GIS in Development Control Process: The Case of Development Control System for City Hall of Kuala Lumpur

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Abstract

Development control involves a complex process and tedious procedures. The due consideration given to an application for planning requires a tedious process as it will have to go through several committees and technical evaluations. Generally, a planning application will be assessed in terms of current development scenario, land information, planning requirements and planning design. Delay related to the overall process of development control can be attributed to consultation-caused; planning committee-caused and applicant-caused. Issues concerning development control process include delay of planning approval, lack of consistency in decision-making, comprehensive and updated information apart from effective public participation. The continuous occurrences of these issues can no longer be tolerated if Kuala Lumpur is to achieve the status of a world-class city. Given the benefit of IT, it is imperative that the procedures of development control be improved to cater for increasing development rate. Development control and approval, which involves the process of analyzing the appropriateness of planning applications, requires various data from the relevant agencies. Apparently, an information system is necessary not only to keep and display data pertaining to planning application for the purpose of administrative functions but should also be designed to facilitate planning at strategic level. The step taken by the Planning and Development Control Department (JPKB), City Hall of Kuala Lumpur 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 that supported by GIS application. The developed system which integrates seven sub systems including planning authorization, building control, enforcement, geospatial and planning information, information kiosk, meeting presentation and documentation processing, incorporates the use of GIS for planning and monitoring purposes. With its powerful capacity for spatial data management, spatial analysis, and visualization, GIS provides planners with new tools to implement their work more efficiently especially with support of the interactive and user-friendly interface developed to ease the use of the sophisticated system without the need of advanced technical skill. In addition, web-base GIS applications were developed to provide meaningful public participation apart from better data integration and sharing through effective data dissemination techniques. Computerization of crucial procedures help to cut cost and time consumed apart from minimizing the process of bureaucracy throughout the development control process. The implementation of the development control system will inevitably influence the existing structure and practice of urban planning and management in CHKL. The system will be able to support planning and decision-making because it offers relatively quick response to analytical questions and monitoring issues. This paper will explain on GIS application in Development Control System by CHKL for simplify development control process in enhancing Local Authority function and services.

1.0 INTRODUCTION

Planning practice particularly the development control process involves various stages of decision making and basically is a tedious procedure. Most local authorities currently face a costly management and maintenance process due to the ever-increasing planning applications. The

current manual working procedures is time consuming and cost the development proposal. Eventually, it causes the instability progress development and not effective in monitoring the project. The cycle process in planning permission somehow limits and constraints the development growth. In improving development control efficiency, up-to-date and reliable information is needed at the local authority level to facilitate administrative procedures of development control apart from policy planning and plan implementation. Currently, the employment of Information and Communication Technology (ICT) is seen as an evolving approach to become better urban governance. The usage of GIS as a tool for development control process helps in ease planning information system especially in time management and management competence. The needs of GIS usage in development control process is because of plan approval require exact information in analyze the specific area especially for policy and layout plan approval. With its powerful capacity for spatial data management, spatial analysis, and visualization, GIS provides planners with new tools to implement their work more efficiently.

In local planning authorities, GIS are used at various points in the planning process, including analytical and synthesis-oriented tasks such as plan development and evaluation. With the GIS ability to perform mapping tasks more efficiently, a planning department in local authorities may better serve the public. It is likely that some of the analytical tasks in planning process can be better performed with a computer due to their size and complexity. GIS can improve local government's effectiveness by providing better information to planners and decision-makers.

The paper will further explain the relevance of GIS application in the process and procedures of development control. This will be followed by discussion on the benefits and challenges in developing GIS for local authority.

