INFORMATION TECHNOLOGY
USED BY HONG KONG CONTRACTORS.

Keith Futcher and Dr Steve Rowlinson.

ABSTRACT

On-going demand for construction in the Hong Kong Special Administrative Region, and in the neighbouring provinces of China, will attract participation from the global construction industry. As a result, the relative exploitation of construction IT for competitive advantage, by construction companies from different parts of the world, compared to the construction industry in Hong Kong has become an important concern of the industry and the Government.

This paper presents the results of one element of current research into the extent that construction IT is used within the large and dynamic construction industry of Hong Kong. The research provides a measurement of the strategic use of construction information technologies by the public works contractors of the Hong Kong construction industry. It is one element of current research into the use of information technology for project management purposes and, in particular, for the management of portfolios-of-projects.

Keywords: information technology strategies, Hong Kong contractors.

INTRODUCTION

This paper presents the results of current research into the extent that construction IT is used by the contractors of the construction industry of Hong Kong. The research findings are one element of a two stage postal survey of the contractors on the public works list of contractors and the consultants listed in the Government directories of consultants. The list of the contractors, and the directories of the consultants, are administered by the Government of the Hong Kong Special Administrative Region (HKGSAR) as part of their process for the competitive and open bidding of public works contracts and assignments.

The first stage of the postal survey is targeted at a population sample of 316 contractors. The sample ranges from small, local, businesses to large, international, companies. This paper presents one element of the survey: a comparative assessment of the strategic use of IT by the public works contractors of the Hong Kong construction industry. It is a subject of increasing importance to the HKGSAR and to the contractors themselves because of the competition between Hong Kong contractors and overseas companies.

The Government of the HKGSAR plans significantly more construction within the territory of the Hong Kong S.A.R., over the next two decades. The Territorial Development Strategy Review [1] describes the HKGSAR's blueprint for future infrastructure. The current population of 6.5 million is forecast to increase by the year 2011 to between 7.5 to 8.1 million. The consequent land requirements to cater for this population growth are 580-850 hectares for housing; 54-66 hectares for offices; and 259-572 hectares for industry. It is worth noting that these are the relatively small footprints of Hong Kong's high-rise solutions

to a demand for accommodation. The same document identifies the need for US$ 150 billion of infrastructure, including:

- A link from the island of Lantau, the NW New Territories and the Pearl River Delta;
- A new north-south highway across the Territory;
- A new cross-border highway and railway;
- Expansion of the mass transit railway;
- Expansion of the sewerage infrastructure;
- Port facilities;
- Landfills for solid waste disposal.

In addition, the People's Republic of China will continue to offer a huge market for construction. Economic growth in Guangdong; the Pearl River Delta (including the Shenzhen and Zuhai Special Economic Zones) have been the flagship of China's 'open door' policy since 1978. In 1992, Guangdong generated 10% of the national total of gross industrial output. It was second in terms of industrial ranking. It handled 21% of China's exports by value and maintained a 13% growth of GDP (9% of the national total), and it accounted for one third of the national total of foreign funded enterprises. The expansion of Guangdong has been achieved, to a large degree, through substantial investment by Hong Kong entrepreneurs who, in 1992, accounted for about 80% of realised foreign investment in the province over the period 1979-1992. About three million workers in Guangdong are now employed in Hong Kong funded companies. There is a need for expansion of electric power supplies, sewerage collection and treatment systems, potable water supplies, solid waste disposal services, and trunk roads and railways. Development authorities in the Pearl River Delta have major plans for the development of port and airport facilities. It is clear that China's 'open door' policy is generating immense demographic pressures and related economic development needs, Guangdong in general and the Pearl River Delta in particular, are set on a long-term path of industrial-led urbanisation. It is forecast that by 2001 the population of Guangdong Province could have risen from 63 million in 1990 to 80 million, and 94 million in 2011. By 2011, the population of the Pearl River Delta is forecast to be 42 million. [1].

