The Effective Use of Geographic Information System (GIS) in the Planning Departments, Kuala Lumpur City Hall (KLCH)

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ABSTRACT

The paper presents the important factors associated with the effective use of GIS at the Department of Urban Planning (DUP) and the Master Plan Department (MPD) of the Kuala Lumpur City Hall (KLCH) Malaysia. The development of GIS has progressed dramatically in recent years and its use has proliferated in government planning departments in Malaysia. The majority of the information utilised for planning activities such as development control has a geographical component. The aim of the paper is therefore to identify and investigate the level of GIS usage at local planning departments in Malaysia and how it could be used effectively for planning activities. This paper employed a combination of a case study, a semi-structured interview, and a survey questionnaire and observations of the activities of the department. The findings demonstrate that the skill, knowledge and training influence the planning staff to use GIS effectively. At the same time, GIS has various impacts, such as benefits and problems, on the planning departments and the staff involved. It is proved that the manner in which these factors interact with the GIS determines the processes which affect the effective utilisation process of automated systems.

Keywords: GIS; planning departments; benefits and problems; effective use.

INTRODUCTION

The introduction of computers into urban planning activities in 1950s and 1960s forms part of a more fundamental transition of the planning authority from the profession's traditional concern with the design of the physical city to a new focus on the quantitative techniques and theories of the social sciences (Huxhold and Levinsohn, 1995; Klosterman, 2001; Harris and Batty, 2001; Yaakup et al., 2005; Yaakup and Sulaiman, 2007). Planners were in fact one of the earliest users of computers in local government utilising the facility introduced to serve the operational needs of finance departments in order to fulfil more strategic functions (Yeh, 2005; Batty, 2005; Bernhardsen, 2005). However, at that time, the initial access by planners to mainframe computing technology was indirect and had not been used extensively (Prastacos and Karjalainen, 1990; Masri and Moore, 1993). It was very expensive and the usage of information technology among planning departments was limited.

Given the dynamic nature of integrating GIS in the planning process, the planning authorities in developed countries become the largest users of GIS (Yaakup et al., 2005). However, in Malaysia only small numbers of district councils and municipalities have invested in GIS (Yaakup et al., 2005). The previous reluctance of local authorities to embrace the technology was mainly due to the lack of support from the management level; lack of in-house expertise to make use the system; and the cost of GIS software. At the same time, there has been no empirical study which examines the utilisation of GIS in local planning authorities in Malaysia. Thus, as the implementation of GIS is a process embedding the technology-and-its-social system, there is an urgent need to investigate level of GIS usage which can incorporate for the effective use of GIS. The step taken by the DUP, Kuala Lumpur City Hall (KLCH)

through the development of an integrated development control system is seen as an innovative approach to urban planning. The system was designed to cover all the necessary work process involved in development control and approval which supported by GIS application. The paper further explains the relevance of GIS utilisation in the local government planning departments in Malaysia. This will be followed by the discussion of the benefits and drawbacks of the system.

AIM AND OBJECTIVE

As GIS is becoming important for planning activities at local planning departments in Malaysia, the aim of the paper is therefore to identify and investigate the level of GIS usage at local planning departments in Malaysia and how it could be used effectively for planning activities. The objectives are as follows:

a) To identify the level of usage of GIS at planning departments of KLCH; and
b) To identify the role played by the individual planning staff in utilising GIS;

INFORMATION SYSTEM AND PLANNING PRACTICE

The understanding of the information systems and planning practice are fundamental to understanding the issues involved in the need for information technology such as GIS in the local government planning departments. Information system can serve as the eyes and ears to development planning and monitoring process (Yaakup and Sulaiman, 2007). It provides for the monitoring and surveillance of compliance with planning regulations and it serves as early warning systems with regard to sources of friction, imbalances, shortfalls and failures in the process of planning and management.