2.0 DELAYS IN DEVELOPMENT CONTROL PROCESS

Development control involves a complex process and tedious procedures. The due consideration given to an application for planning requires a tedious process as it will have to go through several committees and technical evaluations. Generally, a planning application will be assessed in terms of current development scenario, land information, planning requirements and planning design (Yaakup *et al.*, 2002). Delay related to the overall process of development control can be attributed to consultation-caused; planning committee-caused and applicant-caused. Issues of the development control process which have always been of concern include the lack of consistency in decision making due to personal judgment, comprehensive and updated information apart from effective public participation. The continuous occurrences of these issues can no longer be tolerated if Kuala Lumpur is to achieve a status of world class city. Given the benefit of IT, it is imperative that the procedures of development control be improved to cater for increasing development rate.

Development control and approval, which involves the process of analyzing the appropriateness of planning applications, requires various data from the relevant agencies. Apparently, an information system is necessary not only to keep and display data pertaining to planning application for the purpose of administrative functions but should also be designed to facilitate planning at strategic level. The defining of workflow in system development will help avoid overlapping of information processing. Ideally, the system is developed to accommodate development control tasks such as:

i. to analyze and evaluate the effectiveness of development strategies in terms of the role and function of Kuala Lumpur, taking into consideration the policies outlined by the government;

ii. to provide information for assessing the implications of planning application in terms of the provision of social and community facilities;

iii. to identify potential land available for development as the basis for strategic planning;

iv. to identify areas receiving development pressure to facilitate development control and monitoring of the areas;

v. to facilitate technical evaluation of planning applications by displaying data on land use, plot ratio, transport system, etc. used by other agencies involved in technical aspects;

vi. to supply information on development and administrative policies formulated by the municipality including development status, surrounding development, available infrastructures and other planning requirements which has been translated into spatial entity as it is important to enable the planners to advice applicants.

The implementation of the development control system will inevitably influence the existing structure and practice of urban planning and management in CHKL. The system will be able to support planning and decision-making because it offers relatively quick response to analytical questions and monitoring issues.

2.1 Development Control System Concept

In areas experiencing rapid development activities, the local authorities face a challenge of maintaining a smooth planning control process. The ever increasing planning application means costly management cost. In most local authorities, a planning application will have to be recorded and assessed by a number of personnel as well as committees before it any decision can be endorsed. If done manually, the separate storing of application files and site plans, for example, can caused difficulty in accessing them when needed instantaneously and simultaneously. This contributes to hassles in managing and updating of application information on behalf of the local authorities in the long run.

ICT have contributed significantly to how the procedure can be simplified. For development control purposes, the system should not only be geared to increase efficiency of file processing procedure but also fulfill other development control requirements which include the following criteria:

- **Fast and accurate data retrieval**
  Every decision can be retrieved online by employees without physical file. Base on a central database, user may not have to search physical file for checking and reference. It should also allow retrieval from more than one user at one time.

- **Friendly user interface**
  System interface should have a high level of friendly user interaction. It should ease users especially for staffs involved in updating and retrieving data from database. The feature should include viewing arrangement based on workflow display, display of information needed and reduction of typing function.

- **Monitoring progress of work and increase productivity**
  The development of the system should assist the management in monitoring the staff progress of work. The system should thus allow the top level management to keep tract of

the movement of the officers. These changes should increase the level of efficiency of the staff.

- **Spatial information references**
  Unlike other system development, the system should integrate the spatial information with their attributes. Thus, assessment a proposed development can be determined based on the physical aspects of the proposal which include development of surrounding area, zoning, height, plot ratio, plinth area and density.

- **Evaluation of proposal**
  Assessment of a development will be based on guidelines used by respective departments according to their specialization. At present there is no established procedure in evaluating proposal, thus each department may be furnished with different format of reporting. The system should allow standardization of procedures and each department should have a common set of guidelines and references.

- **Data sharing and integration between technical departments**
  Data sharing and integration between stakeholders involve in the development process should be a feature of the system which will improve the relationship between parties which have interest in the process. This means that data format has to be standardized to ensure the smooth running of the system.