The Hong Kong construction industry will inevitably want to be heavily involved in these business opportunities.   The relative exploitation of construction IT for competitive advantage, by construction companies from different parts of the world, has therefore become important to the industry in Hong Kong. Technological improvement within the construction industry is driven by necessity. Within the public works departments of the HKGSAR there is a trend towards an increasing exploitation of construction IT for improved processes and results. The postal survey is to look for evidence of similar strategic IT innovation within the public works contractors.

USE OF I.T. WITHIN THE PUBLIC WORKS ORGANISATION.
Distributed computing technologies
Futcher and Thorpe [2] describe how the first distributed computing technologies were introduced into the public works organisation in an ad-hoc manner in the early part of the 1980's. The user demand for these low-cost personal computers was not to the requirements and standards previously required for the high-cost and high-complexity main-frame systems in the care of data-processing professionals. The computing expertise within the public works departments was low, but none-the-less, they were responsible for specifying the functional requirements for the distributed computing systems within their organisation. As a

consequence, from the outset, there has been a reliance on easy-to-use proprietary software solutions, or utility packages used for the development of simple user-applications. This culture of making do with low-technology skills has fostered a reliance on packaged solutions. There is now considerably more I.T. expertise within the public works departments and they are specifying more sophisticated information management systems, but they continue their practice of innovation using proven technologies.

Since 1992, direct expenditure per capita, by the public works departments on IT has doubled and the supply of distributed computers has increased four-fold from a 'staff to PC ratio' of 15 in 1992 to 4 in 1996. There is 26,557 professional and technical staff in the public works department. The staffing of departmental computer support units has increased by 10% so that the ratio of support staff to users is now 1:270, but the numbers of staff receiving formal training on the use of computers and software has doubled to 6,000. More significant to the deployment of IT systems, rather than stand-alone computers, is the numbers of staff receiving high-level, mid-career, training in Computer Science. Since 1992, a policy of sponsoring selected staff to attend post-graduate/MSc Computer Science/I.T. courses has generated a steady number of dual-qualified professionals able to envision, define and implement more sophisticated distributed computing systems. Currently 20 persons are on these courses although 30 pa is the average number.

Quantitative Data				Expenditure by Type				Training and technical support				
Year	Staff Nos	Staff per PC	Exp per capita	CAD	OA	dB	PM	IT staff	Nos tr'd	Dip/MSc	Cost per capita	% staff tr'd
1992	24051	15	$4,410	25%	21%	36%	18%	80	2936	32	$142	12%
1993	24338	9	$2,852	13%	16%	9%	53%	106	2575	44	$118	11%
1994	24484	6	$5,689	21%	27%	23%	30%	107	2967	36	$125	12%
1995	25662	5	$7,973	8%	41%	25%	26%	93	5075	35	$137	20%
1996	26557	4	$8,235	10%	33%	34%	25%	98	6065	19	$157	23%

Table 1 I.T. development within the public works organisation.

The demand for better technologies is seen in the change of spending patterns in Table 1. In 1992, computer-aided-drafting systems (25%) and also database applications (36%), dominated the expenditure in new technology. Since 1993, investment in office automation, mostly LANs has increased. In the 1990's, there has been greater demand for increasingly complex public works and a much greater amount of work to be carried out by an organisation permitted only modest expansion. This has fuelled the need for improved processes and the adoption of I.T. where it offers an improvement in project delivery. Today 10% of expenditure is on CAD, 33% on OA, 34% on dBase, and 25% on project delivery systems.