More fundamentally, Klosterman (2001) and Harris and Batty (2001) suggest the search for an appropriate role for computer-based information and method in planning must not begin with a particular technology (or set of technologies) but rather with a conception of planning. In this context, the introduction of particular technology such as GIS or expert systems and then seeing how this tool can be applied to planning threatens to distort the nature of planning. It does so almost inevitably-and unconsciously-by focusing attention on those aspects of planning for which a particular tool is appropriate to be used and neglecting other aspects for which it is less suitable. Klosterman (2001) notes that it was assumed that information technology would play an increasingly important role in collecting and storing the required data. It also proves that such system models could describe the present and project the future, and helping unambiguously to identify the best plan from the range of available alternatives.

GIS IN URBAN PLANNING AND MANAGEMENT

It is assumed that information technology such as GIS is important and cannot be detached from the institutionalisation of planning and the current pressures in contemporary society to reinforce the role of the individual, and to enable a more self-help society to emerge (Batty,

1991 & 2005). As such, technology in planning is dictated by what planners do. Thus, it is hardly surprising that information technology is mainly used in the most modest of applications for comparatively lowly functions involving information, data, and communications rather than the more sophisticated functions associated with modelling, forecasting and design (Batty, 2005). Thus, GIS is most appropriately conceptualised as a package which includes individual staff, organisation (planning department) and technology (GIS technology – hardware and software).

In the 1950s and 1960s, the paradigm which most influenced the development of urban planning was based on a general system theory (Bernhardsen, 2005; Campbell 2005; Drummond and French, 2008; Harris and Batty, 1992; Klosterman, 2009; Longley *et al*., 2005). Cities and regions were considered to be complex systems in which the structures could be understood in terms of hierarchies of subsystems, spatial and otherwise, embedded within dynamic frameworks whose equilibrium properties were assumed to be quite tractable. Planning such systems was seen as one of optimising some general system properties, such as utility or welfare, and the ideal type of system model embodied such optimisation in terms of system behaviour (Batty, 1991; Drummond and French, 2008; Harris and Batty, 1992). Harris and Batty (1992) argue that this characterisation was clearly an ideal type as nowhere did any city or regional system closely approximates this type of functioning. In fact, this view of system models merely pointed the direction towards optimisation in that, although models of the system could be developed in terms of optimal and non-optimal behaviour, such models were seen as simply informing the wider and more significant process of planning. This existed as part of a still wider political reality (Batty, 1991; Carsjens and Ligtenberg, 2007; Harris and Batty, 1992 & 2001)

In this context, urban planning embraced system models and these models were, regarded as embracing the information systems useful in making them operational. The process or relating information, model and planning systems, however, were structured in a sequential process beginning with description and understanding, continuing through the survey and information systems design. This was enhanced through system modelling, which then moved into a design phase in which alternative plans were generated and evaluated often through predictive and prescriptive system models (Drummond and French, 2008; Harris and Batty, 1992; Klosterman, 2009).

The shift from planning as a process of optimising spatial allocation, in terms of limited efficiency and equity to one based on much more general, broader-based issues of equity, serves to increase perception that the use of GIS represented the way forward to better planning (Batty, 1991; Carsjens and Ligtenberg, 2007; Drummond and French, 2008; Harris and Batty, 1992; Klosterman, 2009). The computer revolution in mid-1970s began to make GIS widely felt in a personal context with the development of the microcomputer. It clearly provided advances in graphics enabled computer mapping to become routine (Drummond and French, 2008; Klosterman, 2009).

As planning becomes more pragmatic and concerned with individual systems, the demand for data systems relating to facility location and scheduling, such as emergency services, to resource management and conservation, to property and to tax registers increased the need for GIS (Harris and Batty, 1992; Rushton, 1993). Thus, GIS was developed in as a simple form as possible so that it could be adapted to a wide variety of basic tasks of planning activities and processes and required planning staff with strong GIS knowledge and skills.

