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Creating intelligent enterprises in the Singapore construction industry to support a knowledge economy

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Abstract

Singapore, as a new economy, aspires to become the IT and business hub of Asia. The aim in the Infocomm 21 plan is to develop Singapore into a vibrant and dynamic global infocomm capital with a thriving e-economy and a pervasive and infocomm-savvy e-society. There is an on-going IT development programme for the construction industry known as the CORENET, which was started in 1993. Several industry projects have been implemented to help the construction-sector companies adopt IT. The IT Barometer 2003 survey is a timely check on the levels of general adoption of IT and specific adoption of IT originating from the CORENET. The response rate of the Singapore survey is 11.1% based on 84 returns from a total of 754 questionnaires mailed out. The key findings on IT adoption are summarised and the potential for construction-sector companies to be intelligent enterprises is evaluated. The outcome of the assessment culminates in six directions for the construction industry in Singapore, as well as worldwide, intending to create intelligent enterprises. They are: (1) to tap the advanced telecommunications infrastructure; (2) to operate within a well-established legal and regulatory framework for electronic transactions; (3) to implement ERP systems for integration of databases and applications; (4) to build business intelligence capabilities and plan investments in information systems; (5) to practise business process re-engineering; and (6) for the SMEs, to focus on people, their IT needs and ability to manage change.

1. Introduction

A knowledge-driven economy is one in which the generation and exploitation of knowledge play a predominant part in the creation of wealth [1]. Essentially, knowledge drives the profits of the organisations for gaining and sustaining competitive advantage. And, the knowledge-based economy is all about adding ideas to products and turning new ideas into new products [2,3]. Applying intelligence to an organisation, it can be gathered that intelligent enterprises leverage on technologies as a means to provide better-focused and customised services [4]. Also, through knowledge management and other business intelligence solutions, they enable such enterprises to gain in-depth analytical capabilities needed to turn raw data into actionable knowledge.

In 1999, the Singapore Government envisioned the need to transform the construction sector through the Construction21 Blueprint by a strategic vision for the industry, which is—"To be a World Class Builder in the Knowledge Age" [5]. More specifically, Singapore aspires to become Asia's IT and business hub. The IT2000 master plan for Singapore was initiated in 1991 by the National Computer Board, and the Construction and Real Estate Network (CORENET) is part of the plan for leveraging IT to re-engineer and streamline the fragmented work processes in the construction industry to achieve a quantum leap, especially in quality and productivity

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aspects. Since the commencement of the CORENET national programme in 1993, key IT initiatives have been identified. The Building and Construction Authority (BCA), a government agency, is tasked to push ahead the CORENET programme in partnership with the relevant industry bodies. Appropriate incentive schemes including capital grants for IT development have been put in place to help the industry adopt IT.

2. Purpose and potential findings

The paper presents the findings of an industry-wide survey conducted in Singapore to assess the extent of IT adoption at both the industry and company levels. The end-objective is to evaluate the potential of construction-sector companies to be intelligent enterprises. Specific comparisons are made with countries, namely, Denmark, Sweden and Finland, and the Nordic region as a whole, to gain a better understanding of the local situation. On a broader agenda, the intention is to learn from the Singapore experience so as to map directions for companies with the potential to acquire and build intelligence capabilities necessary to operate successfully in the Knowledge Age.

3. Rationale for the survey, scope and comparison

The IT Barometer project had been used in some Nordic countries since 1997 with the aim "to create a method and perform a survey for measuring the use of IT in the construction industry" [6]. As a long-term strategy, the survey should be repeatable and comparable over time; be comparable between countries; and cover all categories of companies in the construction industry. Hence, a standard format for the survey questionnaire is developed to encompass wide-ranging questions on the extent of IT usage by AEC companies. So far, countries like Sweden, Denmark and Finland, in the Nordic region, have participated in the first survey, as well as a follow-up. They are the "IT Barometer 1998" and "IT Barometer 2000", respectively.

The published results include the Swedish survey in the report "IT-Barometern 1998—Läget för IT-använd-ningen inom byggande och förvaltning i Sverige" by Samuelson [7] and comparisons between the countries by Howard and Samuelson [8], Howard et al. [9] and Howard et al. [10]. In line with the strategy for the survey, the questions were the same in the three countries except for small changes to adapt to local variations.

The "IT Barometer 2003" had been conducted in Singapore. The same strategy was applied which entailed a coverage of all categories of companies and a comparison of results between countries in order to draw meaningful conclusions about IT adoption in the construction industry. In addition, it was noted that there are comparable characteristics of Singapore and her construction industry with the selected Nordic countries, namely, Sweden, Finland and Denmark. Table 1 shows the similarities in relation to the size of population, GDP and construction output.

In enabling the national surveys to be compared, it was acknowledged that there must be elements of consistency across the sampling approaches adopted. In this context, two key aspects are discussed here. Firstly, it was noted that in the Nordic surveys, one of the main goals was to be able to describe the situation in the industry as a whole. Hence, size of the companies was a consideration and a weighting had been applied to normalise the data to "make sure that each answer represents its part of the industry" since companies of all sizes had been included in the sample [6]. In the Singapore survey, except for Architecture and Engineering whereby all companies registered with the relevant professional body or association were targeted, the companies in the other categories were pre-selected by size. The general rule is to target the larger companies based on turnover and number of employees when there are numerous companies in that category. This pre-selection implied that a weighting need not be used to normalise the data but, similarly, the goal was to ensure the aggregated response represented that of the whole industry. Secondly, it was noted that all the national surveys targeted between 750 and 2000 companies which showed a certain level of consistency applied across when defining the sampling population.

In addition, it was important to note the time lapse between the national surveys. The timeframe for the comparison of the completed IT Barometer surveys stretches from 1998 to 2003. In instances where a

Table 1
Country statistics for comparison (*Source*: relevant websites)

Profile	Singapore	Sweden	Finland	Denmark
Population, 2002 (millions)	4.45	8.87	5.18	5.37
GDP, 2001 (US$ billions)	106.3	219.0	133.5	149.8
GDP per capita, (US$ billions)	24,700	24,700	25,800	28,000
Construction output, 1998 (US$ billions)	11.6	24.1 (1997)	15.9	11.0
Construction output per capita, (US$)	3000	2700	3100	2048