

THE IMPACT OF CONSTRUCT I.T. AND THE MANAGEMENT OF ORGANISATIONAL CHANGE

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ABSTRACT

The paper introduces preliminary findings derived from a research project that aims at exploring the state-of-the-art of IT applications in the construction and property industry in Hong Kong and assessing their impact on the industry, at both organisational and individual levels. It also aims to assist organisations in the industry to understand IT's impact, and to act positively in designing and managing organisational changes, so as to enhance the competitiveness of local business and industrial sectors, and widen the scope of IT applications.

IT applications are probably the most visible technological change in recent years. Through case studies, this paper illustrates the changes IT can bring into the construction and property industry, and the importance and methods of managing planned change, by which the ability of an organisation to adapt to changes can be improved, and employee behaviour can also be changed.

Keywords: IT, Organisational Impact, Management of Change

1. INTRODUCTION

The construction and property industry's output in Hong Kong approaches HK\$260,000 millions in 1995, which represents some 24% of the territory's GDP. Capital investment in property accounts for around 55% of Gross Fixed Capital Formation in Hong Kong, of which construction contributed more than 30%. Property-related stocks are about 45% of the total stock market capitalisation. With constantly expanding market opportunities, the contribution of the industry to the prosperity of Hong Kong and the creation of a better living environment in the forthcoming years will be outstanding.

There are a number of publications regarding IT applications in Hong Kong. However, no work has been done at a significant scale to investigate the impact of IT applications on the construction and real estate industry in Hong Kong, some fundamental questions relating to the full scale by which IT is applied in the industry have not been fully addressed. For example, what types and sizes of business have taken up IT, what types of IT have been applied and what are their functions, what hardware and software are used to develop and implement IT, how successful IT has been developed and implemented in the industry, what are the main benefits enjoyed by users and main difficulties they encountered, what are the future prospects for IT.

IT has already had significant impact on organisations in Hong Kong, much more dramatic effects are anticipated during the remaining years of the 1990's and the forthcoming 21st century, as Hong Kong moves from a labour-intensive manufacturing centre towards a more advanced skill base. Unfortunately, most applications so far are at microscopic level focusing on individual problem-solving facilities. Much of the impact has been allowed to just happen, without planning, and without accommodating changes in organisational structures and business processes. The result has been that the full potential of IT to improve organisations' efficiency, effectiveness and flexibility

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has seldom been reached. Greater attention must be paid to the interaction of IT with business methods, work patterns, employees and organisational culture.

2. BACKGROUND OF THE RESEARCH

Although it is an established policy of the Hong Kong Government that full advantage should be taken of modern IT (ITSD, 1994), the Government has adopted a laissez-faire policy towards the implementation of IT in the construction and property industry. In contrast to the supporting role the Hong Kong Government has adopted towards IT in the industry, the Singapore Government has taken the initiative in developing a National Information Technology Plan (NITP) in 1986 which provides a blueprint for an action calls for the exploitation of IT to develop a strong export-oriented industry. There are seven interactive elements in the plan: IT Industry, IT Manpower, Information Communication Infrastructure, IT Application, Coordination and Collaboration, IT Culture, and Climate for Creativity and Enterprise.

The construction sector in Singapore is taking up the challenge to work towards the success of the NITP and how the strategies proposed under the NITP can be adopted for the construction industry. Major development in this regard include work carried out in CAD data exchange by Gruman International/Nanyang Technological Institute Centre, the Public Works Department's Project Management Information System, the BuildNet as a construction EDI network by the Construction Industry Development Board, a national graphics database by the Singapore Institute of Architects, and the S\$ 3 million CONCERT concurrent engineering project.

The British Government has taken an early lead in launching the Alvey Programme of Advanced IT in 1983, with a budget of £350 million, aiming to stimulate research and development of IT. Professional bodies in the UK construction industry have also taken a leading role in introducing IT. In 1986, for example, the QS Division of the Royal Institution of Chartered Surveyors, with the financial assistance (£250,000) of the Alvey Directorate and in collaboration with the University of Salford, started the most ambitious research project it has ever undertaken before to investigate the potential of expert systems in quantity surveying, and to produce a prototype system to introduce the profession into the IT era, which leads to the creation of the ELSIE systems.

This research aims at investigating the current state-of-the-art of IT in the construction and property industry in Hong Kong and assessing their impact on the industry qualitatively and quantitatively. It also aims to assist organisations in the industry to understand the impact of IT, and to act positively to design and manage the future, so as to enhance the competitiveness of local business and industrial sectors, and widen the scope of IT applications. It will examine IT in both the public and private sectors and assess their impact at both organisational level and individual level.

