Improving the Outcomes of Public Drainage Projects through NEC3-based Relational Contracting: A Hong Kong Case Study

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Abstract: Since its publication in 2005, the New Engineering Contract Version 3 (NEC3) has increasingly been promoted as a relational contracting instrument for establishing mutual trust and for facilitating inter-organizational collaboration. However, only a few empirical studies have documented the use of this contract in practice. Therefore, the current research investigates the initiation, execution, benefits, and critical factors in the implementation of NEC3-based relational practices. The lessons learned from this implementation are compared with those derived from the application of the integrated project delivery (IPD) approach in the U.S. This study also analyzes the NEC3 Engineering and Construction Contract (ECC) through a case study of the first pilot project in Hong Kong to adopt this new contract. Study findings not only reinforce the usefulness of well-established relational components (namely proactive risk mitigation, efficient change management, and transparent cost monitoring) in the NEC3/ECC, but also highlight local experiences (such as early implementation, joint problem solving, inter-organizational team development, and regular partnering review) to enhance relational contracting further. Finally, NEC3 implementation is compared with that of the IPD. These results are beneficial to clients and contracting organizations, particularly inexperienced ones, in terms of the proper implementation of NEC3-based relational contracting for future projects.
Keywords: New Engineering Contract version 3 (NEC3); Engineering and Construction Contract (ECC); integrated project delivery (IPD); relational contracting; Hong Kong

Introduction

Over the past two decades, relationship-oriented partnering schemes have been widely implemented in both the public and private sectors of Hong Kong. In particular, these schemes have recently been incorporated into the current relational contracting practices through the adoption of a relational contracting instrument, namely the New Engineering Contract Version 3 (NEC3). NEC3 stems from an initiative of the U.K. Institution of Civil Engineers in 1985 to "lead a fundamental review of alternative contract strategies for civil engineering design and construction with the objective of identifying the needs for good practice" (Hughes 2013). As the most recent edition of NEC contracts, NEC3 has developed into a suite of contracts that meet the need of any contract-based construction integrated with relational contracting practices, especially through its Engineering and Construction Contract (ECC) (Gerard 2005). Since its release in 2005, NEC3 has not only been increasingly implemented in the U.K. with recommendation from the country's Office of Government Commerce, but this contract has also been adopted by 20 other member countries of the Commonwealth of Nations (Patterson 2007). Unlike the recent relational contracting practice

in the U.S. that applies integrated project delivery (IPD) approach, NEC3-based relational contracting approach offers unique and mature experiences in facilitating balanced risk sharing, proactive dispute mitigation, efficient change management and transparent cost monitoring given its long development history (Wright and Fergusson 2009).

Following the release of NEC3 in 2005, the Government of Hong Kong Special Administration Region (HKSAR) immediately introduced this contract suite into a pilot project- to improve the Fuk Man Road Nullah (the case project). This project involved the decking and landscaping of a 180-m long and 12-m wide open flood-prevention nullah along the Road. The HKSAR Government intends to improve the administration of public projects via the NEC3-based relational contracting approach, which can effectively accommodate the partnering process and mechanisms. The primary objectives of implementing the NEC3 in the project are: (1) to align team spirit and goals, (2) to apply a pain/gain share mechanism for enhancing the cost effectiveness of the project, and (3) to reduce the risk of cost and time overruns (Drainage Services Department 2013).The successful implementation of a relational contract is critical to effective partnering; nonetheless, only a few cases of NEC3 application have been documented outside the U.K. (Wright and Fergusson 2009). In recognition of this lack, the current study examines the effectiveness of partnering-related factors in NEC3 contracts and formulates a generalized application framework for NEC3-based relational contracting approach according to a case study of the first project in Hong Kong to adopt the NEC contract. The case study can capture the dynamic of NEC3-based relational contracting process within a real life context (Wright & Fergusson 2009). On the basis of archival documents regarding the case project, this study examines and compares NEC3/ECC implementation with IPD application in the U.S. in terms of challenges, application processes, major benefits as well as critical factors.

Case Study

The case project was commissioned by the HKSAR Drainage Services Department in 2006 and was the first pilot project to adopt the NEC/ECC contract on a trial basis (Cheung, 2008). At the time, NEC3/ECC was a new contract alternative for the governmental client; thus, the client hired a technical consultant to support the implementation of this contract for the case project. With reference to the advice of the technical consultant, the client evaluated different contract options, prepared tender documents, consulted government agencies, birefed bidders, and selected contractors; this meticulous process lasted for more than 30 months from the mid 2005 to early 2009 (Chan, 2012). Fig. 1 illustrates a four-phase structured application framework show the process of applying the contract to the case project.

(Please insert Fig.1 here)

Contract Evaluation and Bidding Briefing

A consultant-led management mode was adopted for the case project, and a corresponding traditional bi-party partnering arrangement was implemented to align the interests of both client andcontractor. The client evaluated six main options in terms of client requirements and project conditions with the assistance of the technical consultant. The client then selected the option C target contract with activity schedule as the construction contract because this option aligned the interest of the contracting parties through the pain/gain share mechanism, fair risk sharing, and alternative design improvement (Tsui 2012a). The core clauses of the NEC3/ECC were modified twofold according to the local requirements on cash payment and based on local experience regarding the response to inclement weather (Tsui 2012a). Local standards on safety, labor, and wages were also incorporated into the contract.