METHODOLOGY

This paper employs a case study method eliciting data which includes a questionnaire survey and a semi-structured interview. A case study approach has been selected in order to obtain the depth of study required to investigate the complex and interrelated institutionalisation processes underlying the use of GIS at the DUP and the MPD, KLCH. The DUP and the MPD of the KLCH had been chosen on the basis of statutory responsibilities, active involvement with the development of GIS in the development control and the support and willingness given to facilitate the study.

a) A Case Study Approach

A case study approach was employed as one of the stages of collecting data. It provides the most appropriate basis for exploring the complex processes influencing the utilisation of information technology in organisations (Khalfan, 2004). This approach refers to an in-depth study or investigation of a contemporary phenomenon using multiple sources of evidence within its real-life context (Khalfan, 2004; Yin, 1994). A case study approach is the most appropriate approach for exploratory and explanatory research since it is able to capture a greater depth and breadth of detail on the subject's activity. It helps to construct validity which will be established by triangulation, chain of evidence and formal review by the interviewees for verification. It has been suggested by researchers within the GIS community that a case study approach is appropriate for researching a range of GIS implementation, utilisation, and diffusion issues (Budic and Godschalk, 1993; Onsrud *et al*., 1992; Onsrud *et al*., 1993).

In this study, the Kuala Lumpur City Hall (KLCH) has been selected as a case study. It focused on two planning departments; the Department of Urban Planning (DUP) and the Master Plan Department (MPD) which was undertaken from November 2007 to February 2008. The DUP and MPD are appropriate choices because they act as primary sources for gathering information about the implementation and the use of GIS. These two planning departments had been chosen on the basis of statutory responsibilities, active involvement with the development of GIS and the support and willingness given to facilitate the study.

b) Questionnaire Survey

A stratified random sampling technique was adopted in selecting the sample in order to represent the planning staff that have used GIS or are learning to use GIS. For this purpose, the planning staff from the DUP and the MPD, KLCH was stratified according to their positions which consist of planning officers, technical assistants and draughtsman. The questionnaire contains four main sections namely i) respondent profile; ii) experience and complexity in using GIS; iii) attitude towards work-related change; and iv) the relationship between the planning staff and GIS. Response were scored on a five-point Likert scale ranging from (1) “strongly disagree” to (5) “strongly agree”. The survey had been designed to investigate the degree of GIS usage at the DUP and MPD. The first section, the survey questions associated with the respondents’ backgrounds. The second section asked respondents about their experiences and problems while using GIS. The respondents were asked about the purposes of using GIS and whether or not do they have requested any information about GIS from colleagues. The third section asked respondents about their

changes from the old method (drafting board) to computer-based information systems. The final section asked respondents about the relationship between planning staff and GIS. As a result, a sample of 153 respondents (n = 153) was selected with a 95% confidence level.

c) Interview

In total, 16 respondents were selected for the interview. They were planning officers and top managements officers involved in the development of GIS for the planning activities. They were selected based on their educational backgrounds and experiences in urban planning departments, and their roles in the planning departments concerning policy-making, management and research. This was undertaken in order to ensure that they have a relatively high level of knowledge and expertise in the field. At the same time, they are also involved in managerial and decision-making positions which indicate that they have influence over policy and/or practice on the ground. They are grouped according to the nature of their positions, namely planning directors, deputy directors, senior town planning officers and planning officers.

METHOD OF ANALYSIS

A combination of both qualitative and quantitative methods of data analysis gives a comprehensive explanation of the gathered information. The data collected from the survey were analysed by statistical analysis and content analysis. The quantitative data which were measured in numbers were analysed using descriptive and inferential statistics. The interview data were analysed using content analysis.

a) Descriptive Analysis

The data sets obtained from the questionnaire survey were analysed using the Statistical Package for Social Sciences (SPSS) Version 12 software. The types of data used are nominal, ordinal and categorical. Discrete data presented are individually organised by listing the attributes of each case and are presented in raw numbers or percentage analysis. Continuous data, such as age, race, educational background, discipline, position/job title and years of experience, are grouped together in order to allow the data to be presented in a more manageable form. This type of data is presented in the form of summary averages or measure of central tendency which includes mode, mean and median.

b) Content Analysis

The analysis of data was conducted through a content analysis technique. Content analysis has become a research tool used by social scientists in making inferences. It has been defined as a systematic, replicable technique for compressing many words of texts into fewer content categories based on explicit rules of coding (Krippendorff, 1980). The process of content analysis simultaneously involves the coding of raw data and the construction of categories that capture relevant characteristics of the document's contents (Tahir, 2005). In this study, data from the interviews were transcribed and the results are presented in the form of content analysis in order to support and provide more insight into the issues discussed.

