013207/>

<sup>33</sup> The cause of late payment in construction. Retrieved from: [https://www.designingbuildings.co.uk/wiki/The\\_causes\\_of\\_late\\_payment\\_in\\_construction](https://www.designingbuildings.co.uk/wiki/The_causes_of_late_payment_in_construction)

<sup>34</sup> Abedelsalam H. Nasser. (2013, November). The Effect of Payment Delay on Construction Projects in GazaStrip. Retrieved from: <http://library.iugaza.edu.ps/thesis/111755.pdf>

<sup>35</sup> Wikipedia, Surety Bond. Retrieved from: [https://en.wikipedia.org/wiki/Surety\\_bond](https://en.wikipedia.org/wiki/Surety_bond)

<sup>36</sup> Wikipedia, Credit score. Retrieved from: [https://en.wikipedia.org/wiki/Credit\\_score](https://en.wikipedia.org/wiki/Credit_score)

**STEP 3: Development of outcomes for each alternatives**

Normally, it could be found that each remedy has advantages and disadvantages. Therefore, while evaluating them, each solution should be compared with others. This article would use weight analysis to score and calculate each method. The 5 attributes would be demonstrated in 3 colour while green is more effective for delayed issue compared with the yellow and red one. This method is considered as **non-compensatory model** based on a disjunctive reasoning, aiming at ranking the grades to compare the effectiveness against the chosen attributes.

	Financial feasibility	Uncertainty	Partnership	Lawsuits/Litigation records	Accuracy	Surety bonding	Credit score	Ordinal ranking
Financial feasibility	0	0	1	0	1	0	0	2
Uncertainty	1	0	1	1	0	0	0	3
Partnership	0	0	0	0	0	0	0	0
Lawsuits/Litigation records	0	0	1	0	0	0	0	1
Accuracy	0	1	1	1	0	1	0	4
Surety bonding	1	1	1	1	0	0	1	5
Credit score	0	1	1	1	1	0	0	4

Figure 2: Pair-wise comparison of attributes<sup>37</sup>

In this assessment, it shows that Sure bonding ranks at the top. Then, it is followed by uncertainty and accuracy, which are weight equally. Nevertheless, the most not necessary attribute is partnership, which could be seen from the table that it always scored at 0 in comparison with other attributes.

**STEP 4: Selection of a criterion**

Here, we would like to apply a **multiple attributes’ decision making model** based on a qualitative analysis, which aims at comparing the attributes to the alternative remedies, in order to figure out the most effective option possible. In the model below we used 3 colors:

- Green= good
- Yellow= medium
- Red= bad

<sup>37</sup> By Author

	Milestone payment	Commercial debt	Liens	Payment bond	Recruitment of agencies	Credit system
Financial feasibility	high	high	medium	high	high	medium
Uncertainty	high	high	medium	high	medium	high
Partnership	no	yes	no	yes	yes	yes
Lawsuits/Litigation records	high	medium	high	medium	low	high
Accuracy	high	medium	medium	high	low	high
Surety bonding	high	medium	medium	high	medium	high
Credit score	high	high	medium	high	high	high

Figure 3: Matrix analysis, non-comparison method<sup>38</sup>

We are now going to weight each attribute:

	Milestone payment	Commercial debt	liens	Payment bond	Recruitment of agencies	Credit system
Financial feasibility	1	1	0,5	1	1	0,8
Uncertainty	1	0,8	0,6	1	0,7	1
Partnership	0,5	0,6	0	1	1	1
Lawsuits/Litigation records	0,5	0,4	1	0,6	0	1
Accuracy	0,8	0,8	0,5	0,9	0	1
Surety bonding	1	0,8	0,6	1	0,6	1
Credit score	0,8	1	0,7	1	1	1
Totals	5,6	5,4	4,1	6,6	4,3	6,8

Figure 4: Matrix analysis<sup>39</sup>

<sup>38</sup> By Author

<sup>39</sup> By Author

In conclusion, through the analysis of this method, we could evaluate the weight of these options. This table demonstrates that each alternative with a total over 6 could be determined as the more effective method. **Therefore, the liens could be eliminated.** To some extent, we can figure out that liens are less likely to make payoff in delayed payment issues. This is because that contractors would pay much money and time in contract conflicts while using liens to ensure prompt payment. Getting legal rights in contract through legal means is complex and time-consuming. Besides, it also shows that recruitment of agencies method is 4,3. Recruitment of agencies could solve some delayed payment issue as the agency company would share some risks. Nevertheless, the collaboration with agencies also have disputes of payment problem.