Contract Awarding and Start-up Workshop

Following the bidding evaluation, the the construction contract was awarded to Chun Wo Construction and Engineering Co. Ltd., which was mainly managed by the client and by its

consultant, Black and Veatch Hong Kong Ltd. (Chan, 2012). Upon signing the NEC3/ECC, the client and the contractor initiated a start-up workshop to define mutual objectives towards improving time performance of the entire project, enhancing its cost effectiveness, and developing a landmark (Tsui 2012a).

Contract Administration

As illustrated in Fig.1, NEC3/ECC has several structured components to facilitate partnering practice. These components can improve performance in terms of effective work collaboration, proactive risk mitigation, limiting cost disputes, and improved project outcomes, among others (Wright and Fergusson 2009; Hughes 2013). Seven critical factors in good relational contracting practice were identified by reviewing the opinions of the client's project executives (Tsui 2012b; Chan 2012). These factors are listed as follows:

1. Early Implementation. In the studied case, the client adopted several strategies to promote partnering practice: (1) employing a technical consultant, (2) evaluating the contract, (3) briefing bidders, and (4) establishing start-up workshops. These efforts facilitated the use of NEC3/ECC and the realization of partnering practice.

2. Proactive Risk Mitigation. Early warning systems are an effective means of proactively mitigating risk. Such systems were included in the NEC3/ECC to encourage the project team to response proactively to matters that may impair the performance of their endeavours. In the case project, a total of 15 early warning notices were issued by the contractor or project manager in relation to contract price adjustments, milestone delay and quality defect correction, among others. All of the issues related to these notices were resolved promptly in joint meetings (Chan 2012).

3. Efficient Change Management. NEC3/ECC addresses pricing and managing changes (mainly claims) through quick settlements in a "compensation event" (Hughes 2013). Throughout the project, 107 such events related to the risk were issued by the contractor in

relation to scope variation, extension of time and loss and expense, among others (Chan 2012). Of these events, 81 (87%) were agreed upon at completion, and the remaining issues were resolved in no more than six months after the project was completed (Tsui 2012b). The average duration for each compensation event was 60 days; this period facilitated the advanced finalization of the project (Tsui 2012b).

4. Transparent Cost Monitoring. This critical factor refers to the establishment of open-book accounting as specified in NEC3/ECC. In this arrangement, a designated account, namely the open-book account, receives payments from a client. In turn, the funds in this account are used to pay contractor and the recognized suppliers. The case project established this accounting method to improve its cost transparency and payment management. Moreover, it facilitated cost auditing after project completion (Chan 2012).

5. Joint Problem Solving. An on-site joint office that housed staff from both contracting parties was established to realize the aims of the case project. This office handled joint activities, such as the coordination of temporary transportation as a result of construction. Two of the senior executives involved in the case project both stated that this mechanism contributed to the successful application of NEC3/ECC (Tsui 2012b; Chan 2012).

6. Inter-organizational Team Development. The individuals involved in the case project formed the Fuk Man Club, which consisted of staff members from the client, consultant and contractor sides who had been within the team since the start of the project in 2012. This social organization organized several inter-organizational team development activities, including soccer games, volunteer services, and dragon boat competitions (Tsui 2012b).

7. Regular Partnering Reviews. During project execution, partnering review surveys were conducted regularly among the two on-site groups in the bi-monthly partnering workshops. These surveys were administered among the managerial staff from the consultant and contractor sides and among frontline staff representatives. The results of separate surveys in

both groups revealed that, on average, the ratings of partnerships among the two groups increase gradually as the project progressed (Chan 2012).

Post-project Review

The results of a post-project review indicated that the case project successfully met its three prescribed objectives through NEC3/ECC implementation in the following aspects: (1) a local landmark was developed to deep public appreciation as evidenced by the nine appreciation letters sent by the local community, (2).the project was completed six months ahead of schedule.(3) the target saving of 5% (HKD 1.5 million) was reached.

Conclusions

The successful application of NEC3 in the first pilot project in Hong Kong not only validates the role of this relational contracting approach in improving inter-organizational collaboration and project delivery effectiveness but also provides new evidence for the potential application of NEC3-based relational contracting approach in small or medium projects, which is seldom addressed in previous studies. This success has paved the way for the implementation of NEC3 contracts in five other public projects in Hong Kong. Through the combination of longitudinal archival and content analysis methods, an exploratory case study is undertaken in this study to capture how NEC3-based relational contracting strategy can generally be evaluated, implemented, and monitored. Furthermore, seven critical factors in implementing NEC3/ECC-based relational process were identified that combined the essence of NEC3-based relational contracting practices with partnering experiences in Hong Kong.