ANALYSIS AND FINDINGS

a) Perceptions of GIS Users

The analysis indicates that there is a high level of use of GIS in the MPD and DUP, KLCH although most of the planning staffs need at least 1 to 6 months to change from manual to the use of GIS. This shows that changing from the manual method to computer-based systems required more time for staff in order to understand GIS before it can be used for planning activities. The important role highlighted here is the way the planning departments and officers have encouraged the staff to use GIS. This is a reflection of the implementation of GIS in the planning departments of KLCH since it was introduced in 1995. In 1997, the DUP appointed an external GIS consultant to help formulate an IT strategy specifically on the use of GIS for planning activities. Ten years later, the adoption and the utilisation of GIS in planning processes and activities have been successful. The continuous GIS training and courses provided have been identified as important steps for helping staff in using GIS. In addition, based on the perceptions by the respondents, most of them (88.2%) agreed that the use of GIS in planning activities has changed the nature of their jobs compared to before they started using GIS. There are no longer drafting boards, scale rulers, sets of water colour and technical pencils used in the planning processes and activities. Everything is now based on the commands on computer screens.

The independent-samples t-test is conducted to compare the mean differences for using GIS between the MPD and the DUP. Nine purposes for using GIS have been tested. Five purposes showed significant differences. They are keying-in data (t=3,247, p=0.001); retrieving data (t=2.607, p=0.010); printing plans (t=4.265, p=0.000); preparing and printing reports (t=2.828, p=0.005); and conducting presentations (t=2.674, p=0.008) (Table 1).

Table 1: Mean differences of the purposes of using GIS according to departments

Purposes	Departments	N	Mean	t	df	p
Key-in data	MPD	70	4.36	3.247	151	0.001
	DUP	83	3.94			
Retrieve data	MPD	70	4.29	2.607	151	0.010
	DUP	83	3.95			
Print plans	MPD	70	4.39	4.265	151	0.000
	DUP	83	3.81			
Process applications	MPD	70	3.70	-0.316	151	0.752
	DUP	83	3.75			
Analysis	MPD	70	3.93	1.958	151	0.052
	DUP	83	3.65			
Prepare and print	MPD	70	4.01	2.828	151	0.005
reports	DUP	83	3.61			
Presentations	MPD	70	3.96	2.674	151	0.008
	DUP	83	3.58			
GIS models	MPD	70	3.60	0.899	151	0.370
	DUP	83	3.46			
System management	MPD	70	3.39	0.083	151	0.934

	DUP	83	3.37				

The results indicate that the mean differences of keying-in data, retrieving data, printing plans, preparing and printing reports and conducting presentations at the MPD are higher than the DUP. This shows that the visibility use of GIS at the MPD is important in order to see the impact for the development and preparing plan processes. This also explains the need to impress upon the top management on GIS implementation at planning departments. These findings correlate with a view by Gill *et al*., (1999) which mentioned that GIS provides an important and useful first stage data handling and presentation within problem-solving processes. Thus, this helps management officers at the decision-making stages as it will support the monitoring processes.

The independent-samples t-test is conducted to compare the mean differences in the benefits of using GIS between the MPD and the DUP (Table 2). Based on the independent t-test, there are mean differences of the benefits of using GIS between the two planning departments at a significant level of p=0.05. The study identifies six benefits which differentiate the two departments. They are improved data sharing (t=2.146, p=0.033), time saving (t=2.495, p=0.014), data standardisation and centralisation (t=2.743, p=0.007), increased productivity (t=3.520, p=0.001), ease of use (t=2.478, p=0.014) and improve decision-making (t=2.305, p=0.023).