The best effective remedy through the assessment are credit system and payment bond.

## FINDING

### STEP 5: Analysis and comparison of the alternatives

After analysis and comparison of these alternatives, now, we are going to summarize the selection and determination of preferred alternatives, which we assessed in step three and four by using **non-dimensional data technique**<sup>40</sup> allowing us to calculate and rank the alternatives by comparing the weight of the attributes with the weight of the alternative. As we suggested to exclude the least influential remedy: liens, we are now focusing on the other five remaining alternatives.

	Step 1	Step 2	Milestone payment		Commercial debts		Payment bond		Recruitment of agencies		Credit system		
	Relative ranking	Normalized weight	(A)	(B)	(A)*(B)	(C)	(A)*(C)	(D)	(A)*(D)	(E)	(A)*(E)	(F)	(A)*(F)
Financial feasibility	2	0,2	1	0,2	0,2	1	0,2	1	0,2	1	0,20	0,8	0,16
Uncertainty	3	0,3	1	0,3	0,3	0,8	0,24	1	0,3	0,7	0,21	1	0,30
Partnership	0	0,5	0	0,5	0	0,6	0	1	0	1	0	1	0
Lawsuits/ Litigation records	1	0,1	0,5	0,05	0,05	0,4	0,04	0,6	0,06	0	0	1	0,10
Accuracy	4	0,4	0,8	0,32	0,32	0,8	0,32	0,9	0,36	0	0	1	0,40
Surety bonding	5	0,5	1	0,5	0,5	0,8	0,40	1	0,50	0,6	0,30	1	0,50
Credit score	4	0,4	0,8	0,32	0,32	1	0,40	1	0,40	1	0,40	1	0,40
Total	10	1,00	1,78	1,78	1,78	1,69	1,69	1,82	1,82	1,11	1,11	1,86	1,86

Figure 5: Non-dimensional data technique<sup>41</sup>

Therefore, through the table, it figures out how to rank different remedies and the final results for suggesting the most feasible alternatives. After the analysis and assessment, it demonstrate that credit system is the most effective, which is followed by payment bond and milestone payment. Nevertheless, recruitment of agencies has much lower impact on ensuring prompt payment.

<sup>40</sup> Nondimensionalization. Wikipedia. Retrieved from: <https://en.wikipedia.org/wiki/Nondimensionalization>

<sup>41</sup> By Author

## STEP 6: Selection of preferred alternative

Following table ranks alternatives from best to worst:

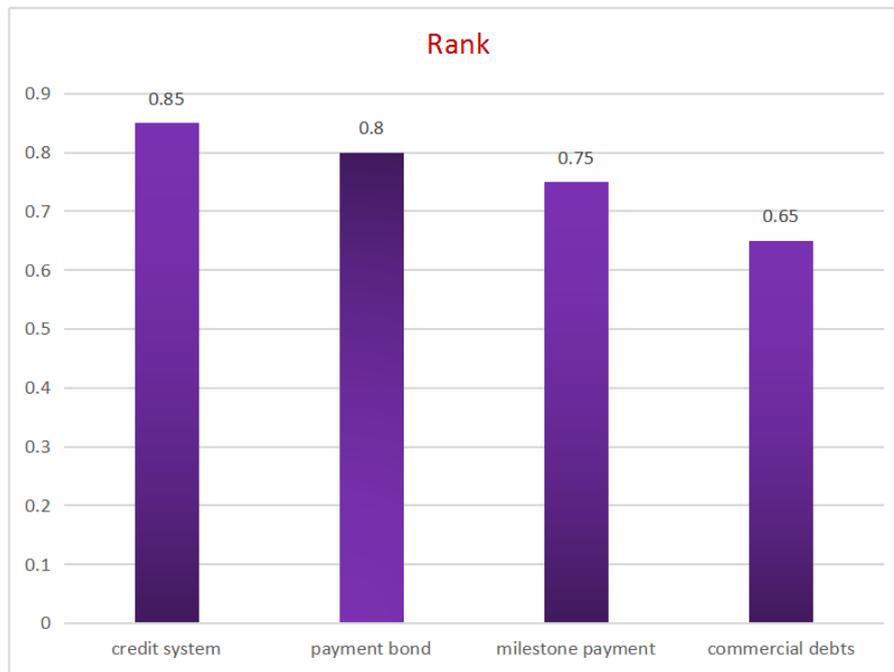


Figure 6: Rank table<sup>42</sup>

Learned from the assessment and analysis, it could be summarized that credit system is most feasible and effective alternative for contractors to ensure prompt payment. Moreover, credit system management plays in essential role in project management, which is closely related with the financial initiation and business negotiation of contract provision. Credit management including trade credit management and supervision should be implemented in every project steps and process.

Thus, **the best alternative option is credit system, followed by payment bond, milestone management and commercial debts.** Those 4 remedies doesn't need to go to verified and are cost and time saving for the parties involved.

Credit system management relates to different departments of corporation as well as principles and regulations of association. During the project, contractors and project owner would verify the credit capability and supervise their credit behavior. Furthermore, these accurate and flexible data of corporation's credit level should be determined by digital assessment. Therefore, the core of credit system is trade credit. "Within the trade credit literature, relatively few studies use industry or sector as a variable. Most of these few studies do not contain quantitative analyses

<sup>42</sup> By Author

of financial structure. One that does is the study BERR commissioned from Professor Nick Wilson of Leeds University Business School's Credit Management Research Centre into business to business payment trends and behaviour in the UK, 1997-2007 (Wilson, 2008)."<sup>43</sup> For instance, there are factual figures show that "for construction, the average ratio of trade creditors to total liabilities showed less volatility and a relatively clear upward trend, rising steadily from 66% in 1997 to 79% in 2006. Construction together with business services had the highest sector means for this ratio. By comparison, the average of trade debtors as a proportion of total assets was much less, at around 39%, and showed no trend change."<sup>44</sup> In conclusion, credit system management should be verified in the whole process of project management with digital confirmation and supervision.

### **STEP 7: Performance monitoring and post-evaluation of results**

Up to now, we have determined and selected the best alternative to prompt payment issues as credit system. Here, we could apply a Pareto analysis in order to evaluate the impact of credit system leading to ensuring prompt payment for contractors. "Pareto Analysis is a statistical technique in decision-making used for the selection of a limited number of tasks that produce significant overall effect. It uses the Pareto Principle (also known as the 80/20 rule) the idea that by doing 20% of the work you can generate 80% of the benefit of doing the entire job. For example, a vast majority of problems (80%) are produced by a few key causes (20%)."<sup>45</sup>

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<sup>43</sup> (2013, July) TRADE CREDIT IN THE UK CONSTRUCTION INDUSTRY: An Empirical Analysis of Construction Contractor Financial Positioning and Performance. Retrieved from: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/210964/bis-13-956-trade\\_credit-in-uk-construction-industry-analysis.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/210964/bis-13-956-trade_credit-in-uk-construction-industry-analysis.pdf)

<sup>44</sup> (2013, July) TRADE CREDIT IN THE UK CONSTRUCTION INDUSTRY: An Empirical Analysis of Construction Contractor Financial Positioning and Performance. Retrieved from: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/210964/bis-13-956-trade\\_credit-in-uk-construction-industry-analysis.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/210964/bis-13-956-trade_credit-in-uk-construction-industry-analysis.pdf)

<sup>45</sup> Duncan Haughey, PARETO ANALYSIS STEP BY STEP. Retrieved from: <https://www.projectsmart.co.uk/pareto-analysis-step-by-step.php>