A new approach to managing project information for corporate control
Wickard, Schmitz and Li [3] describe the adoption of project management techniques, and project information management by the public works organisation of the Government of Hong Kong for the airport core programme of projects. They have written about the concepts of project management embodied in the ACP approach. The project management dynamic of simultaneous control of scope, time, cost and quality. Also, the tools and techniques for capped budgets; client-managed timing of works; client-managed contract interfaces; the time-limited process for dispute resolution; and client participation in the management of the

contracts. Information management was essential to serve all of these requirements, and to ensure timely achievement of a 'big picture' of overall progress, derived from legitimate finer detail. It was needed to integrate the large, and diverse, mega-project organisation

These lessons were carried across into the Public Works Programme (PWP) of the HKGSAR. The PWP is a complex and diverse rolling-programme of 1,500 projects, which, according to the Government classification, includes up to 72 types of public infrastructure: from abattoirs to water-supply. Eight public works departments, in response to requests from eleven Government Bureaux, or 'Ministries' and other quasi-government organisations carry them out. The Works Bureau (WB) of the Government co-ordinates the efforts of the Bureaux and the public works departments to deliver the PWP to everyone's satisfaction. It is not an easy task to manage this complex delivery process, which depends on a highly diverse organisation in which each of the public works departments has different staffing levels, workloads, locations, and each undertake different types of work.

Futcher [4] describes how, in 1994, the Works Bureau commissioned a computer-aided Public Works Management System (PW_MS) to provide a modern communications link between all the public works departments and their clients and to provide an information infrastructure to help better manage the PWP. Today, the PW_MS carries out management support for all the levels of PWP management: from executive level summaries and problem reporting, to project-management tools, which are used by the project team in their day-to-day activities. It uses the detailed project-level data to create executive level reports in the manner described by Cleland and King in 1983 [5].

What is the PW_MS?
The PW_MS is the computerised management information system that stores detailed time, cost and scope information on all public works projects (PWP). The PW_MS computer system holds all data in a central database. One hundred and sixty-five terminals are distributed among the public works departments and Bureaux. Application servers, serving clusters of terminals, are located throughout the public works organisation. They are connected to the central database via a wide area network (WAN) of dedicated data-lines which have sufficient redundancy to allow re-routing of communications if any fail. Futcher [4] explains how the PW_MS fulfils a role in the project management of the PWP, which is based upon a set of concepts, which are called, within the Government, 'a project-management approach to PWP delivery'. These include: the maintenance of a single database of comprehensive information on the PWP projects; the aggregation of this information so it can used by other participants in the PWP process; the reporting of work activities which are not progressing as planned; an early warning of probable delay to planned work, in time for corrective action to be taken; and the bureaux and departments involved in the delivery of the PWP being empowered to efficiently carry out their respective roles and thereby improve the effective delivery of the PWP overall. Other organisations have since used this system to manage, on an international scale, there large portfolios-of-projects. Similar would be useful to any organisation concurrently managing many projects.

A new approach to managing project information for construction management
Futcher and Thorpe [2] describe the recent experience of the works departments of the HKGSAR of a better way for construction information to be produced, and shared, for the purposes of construction project management. In the cases cited, the professionals participating on these public works projects were new to the technology but successfully

worked within I.T. for the management of the ambitious construction projects. Although the requirement for an I.T. system to aid in the project management of these large construction projects merely sought to automate manual methods, an approach was adopted that involved core-process design, ergonomics and the management-of-change. Documents are generated, recorded and stored within a document management system to enable the facts-of-the matter on any issue to be 'discovered' quickly, in an interactive manner, from the desk of manager. This has been achieved on one major project by the use of WAN communications to integrate the widely differentiated participants on a complex project and to accommodate them within a virtual office so they can work co-operatively. In this case, the MIS is not merely preparation for discovery in the event of a dispute; it is a unique ability to access, at any moment in time, the entire dialogue on any issuing arising on that project. As a result, the contentious issues were not confused by imperfect recollections of what had been previously written on difficult-to-find documents, nor was it possible to defend the indefensible because the truth is buried deep within filing cabinets. Discovery of information has become a pro-active process to resolve issues as they arise.

The future
The HKGSAR and its public works departments are moving ahead with their use of IT, but the direction of future innovation includes the clients, consultants and the contractors involved in the projects. The question is: are the consultants and the contractors involved in the public works, ready for this phase of IT innovation. This paper focuses on one aspect of current research into this subject, a postal survey of the exploitation of IT by the public works contractors of the HKGSAR. It sets out to replace subjective opinion with fact, on the extent that IT is deployed within the Hong Kong construction industry by public works contractors.