Table 2: Mean differences of the benefits of using GIS between planning departments

Variable	Department	N	Mean	SD	t	df	p
Improved data management	MPD	70	4.01	0.577	0.973	151	0.332
	DUP	83	3.90	0.790			
Improved data sharing	MPD	70	4.01	0.648	2.146	151	0.033
	DUP	83	3.77	0.738			
Time saving	MPD	70	4.10	0.640	2.495	151	0.014
	DUP	83	3.82	0.735			
Data standardisation and centralisation	MPD	70	3.99	0.625	2.743	151	0.007
	DUP	83	3.66	0.801			
Increased productivity	MPD	70	4.07	0.621	3.520	151	0.001
	DUP	83	3.69	0.714			
Ease of use	MPD	70	3.96	0.669	2.478	151	0.014
	DUP	83	3.65	0.833			
Improved decision-making	MPD	70	3.89	0.649	2.305	151	0.023
	DUP	83	3.63	0.728			
Less workload	MPD	70	3.83	0.816	1.857	151	0.065
	DUP	83	3.58	0.843			

The results show that the highest mean differences between the MPD (M=4.10) and the DUP (M=3.82) is time saving (t=2.495, p=0.014). This corresponds to the findings from other researchers that GIS is a useful tool for reducing time taken for processing planning

applications, development controls, plans and reports printings and assisting in the planning decisions (Batty, 2005; Campbell, 2005; Comber *et al*., 2008; Carsjens and Ligtenberg, 2007; Fedeski and Gwilliam, 2007; Klosterman, 2009; Yeh, 1991, 2005). At the MPD and the DUP, if the planning staff used the manual method for data storing, they have to keep the hardcopy data, such as plans and drawings, in the store using the manual filing system. Whenever there are new applications, the planning staff need to refer to these drawings. If there are amendments, the planning staff have to update them manually. Sometimes, certain hardcopy drawings might go missing. Thus, with the use of computer-based system, the planning staff at the MPD and the DUP only needs to keep the data in a database. The database is also accessible to all staff which in turn helps them to access the same information. Similarly, it helps the planning staff to manage the database effectively compared to the manual filing method.

Despite the widespread availability of GIS in the local government, there is evidence that the potential of GIS as a planning tool is not being exploited. The findings of the survey have raised important issues concerning the problems in using GIS in the MPD and the DUP. Results indicate that more than half of the respondents from the MPD (60%) and the DUP (69.9%) have experienced problems in operating GIS (Table 3).

Table 3: Problems in operating GIS

Departments	**Problems in operating GIS**	**Total**	**Percentage**
MPD	Yes	42	60.0
	No	28	40.0
	Total	70	100.0
DUP	Yes	58	69.9
	No	25	30.1
	Total	83	100.0

When asked about the nature of the problems, the respondents indicated three problems normally experienced while using GIS which in turn hampered the use of computer-based system. They are database problems (MPD=62.8%; DUP= 61.4%), data updating problems (MPD=58.5%; DUP=68.7%) and lack of IT/GIS skills (MPD=71.5%; DUP=59.1%) (Table 4).

Table 4: Problems in operating GIS

Problems	**Department (%)**	
	MPD (70)	**DUP (83)**
Database	44 (62.8)	51 (61.4)
Data updating	41 (58.5)	57 (68.7)
Lack of IT/GIS skills	50 (71.5)	49 (59.1)

When the respondents were asked about the problems related to the lack of IT/GIS skills, they indicated that GIS is not easy to be handled, difficulties with IT language as well as GIS commands and terminologies. As Yeh (1991 & 2005) predicted, lack of training and understanding of GIS potentials seem likely to impede the maturation of GIS applications.

This also explains why the planning staff still need to acquire more training on GIS in order to gain the appropriate skills in operating GIS at the advanced level. Other than needing advanced skills in GIS, the staff also need to learn about the nature of computer-based system.

b) Perceptions of GIS Management

The 16 management officers interviewed include three planning directors (PD), two deputy directors (PDD), four senior town planning officers (STP), and seven planning officers (PO) from the planning departments and agencies. Each respondent was given a code according to his or her position. For example 'PD1' represents respondent number 1 of the three planning directors interviewed.