Unlike existing IPD contracts (e.g. ConsensusDOCS 300, AIA C195, and AIA C191), NEC3/ECC contracts simplify risks in multi-party contract negotiation and implementation as a result of its bi-party setup. Nonetheless, IPD are more advantageous than NEC3 for large projects that require multi-party collaboration to provide deliverables with complicated functionality requirements. Thus, NEC3 must be developed further according to the setup

adopted in IPD under which all key stakeholders involved in a project collaborate under a BIM-based virtual working environment. This trend is perceived to be inevitable for future construction projects. In addition, NEC3 has more advantages than IPD in the risk management process through a combination of several risk mitigation and sharing methods such as capped pain/gain sharing, early warning, compensation events, and open-book accounts. This process can be applied to various projects in any scale. Finally, the findings described above serve as a reference to enhance the application of NEC-based relational contracting approach both locally and internationally.

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References

Chan, K.K. (2012). Administration Experience from Project Manager's Perspective. Drainage Services Department, http://www.dsd.gov.hk/EN/Files/AD%2020120202% 20HKIE_revised. pdf. (10 December 2013)

Gerard, R. (2005). "Relational contracts—NEC in perspective." *Lean Construction Journal*, 2, 80-86.

Hughes, K. (2013). "Understanding the NEC3 ECC Contract: A Practical Handbook." Routledge, England.

Tsui, W. (2012a). "Why NEC in Hong Kong ? DSD's Experience on NEC." Drainage Services Department, http://www.dsd.gov.hk/EN/Files/DD%2020121121_revised.pdf (10 December 2013)

Tsui, W. (2012b). "Tender Preparation and Administration of NEC Contracts." Drainage Services Department, http://www.dsd.gov.hk/EN/Files/DD%2020120602_revised.pdf (10 December 2013).

Wright, J.N., Fergusson, W. (2009). "Benefits of the NEC ECC form of contract: A New Zealand case study." *Int. J. Proj. Manage.,* 27, 243-249.

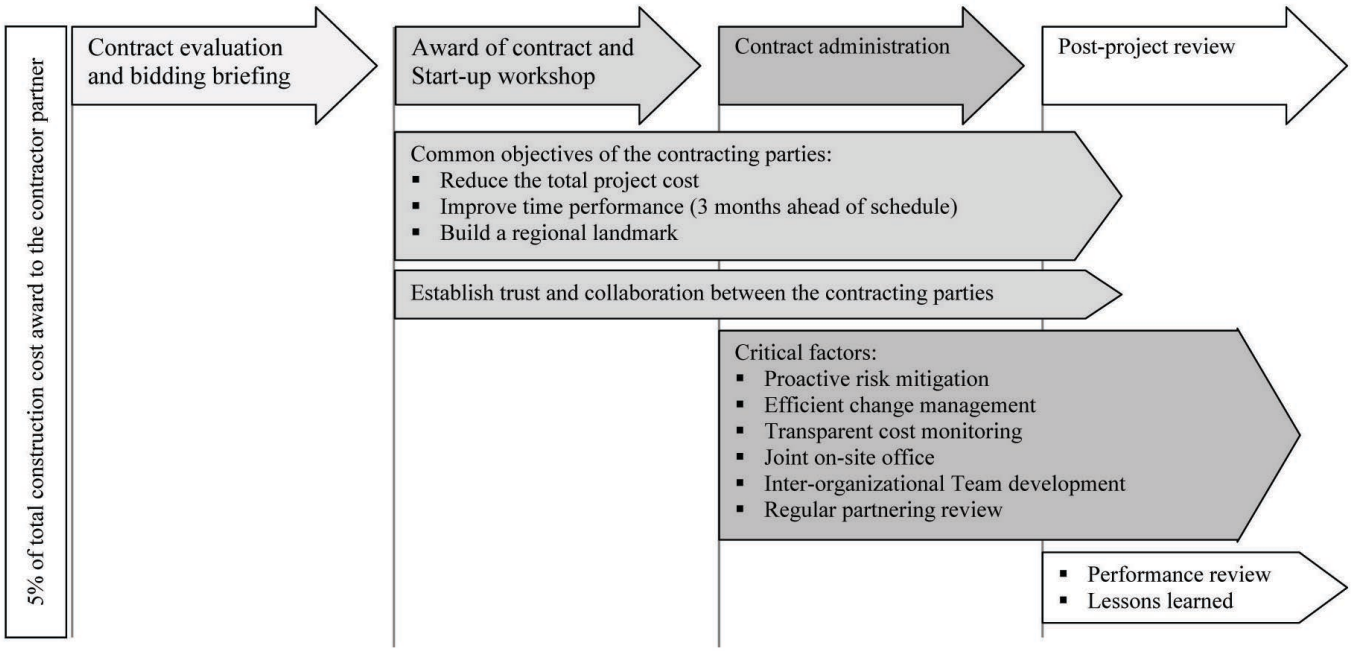

Fig.1 The process and approach for implementing the NEC3/ECC (Chan 2012; Tsui 2012a & 2012b)