It is planned to obtain an up-to-date and holistic view of the state of operational IT in Hong Kong and its impact on the construction and property industry in terms of the stakeholders and the life cycle of building products. All relevant disciplines of the industry will be the subjects of this study. They include architects, structural engineers, building services engineers, quantity surveyors, project managers, contractors and other property professionals. It will also highlight best practices to be followed and pitfalls to be avoided for managers interested in introducing IT in their companies. This research will elevate similar investigation from the bean-counting microscopic level to the macroscopic organisational level, from efficiency considerations to questions of effectiveness, and from a cost-accounting perspective to a managerial one.

The specific objectives of this research in logical sequence are as follows:

1. to identify the **awareness** of IT in the industry,
2. to explore the **opportunities** offered by IT,
3. to provide solutions for firms to **position** themselves in the IT era,
4. to advice on management of organisational change due to IT.

The information gathered from this project will provide first-hand information on how well the construction and property industry in Hong Kong has equipped with IT and what impact IT has created on the industry. This information will be useful in the following four areas: (i) it will be essential for relevant Government departments to prepare strategies for IT in the construction and property industry; (ii) it will promote the awareness of commercial benefits of IT among managers in construction and property companies in Hong Kong and encourage them to seriously consider IT in their business; (iii) the research will also increase the competence and confidence in applying IT by local companies by providing management guidance on the selection and development of IT applications; and (iv) it will be greatly beneficial to the teaching and further research of construct IT in all organisations involved in the tertiary education in Hong Kong.

3. THE IMPACT OF CONSTRUCT IT

3.1 Models for Assessing the Impact of IT

Although no agreement has been reached on why and how IT affect organisational life, it is generally accepted that effectiveness and efficiency are the major factors to be considered. There are two schools of thoughts in analysing the impact of IT: organisational theory and information economics (Burn, 1989).

Organisational theory focuses on the behavioural, social and psychological aspects of individual members of an organisation and on the political structural and operational aspects of groups of individuals. The introduction of new technology, tasks, power structures or other changes can be viewed as a disturbance to the equilibrium of the organisation, which may provoke both intended and unintended changes along a variety of dimensions.

Information economics focuses on the micro-process by which the availability of information can affect the outcome of a decision and thereby affect the utility of the decision making unit. In this context, a change in an organisation's information system will act on utility by producing a change in the set of information available to one of many decision making units within the organisation.

3.2. The Impact of IT on the Construction and Property Industry in Hong Kong

The impact of IT on construction has long lagged behind other major industrial sectors. Little has been reported on the organisational and structural impact of IT applications on the construction and property industry in Hong Kong.

Ng and Lansley (1993) reported a survey of middle managers of Chinese building firms in Hong Kong regarding the impact of IT. They examined the impact of computers on organisational structures and management styles. According to this study, the introduction of IT has had significant impact on both organisational structure and management style of the firms. Organisations have become more centralised, specialised and routinised, with top management becoming more central to the decision making process. As a result of this, top management has become more autocratic, which is unhelpful, as they argued, to the functioning of middle managers and may have prevented the full realisation of the benefits of IT. Because of the availability of information through IT, top

management has become more involved in the routine decision making, rather than be freed to deal with more strategic issues. On the other hand, those middle managers who are in a better position to handle the routine decisions, have become less involved.

Another study by Tang (1993) on computerisation in the Quantity Surveying Branch of the Architectural Services Department has also suggested that the organisational impact of IT cannot be overlooked. The organisational structure of QSB has been changed because of the computerisation. However, it is not well received by the professional staff who felt most of the clerical work has now been shifted to them, they have to spend more time to produce the same amount of work, because additional time was spent in inputting data into computer systems. They also felt that top management demanded more information after the computerisation. It is therefore suggested that the QSB staff members are unwilling to accept the change created by computerisation. This situation would be significantly improved if the end users i.e. QS professionals were brought in the decision process. Their involvement would create a sense of ownership, reduce resistance, obtain commitment, and increase the quality of the change decision.

The computerisation in the QSB also has some impact on other organisations, in particular, private consulting QS firms which have business connections with the QSB have been encouraged (or forced) to use computers. In one way or another, they have to match the format of the computerised output of bill of quantities and other documents. Similarly the Mass Transit Railway Corporation requests all contractors to submit tenders on diskettes.