The management officers believed that moral support obtained from the management level is a very important aspect that influences the utilisation of GIS in planning departments. The use of technology is strongly influenced by users' understandings of the properties and functionality of a technology (Orlikowksi, 2000; Orlikowski *et al*., 1995). This view has been strongly supported by the encouragement and support from officers within the departments. When questioned whether the mayor supports the application of GIS at the DUP, a Deputy Director from the department made a similar comment:

> "…our director shows us the benefits of GIS for our planning activities." PDD1

Another senior town planning officer (STP2) made a similar comment:

> "We have support from the top-management to use GIS." STP2

According to STP2 (a Senior Town Planning Officer), the support that they had received are mainly from the planning director and the mayor. He added that their Planning Director was aware of the importance of GIS for the planning works, especially in plan making. Meanwhile, the Mayor was aware of the use of GIS in order to help the government to have good governance over local authorities.

PD2 further comments about the need of GIS in planning activities:

> "…Basically it is a natural move from the ways of doing jobs manually to the digital approaches…so you know that…I do not have to get into details…because you know the benefits of digital technology…we are now in the IT era, so it is not a question of to consider or not to consider…it is just a natural step from preparing plans manually with the introduction of computer…so you obviously exploit this technology…and you exploit the technology of IT." PD2

This therefore shows that the importance of using computer-based system in handling planning works. As the local government moves toward an electronic-government (e-government) approach, there is a need for planning departments to utilise technology such as GIS in their practices. It helps the government to have good governance over local authorities. According to PD2:

> "So we have to keep abreast with the various technologies where we require data. We are talking about land-based data; land-based agency data, we definitely need it for our assessment of problems; we need topography data, we need it for administrative

purpose, cadastral data, we need the aerial photo, so we need all these data. So, we need to apply and exploit the benefits of the technology (GIS)". PD2

All the management officers agreed that GIS has helped them to save time in processing planning applications, preparing and printing maps and plans, producing reports, colouring plans and checking plans. A Planning Director (PD1) certainly agreed that GIS has helped planning staff to save time, for example, on the use of GIS to print plans. According to PD1:

"…definitely it (GIS) will save time" PD1

Other than GIS as a planning tool, most of the management officers agreed that GIS has assisted planning decision-making processes because of the quality of GIS data: it is accurate, useful, complete, reliable and current. Up-to-date and reliable information are needed by planners in the processes of making decisions as well as for policy plannings and plan implementations (Masser, 2001). The use of updated and current information allows automatic linking between statistical and mapping information (Al-Ankary, 1991; Alterkawi, 2005). These processes allow large quantities of data to be processed quickly and combined in many ways. According to PD1:

"GIS is a tool that contributes to decision planning processes". PD1

Another Planning Director (PD2) and Senior Town Planning Officer (STP3) made similar comments:

"GIS is the ideal tool to assist decision-making". STP3 & PD2

PD2 further explains how GIS supports decision-making in planning processes:

"We used GIS to identify the development and conservation areas…we used it (GIS) to understand and find out about areas that are prone to disasters and all the areas affected that have resulted in disasters due to the development…how far a certain development has encroached conservation areas. We always zone the areas, and we will know whether a certain development has encroached into water catchments area, for example, which is not ideal for development." PD2

In many respect, data are crucial resources and are very expensive to collect, store and manipulate because large volumes are normally required in solving substantive geographical problems. The use of GIS helps to improve data management. According to PD2:

"We are dealing with a large volume of data, and this situation can be improved by using GIS to handle the processing and management of data." PD2

This response emphasizes the management of digital data through the use of GIS. A Deputy Planning Director (PDD1) also made similar comments but highlighted the contribution of the system in avoiding the repetition of data:

"We can easily update the data and detect any new information of certain areas. So, GIS helps us to avoid a repetition of data." PDD1

Although GIS can be beneficial, its implementation can also bring about problems. The management officers indicated that the perceived problems of using GIS in planning departments are shaped by five ongoing issues. There are the level of GIS adoption, staffing/personnel issues, equipment and data issues, IT/GIS skills, and workload and financial rewards for GIS skills.