3.0 DEVELOPMENT CONTROL SYSTEM FOR CITY HALL OF KUALA LUMPUR

The Development Control System developed for Kuala Lumpur City Hall integrates seven sub systems (Figure 1) to execute specific functions which are:

i. Planning Authorization
ii. Building Control
iii. Geospatial and Planning Information
iv. Information Kiosk
v. Enforcement
vi. Documentation Processing
vii. Meeting Presentation

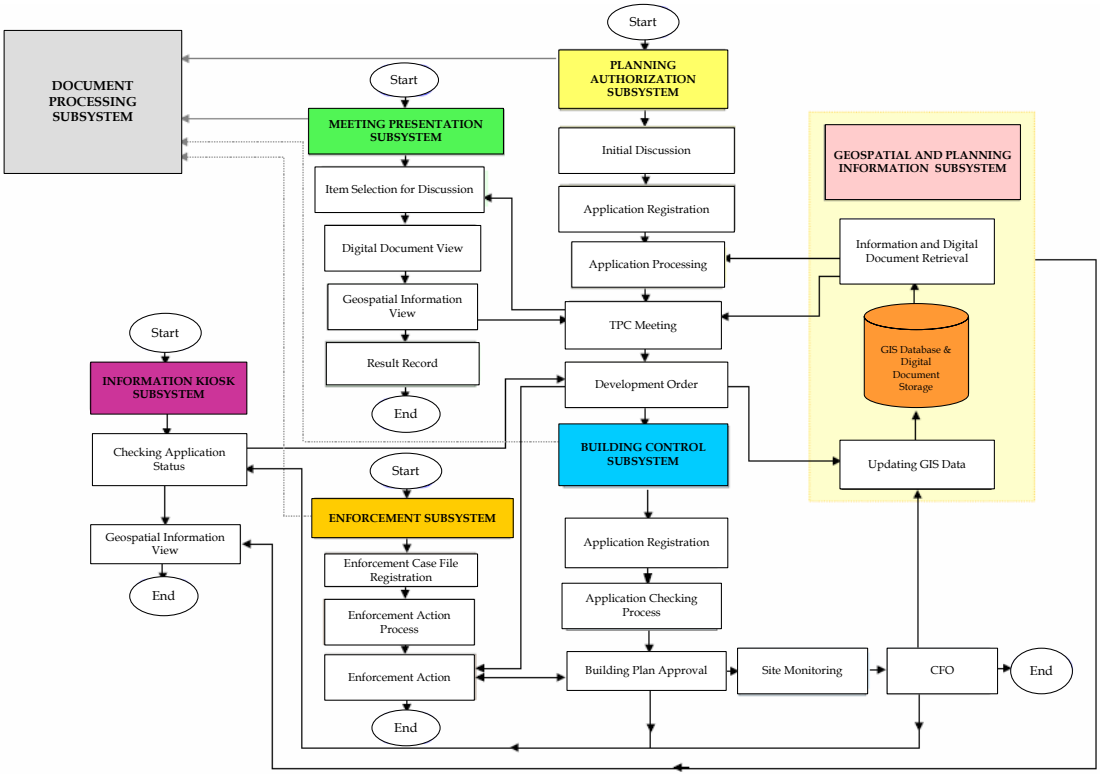

Figure 1: Development Control System Subsystem Integration

3.1 Subsystem for Planning Authorization

The planning Authorization Sub System operates to process planning application, beginning from the submission of an application until the Policy Approval or Development Order is issued. This sub system allows user to comply with the policies and spatial information while evaluating the planning applications and observe the planning requirements. Apart from saving time and space, it helps to minimize workload and reduce the use of paper. Besides, the data-sharing concept will minimize overlapping in the database development and thus, increase the quality and productivity of work.

3.2 Subsystem for Building Control

The Building Control Sub System is derived as a support for the building approval process. This sub system begins from the submission of building plan approval applications to the process of producing Certificate for Occupation. The features are similar to the Planning Authorization Sub System, which include graphic and interactive interface and enable interaction between sub systems. This sub system will assist the Building Control Division in managing their activities.