POSTAL SURVEY OF HONG KONG CONTRACTORS
The postal survey of Hong Kong covered four aspects of project information management:
i)   the use of information technology to assist in the flow of project information;
ii)   the aggregation of project level data into information which indicates the overall status of the portfolio-of-projects; and, the distribution of this information;
iii)   the current methods used for the measurement of the performance of the portfolio-of-projects; and
iv)   a self-assessment of the relative importance given to the strategic use of construction I.T. within the contractor firm.

This paper presents preliminary results from the fourth aspect of the postal survey: a health check of the strategic exploitation of IT.

Strategic I.T. Health Check
With the agreement of Betts, the method developed by Betts and Shafagi, [6] was included as part 4 of the postal survey questionnaire. Their self-assessment health check is 28 questions that companies answer to assess their use, and their management, of IT. The questions are grouped into three categories:
- ❑   the position of IT within the competitive business strategy of the organisation;
- ❑   the overall role of IT within the organisation; and
- ❑   the current IT strategy within the company.

This part of the questionnaire is useful to the companies in the survey population sample because it gives them an instant feedback on the extent of their strategic use of IT compared

to a benchmark standard developed in the UK for this purpose. It also useful to the researcher as it provides a basis for comparison with the same research exercise carried out in Great Britain by Betts and Shafagi [6] and in Australia by Stewart [7]. The results provided the UK construction industry with information on how IT is being exploited within their industry. Including the health check questions in the Hong Kong survey offers the same benefits to the participating contractors. It also allows a side-by-side comparison with the results from the UK and from Australia. It should be noted that the questions in the health check are not precise. The responses are correspondingly subjective, but none-the-less useful because they indicate the construction industry's self regard for their use of IT.

Postal release of the Questionnaire
The questionnaire was posted to the sample population on Saturday, February 28, 1998. The postal distribution followed commonplace rules to encourage participation, it:
- ❏ Provided a self-explanatory covering letter;
- ❏ Included a clearly printed questionnaire with explicit instructions on the first page;
- ❏ Included an addressed, postage pre-paid, envelope for the return of the questionnaire
- ❏ The questionnaire and the return envelope were marked with the respondents unique reference code; and
- ❏ Sets of mailing labels were used to log the postal distribution, receipt of responses, reminders, and data transcription.

The deadline set for receipt of response was March 20, 1998. The percent level of response was measured and a list of responses created. Reminders were then issued and the registration process repeated for the second round of responses. A second reminder letter was sent out to remaining companies who had not responded. This reminder included a further copy of the questionnaire. Due to timing, this paper is based on the responses received up to the first deadline.

Sample population
The sample population is taken from the list of approved Contractors, kept by the Professional Services Unit of the Works Bureau of the Government of Hong Kong. Works Branch Technical Circular No 9/97 (1997) describes the HKG rules for admission to the list. This is primarily a pre-qualification process which, when satisfied, allows a Contractor to submit a tender bid for the construction of public works projects. The Contractors are grouped according to their proven track record and their ability to finance construction. The groups are Group A, Group B, and Group C. Each group is able to tender for public works contracts whose value falls within certain limits which are periodically adjusted by the HKG. The current limits are stated in Table 2.

Group A	- Contracts of value up to HK$ 20 million.
Group B	- Contracts of value up to HK$ 50 million
Group C	- Contracts of any value exceeding HK$ 50 million

Table 2. Group Tender Limits for HKG public works contractors.

The Contractors are approved within one or more, of five categories of public works. These are: buildings (BD); port works (PW); roads and drainage (RD), site formation (SF), and water works (WW). The suitability of a contractor for inclusion in one or more of the categories and a particular group is assessed from the contractor's global business activity and

construction activity in Hong Kong. Initially a contractor is added to the list on probation within a group and within appropriate categories.