Most of the management officers indicated that the planning staff, especially the technicians and the draughtsmen, have faced problems in understanding GIS commands because all commands are in English and that it is difficult to understand the IT commands because they are new to them. According to Yeh (1991), a low level of GIS understanding is one of the impediments in using GIS for planning organisations. A Planning Director (PD2) from the Federal Department of Town and Country Planning (FDTCP) made a comment when asked about the difficulties faced in using GIS. PD2 agreed that GIS is difficult to understand and it is challenging for the planning staff, especially the technicians and the draughtsmen, to use GIS. He suggested that these groups of staff need to be guided by the planning officers in order to ensure the understanding of the IT/GIS language and commands.

> "It is complex to understand; not an easy subject. The more complicated the tool, the more powerful the tool, the more complex it becomes". PD2

The management officers indicated at the beginning of the GIS implementation that there were some planning staff who refused to change from manual to computer-based systems applications (GIS). According to PDD1:

> "Especially for senior technical staff with more than 15 years working experience with us…it is difficult for them to accept new technology" PDD1

The above responses highlight that the senior technical staff of the DUP, KLCH refused to use GIS. According to PDD1, these senior technical staff preferred to use the manual technique as their planning tool because they were more familiar with the drafting boards and the use of technical pens. Another Deputy Planning Director (PDD2) emphasized the same view:

> "They (planning staff) have a slow momentum to change. They prefer to use the manual method. The drawing board and the technical pen are very important to them". PDD2

In terms of staffing issues, the management officers indicated three aspects of GIS utilisation in planning departments. They include a lack of technical specialists, a lack of experience, and scope of work. A lack of technical specialists is an important issue in the use of GIS in planning department. A response by the Deputy Planning Director (PDD2) focused on the number of staff involved in GIS. According to him, the department was lack of staff who could concentrate on managing and maintaining the database. He stated:

> "We have only a small number of staff that are involved in GIS". PDD2

Some of the management officers indicated that the scope of work and the involvement of planning staff with management tasks and administrative works were also the reasons for the slow utilisation process of GIS in the planning department. A Senior Town Planning Officer (STP4) mentioned that senior staff with 20 years of using drawing boards had given many reasons to refrain from using GIS. According to STP4, these senior staff always give excuses that they have regular jobs (using manual), and provided reasons such as "I cannot", and "I do not have time". As Deputy Planning Director (PDD1) commented:

> "At one point, some of the planning staff took GIS for granted and, because of this, they could not fully concentrate on adopting and using GIS." PDD1

Some of the management officers indicated that one distinctive aspect to proclaiming knowledge of GIS is that it will lead to extra work. A Deputy Planning Director (PDD1) and a Planning Officer (PO5) stated:

> "Some of them (planning staff) know how to use GIS but refuse to publicise this fact for fear of added workload. This is despite the fact that several senior planning staff have attended at least one GIS course and are able to use the technology. For them (planning staff), new technology equates greater workload". PDD1

> "They (planning staff) simply refused to show that they actually know how to use GIS…they thought that it will burden them, more work to do and the workload will increase." PO5

DISCUSSION

The findings indicate that all planning staff at the MPD and the DUP view GIS as a means to accomplish tasks more quickly and easily, improve data management, improve data sharing, standardise and centralise data, save time, increase productivity effectiveness, improve decision-makings, reduce workloads, improve job performances and derive personal benefits in terms of improved professional performances and prestige. The findings show that users' satisfaction is somewhat different for direct and indirect GIS users. Indirect users are those who make use of the technology by relying on other members in the department. For direct GIS users, ease of use, time saving, exploitation of technology, data sharing, data management, improved decision-makings, trainings and documentations are all important for achieving satisfaction. As suggested by Nedovic-Budic (1999) and Gill *et al*., (1999), regardless of the type of GIS use, quality, timeliness, accuracy, format, reliability, and completeness of the GIS products are of central concern in evaluating user satisfaction.