3.3 Subsystem for Geospatial and Planning Application

Geographical Information Technology (GIT) is seen as the most suitable solution for supporting the handling of spatial information, especially throughout the development control and approval

process. Some of the important functions include the ability to retrieve information rapidly and efficiently, model different scenarios and evaluate alternative solutions generated by various modeling procedures and hence, offer a more effective solution to various spatial-related problems. With its powerful capacity for spatial data management, spatial analysis, and visualization, GIT provides planners with new tools to implement their work more efficiently.

The Geospatial and Planning Information Sub System is developed to provide a complete spatial database along with the attribute data, which recorded the Development Order Approval, Building Order Approval, and Building Occupation Order. The implementation of this sub system involves the GIS database development, data collection, data conversion and updating of spatial and attribute data. This sub system also provides support in terms of spatial data for the other sub systems, at the same time enable other divisions to retrieve the spatial information they need through the interface programs that have been developed. Users can specify the type of information they want to retrieve using the query functions based on 'parcel', 'road', 'section' or 'county' identifications. This sub system will help the management to make decisions more systematically and rationally.

The process of development control and approval involves a technique for the systematic compilation of expert quantitative analysis and qualitative assessment of project land use and property development viability, including its effect on the surrounding area, and the presentation of results in a way that enables the importance of the predicted results, and the scope of modifying or mitigating them to be properly evaluated by the relevant decision making body before a planning permission is rendered. The system thus contributes to better local governance as it has the ability to:

i) Help analyze the development strategies in terms of the role and function of Kuala Lumpur taking into consideration the policies outlined by the government.

   At the local government level, the local plans are legal document that become the basis of development guidelines and control. These plans contain such details as land use zoning, development density, building height, plot ratio, etc. which require detailed information of each plot of land to be formulated. The tasks of preparing and analyzing this information can be speeded up and made easy with the help of GIS. A zoning plan, for example, covers a large area that contains various land uses. It will be a great advantage to be able to evaluate each alternative of a zoning plan using GIS (Yaakup and Healey, 1994). This can be done using current data on floor space of the development area as well as the whole planning area. By comparing this information and the control figure projected by the Kuala Lumpur Structure Plan, the effectiveness of the development policies can be evaluated.

ii) Provide information to assess the implication of planning application in terms of the provision of social and community facilities.

   GIS will help planners to project implications and identify alternatives before actions such as land acquisition for road expansion and special needs including schools and public safety facilities take place. Additionally, display of decision can be easily understood and thus better assessed by the potential developers and landowners. Furthermore, visualization is definitely the main advantage in GIS applications where graphic can be manipulated to allow various alternatives evaluated on a fair ground. 3-D analysis is now becoming a major application in GIS. It allows potential viewing on impacts not normally visible by naked eye. Thus, at any given scenario, this application definitely is a part of the development control application. It should be offered to any potential developers so as to give advanced information in the application process.

iii) Help identify potential land available for development as a basis for strategic planning.

This system is expected to provide visual display as well as describe potential alternatives to the particular planning process selected. GIS allows for selection of suitable locations of social amenities, different size of housing, as well as evaluating potential impact on the environment. It can also help explain or inform current landowner of the scenario and overcome potential resistance. This not only be convenient to planners and developers, but also reduce resistance among landowners involved.

iv) Help identify areas receiving development pressure to facilitate development control and monitoring of the areas.

Any given development pattern can be identified from past data and development trend such as floor space and building height. This helps decision-makers identify development activities and potential development in any given site, making it easier to identify potential floor space on a studied area.

v) Facilitate technical evaluation of planning applications by displaying data on land use, plot ratio, transport system, etc. used by other agencies involved in technical aspects.

GIS also provides technical committees with various analyses on proposed development plan comprehensively. Information on present land use status will assist in comparing present scenario with the proposed development. Critical evaluation can be easily done and time spent on various formulations and calculation can be reduced. The capability of carrying out planning analysis will help evaluation process to be completed in a quarter of the present time spent.