The approval assessment considers financial criteria, technical and management capabilities, and general evidence of being suitable to tender for public works projects within a group and for certain categories. As a condition of admission, all applicants must be set up a business in Hong Kong as defined in the Business Registration Ordinance. There is not a requirement that Contractors must be of a minimum size of company. The nature of construction and the high degree of sub-contracting that takes place in construction in Hong Kong make this an imprecise measure of the capability of a company. However, it is a requirement that they employ in Hong Kong, a minimum number of full time management and technical personnel with relevant experience and recognised qualification in engineering and project management. These requirements are not extreme. For example, a Group C contractor in the 'Buildings' category must have 'at least one member of the resident top management [with] . . . a minimum of five years local experience in managing a construction firm obtained in the past eight years'. The minimum technical staff is 'at least two persons with a relevant degree from a Hong Kong University, or equivalent, with at least five years post-graduate experience in building works.' The minimum financial criteria for admission onto the list is changed from time to time to reflect the costs of public works and are currently set at the limits shown on Table 3.

	Minimum employed capital (HK$)	Minimum Working Capital (HK$)
Group A	2.1 million	2.1 million
Group B	5.3 million	5.3 million
Group C	9.0 million	9.0 million

Table 3. Financial criteria for Groups of Contractors on the HKG List.

In addition to the simple criteria stated in Table 3, there is a requirement to maintain minimum working capital to cover the operating costs of new and outstanding works. For Group A contractors, the working capital is the greater of the criteria in Table 3 or 20% of the combined annual value of the new contract and uncompleted works on other current Government contracts. For Group B, the percentage is 10%, and for Group C, it is 6%. A holding company and its subsidiaries shall be permitted to be included in the Contractors List, however they must give an undertaking that only one company will tender for one contract.

The Works Bureau of HKGSAR provided a set of data taken from their computerised list of public works contractors. The population sample from this list is 829 general contractors, 1636 if it included specialist contractors. The list was culled to remove specialist contractors who operate within a field so narrow that it does not represent the industry in general. Companies not registered in Hong Kong or joint ventures were also taken out of the population sample. The common attributes of the culled Contractor population sample are itemised on Table 4. The variable data items, within the culled population sample, are itemised on Table 5.

Common attribute
Approved Contractor on the public works Contractor List of the HKG.
Not a joint venture company.
Questionnaire sent to the Hong Kong registered company address.
General Contractor listed in one, or more, categories of works, which includes: buildings (BD); port works (PW); roads and drainage (RD); site formation (SF); and water works WW).

Table 4 Common attributes of the Contractor population sample.

File	Field data	Field attribute
Contractor *317 records*	CONTRACTOR_REF	Contractor's unique reference code
	CONTRACTOR_NAME	Contractor's name
	CONTRACTOR_ADS	Contractor's address in Hong Kong
	CONTRACTOR_PHONE	Contractor's telephone number
	CONTRACTOR_FAX	Contractor's fax number
	NATION_CODE	Nationality code
	BUS_STATUS	Business status (CO=corp, PT=partnership, PR=proprietorship)
ISO *125 records*	CONTRACTOR_REF	Contractor's unique reference code
	ISO_CERT	Y=yes
Contractor_ List__cat_ _grp *317 records*	CONTRACTOR_REF	Contractor's unique reference code
	CAT_CODE	List category code (BD, PW, RD, SF, WW) (BD, PW, RD, SF, WW)
	GRP_CODE	Group code (A, B, C)

Table 5. Variable data items within the Contractor population sample.

Analysis of the population sample data supplied by the Works Bureau indicates incomplete data across the whole sample. Table 6 lists the attributes of the population sample.

