NEEDS OF SMCs IN HONG KONG: INFORMATION MANAGEMENT AND IT

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Abstract:
Small and Medium Contractors (SMCs) constitute the largest number of business organisations, employ the highest number of employees and make up the biggest segment of the construction sector in most countries, if not all. Moreover, they carry out the largest share of the actual construction works in terms of value, working as subcontractors on large projects and main contractors on smaller projects. Therefore, no improvement initiatives can be achieved without addressing the problems of SMCs and improving their competitiveness. The present paper reports on a recently launched Research and Development (R&D) project in Hong Kong, designed to improve the efficiency of SMCs, and that can eventually feedback into industry improvement. The paper conveys highlights from a preliminary “Needs Analysis” study and consequential conceptualisations for SMC development.

Keywords: Hong Kong, Information Management (IM), Information Technologies (IT), Small and Medium Contractors (SMCs), SMC Needs.

INTRODUCTION

Industry Reports worldwide have long been recommended various measures for performance improvements in construction, and/ or industry development. The recent trend is seen to ensure value for money (OGC 2003, QD 2003) – when evaluating the effectiveness of the project outcomes or the construction industry. Literature suggests that such effectiveness may be achieved either by ensuring project successor improving the competitiveness of the construction organisations. Project success has been suggested to be measured through some project based Critical Success Factors (CSFs). These project-based CSFs include: adequate communication, communication system, control mechanisms, feedback capabilities of both contractors and subcontractors, effective coordination, effective decision making, monitoring, safety and quality assurance program, site management, supervision, and speed of information flow (Chan et al. 2004). These are clearly related to Information Management (IM) and Information Technologies (IT), and their effective use.

On the other hand, construction industry improvements have also been suggested through improvements of some eight CSFs (Abrahám 2003). Four of these CSFs are organisation-specific: organisational structure (the form in which an organisation is internally structured to carry out its business), technical applications (the use of technical applications for advancement of the company), employee enhancements (the life long learning process for employees tied to personal, professional and cultural growth) and process benchmarking (the identification and comparison of processes and procedures and their continual improvement). These issues are internally based, within the organisation itself, and can be addressed through internal organisational or cultural changes – mainly through training and improving personnel capability of adapting and using new technologies and strategies - in order to perform competitively in the industry and survive (Rahman et al. 2003). As in the foregoing paragraph, these are also related to, at least to some extent, IT and IM. Therefore, effective IM and IT may be considered as a means to either ensure project success, or improve the competitiveness of construction organisations, and thereby accelerate construction industry development.
Small and Medium Contractors (SMCs) are ideally positioned to benefit from IM and IT enhancements. Having mostly operated in a ‘hand-to-mouth’ mode, they cannot invest or divert their scarce resources to searching and researching such issues (Rahman et al. 2004). They work as main contractors on small projects and subcontractors/ suppliers on large projects. In fact, they may carry out works of even up to 90% of the total value of the project (Matthews et al. 1997, Nobbs 1993). They form the largest number of business organisations in construction sector, employ the largest number of employees and make up the largest share of the industry (Kaplan 1996). In Hong Kong, the construction industry employs over 9% of the workforce, contributes about 6% to the GDP and accounts for 40% of gross domestic fixed capital formation (CIRC 2001).

Any industry improvement initiative needs collective learning and knowledge transmission/ sharing - to the extent that an organisation requires it. This is fostered by cultural, institutional and geographical proximities, often in combination. The experience of ‘regional clusters’ of high technology Small and Medium Enterprises (SMEs) in Europe also indicates that “[business] networks and [organisational] dependencies may be within, between and outside firms and although they may not be traded [/ exchangeable] (or even tradable [/ exchangeable]) they may have significant effects on the competitive performance of organisations” (Keeble and Wilkinson 1999). From the background data indicating the large SMC sector as mentioned above, it is clear that any improvements in the construction industry cannot be achieved without boosting the competitiveness of the SMCs, and any such initiative should be for a specific geographical area that also matches well with the ‘local’ cultural and institutional environment.

This paper first briefly discusses IM and information flow from the perspectives of SMCs in Hong Kong. It then reports on the first stage of a recently launched project that has been formulated to build an effective IM system for SMCs using available IT. Although improved Knowledge Management (KM) is also very important in this project, KM is not specifically discussed in this paper, since it will be dealt with later in the programme.