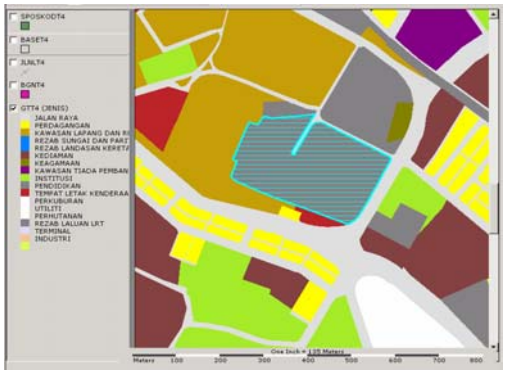

Figure 2: Display of support data for technical evaluation of planning application

vi) Accommodate display of information on development status, surrounding development, available infrastructures and other planning requirements.

Information on development and administrative policies formulated by the municipality which has been translated into spatial entity is important to enable the planners to advice applicants. Information on zonal development policies and administrative policies covering spatial matters are crucial to the planners involved. They need to be well informed before being approached by potential developer. Hence, providing this information under a planning information system helps both parties. GIS database can be incorporated to display and allow certain queries related to these policies. Hence, potential charges resulted from these policies amendments can be easily quantified and translated into dollar and cents immediately.

3.4 Subsystem for Information Kiosk

The Information Kiosk Sub System (Figure 3) is built for the user as well as public to gather information through the Planning and Building Control Department web site. This sub system has detailed information on Kuala Lumpur, Planning Control Building Department, Development Control System and also Enforcement. With the development of the system, user can retrieve

information related to Kuala Lumpur City Hall as well as to obtain some forms. The system also allows the City Hall to announce any issues to the public.

3.5 Subsystem for Enforcement

The Enforcement Sub System is an aid for the Planning and Control Building Department in planning enforcement actions. This includes reports on site investigation, warning notices, control actions and reports on certain decision made by the Planning Control Building Department. This sub system also helps the public to file complaint and receive feedback form the local authority. Besides, it also facilitates the management in receiving investigation reports faster so as to act more effectively, systematically and immediately.

3.6 Subsystem for Document Processing

The Documentation Processing Sub System is designed to enable storing and retrieving of all documents in a more systematic manner. This may solve the problems of storing physical files and locating files. The documents will be transformed from hardcopy to softcopy. Hence, user can manage the document more efficiently and simply as and when the document is needed.

3.7 Subsystem for Meeting Presentation

The Meeting Presentation Sub System is meant to ensure the smooth progress of a carried out meeting through facilities for displaying related information including plans, GIS related data and other associated information (Figure 4). This sub system enables display of information and related matters being discussed such as documents, maps, plans and so forth. As location plans, site image, perspective diagrams, proposal plans can be illustrated within a clearer image compared to conventional procedures, meetings should be able to run smoothly since the information needed can be retrieved promptly.

4.0 GIS Database Design for Development Control of Kuala Lumpur

Information designed must be based on the planning and development control process to be implemented. Based on conceptualized GIS application for planning and development control, there will be several data layers in the database. They are meant for retrieval, analysis and conformed to technical requirements for any planning application. There are eight main elements in the GIS database designed for JPKB which are:

i. Administrative – contain base map, plot coordinate, , map series, locational relationships and spatial entity at land parcel level with assigned ID, land information (parcel no., district, section and status)
ii. Planning requirement and regulation – includes development plan, planning policy, current land use, committed land use, plot ratio, development status, plinth area, height
iii. Building – use of building, condition, height, walkway, etc;
iv. Utilities - electricity (overhead cable and transmission), telecommunication (cable line, public phone and transmitter), water (pipeline and pump station), sewerage (sewerage line, sewerage tank and treatment plant)
v. Hidrography – lake, river, reservoir, drainage

vi. Transportation – present , proposed and dedicated road, bus stop, taxi station, LRT and rail
vii. Relief – contour (topography), slope
viii. Imagery – aerial photo, standard sheet

GIS database for planning and development control will have to be maintained and planning information will have to be updated continuously. Once the decision is made, both the spatial and attribute database should be updated.