Attribute of the population sample
Of the 317 Contractors in the population sample, 317 (100%) are listed in terms of Category and Group.
Of the 317 Contractors in the population sample, 125 (39%) have ISO 9000 certification.
Of the 129 Group C Contractors in the population sample, 103 (80%) have ISO 9000 certification.
Of the 88 Group B Contractors in the population sample, 15 (17%) have ISO 9000 certification.
Of the 100 Group A Contractors in the population sample, 7 (7%) have ISO 9000 certification.
Of the 129 Group C Contractors in the population sample, 21 (16%) are approved for all five Categories of public works.
(2 Group B Contractors also have five Categories, 0 Contractors in Group A.)

Table 6 Attributes of the Contractor population sample in general.

One company went into liquidation, resulting in population sample for the postal survey of 316 contractors.

ANALYSIS METHODOLOGY
Scoring for each question in this part is consistent with the method used by Betts and Shafagi [6] and Stewart [7] so that a comparison with the UK survey and the Australian survey is possible. Answers are given a score of 1 for a 'D', 2 for a 'C', 3 for a 'B' and 4 for an 'A'. For the purposes of later analysis,

a mean score between 0 and 1, is considered a 'D';
a mean score between 1 and 2 is considered a 'C';
a mean score between 2 and 3 is considered a 'B'; and
a mean score between 3 and 4 is considered an 'A'.

A small number of participants were unable to complete all questions in the health check, and the entire response from this company was then removed from data analysis and the formulation of results. The remaining responses were analysed, and the arithmetic means for each of the questions, for the three groups of questions, and for all the questions, from each respondent were calculated. In these same combinations, statistical attributes were calculated to indicate the frequency distribution and the variability within the sample.

The overall result for each company was correlated to the number of employees in the company. Results were also separated into those companies who had ISO9000 certification and those who did not. This enabled a side by side comparison of results to indicate a possible relationship between quality assurance and strategic use of IT.

Results from the Hong Kong survey

By the March 20, 1998 deadline, 95 questionnaire responses were received. Incomplete responses to the health check survey reduced this to 84 for analysis. The 26% response is deemed adequate for this type of survey. Average scores from each of the 28 questions, for the three major sections, and the responses overall were calculated. Distribution statistics were computed, including standard deviations to measure the variability within the sample. These are listed in Table 7 to show the results overall. In Table 8 the results for Group A, B and C companies are listed. Table 9 contains the results of a check for correlation between number of employees in the company and the results from the survey. In Table 10 the results for companies with ISO9000 certification and those without certification are listed.

	High	Low	Median	Mode	Mean	SD
Competition and Business Strategy	25	8	17	16	17	2.98
Role of IT	19	6	10	10	10	2.36
IT Strategy	53	16	33	30	34	6.05
Overall	97	30	61	51	61	11.89

Table 7. Statistical results from the Hong Kong postal survey of 84 contractors.

Group A (19 Contractors)	High	Low	Median	Mode	Mean	SD
Competition and Business Strategy	22	12	17	17	17	2.54
Role of IT	15	7	10	11	10	2.15
IT Strategy	49	19	32	36	32	6.96
Overall	78	39	59	62	58	9.57
Group B (25 Contractors)	**High**	**Low**	**Median**	**Mode**	**Mean**	**SD**
Competition and Business Strategy	19	11	16	16	15	2.43
Role of IT	15	7	10	10	10	2.04
IT Strategy	49	20	30	28	31	6.29
Overall	81	39	55	51	57	9.41
Group C (40 Contractors)	**High**	**Low**	**Median**	**Mode**	**Mean**	**SD**
Competition and Business Strategy	25	8	17.5	16	18	3.18
Role of IT	19	6	11	10	11	2.52
IT Strategy	53	16	38	30	37	8.69
Overall	97	30	68	63	67	12.86

Table 8. Statistical results by Group, from the Hong Kong postal survey of 84 contractors

All Groups (84 Contractors)	Correlation	Comment
Competition and Business Strategy	0.125	No correlation
Role of IT	0.087	No correlation
IT Strategy	0.093	No correlation
Overall	0.112	No correlation

Table 9. Correlation between number of employees of the firm and the IT Healthcheck.