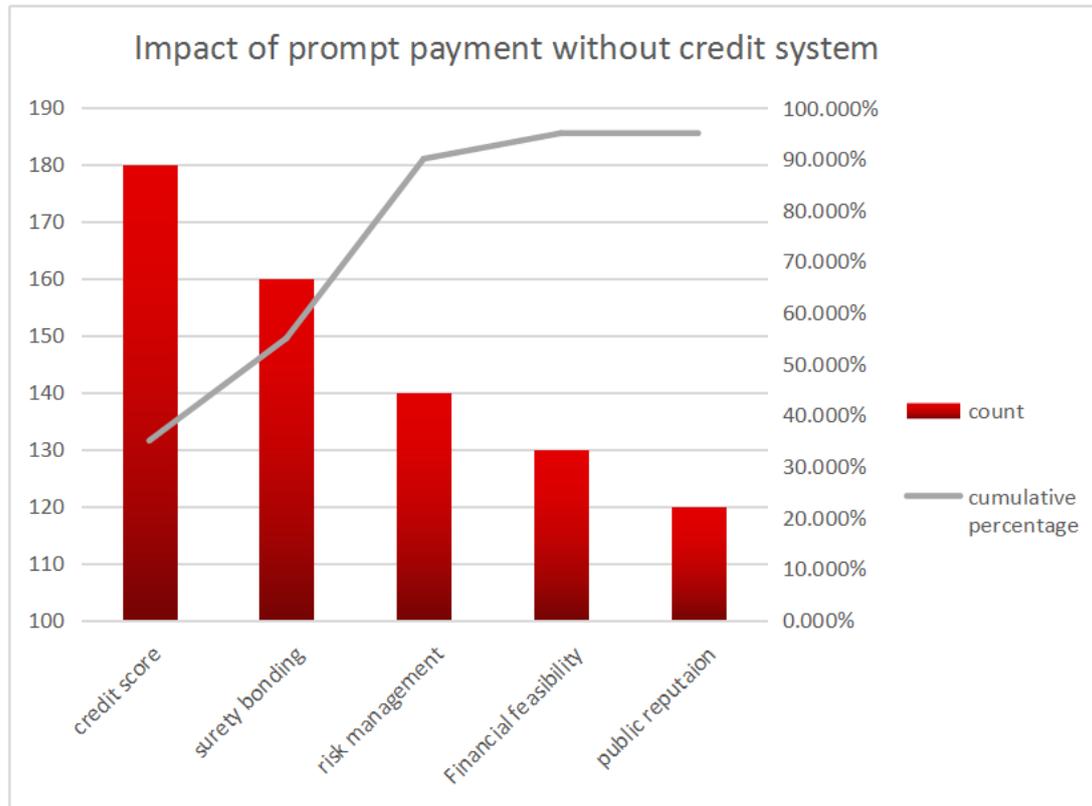


Figure 7: Pareto Analysis<sup>46</sup>

Through the analysis of impact of prompt payment without credit system, it demonstrates that corporation's credit score totally has a direct relation with the credit system. Besides, in the project management, surety bonding also has been highly influenced by credit system, which is followed by risk management of contract.