INFORMATION MANAGEMENT (IM)

In order to meet the ‘market’ demands, production or construction management must take into account and optimise the exchange of data with the environment of the firm, i.e. clients, contractors, consultants, suppliers, subcontractors and other partners (Caillaud and Passemad 2001, Ugwu et al. 2003). IT can provide SMEs with appropriate solutions. Each construction project is unique and since SMCs play the most important role in construction industry, SMCs must optimise the use both of their resources and their exchanges of internal and external data (i.e. IM). Caillaud and Passemad (2001) state, in manufacturing scenarios, that IM is important to:

- clarify the strategy by a micro and macro economical intelligence;
- anticipate new ‘product’ developments by a technological intelligence and a study of the political and legal tendencies (constraints, subventions) ; and
- acquire a flexible, reactive and communicating organisation, … continuous information about the ‘production’ processes and the transverse management of the information circuits, through the optimisation of its exchanges of information with the environment, the evaluation of its performances and through the capitalisation of its knowledge.

In construction scenarios, just as in many other sectors such as manufacturing, SMCs must integrate these various dimensions by using tools in accordance with their needs, such as the management of various processes (workflow management), the sharing of data/ experience (through a common database or ‘platform’), and the capitalisation of experience (i.e. KM) (Chen et al. 1998). In the case of distributed networks (i.e. the supply chain in a construction scenario), a single point information source (i.e. data warehouse), expert systems (i.e. various generic ‘process’ related modules that can be used by a specific organisation and without disclosing to others) and other decision support systems can be more effective (Stevens 1999). A framework of an information system based on Internet and other available IT (tools) answers these needs and allows continuity between the external and internal information flows though the coexistence of heterogeneous and distributed systems (Caillaud and Passemad 2001).

From the perspectives of SMCs, the areas where effective IM aiming at faster and smoother decision-making can be applied with the help of the Internet and other IT (tools) include:
• Data and information required by construction site staff from head office: foremen/ supervisors, gang leaders, individual trades people (e.g. plasterers) – in smaller projects without any site office.
• Data and information required by construction site staff from site office: foremen/ supervisors, gang leaders, individual trades people (e.g. scaffolders).
• Data and information required by site office from various sources: foremen/ supervisors/ gang leaders working at site, individual trades people working at site (e.g. plasterers), head office, client/ owner/ developer, consultant, subcontractor(s) and supplier(s), other suppliers(s) working on the same project/ site (if any).
• Data and information required by head office from various sources: (1) in smaller projects without any site office – (a) foremen/ supervisors working at construction sites, and (b) individual trades people working at sites (e.g. plasterers and scaffolders); (2) different site offices; (3) clients/ owners/ developers, consultants, main contractors (if any), subcontractor(s) and supplier(s); (4) other subcontractor(s) working on common projects/ sites (if any), other suppliers(s) working on common projects/ sites (if any); and (5) other external organisations, e.g. Labour Department, etc.

SMILE-SMC

In order to meet specific needs of SMCs in Hong Kong and to improve their competitiveness, a research and development (R&D) project was launched in November 2003 at The University of Hong Kong. The project is captioned: ‘Strategic Management with Information Leveraged Excellence’ for Small and Medium Contractors (SMILE-SMC). The main objective of this project is to provide affordable integrated solutions to the SMCs, aiming at empowering their continuous improvement by providing a user-friendly framework and various generic modules (e.g. for performance evaluation, benchmarking and improvement) to assist in continuous improvement through strategic IM and KM, using available IT tools and through a ‘single point’ information source/ interface.

The above requires the collection of much diversified information, e.g. multi-project, multi-organisational, and organisation-specific data from SMCs – with sources varying from their day-to-day business activities to strategic decision-making. Therefore, close collaboration and active participation from a motivated set of ‘pioneering’ SMCs or ‘Partner Contractors’ (PCs) was felt essential. Consequently 15 (so that around 10 may be available at any given time) such PCs were enlisted with the help of different ‘Contractors Associations’ and personal contacts. These PCs supply required data, assist in collecting data from their sub- and trade-contractors/ partners, attend monthly full team meetings, and provide feedback and suggestions in developing the SMILE-SMC system, also taking part in its validation and dissemination.