Contractors with ISO certification *(42 companies)*	High	Low	Median	Mode	Mean	SD
Competition and Business Strategy	23	8	17	16	17	3.00
Role of IT	15	6	11	10	11	2.11
IT Strategy	51	16	35.5	30	35.6	8.68
Overall	89	30	63	63	63	12.38
Contractors without ISO certification *(42 companies)*	**High**	**Low**	**Median**	**Mode**	**Mean**	**SD**
Competition and Business Strategy	25	11	16.5	17	16.5	2.92
Role of IT	19	7	10	10	10	2.58
IT Strategy	53	19	32	36	32.5	7.12
Overall	97	39	59	51	59	11.03

Table 10. Statistical results by ISO certification from the Hong Kong postal survey of 84 contractors.

Comparison with results from a survey in the UK and in Australia

The survey in the UK [7] involved eleven companies whose staff participated in interviews to build a consensus for the response in the health check questionnaire. A similar approach was taken by Stewart [7] in his survey of 48 companies in Australia. The approach taken in Hong Kong is different. The population sample is 316 and more varied than the UK and Australian populations. A postal survey is used in Hong Kong to obtain a response to the health check questionnaire. The extent of consensus building that took place within each company as they decided on an answer to each of the questions is not known. The comparative results, in statistical terms, are shown in Tables 11.

Hong Kong postal survey of 84 Contractors	High	Low	Median	Mode	Mean	SD
Competition and Business Strategy	25	8	17	16	17	2.98
Role of IT	19	6	10	10	10	2.36
IT Strategy	53	16	33	30	34	6.05
Overall	97	30	61	51	61	11.89
UK survey of 11 Companies	**High**	**Low**	**Median**	**Mode**	**Mean**	**SD**
Competition and Business Strategy	26	15	19	19	19	3.13
Role of IT	17	8	12	14	12	2.6
IT Strategy	55	37	47	37	47	6.21
Overall	96	60	77.55	84	78	11.07
Australian survey of 36 companies	**High**	**Low**	**Median**	**Mode**	**Mean**	**SD**
Competition and Business Strategy	55	23	39	35	40	8.28
Role of IT	17	7	12	12	12	2.56
IT Strategy	25	13	19	17	19	2.94
Overall	94	47	70	66	71	12.05

Table 11. Comparison of statistical results from the IT Healthcheck survey in the UK, Australia and Hong Kong.

Conclusions

A side-by-side comparison of the overall results from each survey is shown in Table 12. The statistics have been converted back into the grading used in the questionnaire, except for the standard deviations. To introduce more sensitivity into the differences, the grading is further given +ve or –ve bias to better indicate intermediate positions. Also, a score falling on the mid-point between grading is given the combined grade, i.e., 84 = BA and 26=D+.

National Survey	High	Low	Median	Mode	Mean	SD
Survey of 84 HKG works contractors	A	C-	B-	C+	B-	11.89
Survey of 36 Australian construction firms	A	D	B	B	B	12.05
Survey of 11 UK construction firms	A	B-	B+	BA	B+	11.07

Table 12. Comparison of the surveys carried out in HK, Australia and the UK.

The variability of the results obtained is similar in each of the national surveys even though there are differences in survey methodology. No correlation is found between the numbers of permanent employees in the Hong Kong companies and their self-assessment of their use of IT. In the Hong Kong survey, there is slight evidence that those contractors who have a quality assurance certification adopt IT for strategic reasons to a greater extent than those without the certification. The results overall also indicate that the Group C Hong Kong contractors, who are approved for public works projects in excess of HKD $50 million, perform moderately better in the assessment than Group B and Group C. The latter, are similar in their overall performance. In terms of the national surveys carried out in the UK and in Australia [7], and also in Hong Kong. The overall results are similar: the overall mode and the overall mean indicate that the UK is performing better than Australia, and Australia is performing better than the Hong Kong contractors. However, the bias due to differences in the survey methodology is not evident in the in Table 12. The strengths and weaknesses of the overall results from the Hong Kong contractors is shown in Table 13.