It is obvious the IT has made some impact on the construction industry in Hong Kong to date, but in comparison with other industries, the impact is too little and too late. By and large the industry has computerised its traditional systems, without changing relationships within the construction team or crossing professional boundaries, whereas other industries such as the airlines, banking and retails have found that IT has broaden their perceptions of how things can be done differently and IT has changed the way they do business to a much more effective and efficient way.

The research will investigate the impact of IT applications further. It will address the impact in the entire life-cycle of a project, from inception, through design and documentation to construction and occupation. The life-cycle consideration is important because much construction information is created, discarded and recreated again for other purposes. Much research and development attention is being given to the integrated building model which can serve the needs of all stages of the project life-cycle. One possible solution for coordinating professionals effectively and efficiently at the design stage is through value management (Shen, 1995).

4. MANAGEMENT OF ORGANISATIONAL CHANGE

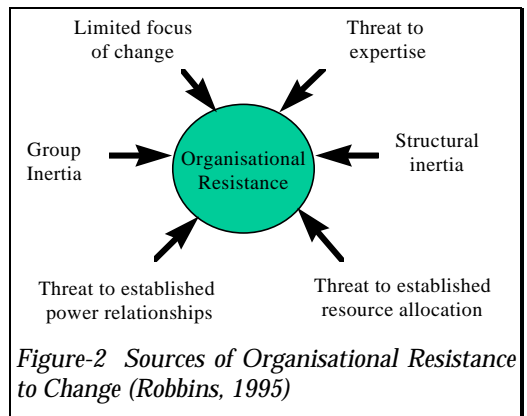
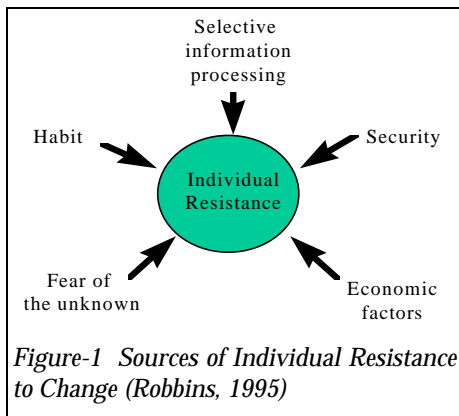
Many organisations face a dynamic and changing environment that requires these organisations to adapt and to implement comprehensive change programmes. There are a number of changing internal and external factors which make changes necessary. They include nature of workforce, technology, economy, social trends, competition, and politics. Among technology changes, the most noticeable change in recent years is perhaps the expanding IT. Many organisations in the construction and property industry have complex information systems and they found themselves become increasingly dependent on these systems. IT has significantly changed the office environment which is dramatically different from its counterpart of the 1970s.

As put by Robbins (1995), one of the most well-documented findings from studies of individual and organisational behaviour is that organisations and their members resist change. The implementation

of IT will not work unless the change resulted from the implementation can be foreseen and managed accordingly. The two case studies stated in the previous section have already demonstrated the necessity to manage change brought by IT.

Resistance to change can appear in a number of different ways. It can be overt or implicit, immediate or deferred, and it is more challenging to manage implicit and deferred resistance than to manage the overt and immediate ones. As shown in Figure-1, five reasons have been identified which explain why individuals may resist change. They are habit, security, economic factors, fear of the unknown, and selective information processing. The first four reasons are self-explanatory, whereas the last one means that people have their perceptions of the world, they hear what they want to hear and ignore the information that may challenge their perceptions.

Since organisations are comprised of a group of individuals, individuals' resistance to change will inevitably reflect in organisational behaviour. Organisations, by their very nature, are conservative (Robbins, 1995). In comparison with other industries, the construction and property industry is perhaps the most conservative industry among others. It is certainly considered by the public as one of the backward industries. Robbins has identified six major sources of organisational resistance. As shown in Figure-2, they are structural inertia, limited focus of change, group inertia, threat to expertise, threat to established power relationships, and threat to established resource allocations.



Although the last three sources are easy to understand, the first three sources need some explanations. The structural inertia refers to the built-in mechanisms which produce stability. When an organisation is confronted with change, this structural inertia acts as a counterbalance to sustain stability. Limited focus of change implies that organisations are made up of a number of inter-dependent subsystems, the change of a subsystem necessitates the change of others. It supports the argument that a change in the technological processes is not likely to be accepted unless simultaneously modifying the organisational structure to match. Group inertia refers to that even if individuals want to accept change, group norms may act as a constraint.