‘PILOT NEEDS ANALYSIS’

It was first decided to identify the core problem areas – through a structured “Needs Analysis” exercise – in order to identify knowledge gaps, information bottlenecks, and communication and co-ordination barriers for SMCs. A semi-structured questionnaire was developed after a literature review and through brainstorming of the core research team. Data was collected from 14 PCs through in-depth interviews – lasting an hour and a half on an average – for this pilot exercise. This allowed the PCs to express their own problems, needs, ideas and suggestions. It was revealed from the interviews that the single most common barrier to SMCs is that they do not know where to get ‘useful’ information. This was related to the general lack of a ‘single source’ of information. There are no appropriate publications catering to their needs and at their ‘level’ of reader friendliness. It is difficult to extract useful information from broad, sparse and general sources, which is also expensive to some SMCs. In addition to this, some companies do not reveal their information. Also, some available information lacks accuracy/ authenticity, and they therefore do not feel confident in using those sources. This justifies the main objective of the SMILE-SMC project.

The information collected from these interviews and constructive suggestions at the monthly meetings resulted in identifying some ‘needs’ areas, where the researchers can concentrate to develop SMILE solutions and assist SMCs for improving their ‘processes’, and thereby competitiveness. Those are shown in Table 1.
### TABLE 1.
Potential Business/ Work Processes for Improvements

<table>
<thead>
<tr>
<th>General Team Interactions</th>
<th>Company specific/ business related issues</th>
<th>Selection, co-ordination and training</th>
<th>Site inspection/ supervision and Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Supply Chain Management (to enhance general communications &amp; relationships with subcontractors/ suppliers/ workers; to improve speed, reliability, etc)</td>
<td>• Business Intelligence (to track profitability, new opportunities, competitor strategies, etc)</td>
<td>• Subcontractor selection</td>
<td>• Capture and send photos from site to Head office, to facilitate inspection &amp; decision-making</td>
</tr>
<tr>
<td>• Client/ consultant communication (to improve efficiency, e.g. on instructions and claims)</td>
<td>• Finance (to help initial investment, maintain cash flow, etc.)</td>
<td>• Subcontractor management (to coordinate &amp; improve interface management).</td>
<td>– using PDA (with the wireless LAN)</td>
</tr>
<tr>
<td>• General Project Management (to coordinate among different parties, overcome interface problems, complete work in time, etc.)</td>
<td>• Estimating and Tendering (to increase the steps in an accurate and timely way, increase the chance of winning a contract, etc.)</td>
<td>• Supplier selection</td>
<td>• Capture and send photos from site to Head office, to facilitate inspection &amp; decision-making</td>
</tr>
<tr>
<td>• Administration (to maintain accounts, manage personnel, etc.)</td>
<td>• Billing (to prepare and follow up on bills and payments for work done)</td>
<td>• Supplier management (to coordinate and improve interface &amp; inventory management)</td>
<td>– using mobile phone &amp; SMS service</td>
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<tr>
<td>• Web based platform for communication among client, contractor, consultant, supplier, subcontractor, site office, Head Office, supervisors, etc.</td>
<td>• Contractual issues (to prepare &amp; follow up on variation/ change orders, claims, etc,)</td>
<td>• Management of self-employed worker and self-employed subcontractor</td>
<td>• Capture photos from site by digital video camera and send to Head office through web, to facilitate inspection and decision-making</td>
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<td></td>
<td>• Planning (to reduce rework/ wastage/ cost/ time, complete work in time, etc)</td>
<td>• Worker/ supplier/ subcontractor training (to use special/ innovative systems)</td>
<td>• Install web cameras at site, to facilitate real time inspection &amp; monitoring</td>
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<tr>
<td></td>
<td>• Value Management (to decrease cost, add value and increase profit margin)</td>
<td>• Training of managers (including supervisors) to use special/ innovative systems</td>
<td>• Retrieve drawings &amp; documents at site for reference/ consultation purposes, using PDA, Notebook computer or Mobile phone</td>
</tr>
<tr>
<td></td>
<td>• Productivity (to decrease cost, increase profit margin, etc.)</td>
<td>• Skills/ techniques (to reduce risks, decrease cost/ time, etc.)</td>
<td>• Download, fill up and send/ submit various forms (during site visit, sending report on progress/ quality, etc.) from/ through web – using PDA or pocket PC</td>
</tr>
<tr>
<td></td>
<td>• Skills/techniques (to reduce risks, decrease cost/ time, etc.)</td>
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<tr>
<td></td>
<td>• Web based Inventory control e.g. of equipment and materials (to forecast/ higher/ return, effectively, minimize rent/ cost and wastage, promote ‘Just In Time’ deliveries)</td>
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</tr>
<tr>
<td></td>
<td>• Web based project management for your company (to manage purchase orders, invoices, contract information, payments to subcontractors/ suppliers, etc)</td>
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The PCs also expressed their interest to know, discuss and share their concerns on a common platform. These issues vary from general project management to political issues that affect the construction industry. The highest concern appeared to centre on supply chain management. It was also revealed that PCs predominantly use, as well as prefer, traditional and already practised methods for communicating and transferring their information, although the usage of various methods differs considerably among individuals. The most common method of communication is telephone and pager services, since one can directly contact and pass the information to the appropriate person without wasting any time. Some PCs preferred face-to-face discussions for the issues requiring more explanations. They use faxes for transmitting the information that does not require any explanation or immediate feedback. However, PCs preferred to increasingly use email, PDA and Internet based services for communicating from office to work site and vice versa.
CONCEPTUALISATION OF NEEDS AND POTENTIAL SERVICES