<sup>46</sup> By Author

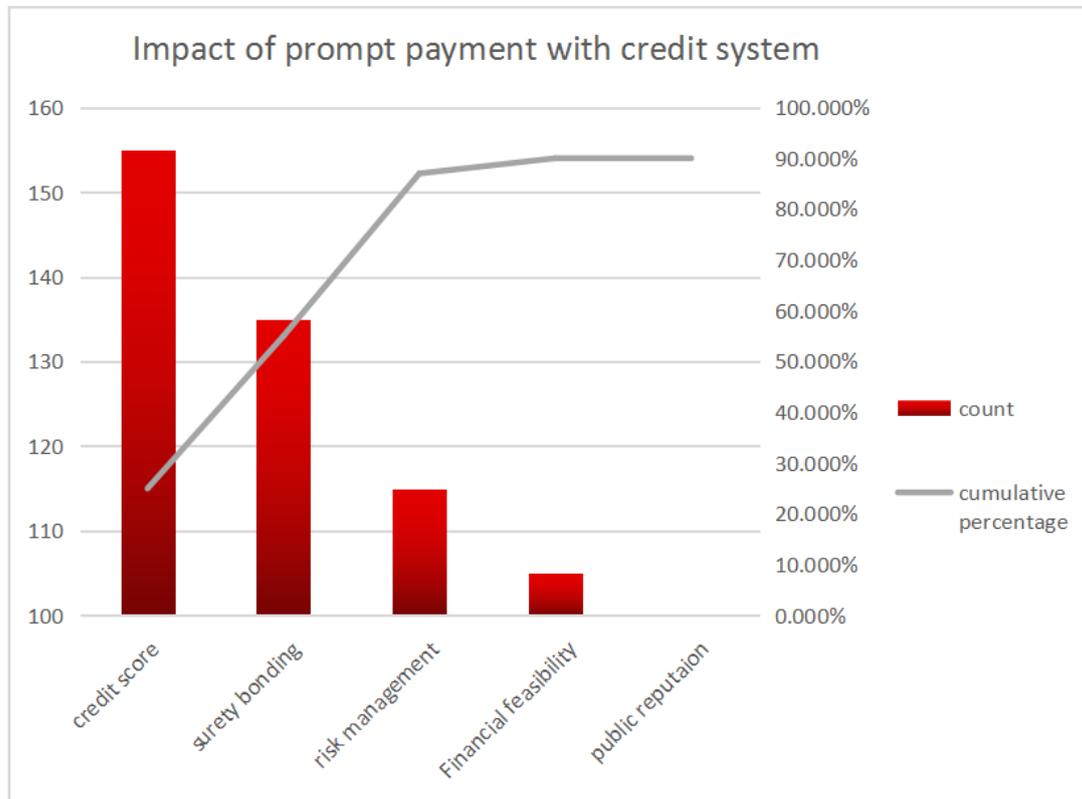


Figure 8: Pareto Analysis<sup>47</sup>

As a result, after the implementation of credit system, the possibilities of credit score for influencing prompt payment significantly decrease, accompanying by surety bonding and risk management. Therefore, for corporation’s reputation and financial feasibility would generate improvement, too.

## CONCLUSION

In conclusion, this paper mainly explained and answered two questions. The first question is: from the perspective of contractors, what are the leading causes for delayed and late payment issues? What’s more, the second question is: what are the feasible remedies for contractors to release and handle this issue?

After coming up with these questions, it started to explain the detailed performance of these leading causes and implementation of these effective remedies. Here, it should be focused on that different alternatives: Milestone payment, Commercial debt, Liens, Payment, Recruitment agencies and credit system. In this paper, it takes several steps to elucidate, analyze and evaluate these alternatives. Thereby, it suggests excluding the remedy of using Liens and figures out the impact of recruitment of agencies is much less than other alternatives. Nevertheless, it is

<sup>47</sup> By Author

reported that "Within the industry, in spite of the enactment of the CCA to improve cash flow, using speedy dispute resolution measures. The result shows that payment delays are more frequent than losses."<sup>48</sup> Most payment issues of construction projects are determined by complex and multiple factors as well as the solutions to handle these issues should be interact and use together. Moreover, in this paper, it figures out credit system could be the most feasible remedy, with payment bond ranking second and milestone payment ranking third.

Obviously, credit system is organized and regulated in corporation's constitution and project management. To some extent, every corporation has its own credit system and it has been assigned in corporation management and operation. To develop and improve credit system of project is beneficial for avoiding delayed and non-payment issues. Moreover, to emphasize and concentrate, the key words of this paper: construction industry, delayed payment, milestone, debt, credit

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<sup>48</sup> Thanuja Ramachandra and James Olabode Bamidale Rotimi. ( 2012, September, 24-26 ). Construction payment delays and losses: Perceptions of New Zealand. Retrieved from: [http://aut.researchgateway.ac.nz/bitstream/handle/10292/5812/rotimi\\_constructionpaymentdelaysandlosses\\_perceptions\\_of\\_newzealand\\_text.pdf?sequence=4](http://aut.researchgateway.ac.nz/bitstream/handle/10292/5812/rotimi_constructionpaymentdelaysandlosses_perceptions_of_newzealand_text.pdf?sequence=4)

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**Hongjing Lai** is an international student with 1 and a half years of learning experience in project management and business development. Born in the Basin of Sichuan Province, she received her Bachelor Certification with French language and literature major at local University in China before embarking on the adventure of expat living, learning in France. Studying in France since 2017, she serves as an international student with a serious learning attitude and habits, who also devotes to more professional certifications as well as academic developments. During this learning process, she noticed the difference of studying methods and habits and decided to overcome problems as much as possible. At present, she still studies hard in project management and business development courses like international contract management, sustainable project management etc... with rich teaching resources. Through these courses, she has investigated some issues like delayed payment and contract's termination in construction industry and plans to deeply research from previous and typical academic materials and reference as well as project case studies.

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