The findings of the survey and interviews indicate that the planning staff at the MPD and the DUP are more likely to regard GIS as a positive aid for their planning activities and processes. The notion of 'GIS as a tool' has been repeatedly invoked by the respondents. It has been usually accompanied by the assumption that, as a spatial data handling tool, GIS will be a useful tool for planning processes. The term 'tool' is readily adopted by the planning staff and GIS has been constructed as a flexible piece of technology that will facilitate efficient working practice. Its usefulness has been reflected by respondents who referred to a number of tasks which they considered would have been more efficiently performed using GIS. These tasks include keying-in data, retrieving data, printing plans, processing planning applications, performing mappings, performing analyses, printing reports, conducting presentations, running models, and operating the system management. The notion that GIS incorporates a range of functionality that enables spatial data to be handled effectively is therefore utilised by respondents in order to support their understanding of GIS as a 'tool'. Most of the staff whose interest in technology is related to their work are not naturally eager about GIS; however, they perceive that knowledge of IT may be advantageous to the departments and the organisations as well as to their individual career advancements. However, there is also a minority of the planning staff who have avoided using GIS and have shown willingness in learning how to use it.

The results of the interview suggest that the Planning Director has made a highly significant contribution in obtaining the resources necessary for the development of computer-based information systems in the MPD and the DUP. A primary function of this leadership role is to set clear goals and objectives, to win acceptance among end users for such goals and objectives, and to provide the commitment which enables these goals and objectives to be realised in the utilisation process. The role of the Planning Director can be made easier if he/she receives support from the middle management. In addition, it is often found that the technical skills and interests of the Planning Director play an important role in encouraging the use of GIS among planning staff (Campbell, 2005; Drummond and French, 2008; Yeh, 2005). As GIS is rather new in the planning departments of the KLCH, the planning heads and officers need to gain more skills before they can provide leadership in promoting the use of GIS in their departments. They also need to have a generally good comprehension and appreciation of computer applications.

The emphasis that the Planning Director places on the role of GIS/information system in strategic planning processes is also significant. As a result, an information management strategy (the Development Control System within the DUP) has been developed which gives consideration to data accessibility and associated issues such as staff training. This has encouraged the adoption of a centralised approach in the use of GIS in planning departments. Consequently, these findings suggest that the activities of the Planning Director and supported by the Mayor, the Planning Officers, and all planning staff have been responsible for the creation of a favourable internal organisational context in which to utilise GIS in planning departments.

This study has revealed the relationship between the planning staff and GIS are mutually productive, where GIS will not only affect the working practices of the planning departments but also its adoption will impact upon GIS itself. It has been frequently argued that, as GIS becomes embedded in current practice, greater numbers of potential users will become more aware of it and its use will therefore become more widespread. Concurrently, this will promote investments and developments of the software and, as systems become refined and standardised as good practice, it will be increasingly difficult for users to circumvent the system.

CONCLUSION

The findings of this study have profound implication for the design, implementation and organisation of information systems. Given the significance of human and organisational considerations to the effective utilisation of GIS, there are important ways in which planning staff affect the development of GIS at the same time that GIS affects the planning departments. Understanding the roles played by the planning department and planning staff involved are very important in determining the effective utilisation of new information technology. While GIS potentially offers new ways of becoming embodied within the planning activities, the practice of GIS actively contributes to the construction of social coordination amongst people and the technology itself. The results suggest a situation of mutual dependency whereby these factors influence the utilisation of the computing technology and, at the same time, the technology has various impacts on the organisation and people involved. This study has identified that there is a strong contribution of organisational

contexts, people and technology factors to an understanding of GIS usage in the DUP and the MPD, KLCH. The identification of the pertinent factors and the manner in which they interact enable greater understanding of the processes affecting the effective use of GIS in the DUP and the MPD, KLCH.

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