5.0 GIS APPLICATION IN DEVELOPMENT CONTROL PROCESS

The control of development which involves the process of analyzing the appropriateness of planning applications requires various data from the relevant agencies. A planning application will be assessed in terms of current development scenario, land information, planning requirements and planning design (Yaakup *et al.*, 2002a). The application will not only be reviewed in terms of basic utilities (water supply, sewerage and telecommunication) but also public facilities (availability of public transport, education facilities, religious facilities and safety factor). The GIS development for development control process thus comprises the capabilities to:

- Analyze development strategies in terms of the role and function of local authority which take into consideration the policies outlined by the government. This can be done using current data on floor space of the development area as well as the whole planning area.
- Provide information to assess the implication of planning applications in terms of the provision of social and community facilities;
- Identify potential land available for development. This is useful to both the public and private sectors to determine supply of floor space.
- Identify areas receiving development pressure to facilitate development control and monitoring of the areas;
- Facilitate technical evaluation of planning applications by displaying data on land use, plot ratio, transport system, etc. used by other agencies involved in technical aspects;
- Display information on development status, surrounding development, available infrastructures and other planning requirements.

The relevance GIS to the stages of development control in local authorities is simplified in the following table:

Table 1: Function of GIS in development control stages

Stages	Function of GIS	Information required/Development Control tools involved
Initial Discussion	Spatial Data View	*Spatial Data* • Current Development Plan • Site characteristic - Current condition, topography • Committed Development Plan *Attribute Data* • Land information – land status, ownership • Current development • Land condition • Development status • Building information

		• Building design guideline
Early checking	Data query and viewing	*Spatial and Attribute Data* File checking - identifying application status
Registration	Data query and viewing	*Attribute Data* Data entry – new application
Detail checking - Technical checking	Data query and viewing	*Data spatial* • Map checking – must include planning control such as Zoning Map, Plinth Area, Plot Ratio, Building Height, Surrounding Land Uses, guideline etc.
Site Investigation	Data query before site investigation. Data updating after site investigation	*Spatial Data* • Current development plan including committed development • Site location including site characteristic • Surrounding area development
Technical Department Evaluation/ Comment	Application Analysis	*Spatial Data* • Drainage, infrastructure and utilities map. • Development suitability analysis map *Attribute Data* • Reports - Environmental Impact Assessment etc (if available) • Local Authority Guideline
Invitation for Objection	Spatial and Attribute Data View	*Spatial Data* • Application Map • Development suitability analysis map • Development impact map to the adjacent landowner. *Attribute Data* • Land owner information • Adjacent land owner information • Lot number • Type of Development
Meeting Presentation	Spatial and Attribute Data View	*Spatial and Attribute Data* • Map View • Application site information
Approval by Technical Committee	Data View	Local Authority Guideline *Spatial Data* • Analysis Map
Town Planning Council Result	Data View	Result – Approve or reject
Updating	Updating spatial and attribute data	• Approve application

Sources : Che'Man N, 2001

6.0 BENEFIT AND CHALLENGES

GIS have been mostly used for replacing the traditional manual techniques of dealing with maps and also the daily tasks related to data processing. In many cases complicated applications

have little success. For British local governments, the success of GIS implementation depends on the organizational culture of local governments (Campbell 1994). In Sweden, GIS development is hampered by the lack of competence among staff and decision-makers (ULI, 1997). In Denmark and Finland, there is a correlation between municipality size, the economic capacity of local government, and the implementation level of GIS and other related technologies (Kiib, 1996; Nuora, 1995).