Question	Perform very poorly D	Perform poorly C	Perform well B	Perform very well A
IT support of core competencies.			Yes	
How IT helps company compete.			Yes	
Impact of IT on goals and objectives			Yes	
Position of IT compared to others.			Yes	
Impact of IT on Clients.			Yes	
Belief that IT expertise wins work.			Yes	
Use of IT as part of strategic alliances.			Yes	
Current use of IT in the company.			Yes	
Relationship between IT and business strategy			Yes	
Participation of IT in forming business strategy		Yes		
Impact of IT on operational strategy.			Yes	
IT influence on marketing strategy		Yes		
Use of IT systems in company		Yes		
Objectives of IT strategy.		Yes		
Thrust of IT strategy		Yes		
Management of IT in the future			Yes	
CSF's for competitive advantage through IT			Yes	
Management of IT projects and innovation.			Yes	
Level of R&D in IT		Yes		
Nature of IT department.		Yes		
Importance of IT skills in company.		Yes		
Awareness of IT strategy.			Yes	
Involvement of Users in IT strategy.			Yes	
Risks associated with IT strategy.		Yes		
Periodic review of IT strategy.			Yes	
Measurement of IT performance.			Yes	
Characteristics of IT strategy.			Yes	
Who champions IT in the company?			Yes	

Table 13. Graded performance overall of the postal survey of 84 Hong Kong contractors.

In terms of each of the 28 questions, the Hong Kong contractors performed-well overall in 64% of the questions, and performed-poorly overall in 34% of the questions. Stewart [7] lists those areas in the questionnaire that show the Australian companies to perform-well and those that indicate that they perform-poorly. He also cites the areas that the UK companies performed-well, and the areas they performed-poorly. The threshold for the distinction of performing well, or of performing poorly, is not stated. It is therefore not possible to include in this paper a meaningful comparison of results, in terms of specific strengths and weaknesses. However, the results for the Hong Kong survey are described by a categorisation stated by Betts:

A = Perform very well
B = Perform well
C = Perform badly
D = Perform very badly

Table 13 is a list of the paraphrased questions and the overall grading achieved by the Hong Kong contractors according to this measurement of performance. The performance overall is neither outstandingly-good or outstandingly-poor. In general, the assessment is that the Hong Kong contractors perform well in most aspects other than including IT in the formulation and delivery of the business strategy and in the marketing strategy. The use and thrust of the IT is not aligned with the goals and objectives of the company. The level of R&D is not high. IT staffing, expertise and skills are not rated highly. Possibly for that reason, the risks associated with IT are perceived as financial, or technical, and not business or strategic risks.

For reasons already explained this survey is subjective. However, the evidence gained indicates that the extent of the strategic use of IT by the Hong Kong contractors is much the same as their counterparts in the UK and in Australia.

References
[1] TDSR, (1998) The territorial development strategy review. Government of the Hong Kong Special Administrative Region of China: Hong Kong Government Printer.
[2] Futcher, K., and Thorpe, T., (1998) The significance of data 'held in context' in project information management systems. Proceedings of the second international conference on construction project management. Singapore
[3] Wickard, D and Schmitz, J and Li, K. "Taking Project Management Abroad: Technology Transfer in PM - Lessons Learned" Project Management Institute 27th Annual Symposium 1996 Boston: Project Management Institute
[4] Futcher, K. (1997) Core-process redesign for productivity gain in the public works organisation of the Government of Hong Kong. Proceedings of the international conference on construction process re-engineering. Ed. Sherif Mohamed. Griffith University: Queensland.
[5] Cleland, D.., and King, W. 1983. Systems analysis and project management. McGraw-Hill International Editions: Singapore.
[6] Betts, M., and Shafagi, M. (1997) A strategic IT health check. Construct IT Centre of Excellence, University of Salford
[7] Stewart, P., (1997) The Australian experience of the Strategic IT Health Check. Unpublished Strategic Healthcare Check Report, RMIT University