The tactics that can be used in managing resistance to change are: education and communication, participation, facilitation and support, negotiation, manipulation and co-optation, and coercion. Two viable approaches to managing change as a result of IT applications are: the classic three-step model of the change process developed by Lewin (1951) and the present rational action research model. The first approach follows three steps: **unfreezing** the status quo, **movement** to a new state, and

refreezing the new change to make it permanent. The second approach follows a series of rational actions: diagnosis, analysis, feedback, action, and evaluation. Because it is a problem-focused and it brings employees into the change process, resistance to change is reduced.

5. PLAN FOR FURTHER INVESTIGATIONS

This research plan is based on the desired characteristics of the project. In order to achieve the objectives, the following instruments will be used for the research: structured questionnaire survey and follow-up interviews. To ensure the reliability of the survey data and a reasonable high response rate, the questionnaire will be carefully designed and pilot work will be conducted by the research team. Following detailed analyses of the responses, additional follow-up interviews will be carried out to further investigate particular interesting cases and to explore people's views and experiences in greater depth. It is envisaged that this project will consist of six major distinguishable stages (some of them are overlapped). A brief description of the major phases is as follows:

5.1 Questionnaire Design and Survey

Based on the information gathered through literature review, a questionnaire regarding the use of IT in the construction and property industry in Hong Kong and the impact created by IT on the industry will be designed and tested through pilot works. In the private sector of the construction and property industry, it is estimated that there are some 9000 contractors, 400 professional practices, over 20,000 manufacturers and suppliers of construction materials. A sample of 800 companies in the private sector and all relevant Government departments will be selected for the survey including: Buildings Department, Department of Civil Engineering, Architectural Services Department, Housing Department, Drainage Services Department, and Department of Highway.

The following areas of IT will be investigated in details: IT coverage (e.g. types and size of business has taken up IT, types of computer applications and their functions); development and operation (e.g. how successful IT have been developed and implemented); problems and benefits (e.g. main benefits enjoyed by users and main difficulties they encountered with IT); outlook for IT (e.g. the future prospects for IT in the construction and property industry in Hong Kong). The data gathered from the survey will be stored in a sophisticated statistical package, namely SPSS/PC and will be analysed both qualitatively and quantitatively.

5.2 Follow-up Interviews and Impact Assessment

The above questionnaire survey should reveal a holistic view on the current state of IT applications in the construction and property industry in Hong Kong. It is planned that some 50 follow-up interviews will be conducted in order to investigate the problem areas in more depth. In order to assess the impact created by IT on the industry, an appropriate model for assessing the impact will be selected and tested with two large organisations. Necessary modifications will be made on the model to suit the nature and specific needs of this study. The revised model will then be applied to this research project.

The impacts of IT will be further investigated at individual and organisational levels. At individual level, it examines the ease-of-use of a computer system, how a system matches the task of the manager, impact of a system on task content, and satisfaction of the manager with the system. At organisational level, it studies the impacts of IT on discretion/autonomy of different types of managers, on leadership style, on relationship between manager and subordinates, on organisational control and power structures, and on centralisation or decentralisation of organisational structure.

The study will make a “before” and “after” comparison and take into account a wide variety of variables involving different theoretical models and different levels of analysis.

5.3 Comparative Studies with UK and Singapore

It is planned to undertake a comparative study to identify how well the construction and property industry in Hong Kong stands among other developed countries in the IT era, and to reveal the differences between these countries and the reasons behind them. Two countries will be chosen for this purpose: Singapore and the UK. Singapore is chosen because it is similar to Hong Kong in terms of history of economic development, size of the economy and the industry concerned. Although the size of the economy in the UK is much larger than the one in Hong Kong, for historical reasons, the construction and property industry in Hong Kong is very similar to the one in the UK. A comparison between Hong Kong and the UK is therefore also planned.

6. CONCLUSIONS

To date, IT has made little impact on the construction and property industry in Hong Kong. Unlike other industries, IT has not received adequate attention from managers in the industry. Results of the questionnaire survey, follow-up interviews, and comparative study will be presented at the later stage of the project. It is envisaged that findings of the research will provide essential information for the Government to prepare relevant policies regarding the applications of IT in the construction and property industry in Hong Kong.

While the theme of much of today's IT is convergence, there has been a steady divergence of research, development and practice in the construction and property industry. It is envisaged that this research would contribute in bridging the gap between researchers and developers on the one hand and building industry professionals and practitioners on the other.

The success of IT applications to a large extent relies on the industry's attitude towards IT. The rapid growth of personal computing may soon bring about a significant change in the industry's attitude towards IT. Given the competitive nature of the construction and property industry in Hong Kong, we must do whatever we can to make the most from IT as business needs and technology change, and to make IT a strategic contributor to the success of our business. Previous studies already show that, once behind in IT applications, it is almost impossible to catch up.

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