

# A cost control system development: A collaborative approach for small and medium-sized contractors

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## Abstract

Construction business comprises a number of small and medium-sized contractors which form the major part of the industry. The existing research on the new ICT development is creating very sophisticated and complex systems which are not yet applicable to this part of the construction industry. With regard to general limitations as design criteria, this research uses a collaborative approach to develop a cost control system for five selected small and medium-sized contractors. The new efficient cost control system is adopted on the earned value concept and is developed using available ICT tools which are familiar and easy-to-learn. A collaborative approach can ensure the diffusion of technology to these companies.

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## 1. Introduction

Construction is a very competitive business mainly by prices. To maintain success, contractors have to continuously improve the efficiency of their business processes. Modern information and communication technology (ICT) holds promising advantages to improve the business processes of the construction industry particularly in the field of management. Many new system developments are being created in relation to research findings and they are getting more sophisticated with the current trend of integrating everything. Small and medium-sized companies with their limited resources and some other constraints are not ready to implement and obtain benefits from the technology.

This paper reports the research project which aims to analyze the existing business processes of small and medium-sized construction companies (or construction SMEs)

and identify priority area of improvement. It also aims to determine the methodology and to develop a new ICT system that can be successfully implemented on construction SMEs' business. A collaborative approach is employed to overcome limitations on physical and psychological factors. The approach is emphasized on the company involvement throughout the development process. Finally, the cost control system is particularly developed for the collaborative construction SMEs. The system is adopted on the earned value concept and their existing documentation-based control.

## 2. Recent system developments for construction SMEs

### 2.1. Importance of construction SMEs

The National Statistical Office has conducted a nationwide survey of IT applications in the construction industry in 2004. The report [13] shows that the construction industry in Thailand is very fragmented. It consists of a number of small and medium-sized companies that represent about 92% of the whole industry. Ninety-five percent of all

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construction companies have registered capitals of less than 1.5 million US dollars. The reports also show that construction SMEs have developed very few of their own in-house software which is only 1.7%. This insufficiency is partly a cause of many problems in this industry, such as lack of efficient control systems, project delays, poor quality of work, and high costs. Kaplan [15] has argued that American Society of Civil Engineers (ASCE) through their publications is neglecting the big picture that the major components of the civil engineering community and their employers are indeed small-business entities. He requested more attention to foster small-business groups and local sections. These construction SMEs are currently using primitive business processes which rely largely on manual, paper-based data, intuition, and experience, but not ICT. The government is concerned about this issue and urges SMEs of many industries to implement new ICT applications as their competitive advantages. Many government initiatives are now encouraging them to improve their business processes and to increase their capabilities through ICT.

This situation is similar to that of many other developing countries. Jaafar et al. [14] have done a survey study to confirm that construction companies regardless of their sizes have been seeing IT as their opportunity for improvement. Goh [12] concluded from his survey study focusing on people, their IT needs, and ability to manage change. The new system must be compatible with their normal work routines and easy to use because SMEs have limited resources for training and time. Yang et al. [21] found that most field managers prefer to use Excel for recording and processing cost data, notwithstanding the introduction of specialized computer applications for project management. Cumbersome workloads associated with data update in the commercial project management applications make managers hesitant to use. Thus they try to handle not only the cost but also scheduling data using Excel. Acar et al. [2] studied the relationship between an organizational size and the use of ICTs within the SMEs in the building construction sector in Turkey. They concluded that the larger the firm sizes are the more intensive use of ICTs contractors do. This is not a surprising finding because the applications of ICTs come with a large amount of investment and that is a limitation of construction SMEs. With their limited capitals, most construction SMEs are cost concerned.

## 2.2. Modern ICT for construction industry

ICT has already been adopted on the construction industry for a while. Aouad et al. [5] showed that all publications from 1990 to 1994 revealed the applications of IT in construction in 16 different fields. El-Ghandour and Al-Hussein [9] also conducted a comparable study of publications during 1992–2001 and they categorized the applied IT in nine main different fields. There are many ICT system developments available in the literature and commercial packages. Most of these systems are in the trend of data

integration which prefers to combine different functions together. The building information model (BIM) is created to cover all information associated a building such as geometry, spatial relationships, geographic information, quantities and properties of building components. It aims to share information across different disciplines, platforms, and formats throughout the life cycle of a construction project (i.e. design, construction and operation) and this will achieve the data interoperability. The systems that are developed upon BIM can add to and reference back all information acquired without losing. These developed systems tend to be complex and difficult to comprehend and operate. Despite that, only a few of them were particularly designed for construction SMEs or have considered their limitations on implementation.

## 2.3. Limitations of construction SMEs

With regard to limited resources available for adopting IT in their businesses, Chau [7] found in his study the factors used in the selection of software package in SMEs that SMEs rated the vendor support as the most important factor when selecting package software. This shows that SMEs have inadequate technical personnel. The ease of use/user-friendliness of the software package was viewed as an important factor. Their common software packages are just accounting or word processing-related software. Fink [10] provided an indication of factors important to SMEs when adopting IT. Internal factors such as IT benefits, organizational culture, in-house IT expertise and resources, IT implementation and selection were judged to be more significant than external factors which were external environment, outside support, external resources. Nitithamyong and Skibniewski [17] have conducted a survey study to identify the success and failure factors of performance of commercial Web-based project management systems. They concluded that the two most influential groups of factors were the characteristics of the system, such as ease of use, system reliability, output quality, and the project team, such as team attitudes, support from top management, and adequate training. Peansupap and Walker [18] have provided an organizational level framework of ICT innovation diffusion at the implementation stage of a construction project. They identified four groups of factors that influence ICT use and adoption such as management, individuals, technology, and workplace environment. Challenges are the acceptance of prospective users and the diffusion of new applications.

## 2.4. Applications for construction SMEs

Available system developments that were created for construction SMEs were investigated and summarized as follows. Love and Irani [16] confirmed the benefits of ICT to the management practices of construction SMEs. Primary motivations for IT adoption of SMEs were identified as productivity and business processes improvement,

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