Based on the information collected from the ‘Pilot Needs Analysis’ from 14 PCs, their feedback, further suggestions and discussions in the monthly meetings, the business goals and implementation strategies of SMCs in Hong Kong was conceptualised as shown in Figure 1. This mainly targets cost minimisation and revenue maximisation. Items shown in *italics* in the boxes at the left and right extremes of this figure refer to areas where information and knowledge may be shared between SMCs. Other information are more company specific and may not be shared. However, items shown in the figure are from the preliminary conceptualisation. This is expected to be adjusted and refined during the course of the study. Items may be added, modified, fine tuned, or even discarded.

Following the initial appraisal, it has been proposed that the SMILE-SMC services will be provided in five broad areas: inter-organisational information exchange, inter-organisational discussion forum, intra-organisational information and knowledge flow platform, performance improvement module(s) and a benchmarking club. The basic structure of the proposed SMILE-SMC website has been conceptualised as shown in Figure 2, which will then serve as a ‘single point information source’ and knowledge management platform for SMILE-SMC members. The services will be provided as shown in the lower six boxes of the Figure 2, while the upper boxes show the potential SMILE-SMC users.

**Figure 1: Conceptualisation of SMC Business Goals and Strategies**
Services offered by SMILE-SMC

Figure 2: Conceptualisation of SMILE-SMC Services

SMILE members will be able to seek business opportunities, search for business partners (i.e. subcontractors, suppliers, main contractors), discuss various concerns, exchange information, and organise and manage their most frequently used information flows. They will also be able to use some specific modules and formats in improving their performances and competitiveness, and benchmark among each other. Specific attention will be given to compatibilities while developing the SMILE website, so that SMCs can use commonly available software with add-ins/ plug-ins for utilising the services. Dissemination of the SMILE project will include periodical newsletters and e-bulletins, seminars and workshops. A ‘train-the-trainer’ policy will be adopted to familiarise end users with SMILE services, beginning with the PCs. Self-learning packages will also be developed for further dissemination. These services will be made available to the SMCs freely at the beginning, while a nominal subscription fee will be received from the members for the maintenance of both the system and the services after the development period.

CONCLUSIONS AND ONGOING RESEARCH

The on-going R&D project requires the collection of many diversified, e.g. multi-project, multi-organisational, and organisation-specific data from SMCs. Preliminary data has already been collected from the PCs through the “Pilot Needs Analysis” exercise. Based on this pilot exercise and consolidating the diverse comments and suggestions from the PCs, a business goal-strategy framework of SMCs in Hong Kong has been conceptualised. In order to achieve the business goals, the broad services that may be offered through the SMILE-SMC have also been conceptualised. These conceptualisations will be adjusted and enriched during the project and with the collection of various focused information.

For example, a questionnaire has already been developed to collect wider industry perceptions in order to narrow down the issues shown in Table 1. This will lead the researchers to identify a few ‘most needed’ areas for further investigation, and development of some user friendly and useful modules. Then SMCs can draw from these modules to improve their organisational competitiveness and help deliver projects more efficiently, and thereby accelerate construction industry development. Further
specific information collection strategies include focused questionnaire surveys of SMCs on different specific issues, in-depth interviews and mini-case studies including workflow analysis of the PCs. The Hong Kong Construction Association, Federation of Electrical and Mechanical Contractors, and the Construction Industry Training Authority agreed to cooperate in this project from the outset. The Hong Kong General Building Contractors Association, an association of SMCs in the building sector, is already assisting the project actively. It is expected that such wider industry participation and assistance in this R&D project will produce more useful and sustainable deliverables for overall industry development.

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