Study has shown that a development control system which integrate GIS in the system have great impact on the processes. These include:

- Streamline processes – Detailed workflow of current work process is formulated to enable the flow to be transparent. Automatic task distribution in application processing should therefore reduce waiting time for files to be distributed to staff.
- Perform joint project analysis – more effective planning analysis using GIS software tools.
- Reduce redundant datasets – One of the goals of computer systems and database development is to eliminate redundant data collection and storage. The principle is that data should be collected only once and then accessed by all who need it. This not only reduces redundancy; it also allows for more accurate data and a greater understanding of how the same data is used by multiple departments.

The advantages acquired through the implementation of GIS for local authority includes:

- **User friendly environment**
  The system is designed to provide a highly user-friendly environment to enable easy use and capture the interest of users. The design facilitates users especially the department staffs in terms of updating and accessing the database. The features involved include arrangements of interface that suit the workflow, displaying the required information and reducing paperwork.

- **Facilitates the monitoring of staff performance**
  Using the system, every application submitted will be recorded into the database. Hence, the status of each application is easily assessed. Apart from that, the higher-level officers will be able to monitor the work performance of staffs under his supervision.

- **Easy access of data**
  The information stored in the database will enable the evaluation of application to be done in a timely manner apart from deriving at a more rational decision. All the results of the applications can be accessed directly from this centralized data system by all officers involved without having to refer to files manually. The aggregated system being developed also enables the access to a single file by more than one user simultaneously.

- **Provides reference in terms of spatial information**
  The Planning and Building Approval System also provides spatial reference to planning application data which enables the evaluation to take into consideration the current development status of the site affected as well as its surrounding areas. This will result in a more rational decision.

- **Enables informative evaluation**
  Evaluation on an application needs to be made base on the guidelines outlined by the evaluating agencies involved. In the current situation, there is no specific database providing this information making evaluation of application less informative but rather based on individual perception in convincing the approving committee. There has been a vast improvement in the capacity of GIS as an instrument for helping decision-making via

the Internet. For GIS users it provides a means of data sharing, maintenance and dissemination besides the possibility of conducting analysis over the Web. Internet GIS may facilitate integration and coordination because spatial data can now be accessed and shared.

Meanwhile the challenges in GIS development are:

- **Well-trained GIS personnel**
  There is a general shortage of well-trained personnel in operational management and application of GIS.

- **System break down**
  Electricity break down may cause worthless system. Computer usages which require electrical supply face problems due to frequent electrical breakdown. Local Authority need to have a backup to ensure the smooth running of the systems.

- **Database security**
  It has been recognized that the integration of information between those involved in decision making will faced a number of obstacles i.e. technical, legal, institutional and cultural. Issues of confidentiality and privacy are unlikely to be resolved in a near future because new mechanisms and norm need to be established to promote the flow of information, yet protecting the rights of individual privacy. Database security is one of the factor that were given due consideration in GIS development. The departmental staff should be responsible to ensure validity of password to avoid system intrusion. Data recovery procedure have however been established to address this matter.

7.0 CONCLUSION

With the continued development of GIS, there is a major opportunity for local authorities to use it to manage the allocation of scarce resources in a rapidly changing environment. The quality of urban planning and management can be upgraded when available and valid data are handled in an advanced manner with the aid of computers. GIS can support planning and decision-making because it offers relatively quick response on analytical questions and monitoring issues. Some of the important functions include the ability to retrieve information rapidly and efficiently, to model different scenarios and to evaluate alternative solutions generated by various modeling procedures.

Although GIS is often viewed as technically sophisticated computer professional, the development of a successful government-based GIS is very dependent on proper management, participation and supervision. GIS development is a process of technological innovation and requires management awareness suitable to the local government needs. Much of the disillusions and dissatisfaction with GIS projects stems not from a failure of the technical components of the GIS but rather from a lack of understanding of the process of technology innovation and the lack of realistic expectations of all parties associated with the department. With the GIS development, it is also expected to provide interactive mapping and spatial analysis capabilities for enhancing public participation and collaboration in decision-making processes to improve local authority function.

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